Section 3.9 Related Rates

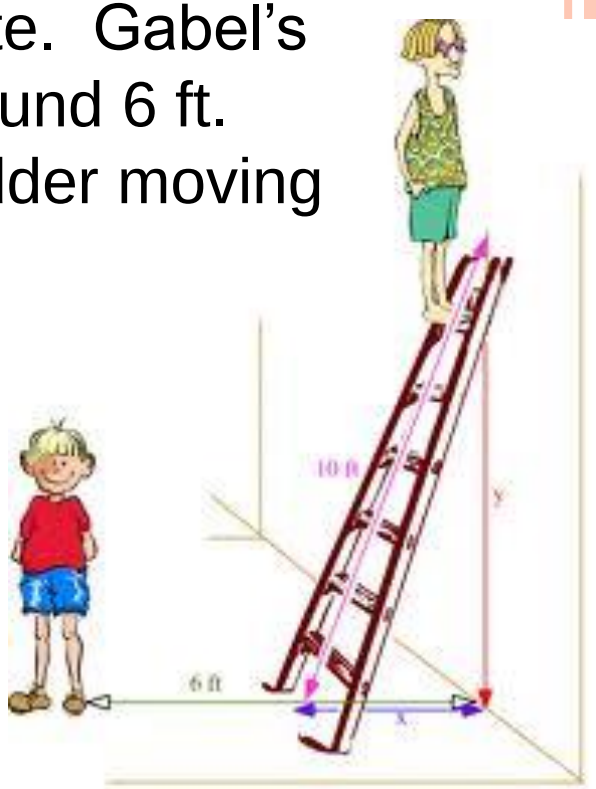
All related rates problems involve something changing with respect to time.

- Example: Let $y = 3x^2 + 5$ and $\frac{dx}{dt} = 2$; find when x = 1

- First, take the derivative of each side of the equation with respect to time. Then substitute what you know.

Example:

- Gabel is perched precariously on the top of a 10 ft ladder leaning against the back wall of an apartment building (spying) when it starts to slide down the wall at a rate of 4 ft per minute. Gabel's accomplice, Nik, is standing on the ground 6 ft. away from the wall. How fast is the ladder moving when it hits Nik?



Example

- Andrew and Ryan are going to begin a hike at the same location and travel in perpendicular directions. Andrew travels due north at a rate of 5 mph; Ryan travels due west at a rate of 8 mph. At what rate is the distance between them changing 3 hours into the hike?

Example

- Sam has anchored an oil tanker in a calm bay, and it is leaking oil. As time goes on a circular oil slick is formed with the tanker at the center. Both the radius and the area of the slick change with time. If the radius of Sam's oil slick is growing at a rate of 5 meters per hour, then how fast is the area of Sam's oil slick growing 3 hours after the spill?

Example

- Madison is given a cone that is 10 in high and 6 in wide at the top. Adelle starts to pour water into the cone. When there is 6 inches of water in the cone, the height of the water is increasing at 7 inches per minute. How fast is the volume of water in Madison's cone increasing?
- What is the relationship between the height of the water and the radius of the top circle of water?
- What formula do they need?
- Write the formula as a function of *h* alone.
- What rate do they know?