

Related Rates (Day 2)

1. A ladder 25 feet long is leaning against the wall of a house. The base of the ladder is pulled away from the wall at a rate of 2 feet per second.

- a. How fast is the top of the ladder moving down the wall when the base of the ladder is 7 feet, 15 feet, and 24 feet from the wall? $-\frac{7}{12} \text{ ft/sec}$, $-\frac{3}{2} \text{ ft/sec}$, $-\frac{48}{7} \text{ ft/sec}$
interpret: the ladder is sliding down the wall at a rate of $\frac{7}{12} \text{ ft/sec}$ when $x=7\text{ft}$ etc.
- b. Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area is changing when the base of the ladder is 7 feet from the wall. $\frac{527}{24} \text{ ft}^2/\text{sec}$
- c. Find the rate at which the angle between the ladder and the wall of the house is changing when the base of the ladder is 7 feet from the wall. $\frac{1}{12} \text{ rad/sec}$

2. A boat is pulled into a dock by means of a winch 12 feet above the deck of the boat.

- a. The winch pulls in rope at a rate of 4 feet per second. Determine the speed of the boat when there is 13 feet of rope out. What happens to the speed of the boat as it gets closer to the dock? speed = 10.4 ft/sec ; the speed is increasing
- b. Suppose the boat is moving at a constant rate of 4 feet per second. Determine the speed at which the winch pulls in rope when there is a total of 13 feet of rope out. What happens to the speed at which the winch pulls in the rope as the boat gets closer to the dock? $\frac{20}{13} \text{ ft/sec}$; the speed is decreasing

3. An air traffic controller spots two planes at the same altitude converging on a point as they fly at right angles to each other. One plane is 150 miles from the point moving 450 miles per hour. The other plane is 200 miles from the point moving 600 miles per hour.

- a. At what rate is the distance between the planes decreasing? 750 mph
- b. How much time does air traffic controller have to get one of the planes on a different flight path? $\frac{1}{3} \text{ hr} = 20 \text{ minutes}$

4. A man 6 feet tall walks at a rate of 5 feet per second away from a light that is 15 feet above the ground. When he is 10 feet from the base of the light,

- a. at what rate is the tip of his shadow moving? $\frac{25}{3} \text{ ft/sec}$
- b. at what rate is the length of his shadow moving? $\frac{10}{3} \text{ ft/sec}$

5. A man 6 feet tall walks at a rate of 5 feet per second towards a light that is 20 feet above the ground. When he is 10 feet from the base of the light,

- a. at what rate is the tip of his shadow moving? $-\frac{50}{7} \text{ ft/sec}$
- b. at what rate is the length of his shadow moving? $-\frac{15}{7} \text{ ft/sec}$

6. A balloon rises at a rate of 3 meters per second from a point on the ground 30 meters from an observer. Find the rate of change of the angle of elevation of the balloon from the observer when the balloon is 30 meters above the ground.

$$\frac{1}{20} \text{ rad/sec}$$