

## Lesson 17: Section 3.11 Part 1

### Related Rates Strategy

1. Read the problem carefully; underline given numerical information
2. Draw a diagram.
3. Assign variables to quantities that change with time.
4. What information do we know? What do we want to find?
5. Relate what we know and what we want to find using an equation.
6. Use implicit differentiation and the chain rule to differentiate both sides of the equation with respect to time (variable  $t$ )
7. Substitute the given information and solve for the rate we want to find.

L17 P1

## Common Ways to Relate Quantities (Step 5)

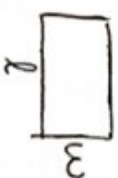
- Pythagorean Theorem



$$a^2 + b^2 = c^2$$

- Area Formulas:

- Rectangle



$$A = l \cdot w$$

- Circle



$$A = \pi r^2$$

- Triangle



$$A = \frac{1}{2} b \cdot h$$

• Volume Formulas

- Rectangular Prism (box)



$$V = l \cdot w \cdot h$$

- Sphere



$$V = \frac{4}{3} \pi r^3$$

- Right Circular Cone



$$V = \frac{1}{3} \pi r^2 h$$

- Cylinder



$$V = \pi r^2 h$$

Practice Problems

1. A 13 foot ladder is leaning against a wall. If the top of the ladder ~~is~~ slips down the wall at a rate of 2 feet per second, how fast will the foot of the ladder be moving away from the wall when the top is 5 feet above the ground?

2. Let  $V$  be the volume of a cylinder having height  $h$  and radius  $r$ , and assume that  $h$  and  $r$  vary with time. At a certain instant, the height is 6 inches and increasing at a rate of 1 inch per second, while the radius is 10 inches and decreasing at a rate of 1 inch per second.

(a) How fast is the volume changing at this instant?

(b) How fast would the height have to increase so that the volume remains constant?