Math 1371 – Lecture 24

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1 Warmup: Do this problem before class begins.

Let R be the region bounded by the graph of the function

$$f(x) = \frac{1}{\sqrt{9+x^2}},$$

the x-axis, the y-axis, and the line $x = 2$.

Find the volume of the solid formed by rotating R about the y-axis.

2 Nuts and bolts

1. Read the following sections before workshop tomorrow:
   - 6407 (listed as 6507 in the table of contents) "Hard" volumes of revolution
   - 6411 Work
2. Office hours this week: MWF 11-12.
3. Exams in the next three weeks:
   (a) Third-chance gateway exam: tomorrow 5 p.m. in 125 Science Classroom Bldg. or Wednesday 5 p.m. in 275 Nicholson Hall
   (b) Exam III: Thursday, December 6.
   (c) Final Exam: Thursday, December 13, 1:30 p.m.

3 What's happening today

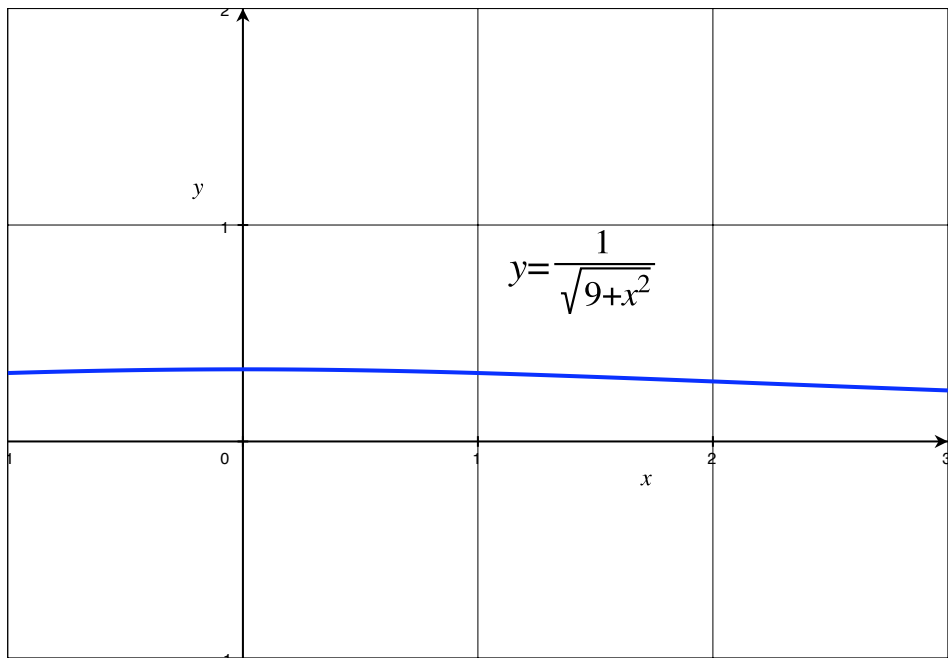
1. More volumes and areas
2. Work

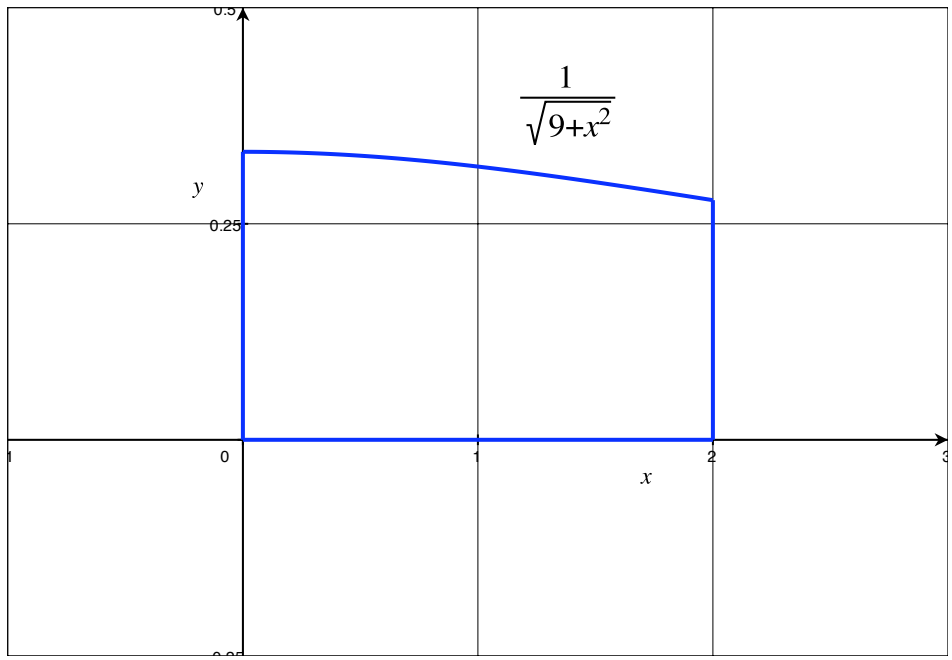
4 Volumes and areas

Example 1. Let R be the region bounded by the function

$$f(x) = \frac{1}{\sqrt{9+x^2}},$$

the x-axis, the y-axis, and the line $x = 2$.





1. Find the volume of the solid formed by rotating R about the y-axis.
2. Find the volume of the solid formed by rotating R about the x-axis.
3. Find the area of R.
4. Find the volume of the solid formed by rotating R about the line $x = -2$.
5. Find the volume of the solid formed by rotating R about the line $y = -3$.

5 Work

This is not physics class, but it's useful to remember these basics:

Force = Mass $\times$ Acceleration (typically, of gravity).

The standard units of Force are pounds and Newtons ($kg \cdot m/s^2$).

Work = Force $\times$ Distance.

The standard units of Work are foot-pounds and Joules (Newton-meters).

1 foot-pound is the work performed while applying 1 pound of force through a distance of 1 foot.

1 Joule is the work performed while applying 1 Newton of force through a distance of 1 meter.

Example 2. Suppose that a 10-pound bucket is hanging over the side of a bridge by a 20-foot rope (of negligible weight). What is the work required to bring the bucket to the top?

Example 3. Suppose that 20-foot chain that weighs 100 pounds (uniformly distributed along its length) is hanging over the side of the bridge. What is the work required to bring the chain to the top?

Example 4. An object is being moved along the y-axis vertically from $y = 0$ to $y = 10$ feet by a force of $2 + \sin(2\pi y)$ lbs. Find the work.