Kim Klinger-Logan | Teaching Portfolio

Teaching Statement
Sample Syllabi
Sample Worksheets
Sample Projects
Evaluations
I have taught over 15 different classes at 4 different universities. These classes include traditional day
classes, night classes for nontraditional students, and even online classes. I have taught small classes at
liberal arts colleges, large classes at public universities and much in between. Each of these settings
brings its own unique challenges and I enjoy the problem solving that comes with addressing them.

Teaching Practices
I believe that if they want to students can learn almost anything as long as they have the appropriate
guidance. I bring this philosophy to fruition with the following tools:

(i) Worksheets
(ii) Groupwork
(iii) Investigative Papers – Students explore a new topic with a few guided questions.
(iv) Homework Drafts – Along with the usual homework assignment, I require students to submit
weekly drafts of one of the problems. Their “draft” must contain two self-marked-up versions of
the solution along with the final one.

Students consistently report on evaluations that these worksheets (i) are a very helpful tool for their
learning. I will now describe how I use these tools both in and out of the classroom.

In the classroom. In a typical class, I arrive a few minutes early to write the day’s agenda on the board.
This list contains information like reminders to turn in homework, dates of upcoming exams, lists of
topics I plan on getting to that day and other relevant information. I leave this information on the side
of the board throughout the class. I’ve noticed that doing so has two e
ffects. First, it cuts down class
time spent repeatedly answering questions and students with such questions are better able to focus
during class. Second, the students get a cue that they are approaching this class period with goals.

In lower division classes like Calculus I, I do a brief motivation of the day’s topic and then distribute
a tailored worksheet. The worksheet is not a replacement for the lecture but a supplement that allows
me to communicate in both oral and written form in order to reach students with di
ferent needs. My
worksheets always have two components: a facts component and an exercises component.

Often the facts component is a skeleton outline of the lecture. In the facts component, students
recall or are given content that is needed to understand the topic. Examples of such information include
definitions, derivations or explanation of the major concepts. The students also have space to take
notes on what I am saying and to answer open ended questions like “What do you notice?” Having the
question actually written on the page makes each student responsible for answering it – not just the one
student who raises her hand. The outcome of using these worksheets is a more equitable classroom
that is accessible to students with a variety of disadvantages. For instance, in Calculus I when we are
deriving the derivative of a logarithm, I can put important properties of logarithms on the worksheets
for students who may have forgotten them without spending valuable class time writing these facts on
the board. These worksheets also give students a direct connection between what is happening on the
board and what is happening on their desk in front of them.

In the exercises component of the worksheet, students learn that being successful in a math class,
like most things, is all about practice. In this component, students are asked to use the information
given in the facts component to solve a variety of problems. These problems can be done individually
or in groups (as in (ii)) to allow my students time and space to work through their confusion while I am
present. I find this is especially helpful to members of groups that are underrepresented in STEM who
may find it overwhelming to ask such questions in front of the whole class. While students are working
on these exercises, I encourage them to work with and compare answers with their neighbor since
it gives quieter students confidence to ask questions. I regularly find that those underrepresented in STEM are most likely to pull me aside and ask questions at this time as opposed to in front of the whole class. While students are working, I circulate through the classroom to assess their understanding of the material. Students can test where in the new concept they are stuck and ask clarificatory questions. This not only helps the ‘classwork to homework’ transition but helps train them to be active participants in their own learning.

Usually the facts and exercises components are intermixed so that students have a chance to work examples without having to carry the cognitive load of an entire lectures worth of material. For advanced classes, I incorporate traditional lectures at the board and worksheets that are more in-depth. For instance when I taught Modern Algebra, students work through scaffolded problems to sort out different isomorphism classes of groups of different sizes by first having them experiment with the symmetries of the triangle and then the permutations of 3 elements.

At the end of class, I relay what parts of the previously assigned homework they should now be able to complete so that my expectations are clear. I also design assessments with clear expectations by providing exam reviews and quizzes that pulled from the assigned homework or worksheets.

Out of the classroom. Learning also needs to happen outside of the classroom. Students regularly come to my office hours with these worksheets in hand and ask direct questions about them even though they were not being graded. In fact, almost every student that does come to my office hours uses these worksheets as a guide for doing their homework.

Ensuring that learning happens outside the classroom can take many different forms in different classes. In Precalculus, I assigned investigative papers (iii) on topics students had probably not seen before (i.e. limits or groups) to teach students that math is about more than rules. These projects not only challenge the students to learn how to teach themselves something new, but students saw that they could learn anything with enough time, effort and support. In my Modern Algebra course, I assigned weekly homework drafts (iv) to help them develop their proof-writing skills. Students reported finding this exercise helpful and by the end of the course, all of my students were turning in readable mathematics. Providing support and having clear expectations shows students that math is not something you are born being good or bad at but rather something you work to understand.

Undergraduate Research Mentoring

While at the University of Minnesota, I have mentored three undergraduates in math research. For two of the students, I aided in writing a proposal for UROP (Undergraduate Research Opportunities Program at the UMN) which funded their work. North Star STEM Alliance (The Minnesota Louis Stokes Alliance for Minority Participation) is funding my other student’s work. Picking an answerable open question to investigate is too big a task for a student with limited experience. I helped guide them by suggesting reading related to their project and helping narrow their focus to smaller, achievable goals. I also helped them identify what makes a good proposal such as a clear explanation of the subject and concise statements of the problems and procedures one looks to address.

During the course of these projects, I regularly met with these students to guide their progress and answer questions. My main focus for these students was to help them develop healthy research habits. I gave my students clear tasks and directions to help break down the larger goal of each project and taught them about the value of keeping good notes and typing up their work regularly. I helped these students outline their talks and practice their talks with me before their official presentation. I look forward to mentoring undergraduates throughout my career.

Course evaluations available upon request and on my website (math.umn.edu/~kling202/Teaching).
Prerequisites: Math 2283 or 3283W  
Credits: 4  

Textbook: Theodore Shifrin’s Abstract Algebra: A Geometric Approach  
Other recommended texts: John R. Durbin’s Modern Algebra: An Introduction  
John B. Fraleigh’s A First course in Abstract Algebra  

Course Objectives  
This is an introductory course in abstract algebra. It differs from Math 5285H: Fundamental Structures of Algebra by being slightly less theoretical and covering slightly different course material. Course content is drawn from the first 7 chapters of the textbook, covering introductory topics like modular arithmetic, polynomials, as well as a basic introduction to basic group and ring theory, and field extensions. Beginning with familiar structures, such as integers, polynomials, and vector spaces, we will develop the underlying theory that connects these various concepts which will allow us to introduce more exotic examples. We will end this course with a study of symmetries which will illustrate how these different algebraic structures are all interconnected.  

Along the way, we will establish a few of the fundamental properties satisfied by these algebraic objects and illustrate their importance by looking at applications that follow from their properties. Algebra has a very different feel from calculus and geometry. One starts with a list of allowable axioms that define the algebraic structures and all properties and results flow from these axioms. The material often comes off as abstract; be prepared to put in extra time if this is not your natural inclination. After working with these structures for a while, things become more familiar and natural.  

Grading Scale: Your grade will be weighted in the following categories...  
  
  Homework: worth 25% of the course grade  
  Quizzes: worth 10% of the course grade  
  Exam 1: worth 15% of the course grade in-class on June 29  
  Exam 2: worth 20% of the course grade in-class on July 27  
  Final Exam: worth 30% of the course grade in-class on August 4  

Homework  
There will be due on Mondays. Homework is to be neatly written or typed (with the problems appearing in order), stapled and turned in at the beginning of class. You are encouraged to work in groups on the assignments but you must write up and turn in your own work.  

Editing: Some portion of your homework grade will be based on editing selected homework problems. The problems that you will be expected to edit will be starred (*) on the homework list and are to be turned in the Friday before the rest of the homework set is due.
Quizzes
There will be weekly quizzes on Thursdays (except midterm exam weeks–where they will be on Tuesdays), covering definitions, examples, and proofs from lecture and prior homework. There will be no makeup quizzes, but your lowest quiz score will be dropped. Quizzes will be at the beginning of class.

Exams
There will be two in-class exams and a final. Given that the material builds and the final is cumulative, they are weighted accordingly. The exams will take place during the first hour of class and consist problems that are similar to those discussed in class and those that appear on the homework and quizzes.

Exam 1: June 29 (roughly covering 1.1-2.4)  
Exam 2: July 27 (roughly covering 3.1-6.4)  
Final Exam: August 4 (cumulative)

No books, notes, computers or calculators allowed on exams.

Attendance
Attendance will not be taken in class, but will be key to understanding the information presented in the textbook. This means that although there is not a percentage assigned to attendance, your presence in class will be reflected in the grades you receive on quizzes and on exams. Simply put, although it is not required that you attend class, it will be a necessary tool for success in the course. If you need to miss a class period, it is your responsibility to get the notes and other information in a timely manner.

Succeeding In This Course
For many students this is the hardest class that they will take in college. Choosing to take it over the summer does not make it any easier. It is my job to help present the material in a clear and motivated way but it is your job to put in the time to make sure that the concepts resonate. It will require that you understand things conceptually, not merely mechanically. At the 4000-level it is expected that you will study and do exercises even if they will not be turned in. It is important that you do this work (and other recommended work) if you wish to succeed. You will at times get confused while doing this homework because I will assign problems that require you to extend the concepts I have covered in class. I recognize that being confused is frustrating, but be assured it is an important and fruitful part of the learning process.

You should expect to spend 10 to 21 hours per week outside of class for your own preparation. It is expected that you will be spending time reviewing the material and working on exercises every day. The material in this course is covered at a steady and rapid pace. More importantly, the material become steadily more challenging at the semester progresses so it will be very important not to fall behind. Furthermore, do not be mislead if the first week contains a lot of material that you are familiar with–that will change quickly.

Disability Accommodations
The University is committed to providing quality education to all students regardless of ability. Determining appropriate disability accommodations is a collaborative process. You as a student must register with Disability Services and provide documentation of your disability. The course instructor must provide information regarding a course’s content, methods, and essential components. The combination of this information will be used by Disability Services to determine appropriate accommodations for a particular student in a particular course. For more information, please reference Disability Services:
http://ds.umn.edu/student−services.html.

Academic Freedom and Responsibility
Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgement and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgement about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the
Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [Customize with names and contact information as appropriate for the course/college/campus.]

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Additional Remarks and Policies

- **Academic Honesty:** I encourage you to collaborate with others on suggested homework, but cheating on exams or quizzes is not acceptable under any circumstances. As you are students of the University of Minnesota, I expect you to follow the student code of conduct which can be found at: http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html.

- **Incompletes:** No incomplete grades will be given except in extraordinary circumstances. Moreover, to be eligible for an "I" you must successfully complete 70% of the course.

- **This Document:** You are responsible for knowing and adhering to the contents of this document. **Should the need arise, I reserve the right to add homework problems and assignments throughout the semester as well as alter the material to be covered on exams.**

- **Respect:** I expect us to behave like adults and to respect one another. Failure to do this is grounds for immediate removal from my class. Egregious incidents will be reported to the University for disciplinary action.

  *Sexual Harassment:* "Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual’s work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:

  http://www1.umn.edu/regents/policies/humanresources/SexHarassment.html

  *Equity, Diversity, Equal Opportunity, and Affirmative Action:* The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:


- **Mental Health and Stress Management:** As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

- **Frustration:** You will get confused sometimes. This is ok. If your confusion is causing you to get frustrated, this too is ok. Please, before giving up on the class, give up on the problem/activity that is causing the frustration.

- **Course Schedule**

  Please find a course schedule attached.
<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Sections</th>
<th>Topic</th>
<th>Events</th>
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<tbody>
<tr>
<td>I</td>
<td>6/12</td>
<td>Intro, 2.4</td>
<td>Roots of Polynomials</td>
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<td>6/13</td>
<td>A.1, A.2, A.3</td>
<td>Review</td>
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<td>6/14</td>
<td>1.1</td>
<td>Integers</td>
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<td>6/15</td>
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<td>Quiz 1</td>
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<td>6/16</td>
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<td>Euclidean Algorithm, Prime Numbers &amp; Factorization</td>
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<td>II</td>
<td>6/19</td>
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<td>Modular Arithmetic &amp; Solving Congruences</td>
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<td>6/20</td>
<td>1.3</td>
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<td>6/21</td>
<td>1.4</td>
<td>Rings, Integral Domains and Fields</td>
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<td>6/22</td>
<td>1.4</td>
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<td>2.1, 2.2, 2.3</td>
<td>Rational &amp; Real &amp; Complex Numbers</td>
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<td>III</td>
<td>6/26</td>
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<td>Quadratic and Cubic Formulas</td>
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<td>6/27</td>
<td>2.4</td>
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<td>6/28</td>
<td>3.1</td>
<td>Euclidean Algorithm</td>
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<td>6/29</td>
<td>1.1-2.4</td>
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<td>6/30</td>
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<td>Polynomials with Integer Coefficients</td>
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<td>7/4</td>
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<td>Fourth of July</td>
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<td>7/5</td>
<td>4.1</td>
<td>Ring Homomorphisms &amp; Ideals</td>
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<td>7/6</td>
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<td>Constructions with a Compass and Straightedge</td>
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<td>7/12</td>
<td>5.3</td>
<td>Finite Fields</td>
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<td>7/18</td>
<td>6.2</td>
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<td>7/19</td>
<td>6.3 Cosets, Normal Subgroups &amp; Quotient Groups</td>
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<td>7/20</td>
<td>6.3 Symmetric Group</td>
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<td>7/21</td>
<td>6.4</td>
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<td>7/24</td>
<td>7.1 Group Actions on a Set</td>
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<td>7/25</td>
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<td>Quiz 7</td>
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<td>7/26</td>
<td>7.2 The Symmetry Groups on Regular Polyhedra</td>
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<td>7/27</td>
<td>3.1-6.4</td>
<td>Exam 2</td>
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<td>7/28</td>
<td>7.5 Direct Products, p-Groups &amp; Sylow’s Theorems</td>
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<td>7/31</td>
<td>7.5</td>
<td>HW 7</td>
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<td>8/1</td>
<td>7.6 Galois Theory</td>
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<td>8/2</td>
<td>7.6</td>
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<td>8/3</td>
<td>7.6 Review</td>
<td>Quiz 8</td>
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<td></td>
<td>8/4</td>
<td>7.6</td>
<td>Final Exam</td>
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Prerequisites: C- or above in Math 1271 or equivalent

Course Objectives
In Calculus I (Math 1271) we were introduced to the main players on calculus— the derivative and the integral—and how they relate, the focus of Calculus II is on their use, both within mathematics and in applications. Broadly speaking, the class has four main goals (below each goal is a list of topic we will study to help us reach it):

- Learning how to integrate complicated functions.
  - techniques of integration (including integration by parts, simple trig substitutions, partial fractions); basic numerical integration; improper integrals; arc length; area of surface of revolution
- Using integration techniques to solve differential equations, especially those coming from physical or social systems.
  - separable differential equations; Euler’s method; exponential growth and decay.
- Using sequences and series to compute/approximate numbers or functions.
  - sequences and series, comparison and ratio tests; Taylor series and polynomials
- Studying geometric objects in two and three dimensions using tools from calculus.
  - parametric curves and polar coordinates; review of conic sections; vectors in three dimensions, dot product, cross product, lines, planes, cylinders, quadric surfaces; cylindrical and spherical coordinates

Grading Scale: Your grade will be weighted in the following categories...

**Quizzes:** every week and worth 25% of the final grade

**Exams:** 3 exams 60-minute in-class exams each worth 15% of the final grade

**Final Exam:** worth 30% of the final grade in-class on Monday, May 7 from 12-3pm

Quizzes
There will be a quiz nearly every Wednesday (except exam days). On exam weeks, there is a take-home quiz due Monday (labeled ‘T-H’). These quizzes will cover problems similar to the suggested homework list. There will be no make-up quizzes. Take-home quizzes are to be turned in at the beginning of class on the day that they are due and no late quizzes will be accepted. At the end of the semester your lowest 2 quiz scores will be dropped. You may use a scientific calculator or lower (no graphing calculators) on quizzes, but they are not required.

Exams
There will be three exams. The exams will take place during the first hour of class and consist problems that are similar to those discussed in class and in the homework.

- **Exam 1:** Wednesday, February 14 (roughly covering 5.5-8.4)
- **Exam 2:** Wednesday, March 2 (roughly covering 9.1-10.6)
- **Exam 3:** Wednesday, April 18 (roughly covering 11.1-11.11)
No books, notes, or computers allowed on exams. You will be allowed a nongraphing scientific calculator on all exams and quizzes.

Homework
Suggested homework will be assigned each class period. You will not be required to turn this homework in, but it is strongly suggested that you complete and understand these problems because similar problems will appear on the quizzes. Most of the assigned problems will be odd numbers so that you can check your answers in the back of the book.

Homework (and other) Questions
I love answering questions when we have the time in class. Unfortunately, as you will quickly see, our time together is very limited. It you are struggling with the particular homework problem, here are three good options:

a. Come to office hours.

b. If office hour times do not work for you, send me an e-mail about arranging a separate time to meet.

c. E-mail me: In your e-mail, please include
   (1) the Section and Problem # as well as
   (2) a description of what the problem asks and
   (3) what you have attempted to do, where you are stuck and what you are explicitly confused about.

   If your e-mail does not include this relevant information, responses may take much longer. You are encouraged to attached photos/scans of your work if that makes communication easier. I will either respond via e-mail or in class.

Calculator Policy
Only non-graphing scientific calculators are allowed on exams, quizzes and homework. Scientific calculators are inexpensive, have one-line displays and cannot display graphs of functions, perform symbolic manipulations, or store text in memory. If you are unsure whether your calculator is allowed, check with me before the day of the quiz. Cell phones and internet-connected devices are not allowed on quizzes, exams, or the final exam. You are not allowed to share calculators.

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- **Incomplete:** No incomplete grades will be given except in extraordinary circumstances. Moreover, to be eligible for an "I" you must successfully complete 70% of the course.

- **This Document:** You are responsible for knowing and adhering to the contents of this document. **Should the need arise, I reserve the right to add homework problems and assignments throughout the semester as well as alter the material to be covered on exams.**

- **Respect:** I expect us to behave like adults and to respect one another. Failure to do this is grounds for immediate removal from my class. Egregious incidents will be reported to the University for disciplinary action.

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- **Course Schedule**
  Please find a course schedule attached. Note that this is a *tentative* schedule and is subject to change throughout the semester.
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<tr>
<th>Week</th>
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*The answer should be (D) diverges.*
**Math 1142: Short Calculus**

**Room:** Folwell Hall 12  
**Time:** MTWHF 9:05-11am  
**office hours:** MTWHF 8:10-9am (classroom)  
**Textbook:** *Brief Calculus and Its Applications*, custom edition for the University of Minnesota  
by Goldstein, Lay, Schneider, Asmar  
**webpage:** math.umn.edu/~kling202/math1142_S16

**Instructor:** Kim Logan  
**e-mail:** kling202@umn.edu  
**office:** Vincent Hall 503

**Prerequisites:** C- or above in Math 1031 or 1051 or satisfactory score on the Placement Exam.  
**Note:** Math 1142 is not a prerequisite for any higher level math class.  
**Credits:** 4

**Course Objectives**  
This is a one-semester course covering the basic concepts and methods used in differential and integral calculus. The focus in this course is mostly on techniques and applications, with only a small consideration of mathematical theory. It is important for students here to be already comfortable with applying the material in the topics in either Math 1031 or Math 1051. A list of the topics with which students are expected to be familiar is given on the last page of this syllabus.  
This course satisfies the Mathematical Thinking component of the Liberal Education requirements at the University of Minnesota. An important component of a liberal education is to develop a working appreciation of mathematics as a body of thought which has been developed both for aesthetic reasons and to solve concrete problems. Developing your ability to translate real world problems into mathematics and to solve them using the mathematical techniques described in the course is an important goal. This course is meant to provide a base for future study in business and economics, as well as other fields that require a basic understanding of calculus.

**Grading Scale:** Your grade will be weighted in the following categories...

- **Quizzes:** almost every Monday, Wednesday and Friday and worth 20% of the final grade  
- **Exams:** 3 exams 50-minute in-class exams on June 24, July 8 and July 22 each worth 15% of the final grade  
- **Final Exam:** worth 35% of the final grade in-class on August 5

**Quizzes**  
There will be a quiz nearly every Monday, Wednesday and Friday (with the exception of exam days). These quizzes will cover the material from the suggested homework list. There will be no make-up quizzes. At the end of the semester your lowest 3 quiz scores will be dropped. You may use a scientific calculator or lower (no graphing calculators) on quizzes, but they are not required.

**Exams**  
There will be three exams. The exams will take place during the first hour of class and consist problems that are similar to those discussed in class and in the homework.

- **Exam 1:** June 24 (roughly covering 0.1-1.8)  
- **Exam 2:** July 8 (roughly covering 2.1-3.3)  
- **Exam 3:** July 22 (roughly covering 4.1-6.2)

No books, notes, computers or calculators allowed on exams.

**Homework**  
Suggested homework will be assigned daily. You will not be required to turn this homework in, but it is strongly suggested that you complete and understand these problems because similar problems will appear on the quizzes.
If you are deeply stuck on a particular problem please send me an email and/or bring that problem to office hours and ask a question about it there.

**Attendance**
Attendance will not be taken in class, but will be key to understanding the information presented in the textbook. This means that although there is not a percentage assigned to attendance, your presence in class will be reflected in the grades you receive on quizzes and on exams. Simply put, although it is not required that you attend class, it will be a necessary tool for success in the course.

**Succeeding In This Course**
This course will not be easy. It will require that you understand things *conceptually*, not merely mechanically. I will assign a substantial amount of work for you to do. It is important that you do this work if you wish to succeed. You will at times get confused while doing this homework because I will assign problems that require you to extend the concepts I have covered in class. I recognize that being confused is frustrating, but be assured it is an important and fruitful part of the learning process.
You should expect to spend 9 to 12 hours per week outside of class for your own preparation. Regular practice of assigned problems will increase your likelihood of success, as is true for any skill. The material in this course is covered at a steady and fairly rapid pace, so it will be important not to fall behind.

**Disability Accommodations**
The University is committed to providing quality education to all students regardless of ability. Determining appropriate disability accommodations is a collaborative process. You as a student must register with Disability Services and provide documentation of your disability. The course instructor must provide information regarding a course’s content, methods, and essential components. The combination of this information will be used by Disability Services to determine appropriate accommodations for a particular student in a particular course. For more information, please reference Disability Services:

**Academic Freedom and Responsibility**
Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgement and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgement about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*
Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [Customize with names and contact information as appropriate for the course/college/campus.]
* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students”.

**Additional Remarks and Policies**
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<tr>
<th>Week</th>
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<th>Sections</th>
<th>Events</th>
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|    | 7/13 | 4.6      | Quiz 10 | 4.6: 1-11 (odd), 19, 25, 31, 35, 39, 49 |
|    | 7/14 | 5.1      |      | 5.1: 1, 3, 11, 13, 15, 29, 31 |
|    | 7/15 | 5.1, 5.2 | Quiz 11 | 5.2: 3, 9, 11, 15, 7, 21 |
| VI | 7/18 | 5.3, 5.4 | Quiz 12 | 5.3: 1, 3, 9, 11, 19, 21  
|    |      |          |      | 5.4: 6, 7, 11  |
|    | 7/19 | 6.1      |      | 6.1: 1-23 (odd), 27, 33, 43, 45, 55, 59, 61 |
|    | 7/20 | 6.2      | Quiz 13 | 6.2: 3, 7, 17, 21, 23, 25 |
|    | 7/22 |          | Exam 3 |        |
| VII | 7/25 | 6.4, 6.5 | Quiz 14 | 6.4: 2, 7, 9, 13, 17, 21, 29  
|    |      |          |      | 6.5: 5, 7, 9, 23, 27, 29, 35 |
|    | 7/26 | 9.1, 9.2 |      | 9.1: 1, 7, 13, 23, 31  
|    |      |          |      | 9.2: 3, 5, 13, 15, 21 |
|    | 7/27 | 9.3      | Quiz 15 | 9.3: 3, 5, 13-16 |
|    | 7/28 | 9.5, 9.6 |      | 9.5: 1, 5, 9, 11, 13  
|    |      |          |      | 9.6: 13, 21, 33, 35, 48 |
|    | 7/29 | 7.1      | Quiz 16 | 7.1: 1, 7, 9, 15, 23-26 |
| VIII | 8/1 | 7.2      | Quiz 17 | 7.2: 3, 7, 9, 15, 19, 21, 23, 25, 27, 35 |
|    | 8/2 | 7.3, 7.4 |      | 7.3: 1, 5, 11, 13, 17, 19, 23, 25  
|    |      |          |      | 7.4: 1-10, 12, 14, 21 |
|    | 8/3 | 7.6      | Quiz 18 | 7.6: 1-12 |
|    | 8/4 |          | Review |        |
|    | 8/5 |          | Final Exam |      |
Prerequisites: The prerequisites for this course are

(1) Satisfactory completion of Math 115, or

(2) Placement at the Math 120 level (or above) on the mathematics assessment test offered by Diagnostic Services.

This is elaborated later in the syllabus in order to make clear what is expected of you.

Introduction

From the catalog:

“This course is designed to prepare students for calculus. Topics include polynomial, rational, exponential, logarithmic, and trigonometric functions; the algebra of functions; multiple function representations; and an introduction to analytic geometry.”

Notice the emphasis on functions in this description. My goal in this course is to ensure you have a sufficiently developed understanding of the concept of a function to ensure your success in future mathematical endeavors. In particular, I will introduce you to the elementary analytic, algebraic, and geometric properties of certain classes of functions that are of extreme importance in the natural and social sciences. Furthermore, given that this is a precalculus class, I would like to ensure that you are competent in the material expected of you in order to be successful in calculus: algebra, visual representations of functions and basic unit circle trigonometry.

Succeeding In This Course

This course will not be easy. It will require that you understand things conceptually, not merely mechanically. I will assign a substantial amount of work for you to do. It is important that you do this work if you wish to succeed. You will at times get confused while doing this homework, because I will assign problems that require you to extend the concepts I have covered in class. I recognize that being confused is frustrating, but be assured it is an important and fruitful part of the learning process.

The center for academic excellence is a wonderful resource, please use them. The very best students are those who take advantage of all the resources available to them.

Grading Scale

Your grade will be weighted in the following categories...

- **Examples**: All example sets will be equally weighted and, combined, will account for 10% of your grade.
- **Quizzes**: All quizzes will be equally weighted, and combined these account for 30% of your grade.
- **Midterm**: There will be one midterm July 3rd worth 20% of your grade.
- **Final**: There will be one final on August 14th worth 20% of your grade
- **Projects**: You will be required to do one project due August 14th worth 20% of your grade.
Homework Policy
Homework will be assigned but is not graded, but the daily quizzes are drawn from homework problems. If you are deeply stuck on a particular problem and cannot find time to go to a tutoring center, please bring that problem to class and ask a question about it there. It is extremely unlikely that you are the only person confused about it, and such questions help everyone to understand the material better.

Examples
On ten occasions (of your choosing) throughout the semester, you are to copy all of the examples in the text by hand and present them to me in class. The examples you present to me that day should be covering all of the examples in each section that is to be covered in class that day. You will not receive credit if you copy the examples from sections that have already been discussed in class in previous weeks. Nor will you receive credit if you copy only some of the examples.

Quizzes
Each class there will be two quizzes given: one at the beginning of class and one at the end of class. The first quiz will consist of a few (three or four) problems randomly selected from the homework assignment for that day. Note that you will be allowed to have your homework with you when taking the quiz, so if you have done the homework you can copy your answers from the homework onto the quiz. The second quiz will ask a number of algebraic computation problems (see Appendix B for examples). There may occasionally be one or two conceptual questions about material covered in the lectures or extremely elementary applications of these concepts. The questions will all have answers that come directly from the lecture. Quizzes cannot be made up. Contact me if you miss quizzes.

Exams
There will be one midterm exam and one final examination. If you will miss an exam, let me know as far in advance as possible; we can arrange for you to take the test at a testing center. The exams will consist of 10-20 problems that are similar to those discussed in class, homework and quiz problems as well as questions regarding definitions and class results.

Midterm: July 3
Final: August 14
I may “curve” the midterm and final grades. Grades will match the usual scale: for an A, 90% or above is needed, for a B, 80% or above, etc, after any curving.

Projects
The material presented in class will relate to a more advanced topic in mathematics, which we will explore in order to motivate the material being covered. You are responsible for further studying one of these topics on your own, and writing a 3-6 page paper about some aspect of this research. A more detailed description of this project will be handed out separately. You will not be required to turn in a draft, but are highly encouraged to do so. You will then edit your draft and then resubmit a final draft of the paper. Failure to submit a draft may result in a substantial reduction in the grade you receive on this part of the class.

Important Note about Projects: The topics covered and questions asked in these projects are way too difficult. However, my choice to assign them is intentional. I am giving you permission to try and still fail without fatal repercussions. The goal of the projects is to let you push yourself and work at learning something completely foreign on your own terms. You will thus be graded on (a) apparent effort, (b) creativity, and (c) your ability to improve based on my comments. While these criterion may seem subjective, it is blatantly obvious which projects have taken much time, care and thought, and which have been submitted hastily and I will grade them accordingly. If you decide to start this project the week it is due, you will not like your grade, nor will you gain much (if anything) intellectually from the project.

Additional Remarks and Policies
- Incompletes: No incomplete grades will be given except in extraordinary circumstances. Moreover, to be eligible for an “I” you must successfully complete 70% of the course.
• **This Document:** You are responsible for knowing and adhering to the contents of this document. **I reserve the right to add quizzes and homework problems throughout the semester should the need arise.**

• **Respect:** I expect us to behave like adults and to respect one another. Failure to do this is grounds for immediate removal from my class. Egregious incidents will be reported to the University for disciplinary action.

• **Academic Honesty:** Please do work together if that helps you learn. Do not cheat. I will probably catch you, and have a zero-tolerance policy. If you cheat, you fail my class, and are immediately referred to the university for disciplinary action. Do not cheat.

• **Frustration:** You will get confused sometimes. This is ok. If your confusion is causing you to get frustrated, this too is ok. Please, before giving up on the class, give up on the problem/activity that is causing the frustration.

• **Course Schedule**

Please find a course schedule attached.

Explicit Prerequisites
It is expected that you are comfortable with basic arithmetic, algebra and graphing in Cartesian (rectangular) coordinates. You will be quizzed on such material (both implicitly and explicitly) weekly. In order to test your knowledge and/or review, I recommend you look at:

- **Appendix B**—Make sure that you all able to confidently do all of the exercises in each section of this appendix.

- **Chapter 1**—*Complete the Chapter Review* at the end of this chapter and refer back to the appropriate section if there is any material that you would like to further review. Other specific problems to be familiar with are:
  
  - 1.2: #1-16, 23, 24, 49-60 (multiples of 3), 65, 66.
  - 1.6: #1-4, 12, 15-28 (evens).

- **Chapter 2**—*Complete the Chapter Review* at the end of this chapter and refer back to the appropriate section if there is any material that you would like to further review. Other specific problems to be familiar with are:
  

If doing these exercises is more than just a ‘refresher,’ you are not ready for this course.
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Sections</th>
<th>Homework (To be completed prior to the next class meeting.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/15</td>
<td>Introduction, Fundamentals and Functions</td>
<td>1.1, 12.1, 3.1</td>
<td>Bold problems may be on the quiz and the rest are recommended for extra practice.</td>
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</tbody>
</table>
| 5/22 | More on Functions and Average Rates of Change | 3.3, 3.5, 3.6 | Assignment 1:  
  - ‘Explicit Prerequisites’ problems  
  - 1.1: #1-10 (evens).  
  - 12.1: #1-51 (odds).  
| 5/29 | Graphing Functions                        | 3.2, 3.4       | Assignment 2:  
  - 3.3: #3, 5, 9-16 (evens), 23-27, 41-44.  
  - 3.5: #1-20 (evens).  
  - 3.6: #1-21, 48-52. |
| 6/05 | Linear, Quadratic Functions and Min and Max Problems | 4.1, 4.2, 4.5 | Assignment 3:  
  - 3.2: #1-18 (evens), 23, 26, 35, 36.  
| 6/12 | Polynomials and Rational Functions        | 4.6, 12.2      | Assignment 4:  
  - 4.1: #1-14 (evens), 37, 41-44, 50-52, 54.  
  - 4.2: #6-30 (evens), 57-62.  
  - 4.4: #1-15 (evens).  
  - 4.5: #1-20 (evens). |
|      |                                           |                | Assignment 5:  
  - 4.6: #1-43 (odds), 65.  
  - 4.7: #1-45 (odds).  
  - 12.3: #1-23 (odds).  
  - 12.4: #1-17 (odds), 12.3-12.4 worksheet |
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Sections</th>
<th>Assignment</th>
</tr>
</thead>
</table>
| 6/19  | Division of Polynomials and Partial Fraction Decomposition           | 12.2, 12.7, 12.8 | Assignment 6:  
- 12.2: #1-39 (odds).  
- 12.7: #1-22 (evens).  
- 12.8: #1-31 (odds). |
| 6/26  | Exponential and Logarithmic Functions and Review                     | 5.1, 5.3; Review | Assignment 7:  
- 5.1: #1-31 (odds), 45, 46, 47.  
- 5.3: #1-31 (odds), 69, 70. |
| 7/03  | Midterm Exam                                                         | In Class   | The test will cover the material from class lectures 1-6 and homework assignments 1-6. |
| 7/10  | Logarithmic and Trigonometric Functions                              | 5.4-5.5, 6.1 | Assignment 8:  
- 5.4: #3-66 (multiples of 3), 81, 83  
- 5.5: #3-72 (multiples of 3).  
- 6.1: #1-27 (odds). |
| 7/17  | More Trigonometry                                                   | 6.2, 7.1, 6.3, 6.4 | Assignment 9:  
- 6.2: #1-73 (odds).  
- 7.1: #1-45 (odds).  
- 6.3: #1-27 (odds).  
- 6.4: #1-61 (odds), 69, 71 |
| 7/24  | Graphs of Trigonometric Functions, DeMoivre’s Theorem and Trigono- | 7.2-7.3, 7.5, 13.6, 8.1, 8.2 | Assignment 10:  
- 7.2: #1-35 (odds), 57, 59.  
- 7.3: #1-31 (odds).  
- 7.5: #1-11 (odds), 21-33 (odds).  
- 13.6: #1-28 (multiples of 3), 73, 74.  
- 8.1: #3-60 (multiples of 3).  
- 8.2: #3-48 (multiples of 3).  
Projects to be chosen before this date. |
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Section</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/31</td>
<td>More Analytical Trigonometry</td>
<td>8.4, 8.5</td>
<td>Assignment 11:</td>
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<td>- 8.4: #1-23 (odds), 45-51 (odds).</td>
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<td></td>
<td></td>
<td>- 8.5: #1-33 (odds).</td>
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<tr>
<td>8/07</td>
<td>Polar Coordinates and Review</td>
<td>9.6, 9.7; Review</td>
<td>Assignment 12:</td>
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<td>- 9.6: #1-24 (odds), 57, 59.</td>
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<td></td>
<td>- 9.7: #11-30 (odds).</td>
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<td></td>
<td>Project drafts due by this date.</td>
</tr>
<tr>
<td>08/14</td>
<td>Final Exam</td>
<td>In Class</td>
<td>The final is not cumulative. The test will cover the material from lectures 8-12 and homework assignments 8-12</td>
</tr>
</tbody>
</table>
SAMPLE WORKSHEETS
1.4 Rings, Integral Domains and Fields

Define the following ...

**Ring:** A set $R$ closed under 2 operations: $+$ & $\times$ is called a ring if the following hold:

1. **Additive commutative:** $\forall a, b \in R, a + b = b + a$
2. **Additive associative:** $\forall a, b, c \in R, (a + b) + c = a + (b + c)$
3. **Additive identity:** $\exists 0 \in R \text{ s.t. } \forall a \in R, 0 + a = a$
4. **Additive inverse:** $\exists -a \in R \text{ s.t. } a + (-a) = 0$
5. **Multiplicative associative:** $\forall a, b, c \in R, (ab)c = a(bc)$
6. **Multiplicative identity:** $\exists 1 \in R \text{ s.t. } \forall a \in R, 1a = a$
7. **Multiplication distributes over $+$:** $\forall a, b, c \in R, a(b + c) = ab + ac$

Come up with as many examples as you can think of:

$\mathbb{Z}, \mathbb{Z}_m, \mathbb{R}, M(\mathbb{Z}), M(\mathbb{R}), \mathbb{Q}, \mathbb{C}$

**Integral Domain:**

A commutative ring with no zero divisors

$\forall a, b \in R, ab = 0 \Rightarrow a = 0 \text{ or } b = 0$

Are any of your above examples also examples of an integral domain? If not, what is an example of an integral domain?

**Field:** A commutative ring where every non-zero element has a unit

$M(\mathbb{Z}) \text{ & } M(\mathbb{R})$ are not

Are any of your above examples also examples of a field? If not, what is an example of a field?

$\mathbb{Z}_p, \mathbb{R}, \mathbb{Q}, \mathbb{C}$

$\mathbb{Z}, \mathbb{Z}_m$
1. (a) Show that \( R = \{a + b\sqrt{2} \mid a, b \in \mathbb{Z}\} \) is a commutative ring (with addition and multiplication defined as usual).

Let \( x, y, z \in R \) so \( x = a + b\sqrt{2}, y = c + d\sqrt{2}, z = e + f\sqrt{2} \) for \(a, b, c, d, e, f \in \mathbb{Z} \.

**Closure:**
\[
x + y = (a + b\sqrt{2}) + (c + d\sqrt{2}) = (a + c) + (b + d)\sqrt{2} \in R
\]
\[
x + z = (a + b\sqrt{2}) + (e + f\sqrt{2}) = (a + e) + (b + f)\sqrt{2} \in R
\]
\[
x + y + z = (a + b\sqrt{2}) + (c + d\sqrt{2}) + (e + f\sqrt{2}) = (a + c + e) + (b + d + f)\sqrt{2} \in R
\]
\[
x \cdot y = (a + b\sqrt{2}) \cdot (c + d\sqrt{2}) = ac + ad\sqrt{2} + bc\sqrt{2} + bd\sqrt{2} = (ac + 2bd) + (ad + bc)\sqrt{2} \in R
\]
\[
x \cdot z = (a + b\sqrt{2}) \cdot (e + f\sqrt{2}) = ae + af\sqrt{2} + be\sqrt{2} + bf\sqrt{2} = (ae + bf) + (af + be)\sqrt{2} \in R
\]
\[
x \cdot y \cdot z = (a + b\sqrt{2}) \cdot (c + d\sqrt{2}) \cdot (e + f\sqrt{2}) = (a + b\sqrt{2})(c + d\sqrt{2}) \cdot (e + f\sqrt{2}) = \ldots \in R
\]

**Commutativity:**
\[
x + y = y + x
\]
\[
x \cdot y = y \cdot x
\]

**Additive Identity:**
\[
0 + x = x
\]
\[
x + 0 = x
\]

**Additive Inverse:**
\[
x + (-x) = 0
\]
\[
-x + x = 0
\]

**Multiplicative Identity:**
\[
1 \cdot x = x
\]
\[
x \cdot 1 = x
\]

**Multiplicative Inverse:**

(b) Is \( R \) an integral domain?

**Yes:**

It is commutative under \(+\).

And has no zero divisors.

(c) What are the units of \( R \)?

Only \( \pm 1 = \pm 1 + 0\sqrt{2} \) are units!!
2. Let $M_2(\mathbb{Z}) = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} \mid a, b, c, d \in \mathbb{Z} \right\}$

(a) Is $M_2(\mathbb{Z})$ a ring? If so, what are the additive and multiplicative identities?

Yes $1_M = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $0_M = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

(b) Is $M_2(\mathbb{Z})$ commutative? If so, prove it. If not, demonstrate a case where commutativity fails.

No $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$

$AB = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ but $BA = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

(c) Prove that $A \in M_2(\mathbb{Z})$ is a unit if and only if $\det(A) = \pm 1$.

$\Rightarrow$ Assume $A \in M_2(\mathbb{Z})$ is a unit.

By Cor. 2.10 (p. 390), $\det(A^{-1}) = \frac{1}{\det(A)}$ but $\det(A^{-1}) \in \mathbb{Z} \Rightarrow \det(A) = \pm 1$.

$\Leftarrow$ Assume $\det(A) = \pm 1$, where $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

Then $A^{-1} = \frac{1}{\pm 1} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix} \in M_2(\mathbb{Z})$.

And $AA^{-1} = A^{-1}A = 1$.

(d) Prove that $B \in M_2(\mathbb{Z})$ is a zero divisor if and only if $\det(B) = 0$ and $B$ is not the zero matrix.

$\Rightarrow$ Assume $B \in M_2(\mathbb{Z})$ is a zero divisor. $\Rightarrow B$ is a zero divisor.

Then $B \neq 0_M$ and $AB = 0_M$ for some $A \neq 0_M$ in $M_2(\mathbb{Z})$.

$\Rightarrow$ $\det(AB) = \det(A) \cdot \det(B) = 0$.

If $\det(A) \neq 0$ then $A$ is invertible in $M_2(\mathbb{Z})$.

$\Leftarrow$ Assume $\det(B) = 0$ and $B \neq 0_M$. If $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, let $A = \begin{bmatrix} -d & c \\ -b & a \end{bmatrix}$

Then $BA = 0_M$ but $A \neq 0_M$. Thus $B$ is a zero divisor.
3. (a) Make multiplication tables for \( \mathbb{Z}_6 \) and \( \mathbb{Z}_8 \).

\[
\begin{array}{c|cccccc}
\mathbb{Z}_6 & 0 & 1 & 2 & 3 & 4 & 5 \\
\hline
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 2 & 3 & 4 & 5 \\
2 & 0 & 2 & 4 & 0 & 2 & 4 \\
3 & 0 & 3 & 0 & 3 & 0 & 3 \\
4 & 0 & 4 & 2 & 0 & 4 & 2 \\
5 & 0 & 5 & 4 & 3 & 2 & 1 \\
\end{array}
\quad
\begin{array}{c|cccccc}
\mathbb{Z}_8 & 0 & 1 & 2 & 3 & 4 & 5 \\
\hline
0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 2 & 3 & 4 & 5 \\
2 & 0 & 2 & 4 & 0 & 2 & 4 \\
3 & 0 & 3 & 6 & 1 & 4 & 7 \\
4 & 0 & 4 & 0 & 4 & 0 & 4 \\
5 & 0 & 5 & 2 & 7 & 4 & 1 \\
6 & 0 & 6 & 4 & 2 & 0 & 6 \\
7 & 0 & 7 & 6 & 5 & 4 & 3 \\
\end{array}
\]

(b) Prove that \( \text{gcd}(a, m) = 1 \) if and only if \( \bar{a} \in \mathbb{Z}_m \) is a unit.

\[\Rightarrow \text{Assume gcd}(a, m) = 1. \text{ Then } \exists x, y \in \mathbb{Z} \text{ such that } \]
\[a x + m y = 1 \Rightarrow a x - 1 = -m y \Rightarrow m \mid (a x - 1) \Rightarrow a x \equiv 1 \pmod{m}\]

Since \( \mathbb{Z}_m \) is commutative, \( \bar{a} \) is a unit.

\[\Leftarrow \text{Assume } \bar{a} \in \mathbb{Z}_m \text{'s a unit}. \text{ Then } \bar{a} \bar{b} = \bar{0} \Rightarrow \bar{b} \text{ too.} \text{ Since } \mathbb{Z}_m \Rightarrow \bar{a} \bar{b} \equiv 1 \pmod{m} \Rightarrow m \mid (a b - 1) \Rightarrow m \mid k (a b - 1) \Rightarrow m k = a b - 1 \Rightarrow 1 = a b - m k \Rightarrow \]
\[\text{gcd}(a, m) = 1.\]

(c) Prove that if \( \bar{a} \in \mathbb{Z}_m \) is a zero divisor then \( \text{gcd}(a, m) > 1 \) and conversely, provided \( m \) does not divide \( a \).

\[\Rightarrow \text{Assume } \bar{a} \in \mathbb{Z}_m \text{'s a zero divisor}. \text{ This means } \bar{a} \bar{b} = \bar{0} \text{ where } \bar{a} \neq \bar{0} \text{ and } \bar{b} \neq \bar{0}. \text{ For } \bar{b} \in \mathbb{Z}_m \Rightarrow a b \equiv 0 \pmod{m} \Rightarrow m \mid a b. \Rightarrow m \mid k \Rightarrow k \notin \mathbb{Z}_m \text{ so } m k = a b = \prod p_i^{n_i} \Rightarrow m \mid \prod p_i^{n_i} \Rightarrow m \mid p_i^{n_i} \Rightarrow m \mid p_i \Rightarrow m \mid p_i \mid a \Rightarrow \text{gcd}(a, m) > 1.\]

\[\Leftarrow \text{Assume } \text{gcd}(a, m) = 1 \text{ and } m \mid a. \Rightarrow \text{gcd}(a, m) = 1 \text{ and } m \mid a. \Rightarrow d \mid m \text{ and } d \mid a \Rightarrow \exists x, y \in \mathbb{Z} \text{ so } d x = m \text{ and } d y = a. \text{ Consider } a x = d y x = y d x = y m \Rightarrow m \equiv 0 \pmod{d x}\]

Thus by (c) \( \bar{a} \) is a zero divisor.

(d) Prove that every nonzero element of \( \mathbb{Z}_m \) is a unit or a zero divisor.

Let \( \bar{a} \in \mathbb{Z}_m. \) Assume that \( \bar{a} \) is not a unit.

Then \( \text{gcd}(a, m) > 1 \) by (b).

Since \( \bar{a} \neq \bar{0} \) we know \( m \mid a. \)

Thus by (c) \( \bar{a} \) is a zero divisor.
(e) Prove that in any commutative ring \( R \), a zero-divisor cannot be a unit and a unit cannot be a zero-divisor.

Let \( R \) be a commutative ring.
Assume \( a \in R \) is a zero divisor so \( \exists b \in R \) where \( a \neq 0 \) but \( ab = 0 \). Assume that \( a \) is also a unit so \( a^{-1} \in R \). Then \( a^{-1}ab = a^{-1}0 = 0 \).

But \( b \neq 0 \rightarrow \not{x(a^{-1}b) = 1 \cdot b = b} \).
Not that the order of assumptions does not matter.

(f) Do you think (d) holds for a general commutative ring \( R \)?

\( \text{No: Example } \mathbb{Z} \).

4. (a) Show that if \( a, b \in R \) have multiplicative inverses, then \( ab \) has a multiplicative inverse.

Let \( a, b \in R \) have multiplicative inverses.
Call them \( a^{-1}, b^{-1} \in R \) so that

\[ a a^{-1} = a^{-1} a = 1 \quad \& \quad b b^{-1} = b^{-1} b = 1 \]

Now \( (ab) \cdot (b^{-1} a^{-1}) = a b b^{-1} a^{-1} = a a^{-1} = 1 \). \&

\[ (b^{-1} a^{-1}) \cdot (ab) = b^{-1} a^{-1} a b = b^{-1} b = 1 \]

Thus \( ab \) has a multiplicative inverse.

(b) What is the multiplicative inverse of \( ab \)?

\[ (ab)^{-1} = b^{-1} a^{-1} \]

(c) Give an example of why \( (ab)^{-1} = a^{-1} b^{-1} \) may fail.

\( R \) may not be commutative so

\[ (ab) (a^{-1}b^{-1}) = ab a^{-1} b^{-1} \neq a a^{-1} b b^{-1} \]

Other recommended exercises: 1.4 # 1, 3, 4, 5, 6, 7, 10, 11, 12, 18.
Groups

What is a group? A group is a set $G$ which is closed under an operation $\cdot$ so that:

1. **Associativity:** For all $a, b, c \in G$, $(a \cdot b) \cdot c = a \cdot (b \cdot c)$
2. **Identity:** There exists an element $e \in G$ such that $e \cdot a = a = a \cdot e$ for all $a \in G$
3. **Inverses:** For every $a \in G$, there exists an element $a^{-1} \in G$ so that $a \cdot a^{-1} = e = a^{-1} \cdot a$

Give some examples of groups and their operations:

$\mathbb{Z}$, $(\mathbb{Z}_n, +)$, $(\mathbb{Q}, +)$, $(\mathbb{R}, +)$, $(\mathbb{Z}/2\mathbb{Z}, +)$

What does it mean for a group to be abelian?

\[ a \cdot b = b \cdot a \quad \forall a, b \in G. \]

1. What's purple and commutes?

   An abelian group!

2. Which of the following are groups?

   - (a) \{1, 3, 7, 9\} $\subset \mathbb{Z}_{10}$ with multiplication
     \[ \text{YES} \]

   - (b) \{0, 2, 4, 6\} $\subset \mathbb{Z}_{10}$ with addition
     \[ \text{NO, not closed under +:} \quad 4 + 4 = 8 \]

   - (c) \{x $\in \mathbb{Q}$ | $0 < x \leq 1$\} with multiplication
     \[ \text{NO, does not contain x inverses.} \]

   - (d) \{ix | x $\in \mathbb{R}$\} with addition
     \[ \text{YES} \]

   - (e) $\mathbb{Z}$ with $a \cdot b = a - b$
     \[ \text{NO, not associative!!!} \quad a - (b - c) \neq (a - b) - c \]

   - (f) $\mathbb{Z}$ with $a \cdot b = a + b + 1$
     \[ \text{YES} \]
3. Let $SL_2(\mathbb{R})$ be the set of $2 \times 2$ matrices with entries in $\mathbb{R}$ and determinant 1. Show that $SL_2(\mathbb{R})$ is a group under matrix multiplication.

$SL_2(\mathbb{R}) = \left\{ \begin{bmatrix} a & b \\ c & d \end{bmatrix} \mid a, b, c, d \in \mathbb{R} \text{ and } ad - bc = 1 \right\}$

Let $A, B \in SL_2(\mathbb{R})$

Closed under $\cdot$: $AB = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{bmatrix} \in M_2(\mathbb{R})$

Also $\det(AB) = \det A \cdot \det B = 1 \cdot 1 = 1 \Rightarrow A, B \in SL_2(\mathbb{R})$

Associative: Matrix multiplication is associative ($M_2(\mathbb{R})$ is a ring)

Identity: $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} A = A \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = A \cdot A \in SL_2(\mathbb{R})$.

$\det \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = 1 \Rightarrow \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \in SL_2(\mathbb{R})$

Inverses: Since $\det A \neq 0$, $A$ is invertible.

$A^{-1} = \frac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix} = \begin{bmatrix} d & -b \\ -c & a \end{bmatrix} \in M_2(\mathbb{R})$

$\det A^{-1} = \frac{1}{\det A} (ad - bc) = \det A^{-1} = 1 \Rightarrow A^{-1} \in SL_2(\mathbb{R})$.

4. (a) Prove that if $\gcd(a, m) = 1$ then the cyclic subgroup $(a)$ of $\mathbb{Z}_m$ is the whole group.

Let $\gcd(a, m) = 1$. Then $\exists x, y \in \mathbb{Z}$ so that $xa + ym = 1$, by the E. A.

Let $b \in \mathbb{Z}_m$. Then $b = bx + bym = (bx)a + (by)m = (b\bar{x})a$ in $\mathbb{Z}_m$ where $bx \in \mathbb{Z}$

$\Rightarrow b \in \langle a \rangle$. Thus $\langle a \rangle = \mathbb{Z}_m$.

(b) What can you deduce about $\mathbb{Z}_m$ under addition from (a)?

$\mathbb{Z}_m$ is a cyclic group under $+$!

generated by $a$ when $\gcd(a, m) = 1$.

($\Rightarrow \mathbb{Z}_p$ is cyclic generated by any element $\neq 0$)
5. This example examines the symmetries of an equilateral triangle and works to develop a notation for symmetric groups.

(a) Draw an equilateral triangle and label the three vertices \{A, B, C\}.

(b) Rotate your triangle counterclockwise 120° and label the new corresponding vertices. Then rotate counterclockwise another 120° (240° rotation of the original triangle in (a)) and label the vertices.

What happens if you do another rotation?

\textbf{You get back to the original } \Delta \text{ in (a)}

(c) Sketch an axis through vertex A bisecting the opposite edge, flip the triangle over this axis and label the new corresponding vertices. Then do the same thing with the remaining two vertices on the original triangle in (a).

What happens if you do another flip along the same axis?

\textbf{You get back to the original } \Delta \text{ in (a)}

(d) Label each of the following motions of the triangle:
(a) \(I\) (the unmoved triangle), the two rotations in (b) \(R_1\) (rotating counterclockwise 120°) and \(R_2\) (rotating counterclockwise 240°) and the three flips in (c) \(F_L\) (flip fixing the bottom left vertex), \(F_R\) (flip fixing the bottom right vertex) and \(F_T\) (flip fixing the top vertex).

We can think of each of the rotations and flips by where it maps each of the vertices of the original triangle in (a). For example, \(R_1\) sends \((A, B, C)\) to \((C, A, B)\). We can denote this as

\[R_1 = \begin{pmatrix} A & B & C \\ C & A & B \end{pmatrix}\]

Use this notation to describe the remaining rotations and flips.

\[I = \begin{pmatrix} A & B & C \\ A & B & C \end{pmatrix}\]

\[F_L = \begin{pmatrix} A & B & C \\ A & C & B \end{pmatrix}\]

\[F_R = \begin{pmatrix} A & B & C \\ C & B & A \end{pmatrix}\]

\[F_T = \begin{pmatrix} A & B & C \\ B & A & C \end{pmatrix}\]

Note that this is all permutations of the elements \(\{A, B, C\}\).
(e) Let $S = \{I, R_1, R_2, F_L, F_R, F_T\}$ and define consider the operation $\cdot$ to composition of any two symmetries. Write out a 'multiplication table' for $S$ under this composition.

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(2nd term)

(f) Does $S$ under $\cdot$ form a group? Why or why not?

**YES** closed, contains identity $I$ and every element has an inverse (closure assoc.)

(g) Is it abelian? **NO**. $xy \neq yx \quad \forall x, y \in G$.

$h \cdot F_L \neq F_L \cdot h$

(h) Is it cyclic? **NO**. not generated by 1 element but by $2$, (rotation x flip)

6. Define $\mathcal{V}$ to be the set of four elements under the operation $\cdot$ defined by:

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(a) Does $\mathcal{V}$ under $\cdot$ form a group? Why or why not?

**YES** has identity $e$, closed under $\cdot$. $\mathcal{V}$ has inverses for all elements.

(b) Is it abelian? **YES** $xy = yx \quad \forall x, y \in D$. 

4
(c) Is it cyclic? **No** generated by 2 elements

(d) Compare the multiplication table above with the addition tables of \(Z_4\) and \(Z_2 \times Z_2\). What do you notice?

\[
\begin{array}{c|cccc}
+ & 0 & 1 & 2 & 3 \\
\hline
0 & 0 & 1 & 2 & 3 \\
1 & 1 & 2 & 3 & 0 \\
2 & 2 & 3 & 0 & 1 \\
3 & 3 & 0 & 1 & 2 \\
\end{array}
\]

\[
\begin{array}{c|cccc}
\times & (0,0) & (0,1) & (1,0) & (1,1) \\
\hline
(0,0) & (0,0) & (0,1) & (1,0) & (1,1) \\
(0,1) & (0,1) & (0,0) & (1,1) & (1,0) \\
(1,0) & (1,0) & (1,1) & (0,0) & (0,1) \\
(1,1) & (1,1) & (1,0) & (0,1) & (0,0) \\
\end{array}
\]

\[\text{It is generated by } (1,2) \times (0,1) \times (1,0) \times (0,0).\]

\[\text{It is the Klein 4-group.}\]

(e) Examine the symmetries of the non-square rectangle and confirm that they are represented by \(V\).

\[
\begin{array}{c|c}
\text{see p. 176 Ex. #5:} & \\
\hline
& 3 \\
\end{array}
\]

\[
\begin{array}{c}
\tau = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{pmatrix} \\
\rho = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \end{pmatrix} \\
F_1 = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{pmatrix} \\
F_2 = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \end{pmatrix} \\
\end{array}
\]

\[\text{It is a group of order 4.} \]

\[\rho \cdot \tau = \tau \rho \neq \tau \quad \text{in } Z_2 \times Z_2.\]

\[\text{Since } \tau \cdot \tau = I.\]

*Other recommended exercises: 6.1 # 1 2 4 5 7 10 17 18 19 21 22 23 24*
From Groups to Galois

**GOAL:** To show that a general polynomial of degree \( n \geq 5 \) cannot be solved by radicals.

How can we rephrase our **GOAL** in terms of splitting fields?

To show that a poly \( f(x) \) of deg \( n \geq 5 \) does not have a splitting field \( K \) with only radicals in terms of \( \alpha \).

Let \( F \) be a field. For our purposes we can think \( F = \mathbb{Q} \).

Galois theory is very closely related to the theory of splitting fields. When we were looking for a splitting field, we were looking for a field extension \( K \) of \( F \) that contained all the roots of some irreducible polynomial \( f(x) \in F[x] \).

The Building Blocks...

Let \( K \) be a field extension of \( F \).

What is the **Galois group of** \( K \) over \( F \)?

\[
\text{Gal}(K/F) := \{ \phi : K \rightarrow K | \text{isomorphism and fixes } F \} \quad \phi \sigma = f \forall f \in F.
\]

Observe that \( \text{Gal}(K/F) \) forms a group under function composition.

- \( \text{Gal}(K/F) \) is closed since comp of isomorph \( K \rightarrow K \) is an isomorphism.
- \( \text{Gal}(K/F) \) is associative under comp b/c hom's are.
- \( \text{Gal}(K/F) \) contains inverses of each iso. \( K \rightarrow K \).
- \( \text{Gal}(K/F) \) contains the identity hom.

**EXAMPLE:** Find the Galois group of \( \mathbb{Q}[i] \) over \( \mathbb{Q} \).

\[
\text{Gal}(\mathbb{Q}(i)/\mathbb{Q}) = \{ \phi : \mathbb{Q}(i) \rightarrow \mathbb{Q}(i) | \phi | \alpha = id \} \quad \phi i = i.
\]

\[
\phi(c + di) = c + di
\]

\[
\phi(c + di) = \phi(c) + \phi(d)i = a + b \phi(i) \quad (\text{since } \phi \text{ fixes } \mathbb{Q})
\]

Thus \( \phi \) is determined by where it sends \( i \).

Let \( \phi(i) = c + di \) for \( c, d \in \mathbb{R} \).

\[
-1 = \phi(1) = \phi(i \cdot i) = \phi(i) \cdot \phi(i) = (c + di)(c + di) = c^2 + 2cdi - d^2 = c^2 - d^2 + 2cdi
\]

\[
\rightarrow cd = 0 \quad \text{or } \quad c^2 - d^2 = -1
\]

\[
\Rightarrow c = 0 \quad \text{or } \quad d = \pm 1
\]

\[
\Rightarrow \phi(i) = \pm i.
\]

\( \Rightarrow \phi(1 + ai) = a + bi \) are the only elements of \( \text{Gal}(\mathbb{Q}(i)/\mathbb{Q}) \).

\[
\phi = id \quad \phi(1 + ai) = a + bi
\]

\[
\Rightarrow |G| = 2.
\]
As you can imagine, finding the Galois group of an extension $K$ over a field $F$ gets more complicated as the degree of the extension grows (for example, consider $\mathbb{Q}[i, \sqrt{2}]$ over $\mathbb{Q}$). Thus the following Lemma is very helpful for computing Galois groups:

**Lemma 6.2** Let $K \supset F$ and $\alpha \in K$ be a root of $f(x) \in F[x]$.

Then for any $\phi \in \text{Gal}(K/F)$, $\phi(\alpha)$ is also a root of $f(x)$ in $K$.

Moreover, if $K$ is a splitting field of $f(x)$ and $f(x)$ has distinct roots $\alpha_1, \ldots, \alpha_n \in K$ then $\text{Gal}(K/F)$ is realized as a subgroup of $\text{Perm}\{\alpha_1, \ldots, \alpha_n\}$.

For the previous example $\mathbb{Q}[i]$ is the splitting field of $x^2 + 1$ which has 2 roots: $\pm i \Rightarrow \text{Gal}(K/\mathbb{Q}) \leq \text{Perm}\{i, -i\} \cong \mathbb{Z}/2\mathbb{Z}$, sign(2).

**Example:** Find the Galois group of each $K$ over $\mathbb{Q}$.

1. $K = \mathbb{Q}[\sqrt{5}]$ is the splitting field of $f(x) = x^3 - 5 \in \mathbb{Q}[x]$.

   $\Rightarrow \text{Gal}(K/\mathbb{Q}) \leq \mathbb{Z}/3\mathbb{Z}$.

   $\Rightarrow (\text{Gal}(K/\mathbb{Q}) = \mathbb{Z}/3\mathbb{Z}) \times |\text{Gal}(K/\mathbb{Q})| = 1$

   For $\phi \in \text{Gal}(K/\mathbb{Q})$ if $x$ is a root of $f(x)$ then $\phi(x)$ is also a root

   $\Rightarrow \phi(3\sqrt{5})$ must be a root of $f(x)$ but it only has one root

   $\Rightarrow \phi$ must be the identity by Lemma 6.2.

2. $K = \mathbb{Q}[\sqrt{2}, \sqrt{3}]$ is the splitting field of $f(x) = (x^2 - 2)(x^2 - 3)$

   which has distinct roots $\pm \sqrt{2}, \pm \sqrt{3}$.

   $\Rightarrow \text{Gal}(K/\mathbb{Q}) \leq \text{Perm}\{\sqrt{2}, -\sqrt{2}, \sqrt{3}, -\sqrt{3}\}$.

   But note that if $\phi(\sqrt{2}) = \sqrt{3}$ then

   $2 = \phi(\sqrt{2}) \neq \sqrt{3} = \phi(\sqrt{2}) \cdot \phi(\sqrt{2}) = \sqrt{2} \cdot \sqrt{3} = \sqrt{6} \neq 3$.

   Thus $\sqrt{2} \neq \pm \sqrt{3}$ under any homomorphism $\phi$ in $\text{Gal}(K/\mathbb{Q})$.

   Where

   $\text{Gal}(K/\mathbb{Q}) = \mathbb{Z}/2\mathbb{Z}, \mathbb{Z}/3\mathbb{Z}, \mathbb{Z}/2\mathbb{Z} \times \mathbb{Z}/3\mathbb{Z}$

   $\Rightarrow |\text{Gal}(K/\mathbb{Q})| = 4$

   $\times \text{Gal}(K/\mathbb{Q}) \cong \mathbb{Z}/2\mathbb{Z} \times \mathbb{Z}/2\mathbb{Z}$.

As previously mentioned, finding the Galois group of an extension $K$ over a field $F$ gets more complicated as the degree of the extension grows. **Lemma 6.2** makes sense of this complication – the more roots you throw into $K$ the bigger the permutation group ...
In fact, there is a stronger relationship between the size of the Galois group and the degree of the extension than previously mentioned. (In fact, you may have even conjectured this as you worked through the previous examples/thought about the Lemma above.)

**Prop 6.5** Let $K$ be a field extension of $F$. Then $|\text{Gal}(K/F)| \leq [K : F]$.

To prove this takes a bit of effort but the basic idea is something like this:

Let $K$ be a field extension of $F$ of degree $n > 1$ and suppose $\alpha \in K$.

Then $1, \alpha, \alpha^2, \ldots, \alpha^n \in K$. In fact, they are linearly dependent! Why?

In an n-dim. v.s.

This means that $\alpha$ is the root of an irreducible polynomial $f(x) \in F[x]$ of degree at most $n$.

If we also assume that $K = F[\alpha]$, then the degree of $f(x)$ must be exactly $n$. Why?

In terms of $\text{Gal}(K/F)$ ...

Well $1, \alpha, \alpha^2, \ldots, \alpha^{n-1}$ form a basis for $K$ over $F$ and if we choose $\phi \in \text{Gal}(K/F)$, since $\phi$ is a homomorphism that fixes $F$, we can determine $\phi$ by where it sends $\alpha$.

How many choices are there for this? $n$

What does that mean about $|\text{Gal}(K/F)|$?

In fact ... even if $F[\alpha] \subset K$ there are still at most $[F[\alpha] : F]$ choices for the image of $\alpha$ under any $\phi \in \text{Gal}(K/F)$. Also, $[F[\alpha] : F] \leq [K : F]$.

Hence, $[K : F] = |\text{Gal}(K/F)|$

In fact, we say an extension $K$ is a **Galois extension** of $F$ if $|\text{Gal}(K/F)| = [K : F]$.

Which of the extensions in the previous examples were Galois?

- $\mathbb{Q}[\sqrt{2}]$ is a Galois extension of $\mathbb{Q}$ since $|\text{Gal}(\mathbb{Q}[\sqrt{2}]/\mathbb{Q})| = 2$
- $\mathbb{Q}[\sqrt{2}, \sqrt{3}]$ is a Galois extension of $\mathbb{Q}$.

(Note $\not\cong \mathbb{Q}[\sqrt{2}, \sqrt{3}]$)

**Note:** To actually prove Prop 6.5 above in general, it is useful to work with "extending" isomorphisms of fields. Namely, if we have an isomorphism $\varphi : F \to F'$

how can we extend it to an isomorphism $\tilde{\varphi} : F[x] \to F'[x]$

so that $\tilde{\varphi}(a) = \varphi(a)$ for all $a \in F$. It turns out that since elements of $F[x]$ are polynomials with coefficients in $F$, there are limited ways that we can do this while maintaining the homomorphism property ...
Furthermore, we can use an extending isomorphism to inform us about splitting fields. Since a splitting field $K$ has the form $F[x]/(f(x))$ (see Thm 4.2.4 and Cor 4.2.5 that we previously proved) such extended isomorphisms actually inform us about splitting fields. In fact …

Relation to Splitting Fields …

**Cor 6.7** The splitting field for any polynomial $f(x) \in F[x]$ is unique up to isomorphism.

To prove this we apply:

**Prop 6.6** Let $F$ and $F'$ be fields containing $\mathbb{Q}$ and let $\varphi : F \rightarrow F'$ be an isomorphism.

Suppose that $K$ is a splitting field of $f(x) \in F[x]$ and $K'$ is a splitting field of $\varphi(f(x)) \in F'[x]$.

Then there are $[K : F]$ isomorphisms $\bar{\varphi} : K \rightarrow K'$ extending $\varphi$.

How would that application work?

\[
\text{let } F' = F \quad \& \quad \varphi = \text{id} \Rightarrow \quad \varphi(f(x)) = f(x) \quad \Rightarrow \quad \mathbb{Q}(f(x)) = f(x) \quad \Rightarrow \quad \exists [K : F] \text{ isom } \bar{\varphi} : K \rightarrow K' \text{ extending } F \text{ were } K' \text{ split. fields } \Rightarrow \quad F' \text{ were fields } K' \text{ of } f
\]

In fact, there is an even stronger link between Galois theory and splitting fields:

**Thm 6.8:** Let $F$ be any field containing $\mathbb{Q}$.

If $K$ is the splitting field of $f(x) \in F[x]$ then $K$ is a Galois extension of $F$.

In this case, we call $\text{Gal}(K/F)$ the **Galois group** of $f(x)$.

To prove this we again apply Prop 6.6. How?

\[
\text{let } K \text{ be spe. field of } f(\mathbb{Q}) = F[x]. \quad \text{let } F = F' \quad \& \quad K = K' \quad \& \quad \varphi = \text{id.} \Rightarrow \exists [K : F] \text{ isom } K \rightarrow K' \Rightarrow \quad \text{then } |\text{Gal}(K/F)| = [K : F]. \Rightarrow K \text{ a Gal. exten. of } F.
\]

The next natural question is:

*Is the converse true?*

What if I have an extension $K$ of $F$ that I know is Galois – will there be a polynomial $f(x) \in F[x]$ that $K$ is the splitting field of?

...YUP!

**Thm 6.10:** Let $F$ be a field and $K$ a Galois extension of $F$.

Then $K$ is the splitting field of some $f(x) \in F[x]$.

*Proof by choosing a basis of $K$ and making an irredu. poly.*
The Holy Grail ...

Thus far we have given a bunch of definitions and thought about how Galois extensions relate to splitting fields but it feels like there is something more going on here.

Don’t get me wrong, if creating Galois groups only allowed us to show that splitting fields were unique it would totally be worth it ... but it feels like there is something deeper going on with

the relationship between fields (and their extensions) and groups.

Specifically, we are working with the group of automorphisms on a field \( K \) so what does the structure of this group tell us about the field \( K \)?

Is there a relationship between the subgroups of \( \text{Gal}(K/F) \) and the subfields of \( K \)?

The Fundamental Theorem of Galois Theory answers these questions:

**THM 6.10: Fundamental Theorem of Galois Theory**

Let \( K \) be a Galois extension of \( \mathbb{Q} \) and let \( G = \text{Gal}(K/\mathbb{Q}) \).

Then there is a bijection between

the fields \( \mathbb{Q} \subset E \subset K \) and the subgroups \( H \subset G \)

given as follows:

\[
K^H := \{ \text{the elements of } K \text{ fixed by } H \} \quad \longleftrightarrow \quad H
\]

Furthermore, under this correspondence, we have:

(i) \( K \) is a Galois extension of \( E \) and \( \text{Gal}(K/E) = H \)

(ii) \( [K : E] = |H| \) and \( [E : \mathbb{Q}] = [G : H] \)

(iii) \( E \) is a Galois extension of \( \mathbb{Q} \) if and only if \( H \) is a normal subgroup of \( G \), in which case, \( \text{Gal}(E/\mathbb{Q}) \cong G/H \).

Summarizing this theorem in a diagram:

```
ASSUME K/F Galois

\( \frac{\text{FIELDS}}{K} \)

\( \frac{\text{GROUPS}}{\frac{\mathbb{Q} \subset E \subset K}{\text{Galois}}} \)

1) Galois \( \rightarrow \) U

\( \frac{E}{F} \)

\( \frac{H \triangleleft G}{Q = F} \)
```
We certainly will not try to prove this here but a proof is sketched out in your text. Instead, let's see it in action.

**EXAMPLE:** Analyze the Galois correspondence for $K = \mathbb{Q}[\sqrt{2}, \sqrt{3}]$.

There are 2 choices for $E$...

- $E = \mathbb{Q}[\sqrt{2} \lor \sqrt{3}]$ or $\mathbb{Q}[\sqrt{2}] \lor \mathbb{Q}[\sqrt{3}] \lor \mathbb{Q}[\sqrt{6}]$

(Note that for either choice, $H \cong \mathbb{Z}_2$)

$\mathbb{Q}[\sqrt{2}, \sqrt{3}] = K$

$v \cong \mathbb{Z}_2$

$E$

$\lor$

$\mathbb{Q}$

$= F$

$G = \text{Gal}(K/\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_2$

Note: $H \cong \mathbb{Z}_2$ & is normal in $G$ since $G$ is abelian.

From FTQG21: (i) $\mathbb{Q}[\sqrt{2}, \sqrt{3}] = K$ is a Galois extension of both $\mathbb{Q}[\sqrt{2}] \lor \mathbb{Q}[\sqrt{3}]$

$\Rightarrow [\mathbb{Q}[\sqrt{2}, \sqrt{3}]: E] = 2 = [\text{Gal}(K/E)]$ for some $E$

i.e. the Galois group of $K$ over $E$ is the group of order $2$.

$H = \text{Gal}(K/E) \cong \mathbb{Z}_2$

(ii) Also $[\mathbb{Q}[\sqrt{2}, \sqrt{3}]: Q] = [\mathbb{Q}[\sqrt{2}]: Q] = 2$

$\Rightarrow \mathbb{Q}[\sqrt{2}]: Q] = 2$ & $[\mathbb{Q}[\sqrt{3}]: Q] = 2$

& $[\mathbb{Z}_2 \times \mathbb{Z}_2: \mathbb{Z}_2] = 2$.

(iii) $H \triangleleft G \Rightarrow E$ is a Galois extension of $\mathbb{Q}$.

$\Rightarrow |\text{Gal}(E/\mathbb{Q})| = [E: \mathbb{Q}] = 2$

$\Rightarrow \text{Gal}(E/\mathbb{Q}) \cong \mathbb{Z}_2$.

$k$ is the splitting field of $f(x) = 6x^2 + 2|x^2 + 3|$.
Our Goal revisited...

I know what you are thinking... "Kim, what does this have to do with our goal?!... Wait, what the heck was our goal. I don’t even know what we are doing anymore... Who am I?!

Calm down. Luckily, we have been writing things down so let’s just flip back and re-visit our original goal.

**GOAL:** To show that a polynomial of degree n ≥ 5 cannot be solved by radicals.

We can say \( f(x) \in \mathbb{Q}[x] \) is solvable by radicals if \( f(x) \) splits in \( K \) and there is a chain of fields

\[
\mathbb{Q} = K_0 \subset K_1 \subset K_2 \subset \cdots \subset K_i \subset K_{i+1} \subset \cdots \subset K_t = K
\]

with the property that \( K_{i+1} = K_i[\sqrt[n]{\beta_i}] \) for some \( n_i \) and \( \beta_i \in K_i \).

Does this seem like an OK characterization? **YEAH, IF \( t \) = 1 THEN WE HAVE \( \mathbb{Q} \subset K \) FOR \( \beta \in \mathbb{Q} \) ... but we may need to adjoin more complicated roots.**

Good. But wait! We have another way of saying that \( f(x) \) splits in \( K \) - we call \( K \) a Galois extension. Write this characterization using ‘Galois terminology’:

\[
f(x) \in \mathbb{Q}[x] \text{ is solvable by radicals if } f(x) \text{ has Galois extension } K \text{ with chain } \\
\mathbb{Q} \subset K_0 \subset K_1 \subset \cdots \subset K_t = K \\
\text{so } K_{i+1} = K_i[\sqrt[n]{\beta_i}] \text{ for } \beta_i \in K_i.
\]

There is one last little leap to be made to get the following really useful theorem. It relates to the “\( K_{i+1} = K_i[\sqrt[n]{\beta_i}] \)” part of the characterization. Now this is where we are really gunna hand-wave but bare with me:

The **Fundamental Theorem of Finitely Generated Abelian Groups** says ‘Finitely generated abelian groups look like the product of a bunch of cyclic groups.’

So if I look at \( \text{Gal}(K_{i+1}/K_i) \) in this chain and it is abelian for each quotient, seems like the elements will be powers of elements of \( \mathbb{Q} \)...but that is what we want to adjoin to \( \mathbb{Q} \) to get this solvable by radicals business.

That is the really hard part... It is magic. But it gives us this:

**THEM 6.13** \( f(x) \in \mathbb{Q}[x] \) can be solved by radicals iff a chain of the form

\[
\mathbb{Q} = K_0 \subset K_1 \subset K_2 \subset \cdots \subset K_i \subset K_{i+1} \subset \cdots \subset K_t = K
\]

can be found so that

(i) \( K \) is a Galois extension of \( \mathbb{Q} \) and

(ii) \( K_{i+1} \) is a Galois extension of \( K_i \) and \( \text{Gal}(K_{i+1}/K_i) \) is an abelian group.
Now I take the **Fundamental Theorem of Galois Theory** and Thm 6.13 and I smash them together and I get:

**Cor 6.14** \( f(x) \) can be solved by radicals iff its Galois group \( G \) has the property that:

There is a chain of subgroups

\[ \{e\} = G_\ell \subset G_{\ell - 1} \subset \cdots \subset G_{i+1} \subset G_i \subset \cdots \subset G_0 = G \]

with the property that \( G_i/G_{i+1} \) is abelian for all \( i = 0, 1, \ldots, \ell - 1 \).

(Since ‘smashing’ is not so eloquent, you can follow the more rigorous derivation from the book if you like.)

Finally! WE HAVE ARRIVED! From Cor 6.14 we can deduce:

**Cor 6.15:** If the Galois group of \( f(x) \) is \( A_n \) or \( S_n \) for \( n \geq 5 \), then \( f(x) \) cannot be solved by radicals.

This means it is enough to show that some polynomials of degree \( n \geq 5 \) may have \( A_n \) or \( S_n \) as their Galois group!

To prove Cor 6.15:

Recall (Thm 6.4.10) that for \( n \geq 5 \) has no nontrivial normal subgroup. Since \( A_n \) is not abelian, there can be so such chain of subgroups as in Cor 6.14. In the case of \( S_n \) for \( n \geq 5 \) there, \( A_n \) is the only nontrivial normal subgroup.

\( \mathbb{Z}_3 \leq A_n \leq S_n \) has \( A_n/\mathbb{Z}_3 \) not abelian.

This of course would take a lot of work to find a different one can be found for any \( n \geq 5 \). We will instead find an example for \( n = 5 \).

**Example:** \( f(x) = x^5 - 6x + 2 \in \mathbb{Q}[x] \)

\( f(x) \) is irreducible by Eisenstein w/ \( p = 2 \) criteria.

Also, \( f(x) \) has 3 real roots & 2 complex roots.

(Note: it has at least 1 \( \Rightarrow \) has 1, 3 or 5 real roots)

Let \( K \) be the splitting field of \( f(x) \) & \( \text{Gal} (K/\mathbb{Q}) \) the Galois group of \( f(x) \). By Lemma 6.2 \( \text{Gal} (K/\mathbb{Q}) \cong S_5 \).

Also by Exercise 14, \( \text{Gal} (K/\mathbb{Q}) \) must acts transitively on all 5 roots \( \{w, W, w\overline{w}, \overline{w}, \overline{w}\overline{w}\} \).

\( f(x) \in S_5 \) so \( g \cdot x = \sigma(x) \) for \( \sigma \in S_5 \).

\( \Rightarrow \) a 5-cycle in \( \text{Gal} (K/\mathbb{Q}) \)

Also, a transposition (sending complex conj \( \tilde{x} \rightarrow x \)) in \( \text{Gal} (K/\mathbb{Q}) \)

a 5-cycle & a transposition generate \( S_5 \)

\( \text{Gal} (K/\mathbb{Q}) = S_5 \)

\( \Rightarrow \) my Cor 6.15, \( f(x) \) is not \( 10 \) solvable by radicals!

Other recommended exercises: 7.6 \# 1, 3, 4, 12, 23, 25
EXERCISES:

1. Compute the Galois groups of the following fields $K$ over $\mathbb{Q}$ and determine if every extension $K$ is Galois:

   (a) $K = \mathbb{Q}(\sqrt[4]{2})$ 
   $\alpha = \sqrt[4]{2}, \sqrt[4]{-2}$ are roots of $f(x) = x^4 - 2$ in $\mathbb{Q}(\sqrt[2]{2})$ 
   Let $\phi \in \text{Gal}(\mathbb{Q}(\sqrt[2]{2})/\mathbb{Q})$ 
   $\phi(\alpha) \text{ must be a root of } f(x)$ 
   But Lemma $\alpha \cdot \alpha = \phi(\alpha) = \pm \alpha$. 
   Thus $\text{Gal}(K/\mathbb{Q}) = \mathbb{Z}/2$ where $\phi_x: x \mapsto -x$ 
   But $[K : \mathbb{Q}] = 4$ because $K$ has basis $\{1, \sqrt[4]{2}, (\sqrt[4]{2})^2, (\sqrt[4]{2})^3\}$. 
   $\longrightarrow$ NOT Galois

   (b) $K = \mathbb{Q}(\sqrt[2]{2}, i)$ 
   $\alpha = \sqrt[2]{2}, -\sqrt[2]{2}, i$ and $-i$ are roots of $f(x) = (x^2 - 2)(x^2 + 1)$ 
   in $K$. 
   Let $\phi \in \text{Gal}(K/\mathbb{Q})$ 
   $\phi$ must be a root of $f(x)$ by Lemma $\alpha$. 
   But $\phi(\sqrt[2]{2}) \neq \sqrt[2]{2}$, $\phi(i) = i$ since $\phi$ is a hom. 
   Thus would not be a hom. 
   Thus $|\text{Gal}(K/\mathbb{Q})| = 4 = [K : \mathbb{Q}]$, \Rightarrow $K$ is Galois 
   $\text{Gal}(K/\mathbb{Q}) = \mathbb{Z}/2 \times \mathbb{Z}/2$. 

   (c) $K = \mathbb{Q}(\sqrt[2]{2}, i)$ 
   $\alpha = \sqrt[2]{2}, -\sqrt[2]{2}, i$ are roots of $f(x) = x^4 - 2$ 
   $K$ is the splitting field of $f(x)$ \Rightarrow 
   $|\text{Gal}(K/\mathbb{Q})| = [K : \mathbb{Q}] = 8$ 
   Since $K$ has basis $\{1, \alpha, i, \alpha^2, \alpha^2 i, \alpha^3, \alpha^3 i\}$ 
   Thus $\text{Gal}(K/\mathbb{Q}) \cong \mathbb{Z}/2 \times \mathbb{Z}/4$ as in $(c)$. 
   $\phi$ is Galois. 
   (see $(c)$ 
   for all the 
   isomorphisms:!!)
(d) \( K = \mathbb{Q}[\sqrt{2}, \sqrt[3]{2}] \) ± \( \sqrt{2} \times \sqrt[3]{2} \) are roots of \( f(x) = (x^2 - 2)(x^3 - 2) \) in \( K \) \\

Let \( \phi \in \text{Gal}(K/\mathbb{Q}) \), \( \phi(\sqrt{2}) = \sqrt{2} \Rightarrow \phi(\sqrt[3]{2}) = -\sqrt[3]{2} \)

But \( \phi(\sqrt{2}) \neq \sqrt{2} \) since \( 2 = \phi(2) = \phi(\sqrt{2}^2) = \phi(\sqrt{2})^2 \neq (\sqrt{2})^2 \)

Thus \( \text{Gal}(K/\mathbb{Q}) = \{ \text{id}, \phi(\sqrt[3]{2}) \} = \{1, [\sqrt{2}]\} \) where \( [\sqrt{2}]\) \( \mapsto \sqrt{2} \) \( \mapsto R \cdot \sqrt{2} \) \( \mapsto R \cdot \sqrt{2} \)

Also \( [K: \mathbb{Q}] = 4 \) since \( \mathbb{Q}, \mathbb{Q}[\sqrt{2}], \mathbb{Q}[\sqrt[3]{2}], \mathbb{Q}[\sqrt{2}\sqrt[3]{2}] \)

where \( \Rightarrow K \not\text{is Galois} \)

2. Determine the Galois groups and the corresponding subgroups and the intermediate fields of the following polynomials \( f(x) \in \mathbb{Q}[x] \). Check for normal subgroups and Galois extensions of \( \mathbb{Q} \).

(a) \( f(x) = x^4 - 4 = (x - \sqrt{2})(x + \sqrt{2})(x - \sqrt{2}i)(x + \sqrt{2}i) \)

has splitting field \( K = \mathbb{Q}[\sqrt{2}, i] \), as in (1b), \( \Rightarrow \text{Gal}(K/\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_2 \) \( (\because [K: \mathbb{Q}] = 4). \)

\( K = \mathbb{Q}[\sqrt{2}, i] \)

\( \mathbb{Q}[i] \)

\( \mathbb{Q}[\sqrt{2}] \)

\( \mathbb{Q}[\sqrt{2}, i] \)

\( \mathbb{Q}[\sqrt{2}, i] \)

\( \mathbb{Q}[i] \)

\( \mathbb{Q} \)

\( \Rightarrow K \text{ is a Gal. ext of } \mathbb{Q} \text{ \& } (\forall \psi) \\
\& \ E \text{ is a Gal ext of } \mathbb{Q} \text{ \& } (\forall \psi) \)

\( \text{Gal}(K/E) \cong \mathbb{Z}_2 \) \& \( \text{Gal}(E/\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_2 \)

\( \Rightarrow \mathbb{Z}_2 \times \mathbb{Z}_2 \cong \text{Gal}(K/E) \)
(b) \( f(x) = x^4 - x^2 - 6 = (x^2 - 3)(x^2 + 2) = (x - \sqrt{3})(x + \sqrt{3})(x - \sqrt{2}i)(x + \sqrt{2}i) \).

has splitting field \( K = \mathbb{Q}[\sqrt{3}, \sqrt{2}i] \).

\[ \text{Gal}(K/\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_2 \]

\( K = \mathbb{Q}[\sqrt{3}, \sqrt{2}i] \)

\[ \begin{array}{c|c}
\mathbb{Q} & \mathbb{Q} \\
\hline
\mathbb{Q}[\sqrt{3}] & \mathbb{Q}[\sqrt{2}i] \\
\hline
\mathbb{Q}[\sqrt{3}, \sqrt{2}i] & \mathbb{Q} \\
\end{array} \]

\[ \begin{array}{c}
\mathbb{Z}_2 \\
\hline
\mathbb{Z}_2 \\
\mathbb{Z}_2 \times \mathbb{Z}_2 \cong \text{Gal}(K/\mathbb{Q}) \\
\end{array} \]

\( K \) is a Galois ext. of each \( \mathbb{Q} \times \mathbb{Q} \) each \( \mathbb{Q} \) an algebraically ext.

(c) \( f(x) = x^4 - 2 \)

see next page!!

3. Exhibit a quintic polynomial that cannot be solved by radicals. (Explain briefly why.)

Any irreducible quintic in \( \mathbb{Q}[x] \) w/ 3 distinct real roots & 2 complex roots.

Other recommended exercises: 7.6 # 1, 3, 4, 12, 23, 26
2) \( f(x) = (x^4 - 2) = (x^2 - \sqrt{2})(x^2 + \sqrt{2}) \)

has splitting field: \( \mathbb{K} = \mathbb{Q}[i, \sqrt[4]{2}] \)

which has basis \( \{1, x, x^2, x^3, i, ix, ix^2, ix^3\} \).

\( \text{Gal}(\mathbb{K}/\mathbb{Q}) = \mathbb{Z}_2 \times \mathbb{Z}_4 \) \)

\( \text{where} \)

\( \phi_1: \phi_2: \phi_3: \phi_4: \phi_5: \phi_6: \phi_7 \)

\( \alpha \rightarrow i \alpha \alpha \rightarrow \alpha \alpha \rightarrow -\alpha \alpha \rightarrow \alpha \alpha \rightarrow i \alpha \alpha \rightarrow \alpha \alpha \rightarrow \alpha \)

\( \phi_1^2 = 1 \) for all \( \phi \)

Thus \( \text{Gal}(\mathbb{K}/\mathbb{Q}) \neq \mathbb{Z}_8 \)

Also \( \text{order}(\phi_1) = 4 \)

\( \Rightarrow \text{Gal}(\mathbb{K}/\mathbb{Q}) \cong \mathbb{Z}_2 \times \mathbb{Z}_4 \)

\( \mathbb{K} = \mathbb{Q}[i, \sqrt[4]{2}] \)

\( \mathbb{Q} \backslash \mathbb{K} \) as \( \mathbb{G} \)

\( \mathbb{Z}_2 \times \mathbb{Z}_2, \mathbb{Z}_4 \times \mathbb{Z}_2 \)

as subgroups

\( \mathbb{G} \)

\( \mathbb{G} \)

\( \mathbb{G} \)
Sequences and Series

As mentioned last time, one very important technique that we will address in this course stems from Newton’s idea of representing functions as sums of infinite series. It is very important to distinguish first between a sequence (as discussed last time) and a series.

A sequence is a list of terms written in a definite order

Examples:

\[ 1, 1/2, 1/3, 1/4, \ldots = \sum_{n=1}^{\infty} \frac{1}{n} \]

A series is an (infinite) sum of a list of terms noted: \( \sum_{n=1}^{\infty} a_n \) or \( \sum a_n \)

Examples:

\[ 1 + 1/2 + 1/2^2 + 1/2^3 + \ldots = \sum_{n=1}^{\infty} \frac{1}{2^{n-1}} \]

We will talk about convergence of both but they have different tests for convergence so it is very important to first identify what kind of thing you are testing the convergence of. Most of the rest of this chapter will be spent discussing series.

11.2 Series

To begin talking about convergence of series, let’s examine a canonical examples:

**Example 1:**

\[ 1 + 2 + 3 + 4 + 5 + \ldots + n + \ldots = \sum_{n=1}^{\infty} n \]

\[ \lim_{n \to \infty} \frac{n(n+1)}{2} \rightarrow \infty \text{ diverges} \]

(As we add more and more terms)

**Example 2:**

\[ \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \ldots + \frac{1}{2^n} + \ldots = \sum_{n=0}^{\infty} \frac{1}{2^n} = 1 \]

We can use a similar idea of partial sums to define the convergence of a series.
A partial sum is a finite sum of the form:

\[ S_k = \sum_{n=1}^{k} a_n \]

**Convergence of Series**

Given a series \( \sum_{n=1}^{\infty} a_n \), let \( S_k \) denote its \( k^{th} \) partial sum:

\[ S_k = \sum_{n=1}^{k} a_n = a_1 + a_2 + \ldots + a_k \]

If the sequence \( \{S_k\} \) is convergent and \( \lim_{k \to \infty} S_k = S \) exists as a real number then the series \( \sum a_n \) is called **convergent**. The number \( S \) is called the **sum** of the series.

If \( \{S_k\} \) is divergent then the series is called **divergent**.

**Example 3:** Suppose that the sum of the first \( n \) terms of the series \( \sum_{n=1}^{\infty} a_n \) is

\[ S_k = a_1 + a_2 + \ldots + a_k = \frac{2k}{3k+5} = \sum_{n=1}^{k} a_n \]

Determine the convergence of the series.

\[
\lim_{k \to \infty} S_k = \lim_{k \to \infty} \frac{2k}{3k+5} = \lim_{k \to \infty} \frac{2k \cdot \frac{1}{k}}{(3k+5) \cdot \frac{1}{k}} = \lim_{k \to \infty} \frac{2}{3 + \frac{5}{k}} = \frac{2}{3} \Rightarrow \text{Converges to } \frac{2}{3}
\]

Unfortunately, it is usually not easy to find an expression like this for \( S_k \).

It turns out it is not hard to show that ...

If the series \( \sum_{n=1}^{\infty} a_n \) is convergent, then \( \lim_{n \to \infty} a_n = 0 \).

**Proof:** Assume \( \sum a_n \) converges. Let \( S_n = a_1 + a_2 + \ldots + a_n \).

\[ a_n = S_n - S_{n-1} \]

\( \sum a_n \) converges \( \Rightarrow \sum S_n / 3 \) converges.

Let \( \lim_{n \to \infty} S_n = S \Rightarrow \lim_{n \to \infty} S_{n-1} = S \)

\[ \lim_{n \to \infty} a_n = \lim_{n \to \infty} S_n - S_{n-1} = S - S = 0 \]

Taking the contrapositive of this result gives us a useful test for divergence.
TEST FOR DIVERGENCE

If \( \lim_{n \to \infty} a_n \neq 0 \) (or does not exist), then the series the series \( \sum_{n=1}^{\infty} a_n \) is divergent.

NOTE:
\[ \lim_{n \to \infty} a_n \neq 0 \Rightarrow \sum_{n=1}^{\infty} a_n \text{ diverges} \]
\[ \lim_{n \to \infty} a_n = 0 \not\Rightarrow \sum_{n=1}^{\infty} a_n \text{ converges} \]

EXAMPLE 4: Determine the convergence of \( \sum_{n=1}^{\infty} \frac{n^2}{5n^2 + 4} \).
\[ a_n = \frac{n^2}{5n^2 + 4} \]
\[ \lim_{n \to \infty} a_n = \lim_{n \to \infty} \frac{n^2}{5n^2 + 4} = \lim_{n \to \infty} \frac{n^2}{5n^2 + 4} \cdot \frac{n^2}{n^2} = \frac{1}{4} \]
\[ \Rightarrow \text{ diverges by the Divergence Test} \]

EXAMPLE 5: Determine the convergence of \( \sum_{n=1}^{\infty} \frac{1}{n} \). Notice \( \lim_{n \to \infty} a_n = \lim_{n \to \infty} \frac{1}{n} = 0 \).
\[ S_1 = 1 \]
\[ S_2 = 1 + \frac{1}{2} \]
\[ S_4 = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} > 1 + \frac{1}{2} + \left(\frac{1}{4} + \frac{1}{4}\right) = 1 + \frac{3}{2} \]
\[ S_8 = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} > 1 + \frac{1}{2} + \left(\frac{1}{4} + \frac{1}{4}\right) + \left(\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}\right) = 1 + \frac{3}{2} \]
\[ S_{16} = 1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{16} > 1 + \frac{4}{2} \]
\[ S_{32} > 1 + \frac{5}{2} \]
\[ S_{64} > 1 + \frac{k}{2} \Rightarrow \lim_{k \to \infty} S_{2^k} \to \infty \Rightarrow \text{ divergent} \]

Note that since we are defining convergence of series in terms of convergence of sequences, we get many of the properties of sequences. Namely …

If \( \sum_{n=1}^{\infty} a_n \) and \( \sum_{n=1}^{\infty} b_n \) are convergent series then so are:
\[ \sum_{n=1}^{\infty} (a_n + b_n) \]
and
\[ \sum_{n=1}^{\infty} (a_n - b_n) \]

3
$$\sum_{n=1}^{\infty} c_n = c, \quad \sum_{n=1}^{\infty} a_n$$

$$\sum_{n=1}^{\infty} (a_n + b_n) = \sum_{n=1}^{\infty} a_n + \sum_{n=1}^{\infty} b_n$$

$$\sum_{n=1}^{\infty} (a_n - b_n) = \sum_{n=1}^{\infty} a_n - \sum_{n=1}^{\infty} b_n$$

Geometric Series

**EXAMPLE 2** above was an example of a geometric series:

$$\frac{1}{2} + \frac{1}{4} + \ldots = \sum_{n=1}^{\infty} \frac{1}{2^n}$$

$$\sum_{n=1}^{\infty} ar^{n-1} = a + ar + ar^2 + \ldots + ar^{n-1}$$

We can use the method of **EXAMPLE 3** to test the convergence of the geometric series.

case 1: Suppose that \( r = 1 \).

$$\sum_{n=1}^{\infty} a_n \Rightarrow S_k = \sum_{n=1}^{k} a_n = (a + a + \ldots + a) = ak$$

$$\lim_{k \to \infty} S_k = \lim_{k \to \infty} ak = \infty \Rightarrow \text{divergent}$$

case 2: Suppose that \( r \neq 1 \).

$$\sum_{n=1}^{\infty} ar^{n-1}$$

$$S_k = a + ar + ar^2 + \ldots + ar^{k-1}$$

$$rS_k = ar + ar^2 + \ldots + ar^k$$

$$\Rightarrow S_k - rS_k = a - ar^k$$

$$\frac{1}{1-r} S_k = a - ar^k$$

$$\Rightarrow S_k = \frac{a(1-r^k)}{1-r}$$

$$\lim_{k \to \infty} S_k = \lim_{k \to \infty} \frac{a(1-r^k)}{1-r} = \frac{a}{1-r} - \left( \frac{a}{1-r} \right) \lim_{k \to \infty} r^k$$

$$= \frac{a}{1-r} \text{ when } |r| < 1 \text{ and sums to } \frac{a}{1-r}$$

$$\text{diverges when } |r| > 1$$
CONVERGENCE OF A GEOMETRIC SERIES

The geometric series

\[ \sum_{n=1}^{\infty} ar^{n-1} \]

is convergent if \( |r| < 1 \) and its sum is \( \sum_{n=1}^{\infty} ar^{n-1} = \frac{a}{1-r} \)

If \( |r| > 1 \) the series is divergent.

Example 6: Determine the convergence of \( \sum_{n=1}^{\infty} 2^{2n} \cdot 3^{-n-1} \).

\[
= \sum_{n=1}^{\infty} (2^2)^n \cdot 3^{-(n-1)} = \sum_{n=1}^{\infty} 4 \cdot \left(\frac{4}{3}\right)^{n-1} \]

\[ a = 4, \ r = \frac{4}{3} > 1 \]

\[ \Rightarrow \text{diverges} \]

by geometric series test

Examples

A *Always state which test you are using!*

Determine the convergence of each series. If possible, find its sum.

(a) \[ 5 - \frac{10}{3} + \frac{20}{9} - \frac{40}{27} + \ldots = 5 - 5 \cdot \left(\frac{2}{3}\right) + 5 \cdot \left(\frac{2}{3}\right)^2 - 5 \cdot \left(\frac{2}{3}\right)^3 \]

\[ = \sum_{n=1}^{\infty} 5 \cdot \left(-\frac{2}{3}\right)^{n-1} \]

\[ r = -\frac{2}{3}, \ a = 5 \]

\[ |r| = \frac{2}{3} < 1 \Rightarrow \text{converges} \]

by geometric series test

(b) \[ \sum_{n=1}^{\infty} \frac{1}{n(n+1)} \]

\[ \text{HINT: GEOMETRIC SERIES} \]

\[ \lim_{n \to \infty} a_n = 0 \]

\[ S_k = \sum_{n=1}^{k} \frac{1}{n(n+1)} = \sum_{n=1}^{k} \left(\frac{1}{n} - \frac{1}{n+1}\right) \]

\[ = \left(1 - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \ldots + \left(\frac{1}{k} - \frac{1}{k+1}\right) \]

\[ = 1 - \frac{1}{k+1} \]

\[ \lim_{k \to \infty} S_k = \lim_{k \to \infty} \left(1 - \frac{1}{k+1}\right) = 1 \]

\[ \text{converges} \]

\[ \text{to 1} \]
(c) \( \sum_{n=1}^{\infty} \left( \frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}} \right) \) by telescoping

\[ S_k = \sum_{n=4}^{k} \left( \frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}} \right) = \left( \frac{1}{2} - \frac{1}{\sqrt{5}} \right) + \left( \frac{1}{\sqrt{5}} - \frac{1}{\sqrt{6}} \right) + \left( \frac{1}{\sqrt{6}} - \frac{1}{\sqrt{7}} \right) + \ldots + \left( \frac{1}{\sqrt{k}} - \frac{1}{\sqrt{k+1}} \right) \]

\[ = \frac{1}{2} - \frac{1}{\sqrt{k+1}} \]

\[ \lim_{k \to \infty} S_k = \lim_{k \to \infty} \left( \frac{1}{2} - \frac{1}{\sqrt{k+1}} \right) = \frac{1}{2} \text{ converges} \]

(d) \( \sum_{n=1}^{\infty} \frac{2^n + 4^n}{e^n} \) is a sequence

\[ a_n = \frac{2^n + 4^n}{e^n} \]

\[ \lim_{n \to \infty} a_n = \lim_{n \to \infty} \left( \frac{2^n}{e^n} + \frac{4^n}{e^n} \right) \geq \lim_{n \to \infty} \left( \frac{4}{e} \right)^n = \infty \]

\[ \implies \text{diverges by Divergence Test} \]
Sequences and Series

11.3 Integral Test and Estimates of Sums

It is not a far leap to guess that these infinite series are related to integrals. You might have even guessed that this was true since the sort of look like Riemann sums. But the question is, how are they related?

Sketch a graph of \( f(x) = \frac{1}{x^2} \) and compare \( \int_1^\infty \frac{1}{x^2} \, dx \) and \( \sum_{n=1}^{\infty} \frac{1}{n^2} \).

\[
\int_1^\infty \frac{1}{x^2} \, dx = \lim_{t \to \infty} \int_1^t \frac{1}{x^2} \, dx = \lim_{t \to \infty} -\frac{1}{x} \bigg|_1^t = \lim_{t \to \infty} -\frac{1}{t} + 1 = 1
\]

\( \Rightarrow \) converges

\[
\sum_{n=1}^{\infty} \frac{1}{n^2} = \int_1^\infty \frac{1}{x^2} \, dx \Rightarrow \sum_{n=1}^{\infty} \frac{1}{n^2} \text{ converges}
\]

Sketch a graph of \( f(x) = \frac{1}{\sqrt{x}} \) and compare \( \int_1^\infty \frac{1}{\sqrt{x}} \, dx \) and \( \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} \).

\[
\int_1^\infty \frac{1}{\sqrt{x}} \, dx = \lim_{t \to \infty} \int_1^t \frac{1}{\sqrt{x}} \, dx = \lim_{t \to \infty} \frac{2}{\sqrt{x}} \bigg|_1^t = \lim_{t \to \infty} \frac{2}{\sqrt{t}} - 2 = \infty
\]

\( \Rightarrow \) diverges

\[
\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} = \int_1^\infty \frac{1}{\sqrt{x}} \, dx \Rightarrow \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} \text{ diverges}
\]
THE INTEGRAL TEST

Suppose \( f \) is a continuous positive function on \([1, \infty)\) and let \( a_n = f(n) \).

(i) If \( \int_1^\infty f(x) \, dx \) is convergent, then \( \sum_{n=1}^\infty a_n \) is convergent.

(ii) If \( \int_1^\infty f(x) \, dx \) is divergent, then \( \sum_{n=1}^\infty a_n \) is divergent.

EXAMPLES:

Note: They do not converge to the same value!

1. Test the series \( \sum_{n=1}^\infty \frac{1}{n^2+1} \) for convergence or divergence.

\[
\int_1^\infty \frac{1}{x^2+1} \, dx = \lim_{t \to \infty} \int_1^t \frac{1}{x^2+1} \, dx = \lim_{t \to \infty} \tan^{-1} x \bigg|_1^t = \lim_{t \to \infty} \tan^{-1} t - \tan^{-1} 1 = \pi/2 - \pi/4 = \pi/4 \Rightarrow \text{converges}
\]
By the Integral Test, \( \sum_{n=1}^\infty \frac{1}{n^2+1} \) converges.

2. For which values of \( p \) is the series \( \sum_{n=1}^\infty \frac{1}{n^p} \) convergent?

- If \( p < 0 \), \( \lim_{n \to \infty} \frac{1}{n^p} = \infty \) \( \Rightarrow \) diverges by the Divergence Test.
- If \( p = 0 \), \( \lim_{n \to \infty} \frac{1}{n^p} = \lim_{n \to \infty} 1 = 1 \)

If \( p > 0 \), \( f(x) = \frac{1}{x^p} \) is a unit \( p \)-positive function on \([1, \infty)\).
Also \( \int_1^\infty \frac{1}{x^p} \, dx \) converges if \( p > 1 \) & diverges if \( p \leq 1 \)
by the P-Test for integrals.

THE P-TEST

The \( p \)-series \( \sum_{n=1}^\infty \frac{1}{n^p} \) is convergent if \( p > 1 \) and divergent if \( p \leq 1 \).

EXAMPLES: Determine the convergence of the following series.

1. \( \sum_{n=1}^\infty \frac{1}{n^3} \) \( p = 3 > 1 \) \( \Rightarrow \) converges by the P-Test.

2. \( \sum_{n=1}^\infty \frac{1}{n^{1/3}} \) \( p = \frac{1}{3} < 1 \) \( \Rightarrow \) diverges by the P-Test.
Remainder Estimate for the Integral Test

Suppose \( f(n) = a_n \) where \( f \) is a continuous, positive decreasing function for \( x \geq k \) and \( \sum a_k \) is convergent. If \( R_k = S - S_k \) then

\[
\int_{k+1}^{\infty} f(x) \, dx = R_k = \int_{k}^{\infty} f(x) \, dx
\]

Example:

(a) Approximate the sum of the series \( \sum \frac{1}{n^3} \) by using the sum of the first 10 terms. Estimate the error involved in this approximation.

\[
\int_{k}^{\infty} \frac{1}{x^3} \, dx = \lim_{t \to \infty} \int_{k}^{t} \frac{1}{x^3} \, dx = \lim_{t \to \infty} -\frac{1}{2x^2} \bigg|_{x=k}^{t} = \lim_{t \to \infty} \left( -\frac{1}{2t^2} + \frac{1}{2k^2} \right)
\]

\[
\sum_{n=1}^{10} \frac{1}{n^3} \approx S_{10} = \frac{1}{1^3} + \frac{1}{2^3} + \frac{1}{3^3} + \ldots + \frac{1}{10^3} \approx 1.1975
\]

\[
R_{10} = \int_{10}^{\infty} \frac{1}{x^3} \, dx = \frac{1}{200} \approx 0.005 \text{ error.}
\]

(b) How many terms are required to ensure that the sum is accurate to within 0.0005?

\[
\frac{1}{2k^2} < 0.0005 \quad \Rightarrow \quad k^2 > \frac{1}{0.0005} = 2000 \quad \Rightarrow \quad k > \sqrt{2000} \approx 44.7
\]

\[
k > 45 \quad \Rightarrow \quad 32 \text{ terms}
\]

(c) Use the inequality above with \( n = 10 \) to estimate the sum of the series \( \sum \frac{1}{n^3} \):

\[
S_{10} + \int_{10}^{\infty} \frac{1}{x^3} \, dx \leq S \leq S_{10} + \int_{10}^{\infty} \frac{1}{x^3} \, dx
\]

\[
S_{10} + \frac{1}{2(11)^2} \leq S \leq S_{10} + \frac{1}{2(10)^2} + \frac{1}{2(10)^2} + \frac{1}{2(11)^2}
\]

\[
1.201664 \leq S \leq 1.202532 \quad \Rightarrow \quad \sum_{n=1}^{\infty} \frac{1}{n^3} \approx 1.2025 \quad \text{with error} \leq 0.0005
\]
Examples

If possible determine whether each series is convergent or divergent. If not possible, explain why the Integral Test cannot be used.

(a) \[ \sum_{n=1}^{\infty} \frac{1}{n^{\sqrt{2}}} \]  
\[ p = \sqrt{2} > 1 \] 
\[ \text{so \ converges by the P-test} \]

(b) \[ \sum_{n=1}^{\infty} \frac{\sqrt{n}}{1 + n^{3/2}} \]  
\[ f(x) = \frac{\sqrt{x}}{1 + x^{3/2}} \]  
\[ \lim f'(x) = \frac{1 - 2x^{3/2}}{2x(1 + x^{3/2})^{2/2}} < 0 \]  
\[ \text{dec.} \]

\[ \int_{1}^{\infty} \frac{\sqrt{x}}{1 + x^{3/2}} \, dx = \lim_{t \to \infty} \int_{1}^{t} \frac{\sqrt{x}}{1 + x^{3/2}} \, dx \]
\[ = \lim_{t \to \infty} \frac{2}{3} \ln (1 + t^{3/2}) - \frac{2}{3} \ln 2 = \infty \]

By the integral test, \[ \sum_{n=1}^{\infty} \frac{\sqrt{n}}{1 + n^{3/2}} \] diverges

(c) \[ \sum_{n=1}^{\infty} \frac{\ln n}{n^{2}} \]  
\[ f(x) = \frac{\ln x}{x^{2}} \]  
\[ \text{cont. \& \ pos. on } (2, \infty) \]  
\[ f'(x) = \frac{1 - 2 \ln x}{x^{3}} < 0 \]

\[ \int_{2}^{\infty} \frac{\ln x}{x^{2}} \, dx = \lim_{t \to \infty} \int_{2}^{t} \frac{\ln x}{x^{2}} \, dx \]
\[ = \lim_{t \to \infty} \left( -\frac{\ln x}{x} \bigg|_{x=2}^{t} \right) + \int_{2}^{t} \frac{1}{x^{2}} \, dx \]
\[ = -\frac{\ln t}{t} + 1 + \frac{\ln 2}{2} + \frac{1}{2} \]
\[ = \lim_{t \to \infty} \left( -\frac{\ln t}{t} + 1 + \frac{\ln 2}{2} + \frac{1}{2} \right) \]
\[ = \lim_{t \to \infty} \left( -\frac{\ln t}{t} + 1 + \frac{\ln 2}{2} + \frac{1}{2} \right) \]
\[ = \text{converges} \]

(d) \[ \sum_{n=1}^{\infty} \frac{\cos^2 n}{1 + n^2} \]  
\[ \frac{\cos^2 x}{1 + x^2} \]  
\[ \text{is not decreasing on } (1, \infty) \]  
\[ \text{so the hypothesis for the integral test is not satisfied.} \]

We cannot determine convergence.
Sequences and Series

In the previous section we were able to find power series representations for a certain restricted class of functions. Now we will investigate the following questions:

*Which functions have power series representations?* and *How do we find such representations?*

### 11.10 Taylor and Maclaurin Series

Let's start by assuming that a function \( f \) has can be represented by a power series (say about some point \( a \)). This means

\[
f(x) = c_0 + c_1(x-a) + c_2(x-a)^2 + c_3(x-a)^3 + \cdots \quad |x-a|<R
\]

Let's try to determine what the coefficients \( c_n \) must be in terms of \( f \):

**What happens when you plug \( x = a \) into \( f(x) \)?**

\[
f(a) = c_0 + c_1 \cdot 0 + c_2 \cdot 0 + \cdots = c_0 \quad \Rightarrow c_0 = f(a)
\]

Find \( f'(x) \) by differentiating. What happens when you plug \( x = a \) into \( f'(x) \)?

\[
f'(a) = c_1
\]

Find \( f''(x) \) by differentiating. What happens when you plug \( x = a \) into \( f''(x) \)?

\[
f''(a) = 2c_2
\]

Find \( f'''(x) \) by differentiating. What happens when you plug \( x = a \) into \( f'''(x) \)?

\[
f'''(a) = 3 \cdot 2c_3
\]

What happens when you plug \( x = a \) into \( f^{(n)}(x) \)?

\[
f^{(n)}(a) = n \cdot (n-1) \cdots 3 \cdot 2 \cdot 1 \cdot c_n
\]

\[
\Rightarrow c_n = \frac{f^{(n)}(a)}{n !}
\]
THEOREM

If \( f \) has a power series expansion at \( a \), that is, if

\[
f(x) = \sum_{n=0}^{\infty} c_n(x-a)^n \quad \text{for} \quad |x-a| < R
\]

then its coefficients are given by the formula:

\[
c_n = \frac{f^{(n)}(a)}{n!}.
\]

The series \( f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x-a)^n \) is called the Taylor series of the function \( f \) at \( a \). When \( a = 0 \), we call this the Maclaurin series.

EXAMPLE 1: Find the Maclaurin series of the function \( f(x) = e^x \) and its radius of convergence.

\[
f(x) = e^x \quad \Rightarrow \quad f(0) = e^0 = 1
\]

Maclaurin series:

\[
\sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} x^n = \sum_{n=0}^{\infty} \frac{e^0}{n!} x^n = \sum_{n=0}^{\infty} \frac{x^n}{n!}
\]

Radius of Convergence:

\[
\lim_{n \to \infty} \left| \frac{a_{n+1}}{a_n} \right| = \lim_{n \to \infty} \left| \frac{x^{n+1}}{(n+1)!} \cdot \frac{n!}{x^n} \right| = \lim_{n \to \infty} \left| \frac{x}{n+1} \right| = |x| \lim_{n \to \infty} \left| \frac{1}{n+1} \right| = 0 < 1 \text{ always} \quad \Rightarrow \quad R = \infty
\]

\( \text{CONVERGES for all } x \)

\( \text{NOTE: This just shows } \sum \frac{x^n}{n!} \text{ converges...} \)

\( \text{does not show that } \)

\( \text{it = } e^{2x} \)

EXAMPLE 2: Find the Taylor series of the function \( f(x) = e^x \) at \( a = 2 \).

\[
f(x) = e^x \quad \Rightarrow \quad f(2) = e^2
\]

\[
f'(x) = e^x \quad \Rightarrow \quad f'(2) = e^2
\]

\[
f''(x) = e^x \quad \Rightarrow \quad f''(2) = e^2
\]

\[
\sum_{n=0}^{\infty} \frac{f^{(n)}(2)}{n!} (x-2)^n = \sum_{n=0}^{\infty} \frac{e^2}{n!} (x-2)^n
\]

\[
= e^2 + e^2 \frac{x-2}{2!} + \frac{e^2}{3!} (x-2)^2 + \cdots
\]

\( \text{CONVERGES for all } x \)
Under what circumstances is a function equal to the sum of its Taylor series?

Let the $k$th-degree Taylor polynomial be

$$T_k(x) = \sum_{n=0}^{k} \frac{f^{(n)}(a)}{n!} (x-a)^n$$

In general $f(x)$ is the sum of its Taylor series if

$$f(x) = \lim_{k \to \infty} T_k(x)$$

**THEOREM**

If $f(x) = T_k(x) + R_k(x)$ where $T_k$ is the $n$th-degree Taylor polynomial of $f$ at $a$ and

$$\lim_{k \to \infty} R_k(x) = 0$$

for $|x-a| < R$, then $f$ is equal to the sum of its Taylor series on the interval $|x-a| < R$.

**TAYLOR’S INEQUALITY**

If $|f^{(k+1)}(x)| \leq M$ for $|x-a| \leq d$ then the remainder $R_k(x)$ of the Taylor series satisfies the inequality

$$|R_k(x)| \leq \frac{M}{(k+1)!} |x-a|^{k+1}$$

for $|x-a| \leq d$.

**EXAMPLES 3:** Prove that $e^x$ is equal to the sum of its Maclaurin series.

Need to show: $\lim_{k \to \infty} R_k(x) = 0$. (Want to use Taylor's Inequality)

For $f(x) = e^x \Rightarrow f^{(n+1)}(x) = e^x$ for all $n$.

For any positive real number $d \leq d$. Then

$$|f^{(k+1)}(x)| = e^x \leq e^d$$

By Taylor's Inequality ($a=0, M=e^d$) says

$$|R_k(x)| \leq \frac{e^d}{(k+1)!} \cdot |x|^{k+1}$$

for $|x| \leq d$.

Notice that $M = e^d$ works for every $k$.

And $\lim_{k \to \infty} \frac{e^d}{(k+1)!} \cdot |x|^{k+1} = e^d \lim_{k \to \infty} \frac{|x|^{k+1}}{(k+1)!} = 0$.

By the squeeze theorem, $\lim_{k \to \infty} |R_k(x)| = 0 \Rightarrow \lim_{k \to \infty} R_k(x) = 0$.

$\Rightarrow e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$.
\[ e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}, \quad \text{for all } x \]

**Example 4:** Find the Maclaurin series of the function \( f(x) = \sin x \) and prove that it represents \( \sin x \) for all \( x \).

\[
\begin{align*}
f(x) &= \sin x \\
f'(x) &= \cos x \\
f''(x) &= -\sin x \\
f'''(x) &= -\cos x \\
f^{(4)}(x) &= \sin x \\
f^{(5)}(x) &= \cos x \\
\vdots
\end{align*}
\]

**Proof:** \( \sin x \) is an odd function, \( (f^{(2n+1)}(x)) \) is odd for all \( x \).

\[
\Rightarrow \lim_{k \to \infty} |f^{(2k+1)}(x)| = 0 \quad \text{as } k \to \infty
\]

\[
\Rightarrow \sin x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1}, \quad \text{for all } x.
\]

\[
\begin{align*}
\frac{1}{1-x} &= \sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + \ldots \\
e^x &= \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots, \quad \text{for all } x \\
\sin x &= \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)!} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots, \quad \text{for all } x \\
\cos x &= \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{(2n)!} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots, \quad \text{for all } x \\
\tan^{-1} x &= \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)} = 1 - \frac{x^2}{2} + \frac{x^4}{4} - \frac{x^6}{6} + \ldots \\
\ln(1+x) &= \sum_{n=0}^{\infty} \frac{(-1)^{n+1} x^n}{n} = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots \\
(1+x)^k &= \sum_{n=0}^{\infty} \binom{k}{n} x^n = 1 + kx + \frac{k(k-1)x^2}{2!} + \frac{k(k-1)(k-2)x^3}{3!} + \ldots
\end{align*}
\]

\[
\binom{k}{n} = \frac{k(k-1)(k-2)\ldots(k-n+1)}{n!}.
\]
Example 5: Find the first three non-zero terms on the Maclaurin series for \( \tan x \).

\[
\tan x = \frac{\sin x}{\cos x} = \frac{x - \frac{x^3}{3} + \frac{x^5}{5} - \ldots}{1 - \frac{x^2}{2} + \frac{x^4}{4} - \ldots} = \frac{x + \frac{1}{3} x^3 + \frac{2}{15} x^5 + \ldots}{1 - \frac{x^2}{2} + \frac{x^4}{4} - \ldots}
\]

\[
x - \frac{1}{3} x^3 + \frac{2}{15} x^5 - \ldots - x + \frac{1}{2} x^3 - \frac{1}{15} x^5 + \ldots
\]

\[
\frac{1}{3} x^3 - \frac{1}{15} x^5 + \ldots
\]

\[
\frac{2}{15} x^5 + \ldots
\]

11.11 Applications of Taylor Polynomials

If \( f \) is equal to the sum of its Taylor series at \( a \)

\[
f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(a)}{n!} (x - a)^n
\]

then we can use the \( k \)th-degree Taylor polynomial can be used to approximate \( f \).

To see this clearer, examine the Maclaurin series expansion for \( e^x \):

\[
e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \ldots
\]

\[
T_1 = 1 + x
\]

\[
T_2 = 1 + x + \frac{x^2}{2}
\]

\[
T_3 = 1 + x + \frac{x^2}{2} + \frac{x^3}{6}
\]

The questions we now need to ask are

How good of an approximation is \( T_k \)?

and

How large should we take \( k \) to be in order to achieve the desired accuracy?
To answer these questions, we need to look at the remainder:
\[ R_k(x) = f(x) - T_k(x) \]

There are three possible methods for estimating the size of the error:

1. **Graph** \( |R_k(x)| \) & **estimate** the error using graphing device.

2. If it is an **alternating series**, use **Alternating Series Est. Thm**.

3. **Taylor's Inequality**:
   
   If \( |f^{(k+1)}(x)| = M \) then \( |R_k(x)| \leq \frac{M}{(k+1)!} |x-a|^k \)

**Example 6:**

(a) Approximate the function \( f(x) = \sqrt[3]{x} \) by a Taylor polynomial of degree 2 at \( a = 8 \).

\[
\begin{align*}
  f(x) &= \sqrt[3]{x} = x^{1/3} \\
  f'(x) &= \frac{1}{3} x^{-2/3} \\
  f''(x) &= -\frac{2}{9} x^{-5/3} \\
  f'''(x) &= \frac{10}{27} x^{-8/3} \\
  T_2(x) &= f(8) + \frac{f'(8)}{2!} (x-8) + \frac{f''(8)}{3!} (x-8)^2
\end{align*}
\]

\[
|\sqrt[3]{x}| \leq T_2(x) = 2 + \frac{1}{12} (x-8) - \frac{1}{288} (x-8)^2
\]

(b) How accurate is the approximation when \( 7 \leq x \leq 9 \)?

\[ n = 2 \quad x_0 = 8 \]

\[ |R_2(x)| \leq \frac{M}{3!} |x-8|^3 \]

To find \( M \):

\[
\begin{align*}
  f''(x) &= \frac{10}{27} \cdot \frac{1}{x^{8/3}} & \leq & \frac{10}{27} \cdot \frac{1}{7^{8/3}} < 0.0021 \\
  M &= 0.0021
\end{align*}
\]

Also \( 7 \leq x \leq 9 \Rightarrow -1 \leq x-8 \leq 1 \Rightarrow |x-8| \leq 1 \)

\[ |R_2(x)| \leq \frac{0.0021}{3!} \cdot 1^3 = \frac{0.0021}{6} < 0.0004 \quad \Rightarrow \text{accurate within 0.0004} \]
Example 7:

(a) What is the maximum error possible in using approximation

\[ \sin x \approx x - \frac{x^3}{3!} + \frac{x^5}{5!} \]

when \(-0.3 \leq x \leq 0.3\)? Use this approximation to find \(\sin 12^\circ\) correct to six decimal places.

Error when approx \(\sin x\) by 1st 3 terms is at most

\(\frac{1}{7!} = \frac{1 	imes 17}{5040}\)

If \(-0.3 \leq x \leq 0.3\) then \(|x| \leq 0.3\)

\[ \Rightarrow \text{error} \leq \frac{(0.3)^7}{5040} \approx 4.3 \times 10^{-8} \]

\(\sin(12^\circ) = \sin \left(\frac{12\pi}{180}\right) = \sin \left(\frac{\pi}{15}\right) \approx \frac{\pi}{15} - \left(\frac{\pi}{15}\right)^3 \frac{1}{3!} + \left(\frac{\pi}{15}\right)^5 \frac{1}{5!} \)

\[ \approx 0.20794469 \]

Correct to 6 decimal places

(b) For what values of \(x\) is this approximation accurate within 0.00005?

Want: \(\frac{|x|^7}{5040} \leq 0.00005\)

\[ \Rightarrow |x|^7 \leq 0.252 \quad \text{or} \quad |x| \leq (0.252)^{1/7} \approx 0.821 \]

\[ \Rightarrow \text{need} \quad |x| \leq 0.82 \]
Using Taylor's Inequality for Ex 7

\[ f^{(m)}(x) = -\cos x \Rightarrow |f^{(m)}(x)| \leq 1 \]

\[ \Rightarrow |R_n(x)| \leq \frac{1}{7!} |x|^7 \quad \text{... this gives us the same as Airy Series Method} \]
SAMPLE PROJECTS
This assignment is optional. If you choose to write a paper, your lowest exam score will be raised according to the quality of the paper handed in. (If you get an A on the paper, your lowest exam score will become an A.) However, the paper will not hurt your exam score. (If your lowest exam score is a B and you get a D on the paper your exam score will not be lowered.) In fact, as long as you meet the criteria listed below, your lowest exam score will be raised.

Choose ONE of the following prompts. Please specify which prompt you have chosen. You may write on a topic other than one listed here, but please discuss it with me first. Feel free to elaborate if you feel like you have answered the prompt in less than 4 pages.

Note that many of these prompts may require outside research. (If you use such research please site it. Wikipedia is an acceptable reference for this paper, but do not copy any paste the wikipedia article. I will know and then I will have to take you in front of some disciplinary bored and you may have to get kicked out of school...plagiarism is bad. Very bad.)

In order to receive credit you must write a 4-5 page paper (12 pt font, 1 inch margins, double spaced) that meets the following criteria:

– Contains an introduction (including a thesis!) and conclusion.
– Answers every question from whichever prompt you choose (not necessarily in the order they appear).
– Contains at least 3 quotations from the text relating to your prompt & supporting your argument.
– Has clearly been proof read.

If you fail to meet any of the aforementioned criteria, your paper will not raise your grade.

Logicomix:

1. Explain Russell's Paradox (RP). Explain what it means for something to be a paradox (what the definition is) and why Russell's Paradox is, in fact, a paradox. In doing so, address the following: what RP is about/how it relates to mathematics, why RP is interesting/uninteresting, why RP is difficult to solve, and why it is historically important.
2. Compare and contrast Logicomix with a typical comic book involving a hero on a quest. In doing so, describe how Russell is a hero (what are his strengths and weaknesses? What is his quest? etc).
3. Logicomix is a graphic novel based on the life of Bertrand Russell. However, it is clearly also written to be an entertaining graphic novel. Find a part of the novel that you found historically (or otherwise) questionable. Explain why you think that the authors may not be describing the event accurately. Using outside research, describe what actually happened (whether that is how Doxiadis presented it or not).
4. Explain Russell's great 'quest' i.e. his academic project. Why was it important to the field of mathematics?
5. Explain the relationship between mathematics and philosophy at the time of Russell. In answering, be sure to explain what is meant by 'foundations of mathematics'. How does it seem that philosophy and mathematics relate today? How do you think that they should relate?
6. Choose a character of mathematical significance in Logicomix (i.e. Bertrand Russell, Georg Cantor, Frege, David Hilbert, Kurt Godel, Giuseppe Peano, Ludwig Wittgenstein, etc) Explain the contribution(s) that this person had to mathematics and why it/they is/are important. (If you do not quite understand part of their contribution, clearly explain why it is confusing.)

A Mathematician's Apology:

1. What was Hardy's view of mathematics in A Mathematician's Apology? What do you agree with or disagree with
about Hardy's claims. Did Hardy convince you of his view? Why or why not?
2. What does it mean to be a 'real' mathematician to Hardy? In your answer, make sure you address what 'pure' mathematics is.
3. If you had to identify a thesis for *A Mathematician's Apology*, what would it be? How does Hardy defend this thesis? Can you find any flaws in his argument? Do you agree with Hardy?
MATH 120: Precalculus

PROJECT INSTRUCTIONS

PURPOSE

The purpose of the project is for you to produce a piece of creative and individual research about a mathematical topic.

More generally, I would like for you to realize two things during the course of this project:

1. mathematical thought is creative and
2. the skills you use for mathematical thought and research are valuable and transcend to various areas of life

I will provide a careful outline to aid you in this process. While it may seem that following such a strict outline will entirely stymie any creativity you may attempt to bring to the project, I assure you that this is a trade-off that will work well for you, and that there will be sufficient creative opportunity.

It may also feel that the project instructions and guidelines are vague. This is may be true, but remember, as you research new mathematical (and otherwise) material, you will often be lost and not know which direction will lead you down the ‘right’ path. However, pursuing ‘wrong’ avenues is not always fruitless and can still provide for a valuable learning experience (you will not be penalized for perusing such avenues).

REQUIREMENTS

The requirements are as follows:

• You must choose one of the provided topics.
  
  If you have an idea for a project that is outside of the suggested topics, I am totally open to letting you pursue it. However, you must talk to me about it before beginning. Further, I will require a draft of your project to make sure you are on a fruitful path.

• The length is to be 3-6 pages with approximately 12 point font and 1 inch margins.
  
  You will be unable to address the issues I identify adequately in less than three pages, so that is a lower bound for the length of your paper. The word limit for your final document is 1500 words (this is around 6 double spaced pages).
  
  You are also encouraged to include graphs, diagrams, flow charts, illustrations, etc to clarify your points (but if your diagram takes up a full page, it will not count as a page of your project).

• I will provide a step by step process for accomplishing each project. You must do each step.

• Do not include an introduction or conclusion.
  
  In my experience most students spend far too much time writing these and produce an essentially worthless waste of space nonetheless. Further, the projects are structured in such a way that introduction (and conclusion) will not make much sense.

FURTHER DETAILS

Write the paper so that someone else who is in this class could understand everything you wrote a year from now. Thus, you should include details that are easy to forget, but should not spend lots of time explaining the basics.

There are four things you have to do to produce a well written document: write, edit, edit, and edit. You should be incredibly sick of your own writing at some point. Anything that you find especially clever is probably crap and should be removed. (This is true of most academic writing.)

Finally, your aim in your writing should be, above all else, clarity. To this end, avoid making jokes: they come across poorly and are difficult to understand in written format. Do not be sarcastic, or ask vague questions. Remember this: if I read what you’ve written and think you’re wrong you’ll lose some points, but if I read what you’ve written and don’t know what you mean, you’ll get no points at all.
Procedure

You can choose to do any project you like. I will briefly explain a bit of the context of each project as it arises in class. Some projects are ‘harder’ than others and this will be taken into account when I am grading. Each project will have it’s own specified instructions.

**While it is not required that you submit a draft, it is extremely highly recommended.** The odds of you getting a good grade without submitting a draft are vanishingly small. Feel free to work in groups doing the research and discussing the projects. *All writing must be done individually.* Similarly, please avoid working with a tutor. If you have questions, come speak with me about your confusion. The goal of this project is to have you develop your own original understanding from reading and thinking, not from having someone else teach you and I cannot monitor what the tutors do and do not say. I would much rather that you did not understand everything and clearly communicated your misunderstandings than presented regurgitated correct information.

When you submit a draft, I will mark it up with lots of criticism and probably provide a summary of this at the end. Take as much time as you need editing it again after that. For a second round of criticism from me, ask, and if I have time I will grant your request. I will not provide more than two rounds of criticism. You will not need to use any outside sources, so don’t. Although I do recommend gathering definitions from Wikipedia.

Don’t cheat or plagiarize, it’s extremely obvious when you do (believe it or not). You will receive an F if you plagiarize.
Math 120: Precalculus  Project Option 2: Limits

The purpose of this project is to familiarize you with limits. These play a large role in calculus, so this project will be helpful for those of you planning to go on to take more mathematics here at Metro State.

LIMITS – OUTLINE FOR YOUR PROJECT

Step 1: Limits of Functions
- Examine the Wikipedia entry on limits. There are two notions here that will be important to us: the limit of a function, and the limit of a sequence. You can ignore everything else on the page.
- The first paragraph of the section on ‘limits of functions’ is important for this project. Your first task is to understand it, then to restate it in your own words. (Hint: There should be an \( \epsilon \) and a \( \delta \) in there somewhere!)
- Suppose \( f \) is a function. Explain why it does not make sense to say “the limit of the function \( f \) is \( L \),” but it does make sense to ask “what is the limit of \( f(x) \) as \( x \) approaches \( c \)?”

Step 2: Limits of Sequences
- Examine the wikipedia entry on ‘limits of sequences.’ There is a link to this page at the beginning of the section on limits of sequences in the article on limits. We will only be concerned with the part of this article that deals with real numbers.
- Throughout the article, the notation \((x_n)\) is used for a sequence. This is shorthand for \(x_0, x_1, \ldots, x_n, \ldots\). Often, rather than list the numbers, we give a formula in \(n\) that tells us what the \(n\)th number in the sequence is.
- There is a definition near the top of the section on real numbers. Understand and restate this definition in your own words. Ensure that your rephrasing is equivalent to the original statement.
- Examine the examples.
- For each of the first three examples, write out the first five or so terms of the sequences being discussed. For example, suppose \(x_n = \frac{n-3}{n+1}\). Then the first few terms in this sequence are \(-3, -1, \frac{-1}{3}, 0, \frac{1}{5}, \ldots\). In your examination, make sure you explain the reasoning behind the proofs provided.

Step 3: Understanding the Connection
- This will be the hardest part of the project.
- Prove the following theorem, using the definitions you gave for limits of functions and limits of sequences above:
  \[
  \text{If } \lim_{x \to a} f(x) = c \text{ and } \lim_{n \to \infty} (x_n) = a, \text{ then } \lim_{n \to \infty} f(x_n) = c.
  \]

Step 4: Demonstrate Your Understanding
To demonstrate that you understand what you’ve done, perform one of the following tasks:
• Explain the part of the article on Limits of Sequences that deals with limits in Metric Spaces. To do this, you will need to provide a functional definition of a metric space and demonstrate that you understand this definition.

• Write a Haiku or three about the connection between limits of sequences and limits of functions. Again, this is not a forum for complaints.

• Try to envision a situation in which we might want to say “the almost-limit of this function (or sequence) is 3” or something like this. Come up with a theory of almost-limits based on your idea. Note that this should not be the same as saying “the limit of this function is almost 3.”
The purpose of this project is to get you thinking about periodicity. This is conceptually difficult, so is a good exercise for those planning to take more mathematics. This project will be more casual than some of the other ones.

**PERIODICITY – OUTLINE FOR YOUR PROJECT**

**Step 1:**
- Examine the Wikipedia entry on periodic functions. The definition of “periodic function” that you find there is the following:
  
  A function $f$ is said to be periodic with period $P$ ($P$ being a nonzero constant) if we have
  
  $$f(x + P) = f(x)$$

  for all values of $x$.

- Draw a picture of a periodic function $f$ with period $P$. Label a point $x_0$ on the x-axis. Also label the points $f(x)$, $f(x + P)$ and $f(x + 2P)$.

- The next sentence in the definition of a periodic function in Wikipedia says “If there exists a least positive constant $P$ with this property [i.e., with the property that $f(x + P) = f(x)$ for all values of $x$], it is called the prime period.” Redraw the picture you just drew, identifying (by some reasonable means) in this picture three different periods for $f$, one of which is the prime period.

**Step 2:**
- Recall what the graph of a function is: given a function $f : \mathbb{R} \to \mathbb{R}$, we draw a “picture” of the function by making the points on its graph (which is the set $\{(x, f(x)|x \in \mathbb{R}\})$ a different color than the rest of the points in the plane.

- Suppose that $f$ is a function from the plane to $\mathbb{R}$. Thus, for each $(a, b)$ in the plane, $f(a, b)$ is some number in $\mathbb{R}$. How would we graph such a function?

- Using your conclusions above, draw a picture of the function defined by $f(a, b) = a$. Now draw a picture of the function $g$ given by $g(a, b) = a + b$. Finally, try drawing $h(a, b) = a^2 + b^2$.

- Continue with exercises like these until you’ve developed an intuition for how to graph functions from the plane. Explain your results in a paragraph or two.

**Step 3:**
- We now are going to try to combine the two pieces we just did. Examine the picture of a periodic function you drew in the first part, and then the pictures of functions from the plane that you drew in the second part.

- Now, a function $f : \mathbb{R} \to \mathbb{R}$ is called periodic when $f(x + p) = x$ for all $x$. However, for a function $f$ that maps from pairs of numbers $(a, b)$ to $\mathbb{R}$, there are two ways something like this might happen:

  1. $f(a + p, b) = f(a, b)$ for all pairs of real numbers $(a, b)$
  2. $f(a, b + p) = f(a, b)$ for all pairs of real numbers $(a, b)$
• Explain how this means that I could be periodic “in either dimension.”
• Your task: explain what it means to be periodic “in both dimensions.”
• Hint: you will probably have two periods $P$ and $Q$ in your answer, instead of the one that was found in the definition in the first part.
• Hint: Buy a flat of eggs. Take the eggs out. Look at the flat.

**Step 4: Demonstrate Your Understanding**

To demonstrate that you understand what you’ve done, perform one of the following tasks:

• In the first part, we discussed a “prime period” for periodic functions from $\mathbb{R}$ to $\mathbb{R}$. For functions from the plane to $\mathbb{R}$ that are periodic in both dimensions, we often talk about a “prime rectangle.” How would we define this?

• Come up with a handful of other ways we might define a periodic function, appealing to similar types of things. Draw pictures of these.

• Try to extend what we did above to functions from “spaces” (which have ordered triples $(x,y,z)$) to $\mathbb{R}$. We can draw pictures of these if we color things. How would you go about this?
The purpose of this project is to familiarize you with power series. These play a large role in calculus (beginning in Calculus II), so this project will be helpful for those of you planning to go on to take more mathematics here at Metro State.

**Power Series – Outline for Your Project**

**Step 1:**
- Examine the Wikipedia entry on Taylor Series.
- There are two pictures on the right at the beginning of this entry. They will give you a good intuition of the idea of a power series, if you understand them.
- For the first picture: The colorful functions are all polynomials. You should be able to make a good guess about what polynomial each color represents. Redraw this picture and label each of the polynomials (i.e. if you think the blue function is $x^7$, in your drawing, label that graph $y = x^7$).
- What do you notice about the degrees of these polynomials? There should be a couple things that stick out.

**Step 2:**
- The idea of a Taylor series is to “approximate” a non-polynomial function with polynomials. Continuing with our examination of the first picture, the colorful functions (all of which are polynomial) are supposed to be approximating the function $y = \sin x$, which is graphed in black. Explain in your own words in what way the polynomials shown in the picture are “approximating” $\sin x$ and how it is that these “approximations” change as we increase the degree of the polynomial.
- $\sin x$ is an odd function. This should connect to something else you’ve already said. $\cos x$ is an even function. Use what we’ve done so far to conjecture about how to approximate $\cos x$ using polynomials.

**Step 3:**
- Repeat the above steps for the function $f(x) = e^x$, which is shown in the second picture. This should be harder.

**Step 4: Demonstrate Your Understanding**

To demonstrate that you understand what you’ve done, perform one of the following tasks:
- Explain why we find it helpful to think of functions like $\sin x$ as an “infinite polynomial.”
- We’ve now seen that we can “approximate” functions like $\sin x$ using polynomials. Do you think we can do the converse? That is, does it seem reasonable that we can similarly “approximate” any polynomial function using things that look like
  \[ A_1 \sin (B_1 x + C_1) + A_2 \cos (B_2 x + C_2) + A_3 \sin^2 (B_3 x + C_3) + A_4 \sin (B_4 x + C_4) A_5 \cos (B_5 x + C_5) + \ldots \]
  Explain why you think this will or won’t work.
- By drawing graphs, try to begin a power series for $\ln x$, similar to how we did for $\sin x$ above. Explain what goes wrong in as detailed a way as you can.
This will be one of the more difficult project options. As a result, I will be slightly more lenient in my grading of it. Nonetheless, it will probably be more work than most of the other projects.

**Algebras – Outline for Your Project**

**Step 1:**
- Examine the definition of a ring found on Wolfram Mathworld: http://mathworld.wolfram.com/Ring.html
- Restate the axioms in your own words, making sure that you’ve given an equivalent definition.
- Find interesting examples of rings.

**Step 2:**
- The entry in Wolfram Mathworld on *modules* contains the following:
  “A module is a mathematical object in which things can be added together commutatively by multiplying coefficients... in modules, coefficients are taken in rings.”
- Using this quote and your own research, attempt to provide a collection of axioms for modules.
- Find interesting examples of modules

**Step 3:**
- Examine the Wikipedia entry “Associative Algebra”
- You will notice right away that in order to understand what an associative algebra is you will first need to understand rings and modules. We’ve already done that.
- The definition is given in the introductory section. Explain the definition in your own words.
- There are two examples of algebras over the real numbers that you must examine in this project: the complex numbers \( \mathbb{C} \) and the quaternions, \( \mathbb{H} \). Research these algebras and demonstrate that they are, in fact, associative algebras, and demonstrate that you understand them.

**Step 4: Demonstrate Your Understanding**
To demonstrate that you understand what you’ve done, perform one of the following tasks:
- Explain incidence algebras (this will require you to understand what a poset is).
- Explain how real-valued functions of one variable form an associative \( \mathbb{R} \)-algebra.
- Write a few haiku about algebras.
The purpose of this project is to familiarize you with formalizations of arithmetic. These play a large role in the (unfortunately, dying) field of mathematics known as Foundations. The most active and exciting research currently going on in this field is being done by Harvey Friedman with his Reverse Mathematics program.

**Arithmetic, Formalized – Outline for your Project**

**Step 1: Understanding Formal Languages**
- Examine the Wikipedia entry on Formal Languages.
- Rewrite the definition you find there for formal languages in your own words. Be sure that what you’ve written means the same thing as the definition they’ve given.
- Explain the first example (or another example, if you’d rather) they provide on the Wikipedia entry. (The first example will be the most useful example for the remainder of the project, but do as you please.)

**Step 2: Understanding Formal Systems**
- Examine the Wikipedia entry on Formal Systems.
- The definition provided on that page lists the four pieces of a formal system. You should explain the following relationships:
  - Sentences, as we defined them in the section on syntax and semantics, and “well-formed formulas,” or “wffs,” as they are commonly known.
  - The first two pieces of the definition of a formal system and the definition of a formal language.
- Explain in your own words the meaning of the other two axioms.

**Step 3: First Order Peano Arithmetic**
- The description on this site of the language of Peano Arithmetic is sketchy. Peano Arithmetic is a formal system. To explain what a formal system is, you need to specify the alphabet, the grammar, the axioms, and the deduction rules. Focus first on the alphabet. The first two comprise the language. If you choose this as your project, you’ll probably want to talk to me or check out some other references to help you with this part. A good (but difficult) reference is the *Third Edition* of the text *Computability and Logic* by Boolos and Jeffries. There are many others also.
- Ignore the seventh axiom for now.
- Explain what each of the other axioms means, *in English*. For example, as I read it, the first axiom says “Nothing comes before zero.” Learn how to do this type of translation and translate the axioms as best you can.
- Summarize (briefly) what the deductive system being used is.
Step 4: Demonstrate Your Understanding

To demonstrate that you understand what you’ve done, perform one of the following tasks:

• Translate some simple pieces of mathematics into proofs in PA. This should be done in a way that fits into the paper somehow.

• Write a haiku or three (check out the wiki on Haiku to learn how to do this well) on the topic of one or more of the axioms. This is not a forum to complain about things, but a way to demonstrate insight into what makes Peano Arithmetic interesting or at least a good model of normal arithmetic.

• Understand and explain the seventh axiom.
Math 120: Precalculus            Project Option 4: Addition ≈ Multiplication

The purpose of this project is to demonstrate one of the most important features of the real numbers: not only are they a field in the technical, mathematical sense of that word, but they are an exponential field.

**ISOMORPHISM — OUTLINE FOR YOUR PROJECT**

**Step 1: Knowing the Definition**
- The real numbers ($\mathbb{R}$) have two main operations defined on them: addition and multiplication. The fact that the real numbers are an exponential field is because these two operations look *almost* exactly the same, when you look at them in the right light.
- Read the wikipedia entry on Exponential Fields. Understand as much as you can, and summarize what seem to you to be the important points, being as clear as possible. Do not write down information that you do not understand, but do follow links to other pages in order to get as clear a picture as you can.

**Step 2: Understanding the Definition**
- The operations $+$ and $\cdot$ are examples of what we call binary operations: they take *two* inputs and produce *one* output. Functions, on the other hand, are unary operations: they take one input and produce one output.
- In the definition of an exponential field that you find on the wikipedia page, there are three operations mentioned: addition, multiplication, and an operation they call $E$. Notice that $E$ is a unary operation.
- What are some natural unary operations that you know of on the real numbers? Come up with at least three that are significantly different.

**Step 3: Applying Your Knowledge**
- **Fact:** Let $a \in \mathbb{R}$ be a positive number. Then $\mathbb{R}$ is an exponential field with $E(x) = a^x$.
- Show that the previous fact is true.
- Why did I demand that $a$ be positive?
- Show that, in the case of the real numbers with $E$ defined as above, $E$ in fact defines a bijection between $\mathbb{R}$ and the set of nonzero reals, which is often denoted $\mathbb{R}^*$.

**Step 4: Demonstrate Your Understanding**
To demonstrate that you understand what you’ve done, perform one of the following tasks:
- Look up the definition of isomorphism. Demonstrate that the map $E$ defined above is in fact an isomorphism between the reals under addition (considered as a group, a word that you will have to also look up... search for “group (mathematics)” to find the wikipedia page) and the non-zero reals under multiplication.
- Examine the part of the wikipedia article on exponential fields that deals with exponential rings. Understand what is said there and demonstrate that the integers with the map $n \mapsto (-1)^n$ is indeed an exponential ring.
- Draw a picture of the reals that emphasizes the fact that they are an exponential field. Explain the picture.
• Draw a picture of the definition of an exponential field. Explain our picture.
• Explain clearly which definitions you had a hard time understanding in doing this project, and what you did to try to solve this. Along the way there are probably specific words that were confusing. Highlight a few of these and relate what you did to try to understand what they meant.
Evaluations
Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6:

1 being “Strongly Disagree” and 6 being “Strongly Agree”.

**Math 4281: Intro to Modern Algebra, Summer 2017**
Response rate: 13 out of 19 enrolled

As related to the instructor . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
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<tbody>
<tr>
<td>“The instructor was well prepared for class.”</td>
<td>5.69</td>
<td>6.00</td>
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<tr>
<td>“The instructor presented the subject matter clearly.”</td>
<td>5.62</td>
<td>6.00</td>
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<tr>
<td>“The instructor provided feedback intended to improve my course performance.”</td>
<td>5.69</td>
<td>6.00</td>
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<tr>
<td>“The instructor treated me with respect.”</td>
<td>5.77</td>
<td>6.00</td>
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<tr>
<td>“I would recommend this instructor to other students.”</td>
<td>5.69</td>
<td>6.00</td>
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As related to the course . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
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<tbody>
<tr>
<td>“I have a deeper understanding of the subject matter as a result of this course.”</td>
<td>5.54</td>
<td>6.00</td>
</tr>
<tr>
<td>“My interest in the subject matter was stimulated by this course.”</td>
<td>5.62</td>
<td>6.00</td>
</tr>
<tr>
<td>“Instructional technology employed in this course was effective .”</td>
<td>5.45</td>
<td>6.00</td>
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<tr>
<td>“The grading standards for this course were clear.”</td>
<td>5.54</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this course to other students.”</td>
<td>5.62</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Selected Comments:

- “Kim was always thoughtful in her explanations of material. It was obvious she wanted us all to truly grasp the material and understand it correctly. She broke down difficult concepts in a way that made it easy to understand and learn.”

- “Kim was very approachable and always had an encouraging enthusiasm for the material and its understanding among all students. She really left no excuse for a student to get left behind on material. Furthermore, she put much time into notes/packets/etc. that were not necessary of her, but incredibly valuable.”

- “She is very responsive to questions over e-mail and created amazing worksheets with answers available online.”

- “I thought the course was very thorough and very well-taught.”
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan

TERM: Summer

CURRENT YEAR: 2017

DEPARTMENT: Math

COURSE #: 4781

SECTION: __________

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?
She is very responsive to questions over email and creates amazing worksheets with answers available online.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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RD29492-PP1-54321 Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
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<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
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<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
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<td>2. My interest in the subject matter was stimulated by this course.</td>
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<td>3. Instructional technology employed in this course was effective.</td>
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<td>4. The grading standards for this course were clear.</td>
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<td>5. I would recommend this course to other students.</td>
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<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
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<td>○ 10-14 hours per week</td>
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<td>○ 16 or more hours per week</td>
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</table>

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Exceptional</th>
<th>Satisfactory</th>
<th>Very Poor</th>
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</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Summer
CURRENT YEAR: 2017

DEPARTMENT: Math
COURSE #: 4281
SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Kim was always thoughtful in her explanations of material. It was obvious she wanted us all to truly grasp the material and understand it completely. She broke down difficult concepts in a way that made it easy to understand and learn.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Office of Measurement Services

RD29462-PF1-54321
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan

TERM: Sum 2017

DEPARTMENT: MATH

COURSE #: 4281

CURRENT YEAR: 2017

SECTION: ____________

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**

Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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**What did the instructor do that most helped your learning?**

Kim was very approachable and always had an encouraging enthusiasm for the material and its understanding among all students. She really left no excuse for a student to get left behind on material. Furthermore, she put much time into notes (packets), etc. that were not necessary of her, but incredibly valuable.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
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6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - □ 0-2 hours per week
   - □ 3-5 hours per week
   - □ 6-9 hours per week
   - □ 10-14 hours per week
   - □ 15 or more hours per week

What suggestions do you have for improving the course?

---

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Mathematics
TERM: Summer
CURRENT YEAR: 2017
COURSE #: 4281
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She present the material clearly and made clear what would be tested on.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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RD29462-PF1-54321
Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
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   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

If possible, try to show how abstract algebra is applicable to physics, chemistry, or computer science.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kentucky Logan
DEPARTMENT: Math
TERM: Summer
COURSE #: 428.1
SECTION: 001
CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Surprisingly, the weekly quizzes combined with the longer workshops on Tuesday and Thursday were extremely helpful in "tuning" in to the lecture material and assimilating the lecture

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:
Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable
2. My interest in the subject matter was stimulated by this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable
3. Instructional technology employed in this course was effective. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable
4. The grading standards for this course were clear. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable
5. I would recommend this course to other students. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   [ ] 0-2 hours per week
   [ ] 3-5 hours per week
   [ ] 6-9 hours per week
   [ ] 10-14 hours per week
   [ ] 15 or more hours per week

What suggestions do you have for improving the course?

N/A
I thought the course was very thorough and very well-taught.

Course Environment
How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? [ ] Exceptional [ ] Satisfactory [ ] Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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</table>

What did the instructor do that most helped your learning?

Example: Super helpful.

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
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   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM:  
DEPARTMENT: Math  COURSE #: 6881  SECTION: 001  CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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What did the instructor do that most helped your learning?

The work sheets were clear and well formed.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan

TERM: Summer

DEPARTMENT: MATH

COURSE #: 4281

SECTION: 001

CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required

☐ Required, but one of several choices

☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

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Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan  TERM: Summer  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: Math 429  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
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What did the instructor do that most helped your learning?

patient, well, lecture

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan
DEPARTMENT: MATH
TERM: Summer
CURRENT YEAR: 2017
COURSE #: 422.01
SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

The worksheet is really helpful.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
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   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Need more TA in exam.

I saw someone cheating in exam.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logain

DEPARTMENT: Math

TERM: Summer

CURRENT YEAR: 2017

COURSE #: 4261

SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

Strongly Agree  Somewhat Agree  Somewhat Disagree  Strongly Disagree

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. 
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Somewhat Agree
   - [ ] Somewhat Disagree
   - [ ] Disagree
   - [ ] Strongly Disagree
   - [ ] Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Somewhat Agree
   - [ ] Somewhat Disagree
   - [ ] Disagree
   - [ ] Strongly Disagree
   - [ ] Not Applicable

3. Instructional technology employed in this course was effective.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Somewhat Agree
   - [ ] Somewhat Disagree
   - [ ] Disagree
   - [ ] Strongly Disagree
   - [ ] Not Applicable

4. The grading standards for this course were clear.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Somewhat Agree
   - [ ] Somewhat Disagree
   - [ ] Disagree
   - [ ] Strongly Disagree
   - [ ] Not Applicable

5. I would recommend this course to other students.
   - [ ] Strongly Agree
   - [ ] Agree
   - [ ] Somewhat Agree
   - [ ] Somewhat Disagree
   - [ ] Disagree
   - [ ] Strongly Disagree
   - [ ] Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - [ ] 0-2 hours per week
   - [ ] 3-5 hours per week
   - [ ] 6-9 hours per week
   - [ ] 10-14 hours per week
   - [ ] 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment:

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- [ ] Exceptional
- [ ] Satisfactory
- [ ] Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Knelby Logan                     TERM: Summer 2017  CURRENT YEAR: 2017
DEPARTMENT: Math                      COURSE #: 1271  SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<td>①</td>
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<td>③</td>
<td>②</td>
<td>①</td>
<td>⑥</td>
<td>⑤</td>
<td>④</td>
</tr>
</tbody>
</table>

**What did the instructor do that most helped your learning?**

Good availability after class.

---

Did you take this course because it was required or was it an elective?

① Required
② Required, but one of several choices
③ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

No suggestions

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan
DEPARTMENT: Math
TERM: 
CURRENT YEAR: 
COURSE #: 
SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The instructor was well prepared for class.</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>The instructor presented the subject matter clearly.</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>The instructor provided feedback intended to improve my course performance.</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>The instructor treated me with respect.</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>I would recommend this instructor to other students.</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

What did the instructor do that most helped your learning?

She writes on the board.

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective

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RD28462-PFI-54321
Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Exams can be easier and she should explain things clearer for the materials.

Hard topic are too dense for the last week of class.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6:

1 being “Strongly Disagree” and 6 being “Strongly Agree”.

**Math 1272: Calculus II, Spring 2018**  
Response rate: 17 out of 30 enrolled

As related to the instructor . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The instructor was well prepared for class.”</td>
<td>5.76</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor presented the subject matter clearly.”</td>
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<td>6.00</td>
</tr>
<tr>
<td>“The instructor provided feedback intended to improve my course performance.”</td>
<td>5.76</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor treated me with respect.”</td>
<td>6.00</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this instructor to other students.”</td>
<td>5.88</td>
<td>6.00</td>
</tr>
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</table>

As related to the course . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
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</tr>
</thead>
<tbody>
<tr>
<td>“I have a deeper understanding of the subject matter as a result of this course.”</td>
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<td>6.00</td>
</tr>
<tr>
<td>“My interest in the subject matter was stimulated by this course.”</td>
<td>5.06</td>
<td>5.00</td>
</tr>
<tr>
<td>“Instructional technology employed in this course was effective.”</td>
<td>5.00</td>
<td>5.50</td>
</tr>
<tr>
<td>“The grading standards for this course were clear.”</td>
<td>5.53</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this course to other students.”</td>
<td>5.12</td>
<td>5.00</td>
</tr>
</tbody>
</table>

**Selected Comments:**

- “Ms. Logan has office hours at very consistent times which allow you to go over any questions. She also responds to e-mails within the day. Math isn’t the most exciting but Ms. Logan brings out the best of the class.”

- “Provided lots of information on moodle too. Very helpful when it came to homework and studying. Explained things very clearly. Kimberly is also extremely nice and patient, so she tends to make math feel less stressful.”

- “Presented material extremely clearly with straightforward examples; gave good problems to practice; gave good and fair, frequent feedback.”
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?
- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional    Satisfactory    Very Poor

[Options for ratings]
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Being available in office hours to help with topics that I didn't understand.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
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   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Some of the answer keys & study guides had some wrong answers, so it made it confusing for those questions. If those could be reviewed that'd be great.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soak through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

**CORRECT:**  O  **INCORRECT:** ✓  O  O

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**

Provided lots of information on moodle too. Very helpful when it came to homework and studying.

Explained things very clearly.

Kimberly is also extremely nice and patient, so she tends to make math feel less stressful.

**Did you take this course because it was required or was it an elective?**

- O Required
- O Required, but one of several choices
- O Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I think the midterms account for too large a portion of the class grade.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Yim Logan
TERM: SPRING
DEPARTMENT: MATH
COURSE #: 1272
CURRENT YEAR: 2018
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: ☐
INCORRECT: ☑ ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

Strongly Agree  Agree  Somewhat Agree  Somewhat Disagree  Disagree  Strongly Disagree

What did the instructor do that most helped your learning?

Ms. Logan has office hours at very consistent times which allow you to go over any questions, she also responds to emails within the day. Math isn’t the most exciting but Ms. Logan brings the best out of the class.

Did you take this course because it was required or was it an elective?

☑️ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Projector in our room @ Ford hall was terrible. Possibly have a Microsoft Surface for the teacher to easily present notes.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional
Satisfactory
Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: KIM LOGAN
TERM: spring
CURRENT YEAR: 2018
DEPARTMENT: Math
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☐  INCORRECT: ☑ × ☐ ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
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</tbody>
</table>

What did the instructor do that most helped your learning?

having everything online was great for review

Did you take this course because it was required or was it an elective?

☑ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Mathematics
TERM: Spring 2018
COURSE #: Math 122
SECTION: 001
CURRENT YEAR: 2018

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: 
INCORRECT: ✓ □ □

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She posted solutions to the homework every week.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Find a place with larger tables for mid-terms please!

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Jim Logan
TERM: SP
CURRENT YEAR: 18

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

CORRECT:  
INCORRECT: ✓ X ◼

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

EXPLAINED CONCEPTS THOROUGHLY AND SPECIFICALLY.

Did you take this course because it was required or was it an elective?

Required
Required, but one of several choices
Elective

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Course Items:

Course item survey results will be made available online to help students make course selections.
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
</table>
1. I have a deeper understanding of the subject matter as a result of this course. |
2. My interest in the subject matter was stimulated by this course. |
3. Instructional technology employed in this course was effective. |
4. The grading standards for this course were clear. |
5. I would recommend this course to other students. |
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course? |
   - 0-2 hours per week |
   - 3-5 hours per week |
   - 6-9 hours per week |
   - 10-14 hours per week |
   - 15 or more hours per week |

What suggestions do you have for improving the course?

Larger chalkboard / working projector.

Course Environment

How would you rate the physical environment in which you take this class, especially classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring 2018  CURRENT YEAR: 2018
DEPARTMENT: Mathematics  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

### MARKING INSTRUCTIONS

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- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

**CORRECT:** ●  **INCORRECT:** ✓ ● ● ●

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
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<th>Somewhat Disagree</th>
<th>Disagree</th>
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</tbody>
</table>

What did the instructor do that most helped your learning?

Accommodated for extenuating circumstances

Did you take this course because it was required or was it an elective?

〇 Required  〇 Required, but one of several choices  〇 Elective

Alternative formats of this document are available upon request by contacting oms@umn.edu or 612-626-0006.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Have a working projector so more class time can be utilized.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring  CURRENT YEAR: 2018
DEPARTMENT: Math  COURSE #: Math 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS
• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: ✬   INCORRECT: ✗ x ✩

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

ankey

Did you take this course because it was required or was it an elective?

☒ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Spring
CURRENT YEAR: 2018
DEPARTMENT: Math
COURSE #: 1222
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ☑️
INCORRECT: ✗️

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Presented material extremely clearly with straightforward examples
Gave good homework problems to practice; gave good and fair, frequent feedback,

Did you take this course because it was required or was it an elective?

☒ Required
☐ Required, but one of several choices
☐ Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: MATH
TERM: S
CURRENT YEAR: 10

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: • • • • • • INCORRECT: ✓ X ✓ • • •

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Helpful when talked to

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

idk, cheaper/free textbook would be nice, but I know that's not happening.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Logan  TERM: Spring  CURRENT YEAR: 2018
DEPARTMENT: Math  COURSE #: 1872  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ✔  INCORRECT: ✗

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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</tbody>
</table>

What did the instructor do that most helped your learning?

Worked very well with test issues/assignments
and clearly worked hard to ensure that everyone got the material.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Nothing in particular - the desk camera in the room got wacky sometimes but that's about it.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Spring
CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ●
INCORRECT: ✓ × ● ●

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Gave us packets to fill out with information.

Did you take this course because it was required or was it an elective?

Required
Required, but one of several choices
Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
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4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Don't have night classes.
This class needs discussion sections.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional   Satisfactory   Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Spring
COURSE #: 1272
SECTION: 001
CURRENT YEAR: 2018

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: ☐

INCORRECT: ✓

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Handouts were very helpful in learning course concepts, they were also helpful to use when reviewing.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring  CURRENT YEAR: 2018
DEPARTMENT: Math  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☐  INCORRECT: ⬗️  ☐  ☐

Instructor Items:
Carefully read each statement and select a response:

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

taught well

Did you take this course because it was required or was it an elective?

☒ Required
☐ Required, but one of several choices
☐ Elective

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RD28561-PFI-5432 Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Somewhat Disagree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable

2. My interest in the subject matter was stimulated by this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Somewhat Disagree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable

3. Instructional technology employed in this course was effective. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Somewhat Disagree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable

4. The grading standards for this course were clear. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Somewhat Disagree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable

5. I would recommend this course to other students. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Somewhat Disagree [ ] Disagree [ ] Strongly Disagree [ ] Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course? [ ] 0-2 hours per week [ ] 3-5 hours per week [ ] 6-9 hours per week [ ] 10-14 hours per week [ ] 15 or more hours per week

What suggestions do you have for improving the course?

Nothing

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? [ ] Exceptional [ ] Satisfactory [ ] Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

**CORRECT:** ☑  **INCORRECT:** ✗ X ☐

**Instructor Items:**

Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.   
2. My interest in the subject matter was stimulated by this course. 
3. Instructional technology employed in this course was effective. 
4. The grading standards for this course were clear. 
5. I would recommend this course to other students. 
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan TERM: Spring CURRENT YEAR: 2018
DEPARTMENT: MATH COURSE #: 1272 SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

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- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ● INCORRECT: ✓ X 〇 ●

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

Alternative formats of this document are available upon request by contacting oms@umn.edu or 612-626-0006.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]
2. My interest in the subject matter was stimulated by this course. [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]
3. Instructional technology employed in this course was effective. [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]
4. The grading standards for this course were clear. [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]
5. I would recommend this course to other students. [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week [Scale: Strongly Agree: 5 | Agree: 4 | Somewhat Agree: 3 | Disagree: 2 | Strongly Disagree: 1 | Not Applicable: 0]

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6:

1 being “Strongly Disagree” and 6 being “Strongly Agree”.

**Math 1272: Calculus II, Spring 2017**
Response rate: 22 out of 29 enrolled

As related to the instructor . . .

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<td>“The instructor treated me with respect.”</td>
<td>5.86</td>
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<tr>
<td>“I would recommend this instructor to other students.”</td>
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As related to the course . . .

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<td>“The grading standards for this course were clear.”</td>
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<td>“I would recommend this course to other students.”</td>
<td>5.43</td>
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**Selected Comments:**

- “The instructor explained the content well in the course and she was patient during her office hour.”
- “Great attitude towards all questions. Excellent willingness to help. Very fair. 10/10.”
- “Very clear, I could tell Kim had a genuine interest in the course material so she made the lectures more interesting and therefore easier to follow.”
- “You are awesome, keep it up Kim.”
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: spring  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS
- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Teaching methods were great when explaining off the chalkboard.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   • 0-2 hours per week
   • 3-5 hours per week
   • 6-9 hours per week
   • 10-14 hours per week
   • 15 or more hours per week

What suggestions do you have for improving the course?

Some of the homework solutions on moodle were from the 7th edition book and not the 8th edition.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Spring
CURRENT YEAR: 2017
COURSE #: MATH 72
SECTION: 021

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.
• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ●
INCORRECT: ✓ □

Instructor Items:
Carefully read each statement and select a response.

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Put the solution and worksheet on Moodle everyday.

Did you take this course because it was required or was it an elective?

Required
Required, but one of several choices
Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan   TERM: Spring   CURRENT YEAR: 2017
DEPARTMENT: Math       COURSE #: 1272    SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

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- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ✔   INCORRECT: ✗ ⚫ ●

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

The worksheets are really helpful. It makes it easier to study and keep track of which is which.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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RD20561-PPF-5432  Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan
TERM: Spring
CURRENT YEAR: 2017
DEPARTMENT: Math
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT:  ☑  INCORRECT:  ✗  ☑  ☑

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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What did the instructor do that most helped your learning?

Weekly quiz is good since it reminds me to keep up and review.

Did you take this course because it was required or was it an elective?

- ☑ Required
- ☑ Required, but one of several choices
- ☑ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

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<th>Exceptional</th>
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<th>Very Poor</th>
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<td>5</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Loger TERM: Spring CURRENT YEAR: 2017
DEPARTMENT: Math COURSE #: Math 1272 SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:
Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - [ ] 0-2 hours per week  
   - [ ] 3-5 hours per week  
   - [ ] 6-9 hours per week  
   - [x] 10-14 hours per week  
   - [ ] 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment
How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

[ ] Exceptional  
[ ] Satisfactory  
[ ] Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Cogan
DEPARTMENT: Math
TERM: Spring
CURRENT YEAR: 2017
COURSE #: MATH 127
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ○ INCORRECT: ✓ ✗ ○

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter wasstimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Exceptional</th>
<th>Satisfactory</th>
<th>Very Poor</th>
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<tr>
<td>7</td>
<td>5</td>
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University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**
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- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.
  
  CORRECT: ☒  INCORRECT: ✗  ☐  ☐

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.  
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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<th>Strongly Agree</th>
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**What did the instructor do that most helped your learning?**

She tried her best and gave back feedback on quizzes and exams. Answered HW problems.

**Did you take this course because it was required or was it an elective?**
- ☒ Required
- ☐ Required, but one of several choices
- ☐ Elective

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RD29561-PFI-5432  
Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. 
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Pacing was too fast, a lot of the problems done on board/in class were too conceptual. Wish we had more time to do HW problems in class. Schedule was weird (learn something new on Monday and had only one day to study for quiz on Wed).

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She explains the math problems very clearly and the homework she assigned also matches the important knowledge which can help us understand those knowledge better.

Did you take this course because it was required or was it an elective?

☐ Required  ☐ Required, but one of several choices  ☑ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

maybe we can decrease the amount of quizzes and increase homework.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan TERM: Spring CURRENT YEAR: 2017
DEPARTMENT: Math COURSE #: 1273 SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: • INCORRECT: ✓  ❌

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
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   - 0-2 hours per week
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   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

The packets were fantastic! The review packets were also cool, too. The example problems and answers online to homework were very helpful as well.

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [X] Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. (Strongly Agree) (Agree) (Somewhat Agree) (Disagree) (Strongly Disagree) (Not Applicable)
2. My interest in the subject matter was stimulated by this course. (Strongly Agree) (Agree) (Somewhat Agree) (Disagree) (Strongly Disagree) (Not Applicable)
3. Instructional technology employed in this course was effective. (Strongly Agree) (Agree) (Somewhat Agree) (Disagree) (Strongly Disagree) (Not Applicable)
4. The grading standards for this course were clear. (Strongly Agree) (Agree) (Somewhat Agree) (Disagree) (Strongly Disagree) (Not Applicable)
5. I would recommend this course to other students. (Strongly Agree) (Agree) (Somewhat Agree) (Disagree) (Strongly Disagree) (Not Applicable)
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? (Exceptional) (Satisfactory) (Very Poor)
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**

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- Do not use pens with ink that soaking through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

**CORRECT:** ☐  **INCORRECT:** ✓ ☐ ☐

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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**What did the instructor do that most helped your learning?**

I really thought the way she presented the material for each class was very helpful. The packets were key for easy studying. I really enjoyed the help from office hours as well.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

It was a little frustrating having office hours right over suppertime but it was manageable.

Thank you for making calc II fun!

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Ken Lyons
DEPARTMENT: MATH
TERM: Spring
CURRENT YEAR: 2017
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS
- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☐
INCORRECT: ✓ ✗ ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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What did the instructor do that most helped your learning?

Long of office hours and example problems

Did you take this course because it was required or was it an elective?
☐ Required
☐ Required, but one of several choices
☒ Elective

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RD25561-PFI-5432
Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Lani Logan  TERM: Spring  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ✗  INCORRECT: ✗ ✗ ✗

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

The instructor explained the content well in the course and she is patient during her office hours.

Did you take this course because it was required or was it an elective?

- Required  - Required, but one of several choices  - Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Maybe provide more review samples of exams?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kinley Logan  
DEPARTMENT: Mathematics  
TERM: Spring  
COURSE #: 1274  
CURRENT YEAR: 2017  
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soak through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT:  ✔  
INCORRECT:  X  ❌

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Provided: __________  
Helped: __________  
Required: __________  
Elective: __________

Did you take this course because it was required or was it an elective?

• Required  
• Required, but one of several choices  
• Elective

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RD29561-PFI-5432  
Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response:

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

The course is already good given the amount of time.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Spring
COURSE #: MATH 272
SECTION: 001
CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaking through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ●
INCORRECT: ✓

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

- Very thorough explanations
- Extremely willing to help and meet
- "Dumbed down" hard content very well to help make it easier
- Note handouts made it very easy to follow along and stay on track but still do our own work
- Very helpful.

Thanks!

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

If possible, more lecture/discussion sections. Hard to cram all the content in 2 days/week w/ one prof & busy office hours.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: KIM LOGAN
DEPARTMENT: MATH
TERM: SPRING
COURSE #: 1212
SECTION: 001
CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

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<td>4. The instructor treated me with respect.</td>
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<td>5. I would recommend this instructor to other students.</td>
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What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?
○ Required
○ Required, but one of several choices
○ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

---

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional  
- Satisfactory  
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan
TERM: Spring
CURRENT YEAR: 2017
DEPARTMENT: Math
COURSE #: 1272
SECTION: 002

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☑️
INCORRECT: ✗ 📐 📐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

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What did the instructor do that most helped your learning?

- Great attitude towards all questions.
- Excellent willingness to help.
- Very fair.

10/10

Did you take this course because it was required or was it an elective?

- ☑️ Required
- ☐ Required, but one of several choices
- ☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: 1273  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT:  ○  INCORRECT:  ✗  ✗  ✗

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Really helpful worksheets.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

You are awesome. Keep it up Kim.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Spring  CURRENT YEAR: 2017
DEPARTMENT: MATH  COURSE #: 1272  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ∙  INCORRECT: ✓ × ◯ ●

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She went in depth with the concepts.

Did you take this course because it was required or was it an elective?

☑ Required  ○ Required, but one of several choices  ○ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   [ ] Strongly Agree  [ ] Agree  [ ] Somewhat Agree  [ ] Somewhat Disagree  [ ] Disagree  [ ] Strongly Disagree  [ ] Not Applicable

2. My interest in the subject matter was stimulated by this course.  
   [ ] Strongly Agree  [ ] Agree  [ ] Somewhat Agree  [ ] Somewhat Disagree  [ ] Disagree  [ ] Strongly Disagree  [ ] Not Applicable

3. Instructional technology employed in this course was effective.  
   [ ] Strongly Agree  [ ] Agree  [ ] Somewhat Agree  [ ] Somewhat Disagree  [ ] Disagree  [ ] Strongly Disagree  [ ] Not Applicable

4. The grading standards for this course were clear.  
   [ ] Strongly Agree  [ ] Agree  [ ] Somewhat Agree  [ ] Somewhat Disagree  [ ] Disagree  [ ] Strongly Disagree  [ ] Not Applicable

5. I would recommend this course to other students.  
   [ ] Strongly Agree  [ ] Agree  [ ] Somewhat Agree  [ ] Somewhat Disagree  [ ] Disagree  [ ] Strongly Disagree  [ ] Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   [ ] 0-2 hours per week  [ ] 3-5 hours per week  [ ] 6-9 hours per week  [ ] 10-14 hours per week  [ ] 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  
[ ] Exceptional  [ ] Satisfactory  [ ] Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan  TERM: Spring  CURRENT YEAR: 2019
DEPARTMENT: MATH  COURSE #: 1772  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: ☐  INCORRECT: ✓ ✗ ☐ ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?
☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional   Satisfactory   Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: kim Logan
DEPARTMENT: Math
TERM: Spring
COURSE #: 1272
CURRENT YEAR: 2017
SECTION: (Lee Dix) 00

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☑  INCORRECT: ✗ ◯ ◯ ◯

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

4. The instructor provided feedback intended to improve my course performance.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Explain problems really exclusively and patiently

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective

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RD29561-PF1-5432  Office of Measurement Services
**Course Items:**

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. My interest in the subject matter was stimulated by this course.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Instructional technology employed in this course was effective.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The grading standards for this course were clear.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I would recommend this course to other students.</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 0-2 hours per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 3-5 hours per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 6-9 hours per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 10-14 hours per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ 15 or more hours per week</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What suggestions do you have for improving the course?**

---

**Course Environment**

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Exceptional</th>
<th>Satisfactory</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan    TERM: Spring    CURRENT YEAR: 2017
DEPARTMENT: Math    COURSE #: 1272    SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

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• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: ☐    INCORRECT: ☒    ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

What did the instructor do that most helped your learning?

very clear, I could tell him his genuine interest in the course material so it was much more interesting and therefore easier to follow.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

better classroom, is too small, but I need the book.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6:

1 being “Strongly Disagree” and 6 being “Strongly Agree”.

Math 1272: Calculus II, Fall 2017
Response rate: 15 out of 25 enrolled

As related to the instructor . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The instructor was well prepared for class.”</td>
<td>5.93</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor presented the subject matter clearly.”</td>
<td>5.80</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor provided feedback intended to improve my course performance.”</td>
<td>5.67</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor treated me with respect.”</td>
<td>5.93</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this instructor to other students.”</td>
<td>5.87</td>
<td>6.00</td>
</tr>
</tbody>
</table>

As related to the course . . .

<table>
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<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I have a deeper understanding of the subject matter as a result of this course.”</td>
<td>5.53</td>
<td>6.00</td>
</tr>
<tr>
<td>“My interest in the subject matter was stimulated by this course.”</td>
<td>4.93</td>
<td>5.00</td>
</tr>
<tr>
<td>“Instructional technology employed in this course was effective.”</td>
<td>5.57</td>
<td>6.00</td>
</tr>
<tr>
<td>“The grading standards for this course were clear.”</td>
<td>5.33</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this course to other students.”</td>
<td>4.93</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Selected Comments:

- “Best teacher I’ve had here at the university so far. Really appreciated her office hours were right before lectures so any homework questions could be addressed. She was always easy to talk to and welcoming and extremely helpful in office hours. I really liked how organized her notes were, giving us note packets every time helped me immensely. . . . Best math teacher I’ve had here, Will miss her as I move on.”

- “She was friendly and open to questions or even corrections to her boardwork. She’s always positive and enthusiastic about the class and what we learned which made me interested and more engaged.”

- “Kim is awesome. She provides ample amounts of resources for learning on moodle and she teaches and grades in a clear, and precise way. Best college teacher I’ve ever had. Not kidding.”

- “Kim explains things well in class and responds to my e-mails quickly every time. She also provides clear grade range after exams. I attend[ed] several office hours and she help[ed] me to figure out my problems every time.”

- “Very good job contextualizing what we were doing – important to me.”

- “She is very detail oriented and does not proceed until all of the students are ready.”

- “I can say that Kim has been one of the best instructors I’ve had in college. She is approachable and willing to help no matter what.”

- “Best professor ever.”
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan	TERM: Fall	CURRENT YEAR: 2017
DEPARTMENT: Math	COURSE #: 1272	SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

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CORRECT: □
INCORRECT: ✓ X

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She was very friendly and open to questions or even corrections to her boardwork. She's always positive and enthusiastic about the class and what we learned which made me interested and more engaged.

Did you take this course because it was required or was it an elective?

□ Required
□ Required, but one of several choices
□ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   - Strongly Agree  - Agree  - Somewhat Agree  - Disagree  - Strongly Disagree  - Not Applicable
2. My interest in the subject matter was stimulated by this course.  
   - Strongly Agree  - Agree  - Somewhat Agree  - Disagree  - Strongly Disagree  - Not Applicable
3. Instructional technology employed in this course was effective.  
   - Strongly Agree  - Agree  - Somewhat Agree  - Disagree  - Strongly Disagree  - Not Applicable
4. The grading standards for this course were clear.  
   - Strongly Agree  - Agree  - Somewhat Agree  - Disagree  - Strongly Disagree  - Not Applicable
5. I would recommend this course to other students.  
   - Strongly Agree  - Agree  - Somewhat Agree  - Disagree  - Strongly Disagree  - Not Applicable
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

I'm a PSEO student so I think I was unaware of some things that happen with grading, of the finals and stuff until I had other people tell me, but otherwise no complaints.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  
   - Exceptional  
   - Satisfactory  
   - Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

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**CORRECT:** ☐ **INCORRECT:** ✓ × ☐

---

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

---

**What did the instructor do that most helped your learning?**

Best teacher I've had here at the University so far.

Really appreciated how her office hours were right before lectures so any homework questions could be addressed. She was always easy to talk to and welcoming and explained helpers in office hours.

I really liked how organized her notes were, gave us a note packet every time. Helped me immensely. Also, she projected the pdf onto the white board to help you keep track of your notes was awesome. Best math teacher I've had here. Will miss her as I move on.

---

**Did you take this course because it was required or was it an elective?**

- Required
- Required, but one of several choices
- Elective
Course Items:
Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
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   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Implement some real life applications or some context to everyday

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Fall
CURRENT YEAR: 2017
DEPARTMENT: Math
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

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• Erase thoroughly any answer you wish to change.

CORRECT: ☐
INCORRECT: ✗ ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did examples in class, posted answers online

A very helpful in office hours

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

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1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I think that sometimes the "proofs" of the subject/lecture we are learning can be confusing. Because so much of this I have never seen before, when I am so focused on learning why something works and why we can use the equation it only confuses me.

Last year I had a teacher who only taught what we needed to do w/out proving why we can do it & it was very easy to follow.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Fall
CURRENT YEAR: 2017
DEPARTMENT: MATH
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

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- Make solid marks that fill the response completely.

CORRECT: ☐  INCORRECT: ✓ X ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?
She answered questions and clarified tough concepts during class.

Did you take this course because it was required or was it an elective?
☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

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1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   0-2 hours per week
   3-5 hours per week
   6-9 hours per week
   10-14 hours per week
   15 or more hours per week

What suggestions do you have for improving the course?

Stretch it out over 4 days a week so that each lesson isn't so long.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional     Satisfactory     Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Fall
CURRENT YEAR: 2017
DEPARTMENT: Math
COURSE #: Math 1272
SECTION: 001

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CORRECT: ✐
INCORRECT: ☑ ☑

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

- Worksheets
- Online tests
- Many examples
- No surprises (straight forward)

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☒ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Fall 2017
CURRENT YEAR: 2017
COURSE #: 1272
SECTION: 001

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Correct: ☐ Incorrect: ✓ × ☐

Instructor Items:
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2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Kim is awesome. She provides ample amounts of resources for learning on Moodle, and she teaches and grades in a clear, and precise way. Most college teacher I've ever had.

Not kidding.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Office of Measurement Services
Course Items:

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   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

None. Kim does an awesome job with updating moodle and providing learning resources.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
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- Make solid marks that fill the response completely.

CORRECT: o
INCORRECT: ✓ ☒ ❌

What did the instructor do that most helped your learning?

Kim explains things well in class and responds to my emails quickly everyday. She also provides clear grade range after exams. I attend several office hours and she helps me to figure out my problems every time.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

Alternative formats of this document are available upon request by contacting oms@umn.edu or 612-626-0006.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I think this course is good enough for me.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Fall
DEPARTMENT: Math
COURSE #: 127-2
SECTION: 001
CURRENT YEAR: 2017

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☐
INCORRECT: ✓ ✗ ☑ ✧

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Very good job contextualizing what we were doing, important to me.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☒ Elective

Alternative formats of this document are available upon request by contacting oms@umn.edu or 612-626-0006.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I don't think I could read and understand any of the comments on my exams.

Also get rid of seg and series, too boring lol.

I don't have any constructive feedback.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.
• Make no stray marks on answer sheet.
• Make solid marks that fill the response completely.

CORRECT: 0  INCORRECT: ✓ X 0 *

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She is very detail oriented and does not proceed until all
at the students are ready.

Did you take this course because it was required or was it an elective?

☑ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
YOUR RESPONSES TO THIS QUESTIONNAIRE ARE IMPORTANT BECAUSE THEY WILL BE USED IN REVIEWING THE TEACHING PERFORMANCE OF YOUR INSTRUCTOR. YOUR WRITTEN COMMENTS ARE ALSO REQUESTED TO HELP YOUR INSTRUCTOR IMPROVE FUTURE COURSE OFFERINGS. THE RESULTS OF THIS RATING (INCLUDING ALL RATING FORMS) WILL NOT BE RETURNED TO THE INSTRUCTOR UNTIL AFTER THE FINAL GRADES ARE SUBMITTED FOR THIS COURSE.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT:   INCORRECT:   ✓  ☐  ☑

INSTRUCTOR ITEMS:

Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

I can say that Kim has been one of the best instructors I've had in college. She is approachable and willing to help no matter what.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:
Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   - [ ] Strongly Agree  
   - [ ] Somewhat Agree  
   - [ ] Somewhat Disagree  
   - [ ] Strongly Disagree  
   - [ ] Not Applicable

2. My interest in the subject matter was stimulated by this course.  
   - [ ] Strongly Agree  
   - [ ] Somewhat Agree  
   - [ ] Somewhat Disagree  
   - [ ] Strongly Disagree  
   - [ ] Not Applicable

3. Instructional technology employed in this course was effective.  
   - [ ] Strongly Agree  
   - [ ] Somewhat Agree  
   - [ ] Somewhat Disagree  
   - [ ] Strongly Disagree  
   - [ ] Not Applicable

4. The grading standards for this course were clear.  
   - [ ] Strongly Agree  
   - [ ] Somewhat Agree  
   - [ ] Somewhat Disagree  
   - [ ] Strongly Disagree  
   - [ ] Not Applicable

5. I would recommend this course to other students.  
   - [ ] Strongly Agree  
   - [ ] Somewhat Agree  
   - [ ] Somewhat Disagree  
   - [ ] Strongly Disagree  
   - [ ] Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - [ ] 0-2 hours per week  
   - [ ] 3-5 hours per week  
   - [ ] 6-9 hours per week  
   - [ ] 10-14 hours per week  
   - [ ] 15 or more hours per week

What suggestions do you have for improving the course?

My one qualm with this class, and all math classes at the U are the way in which final grades are handed out.

Course Environment
How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  
   - [ ] Exceptional  
   - [ ] Satisfactory  
   - [ ] Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Fall  CURRENT YEAR: 2017
DEPARTMENT: Math  COURSE #: 292  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

• Use a No. 2 pencil or a blue or black ink pen only.
• Do not use pens with ink that soaks through the paper.
• Erase thoroughly any answer you wish to change.

CORRECT: ★  INCORRECT: ✓ × ±

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

worksheets.

Did you take this course because it was required or was it an elective?

★ Required
○ Required, but one of several choices
○ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
**Instructor Items:**
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The instructor was well prepared for class.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>2. The instructor presented the subject matter clearly.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>3. The instructor provided feedback intended to improve my course performance.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>4. The instructor treated me with respect.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>5. I would recommend this instructor to other students.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
</tbody>
</table>

**What did the instructor do that most helped your learning?**

*Best professor ever.*

**Did you take this course because it was required or was it an elective?**

- ☐ Required
- ☐ Required, but one of several choices
- ☑ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

\[\text{NA}\]

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

[Scale: Exceptional, Satisfactory, Very Poor]
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

CORRECT: ●
INCORRECT: ✓ × ○

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

3. Instructional technology employed in this course was effective.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

4. The grading standards for this course were clear.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

5. I would recommend this course to other students.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional  
- Satisfactory  
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Fall
CURRENT YEAR: 2017
DEPARTMENT: Math
COURSE #: 1272
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

**CORRECT: ●**

**INCORRECT: ✓ × ◎ ●**

**Instructor Items:**

Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**

The worksheets and the clear handwriting.
Also, the content on Moodle is some of the best I've had.

**Did you take this course because it was required or was it an elective?**

- ◯ Required
- ◯ Required, but one of several choices
- ◯ Elective

Alternative formats of this document are available upon request by contacting ons@umn.edu or 612-626-0006.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Make the reviews (if you're going to have them) more balanced. The last exam caught me a bit off guard as I wasn't expecting as much emphasis on the Ratio Test. I still appreciated them though. 😊

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional        Satisfactory        Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

**MARKING INSTRUCTIONS**

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

**INSTRUCTOR ITEMS:**

Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**

The instructor was very clear when answering questions, also gave additional information to help make the answer clearer.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Add a discussion section

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

Exceptional  
Satisfactory  
Very Poor
Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6:

1 being “Strongly Disagree” and 6 being “Strongly Agree”.

**Math 1142: Short Calculus, Summer 2016**
Response rate: 19 out of 23 enrolled

As related to the instructor . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The instructor was well prepared for class.”</td>
<td>5.93</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor presented the subject matter clearly.”</td>
<td>5.79</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor provided feedback intended to improve my course performance.”</td>
<td>5.63</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor treated me with respect.”</td>
<td>5.89</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this instructor to other students.”</td>
<td>5.79</td>
<td>6.00</td>
</tr>
</tbody>
</table>

As related to the course . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I have a deeper understanding of the subject matter as a result of this course.”</td>
<td>5.58</td>
<td>6.00</td>
</tr>
<tr>
<td>“My interest in the subject matter was stimulated by this course.”</td>
<td>4.89</td>
<td>5.00</td>
</tr>
<tr>
<td>“Instructional technology employed in this course was effective .”</td>
<td>5.74</td>
<td>6.00</td>
</tr>
<tr>
<td>“The grading standards for this course were clear.”</td>
<td>5.47</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this course to other students.”</td>
<td>5.26</td>
<td>6.00</td>
</tr>
</tbody>
</table>

**Selected Comments:**

- “Very good at speaking and presenting to a class.”
- “Always open to questions – when asking for help, [I] never felt like [I was] wasting time. [She] wants you to succeed.”
- “The first instructor in the math department I have had who actually cares about the students and has a strong willingness to help and answer question. She was very understanding and wants you to learn, which is nonexistent elsewhere.”
- “I was dreading calculus but Kim made learning easy and clear. She was fantastic ad I would stringky recommend her to my classmates.”
- “She simplified complex concepts and overall was the best math teacher I’ve had so far at the university.”
- ‘Kim was an amazing instructor and I definitely learned a lot from this class.”
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Summer
CURRENT YEAR: 2016
COURSE #: 147
SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?
- provided worksheets for every section
- held office hours every day before class
- put both blank copies and solutions to quizzes/tests online

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional  
- Satisfactory  
- Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☑ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? 

Exceptional | Satisfactory | Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim
DEPARTMENT: Math
TERM: Summer
COURSE #: 1145
SECTION: 1
CURRENT YEAR: 2016

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Very good at speaking and presenting
To a class,

Did you take this course because it was required or was it an elective?
☐ Required
☒ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree
   [ ] Not Applicable
2. My interest in the subject matter was stimulated by this course. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree
   [ ] Not Applicable
3. Instructional technology employed in this course was effective. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree
   [ ] Not Applicable
4. The grading standards for this course were clear. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree
   [ ] Not Applicable
5. I would recommend this course to other students. [ ] Strongly Agree [ ] Agree [ ] Somewhat Agree [ ] Disagree [ ] Strongly Disagree
   [ ] Not Applicable
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   [ ] 0-2 hours per week
   [ ] 3-5 hours per week
   [ ] 6-9 hours per week
   [ ] 10-14 hours per week
   [ ] 15 or more hours per week

What suggestions do you have for improving the course?

Nothing, it went very fast due to Summer. But you can’t do anything about that.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

[ ] Exceptional [ ] Satisfactory [ ] Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Summer  CURRENT YEAR: 2016
DEPARTMENT: Math  COURSE #: 1140  SECTION: 16

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**Strongly Agree**

**Agree**

**Somewhat Agree**

**Disagree**

**Strongly Disagree**

---

**What did the instructor do that most helped your learning?**

In-Class Notes

Before/After-Class Assistance

---

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. My interest in the subject matter was stimulated by this course.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3. Instructional technology employed in this course was effective.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4. The grading standards for this course were clear.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. I would recommend this course to other students.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td>o 10-14 hours per week</td>
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<td>o 15 or more hours per week</td>
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</tr>
</tbody>
</table>

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Exceptional</td>
</tr>
<tr>
<td>3</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>2</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: [Name]  TERM: Summer  CURRENT YEAR: 2016
DEPARTMENT: Math  COURSE #: 142  SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Always open to questions - when asking for help never felt like wasting time - wants you to succeed

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?


Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Nothing

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

NONE.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Summer
CURRENT YEAR: 2016
COURSE #: 1417
SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Summer

DEPARTMENT: ________________________ COURSE #: 1142
CURRENT YEAR: 2018
SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

When teaching the material, she went at a very reasonable pace and asked a few questions at the end.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?


Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
### Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<td>4</td>
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<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

### What did the instructor do that most helped your learning?

The first instructor in the Math Department I have had who actually cares about the students and has a strong willingness to help and answer questions. She was very understanding and wants you to learn, which is nonexistent elsewhere here.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

N/A

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Layon
DEPARTMENT: Math
TERM: Summer 2016
COURSE #: 1142
SECTION: 01
CURRENT YEAR: 2016

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
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<td>✑</td>
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</tbody>
</table>

What did the instructor do that most helped your learning?

She taught the class well.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☒ Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - [ ] 0-2 hours per week
   - [ ] 3-5 hours per week
   - [X] 6-9 hours per week
   - [ ] 10-14 hours per week
   - [ ] 15 or more hours per week

What suggestions do you have for improving the course?

None

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Summer
CURRENT YEAR: 2016/Fall
COURSE #: 1142
SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.

CORRECT: ☐️
INCORRECT: ✔️ × ☐️

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

---

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Summer 2016
COURSE #: 1142
SECTION: 
CURRENT YEAR: 2016

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course.

MARKING INSTRUCTIONS

- Use a No. 2 pencil or a blue or black ink pen only.
- Do not use pens with ink that soaks through the paper.
- Erase thoroughly any answer you wish to change.
- Make no stray marks on answer sheet.
- Make solid marks that fill the response completely.

CORRECT: ☐
INCORRECT: ☑ X ☐

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

Alternative formats of this document are available upon request by contacting oms@umn.edu or 612-626-0006.

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RD20581-PFI-5421 Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response

1. I have a deeper understanding of the subject matter as a result of this course.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

3. Instructional technology employed in this course was effective.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

4. The grading standards for this course were clear.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

5. I would recommend this course to other students.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional  
- Satisfactory  
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Isgar
DEPARTMENT: Math
TERM: Spring, 2016
COURSE #: 1142
SECTION: 
CURRENT YEAR: 2016

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

- Workshops, relevant homework didn't trick us on tests/quizzes.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Maybe have required homework to make up a portion of the total points so that everything is quiz/test points.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: KIM ELIGGE LOGAN  TERM: SUMMER  CURRENT YEAR: 2010
DEPARTMENT:  COURSE #: 1142  SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
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<td>1.</td>
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</tr>
</tbody>
</table>

What did the instructor do that most helped your learning?

I was dreading taking calculus but Kim made learning easy and clear. She was fantastic and I would strongly recommend her to my classmates.

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I was very pleased with everything. My one suggestion would be to allow us to use calculators on the exams.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

She simplified complex concepts and overall was the best math teacher I've had so far at the university.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
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<td>2. My interest in the subject matter was stimulated by this course.</td>
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<td>3. Instructional technology employed in this course was effective.</td>
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<td>4. The grading standards for this course were clear.</td>
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<tr>
<td>5. I would recommend this course to other students.</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
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<td>- 0-2 hours per week</td>
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<td>- 3-5 hours per week</td>
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<td>☐</td>
<td>☐</td>
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<td>- 6-9 hours per week</td>
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<td>- 10-14 hours per week</td>
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<td>- 15 or more hours per week</td>
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<td>☐</td>
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<td>☐</td>
<td>☐</td>
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</tbody>
</table>

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional | Satisfactory | Very Poor
---|---|---
☐ | ☐ | ☐
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

THE PACKETS WERE SUPER HELPFUL! DEFINITELY MADE IT EASIER TO LEARN, FOLLOW ALONG, AND STUDY.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   • 0-2 hours per week
   • 3-5 hours per week
   • 6-9 hours per week
   • 10-14 hours per week
   • 15 or more hours per week

What suggestions do you have for improving the course?

IT WOULD BE HELPFUL TO HAVE DAYS DEDICATED TO DISCUSSION RATHER THAN HAVING LECTURE EVERY DAY.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional   Satisfactory   Very Poor
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?
She provided worksheets with examples, along with solutions to exams and quizzes online.

Did you take this course because it was required or was it an elective?
- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Review packets for each exam

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional   Satisfactory   Very Poor
   5   4   3   2   1
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERMINAL: Summer  CURRENT YEAR: 2016
DEPARTMENT: MATH  COURSE #: 1142  SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th>1. The instructor was well prepared for class.</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. The instructor presented the subject matter clearly.</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Somewhat Agree</td>
<td>Somewhat Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
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<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3. The instructor provided feedback intended to improve my course performance.</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Somewhat Agree</td>
<td>Somewhat Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. The instructor treated me with respect.</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Somewhat Agree</td>
<td>Somewhat Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
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<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5. I would recommend this instructor to other students.</td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Somewhat Agree</td>
<td>Somewhat Disagree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**What did the instructor do that most helped your learning?**

Lots of examples, and she was willing to go over anything and everything I had questions about.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
2. My interest in the subject matter was stimulated by this course.  [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
3. Instructional technology employed in this course was effective.  [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
4. The grading standards for this course were clear.  [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
5. I would recommend this course to other students.  [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Nothing I can think of at the moment. Kim was an amazing instructor and I definitely learned a lot from this class.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  [Exceptional] [Satisfactory] [Very Poor]
Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

**What did the instructor do that most helped your learning?**
- Fast e-mail replies
- Helps students a lot w/ their questions
- Explain problems thoroughly

*Did you take this course because it was required or was it an elective?*
- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?
Below are the responses to evaluations from courses for which I was Instructor at the University of Minnesota. Full evaluations begin on the next page. Students are given each of the following statements for which they much respond on a scale of 1 to 6: 1 being “Strongly Disagree” and 6 being “Strongly Agree”.

**Math 1142: Short Calculus**, Summer 2015
Response rate: 20 out of 24 enrolled

As related to the instructor . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The instructor was well prepared for class.”</td>
<td>5.95</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor presented the subject matter clearly.”</td>
<td>5.95</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor provided feedback intended to improve my course performance.”</td>
<td>5.75</td>
<td>6.00</td>
</tr>
<tr>
<td>“The instructor treated me with respect.”</td>
<td>5.90</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this instructor to other students.”</td>
<td><strong>5.95</strong></td>
<td>6.00</td>
</tr>
</tbody>
</table>

As related to the course . . .

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I have a deeper understanding of the subject matter as a result of this course.”</td>
<td>5.55</td>
<td>6.00</td>
</tr>
<tr>
<td>“My interest in the subject matter was stimulated by this course.”</td>
<td>4.75</td>
<td>5.00</td>
</tr>
<tr>
<td>“Instructional technology employed in this course was effective.”</td>
<td>5.74</td>
<td>6.00</td>
</tr>
<tr>
<td>“The grading standards for this course were clear.”</td>
<td>5.20</td>
<td>6.00</td>
</tr>
<tr>
<td>“I would recommend this course to other students.”</td>
<td>5.50</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Selected Comments:

- “[She] went at an excellent pace, always thoroughly answered questions, prepared handouts and projected material on white boards. Super well-prepared. It was excellent.”
- “Kim was great at answer[ing] questions and put a lot of effort into the class.”
- “Great instructor, came very prepared to teach. Had a lot of energy and [was] excited about math.”
- “Very Good instructor. Presented subject matter clearly; outlines her expectations clearly for exams/quizzes.”
- “[She] presented in depth notes, explain[ed] subject matter clearly, [and] spoke in a language we would understand.”
- “[She has] high energy which is great for early morning and [it] very enthusiastic about teaching. [She] makes the material easy to understand.”
- “If someone asked a question, Kim would try and explain it a different way instead of just repeating herself and was always open to helping us even if it meant we would get behind.”
- “Made a fun learning environment and kept people engaged in coursework.”
- “Lecture and notes were well-structured and correlated. Excellent feedback tailored to each students needs!”
- “Keep Kim! She”s the best teacher I’ve ever had in any subject. She knows how to explain everything in an easy way, and is more than helpful at her job.”
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan TERM: Summer CURRENT YEAR: 2015
DEPARTMENT: MatC COURSE #: 1191 SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

Strongly Agree Agree Somewhat Agree Somewhat Disagree Disagree Strongly Disagree

What did the instructor do that most helped your learning?

Creating worksheets for us to follow along with. Also making herself available of new

Did you take this course because it was required or was it an elective?

☑ Required
☐ Required, but one of several choices
☐ Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Making office hours before class on all quiz days

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Went at an excellent pace, always thoroughly answered questions, prepared handouts and projected material on white boards. Super well-prepared.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
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   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

It was excellent. No suggestions.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan TER Ma SUMMER CURRENT YEAR: 2015
DEPARTMENT: MATH COURSE #: 40 SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Loegel  TERM: Summer 2015  CURRENT YEAR: 
DEPARTMENT: MATH  COURSE #: 1142  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

[Handwritten response: "He was great at answering questions. I put a lot of effort into the class."

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: Math
TERM: Summer
COURSE #: 1142
SECTION: 001
CURRENT YEAR: 2015

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

Strongly Agree  Agree  Somewhat Agree  Slightly Disagree  Disagree  Strongly Disagree

What did the instructor do that most helped your learning?

- Great instructor, came very prepared to teach.
- Had a lot of energy and excited about math.

Did you take this course because it was required or was it an elective?

Required
Required, but one of several choices
Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
# University of Minnesota Student Rating of Teaching

**INSTRUCTOR:** Kim Logan  
**TERM:** Summer  
**CURRENT YEAR:** 2015  
**DEPARTMENT:** MATH  
**COURSE #:** 1142  
**SECTION:** 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

### Instructor Items:
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The instructor was well prepared for class.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2. The instructor presented the subject matter clearly.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3. The instructor provided feedback intended to improve my course performance.</td>
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<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4. The instructor treated me with respect.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>5. I would recommend this instructor to other students.</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

### What did the instructor do that most helped your learning?

She really took her time to explain everything thoroughly so that everyone understood. Unlike Gregory Puffa who just runs through examples disregarding whether or not the class understands.

---

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [x] Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

NOTHING SHE IS AWESOME!!

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  TERM: Summer  CURRENT YEAR: 15
DEPARTMENT: Math  COURSE #: 1142  SECTION: 001

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

- Printing out notes
- Very personable

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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RD239452-PF1-5421 Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Keep Kim! She's the best teacher I've ever had in any subject. She knows how to explain everything in an easy way, and is more than helpful at her job.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional Satisfactory Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Her study guides were extremely helpful, along with her flexible office hours.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

I think having more opportunities for getting grades would help, (i.e. required homework).

Course Environment

How would you rate the physical environment in which you take this class, especially classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional
- Satisfactory
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Logan Kimberly  TERM: Summer 15  CURRENT YEAR: 2015
DEPARTMENT:  COURSE #: 1742  SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Very good instructor. Presented subject matter very well. Outlined her expectations clearly for exams/quizzes.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
   - Strongly Agree  
   - Agree  
   - Somewhat Agree  
   - Somewhat Disagree  
   - Disagree  
   - Strongly Disagree  
   - Not Applicable
2. My interest in the subject matter was stimulated by this course.  
3. Instructional technology employed in this course was effective.  
4. The grading standards for this course were clear.  
5. I would recommend this course to other students.  
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?  
   - 0-2 hours per week  
   - 3-5 hours per week  
   - 6-9 hours per week  
   - 10-14 hours per week  
   - 15 or more hours per week

What suggestions do you have for improving the course?

Warning. Brilliant!

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

- Exceptional  
- Satisfactory  
- Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: 
CURRENT YEAR: 

DEPARTMENT: Math
COURSE #: 
SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

Strongly Agree
Agree
Somewhat Agree
Somewhat Disagree
Disagree
Strongly Disagree

What did the instructor do that most helped your learning?

Always was there to answer any questions I had, and also was available either before or after class everyday to help if needed.

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Office of Measurement Services
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. My interest in the subject matter was stimulated by this course.</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Instructional technology employed in this course was effective.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The grading standards for this course were clear.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I would recommend this course to other students.</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>o 0-2 hours per week</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>o 3-5 hours per week</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
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<tr>
<td>o 6-9 hours per week</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td></td>
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<tr>
<td>o 10-14 hours per week</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o 15 or more hours per week</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What suggestions do you have for improving the course?  

let students know their overall grade

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?  

<table>
<thead>
<tr>
<th>Rating</th>
<th>Exceptional</th>
<th>Satisfactory</th>
<th>Very Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td></td>
<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Logan Kimberly  TERM: Summer  CURRENT YEAR: 2015
DEPARTMENT: Mark  COURSE #: 1142  SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

**Instructor Items:**
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What did the instructor do that most helped your learning?**

- Prepared in depth notes
- Explained subject matter clearly
- Spoke in language we would understand

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. Strongly Agree Agree Somewhat Agree Disagree Strongly Disagree Not Applicable
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? Exceptional Satisfactory Very Poor
Instructor Items:
Carefully read each statement and select a response

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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</thead>
<tbody>
<tr>
<td>1. The instructor was well prepared for class.</td>
<td></td>
<td></td>
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<td>2. The instructor presented the subject matter clearly.</td>
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<td>3. The instructor provided feedback intended to improve my course performance.</td>
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<td>4. The instructor treated me with respect.</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>5. I would recommend this instructor to other students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What did the instructor do that most helped your learning?

Pam helped me answer every question I had in class, in office hours, and in email. She was very good at explaining things.
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
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   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
DEPARTMENT: MATH
TERM: Summer
COURSE #: 1147
CURRENT YEAR: 2015
SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

High energy, which is great for early morning and very enthusiastic about teaching. Makes the material easy to understand.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

2. My interest in the subject matter was stimulated by this course.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

3. Instructional technology employed in this course was effective.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

4. The grading standards for this course were clear.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

5. I would recommend this course to other students.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Disagree
   - Strongly Disagree
   - Not Applicable

6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional
Satisfactory
Very Poor
Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What did the instructor do that most helped your learning?

If someone asked a question, Kim would try and explain in a different way instead of just repeating herself and was always open to helping us even if it meant we would get behind.

Did you take this course because it was required or was it an elective?

- [ ] Required
- [ ] Required, but one of several choices
- [ ] Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.  
2. My interest in the subject matter was stimulated by this course. 
3. Instructional technology employed in this course was effective. 
4. The grading standards for this course were clear. 
5. I would recommend this course to other students. 
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Quizzes every other day are somewhat stressful and I sometimes didn't understand the homework and then had to fail that same question on the quiz the next day.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional  Satisfactory  Very Poor
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Loescher  TERM: Summer  CURRENT YEAR: 2015
DEPARTMENT: Mathematics  COURSE #: 1142  SECTION: 

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

The worksheets are the best mathematics teaching tools that I have seen at the University so far. I hope other instructors can see the utility provided and use them as well.

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have a deeper understanding of the subject matter as a result of this course.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2. My interest in the subject matter was stimulated by this course.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3. Instructional technology employed in this course was effective.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. The grading standards for this course were clear.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5. I would recommend this course to other students.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- 0-2 hours per week
- 3-5 hours per week
- 6-9 hours per week
- 10-14 hours per week
- 15 or more hours per week

What suggestions do you have for improving the course?

Use Kim’s teaching methods. Simple lectures for 2 hours are not effective in my opinion.

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Exceptional</th>
<th>Satisfactory</th>
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<tr>
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<td>2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kimberly Logan  TERM: Summer  CURRENT YEAR: 2015
DEPARTMENT: Mathematics  COURSE #: MTH 119  SECTION: 1

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Made a fun learning environment, and kept people engaged.

in course work

Did you take this course because it was required or was it an elective?

☐ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course. [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
2. My interest in the subject matter was stimulated by this course. [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
3. Instructional technology employed in this course was effective. [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
4. The grading standards for this course were clear. [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
5. I would recommend this course to other students. [Strongly Agree] [Agree] [Somewhat Agree] [Disagree] [Strongly Disagree] [Not Applicable]
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate? [Exceptional] [Satisfactory] [Very Poor]

Hand loud noises for some reason occasionally.
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan  
TERM: Summer  
CURRENT YEAR: 2015  
DEPARTMENT: Math  
COURSE #: 1142  
SECTION:  

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

### Instructor Items:

Carefully read each statement and select a response

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<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The instructor was well prepared for class.</td>
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<td>2. The instructor presented the subject matter clearly.</td>
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</tr>
<tr>
<td>3. The instructor provided feedback intended to improve my course performance.</td>
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<tr>
<td>4. The instructor treated me with respect.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5. I would recommend this instructor to other students.</td>
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<td></td>
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</tr>
</tbody>
</table>

### What did the instructor do that most helped your learning?

Lecture and notes were well structured and correlated.
Excellent feedback tailored to each student's needs.

---

Did you take this course because it was required or was it an elective?

- Required
- Required, but one of several choices
- Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
3. Instructional technology employed in this course was effective.
4. The grading standards for this course were clear.
5. I would recommend this course to other students.
6. Approximately how many hours per week did you spend working on homework, readings, and projects for this course?
   - 0-2 hours per week
   - 3-5 hours per week
   - 6-9 hours per week
   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

No, this short calculus experience has been much better than my last one!

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

<table>
<thead>
<tr>
<th>Exceptional</th>
<th>Satisfactory</th>
<th>Very Poor</th>
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<tbody>
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</tbody>
</table>
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Logan
TERM: Winter
CURRENT YEAR: 2016

DEPARTMENT: Math
COURSE #: 1112
SECTION: 01

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Explain: Explained True concepts!!

Did you take this course because it was required or was it an elective?

☑ Required
☐ Required, but one of several choices
☐ Elective
Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I have a deeper understanding of the subject matter as a result of this course.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2.</td>
<td>My interest in the subject matter was stimulated by this course.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3.</td>
<td>Instructional technology employed in this course was effective.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4.</td>
<td>The grading standards for this course were clear.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5.</td>
<td>I would recommend this course to other students.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6.</td>
<td>Approximately how many hours per week did you spend working on homework, readings, and projects for this course?</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- 0-2 hours per week
- 3-5 hours per week
- 6-9 hours per week
- 10-14 hours per week
- 15 or more hours per week

What suggestions do you have for improving the course?

Thanks!
University of Minnesota Student Rating of Teaching

INSTRUCTOR: Kim Layun
TERM: Summer
CURRENT YEAR: 2015

DEPARTMENT: Math
COURSE #: LKP
SECTION: 021

Your responses to this questionnaire are important because they will be used in reviewing the teaching performance of your instructor. Your written comments are also requested to help your instructor improve future course offerings. The results of this rating (including all rating forms) will not be returned to the instructor until after the final grades are submitted for this course. In addition to a No. 2 pencil, you may use a blue or black pen. Completely fill in the oval of your choice. If you erase, erase completely. Multiple marks will result in the answer being omitted from the results.

Instructor Items:
Carefully read each statement and select a response

1. The instructor was well prepared for class.
2. The instructor presented the subject matter clearly.
3. The instructor provided feedback intended to improve my course performance.
4. The instructor treated me with respect.
5. I would recommend this instructor to other students.

What did the instructor do that most helped your learning?

Did you take this course because it was required or was it an elective?
☐ Required
☐ Required, but one of several choices
☐ Elective

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Course Items:

Course item survey results will be made available online to help students make course selections. Carefully read each statement and select a response.

1. I have a deeper understanding of the subject matter as a result of this course.
2. My interest in the subject matter was stimulated by this course.
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   - 10-14 hours per week
   - 15 or more hours per week

What suggestions do you have for improving the course?

Course Environment

How would you rate the physical environment in which you take this class, especially the classroom facilities, including your ability to see, hear, concentrate and participate?

Exceptional       Satisfactory       Very Poor