PRINT YOUR NAME:

PRINT YOUR TA’S NAME:

WHAT SECTION ARE YOU IN?

Closed book, closed notes, no calculators/PDAs; no reference materials of any kind. Turn off all handheld devices, including cell phones.

Show work; a correct answer, by itself, may be insufficient for credit. Arithmetic need not be simplified, unless the problem requests it.

I understand the above, and I understand that cheating has severe consequences, from a failing grade to expulsion.

SIGN YOUR NAME:
I. Multiple choice

A. (5 pts) (no partial credit) Assume that \( \lim_{x \to 200} (f(x)) = 4 \) and \( \lim_{x \to 200} (g(x)) = 5 \). At most one of the following statements must follow. If one does, circle it. Otherwise, circle Answer e.

- (a) \( \lim_{x \to 200} [(f(x)) + (g(x))] = 9 \)
- (b) \( \lim_{x \to 400} [(f(x)) + (g(x))] = 9 \)
- (c) \( \lim_{x \to 1} \left[ \frac{f(x)}{g(x)} \right] = \frac{4}{5} \)
- (d) \( \lim_{x \to 300} [(f(x)) + (g(x))] \) does not exist
- (e) NONE OF THE ABOVE

B. (5 pts) (no partial credit) A particle travels along a number line. Its position at time 1 is 40 and its position at time 3 is 80. Find its average velocity between time 1 and time 3. Circle one of the following answers:

- (a) 10
- (b) 20
- (c) 30
- (d) 40
- (e) NONE OF THE ABOVE

C. (5 pts) (no partial credit) A line passes through (1, 40) and (3, 80). Find its slope. Circle one of the following answers:

- (a) 10
- (b) 20
- (c) 30
- (d) 40
- (e) NONE OF THE ABOVE
D. (5 pts) (no partial credit) Let \( y = x^2 - x \). Find \( \Delta y \). Circle one of the following answers:

(a) \((x + \Delta x)^2 - (x + \Delta x)\)
(b) \([ (x + \Delta x)^2 - (x + \Delta x) ] + [x^2 - x] \)
(c) \([ (x + \Delta x)^2 - (x + \Delta x) ] - [x^2 - x] \)
(d) \([x^2 - x] - [(x + \Delta x)^2 - (x + \Delta x)] \)
(e) NONE OF THE ABOVE

E. (5 pts) (no partial credit) Compute \( \lim_{x \to 0} \frac{2x^3 - 5x^2}{7x \sin x} \). Circle one of the following answers:

(a) 0
(b) \(\infty\)
(c) \(\frac{5}{7}\)
(d) \(\frac{2}{7}\)
(e) NONE OF THE ABOVE

F. (5 pts) (no partial credit) Compute the largest \( \delta > 0 \) such that: 0 < \(|x - 1| < \delta \) implies \(|(2x + 7) - 9| < 0.05 \). Circle one of the following answers:

(a) 0.2
(b) 0.1
(c) 0.025
(d) 0.01
(e) NONE OF THE ABOVE
II. True or false (no partial credit):
   a. (5 pts) For every real number $x$, $\ln(e^x) = x$.

   b. (5 pts) There is a function with three vertical asymptotes.

   c. (5 pts) A tangent line to the graph of a function cannot intersect the graph of the function more than once.

   d. (5 pts) The function $f(x) = |x|$ is differentiable at every real number.

   e. (5 pts) If a function is differentiable at 0, then it is continuous at 0.
III. Computations. Show work. Unless otherwise specified, answers must be exactly correct, but can be left in any form easily calculated on a standard calculator.

1. a. (5 pts) Compute \( \lim_{h \to 0} \frac{\sqrt{5 + 2h} - \sqrt{5 - h}}{h} \).

b. (5 pts) Compute \( \lim_{h \to 0} \frac{\frac{1}{5+2h} - \frac{1}{5-h}}{h} \).
2. (10 pts) Find all the horizontal asymptotes to \( y = \frac{\sqrt{9x^2 + 5}}{x + 1} \).
3. (10 pts) Compute \( \lim_{x \to 0} \left( \frac{7x^3 + 4x^2}{8x \sin x} \right) \).
4. On the planet of Gallifrey, in an alternate universe, a dropped object travels $t^3 + t^2$ feet during its first $t$ seconds of free fall.

a. (10 pts) For $h \neq 0$, the average velocity between time $t = 2$ seconds and time $t = 2 + h$ seconds is given by a quadratic polynomial in $h$ of the form $ah^2+bh+c$. Find the coefficients $a$, $b$ and $c$.

b. (5 pts) Find the instantaneous velocity at time $t = 2$ seconds.