

# MATH 152

## Today

1. WeBWorK/Questions
2. 7.4 Arc Length

### Goals:

1. 7.4 Arc Length (Understand how to find the arc length of a curve described as a function of  $x$  or parametrically)
2. 7.6 Work Integrals (Understand how to set up integrals giving the work required to perform various tasks)

## Where is today's material used?

1. Physics: Work is a fundamental notion in physics.

## 7.4 Arc Length

1. **Definition:** If  $f'$  is continuous on  $[a, b]$ , then the length of the curve  $y = f(x)$  on  $[a, b]$  is given by  $\int_a^b \sqrt{1 + (f'(x))^2} dx$ .
2. **Theorem:** Suppose that  $S$  is a solid region in space with cross-sectional area given by  $A(x)$  in the vertical plane perpendicular to the  $x$ -axis for each  $x \in [a, b]$ . Then the volume of  $S$  is

$$V(S) = \int_a^b A(x) dx.$$

3. **Definition:** A **solid of revolution** is a solid obtained by revolving a plane region about a line.
4. Examples: 7.4, p. 391: An assortment

## 7.6 Work

1. Recall that the force  $F$  needed to provide a mass  $m$  with an acceleration  $a$  is given by  $F = ma$ . In particular then weight of a mass  $m$  is  $W = mg$ , where  $g \approx 9.8\text{m/s}^2$  is the acceleration due to gravity.
2. **Definition (from physics):** If a constant force  $F$  moves an object a distance  $D$  (in the same direction as  $F$ ), the **work** done by the force is  $FD$ .
3. **Theorem:** The work done by a continuously varying force in moving an object in a straight line from  $x = a$  to  $x = b$  is given by  $W = \int_a^b F(x)dx$ .
4. Alternative perspective: Consider incremental amounts of force applied over distance and add them up (i.e., integrate).
5. Examples: 7.6, p. 408: 15, 10, 13, 17

## Next Time

1. Finish 7.6
2. Start 9.3; Polar coordinates
3. Turn in WeBWorK 7.4 Set15-ArcLength: 2 and 7.6 Set16-Work: 1,3