Math 20A. Homework 3, Part 2.

Exercise 1 A woman is walking away from a building toward a lamp that is shining up from the ground. The lamp is 20 feet from the building and she is six feet tall. At what rate is the length of her shadow on the building increasing when she is 8 feet from the light if at that moment she is walking 5 feet per second?

Answer: Let x be the distance from the woman to the lamp and y the length of her shadow, measured in feet (Figure 1). • Similar triangles: $\frac{y}{20} = \frac{6}{x}$ • $y = 120x^{-1}$ • The length of her shadow is increasing $\frac{75}{8}$ feet per second.

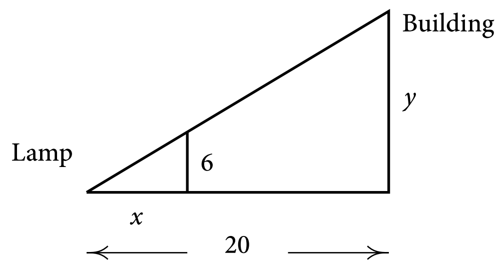

FIGURE 1

Exercise 2 An airplane flying in a straight path with constant velocity at a constant altitude of four thousand feet passes directly over a radar station. A few seconds later, the station determines that the plane is five thousand feet away and that its distance from the station is increasing at the rate of 500 feet per second ($\frac{1}{2}$ thousand feet per second). What is the plane's velocity?

Answer: Let x be the plane's horizontal distance from the radar station and D its diagonal distance, measured in thousands of feet. • Figure 2 • $x = \sqrt{D^2 - 4^2} = (D^2 - 16)^{1/2}$ • [Velocity] $= \frac{dx}{dt} = \frac{1}{\sqrt{5^2 - 4^2}}(5)(\frac{1}{2}) = \frac{5}{6}$ thousand feet per second

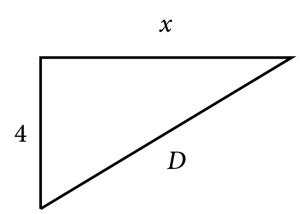

FIGURE 2

Exercise 3 At the end of their conversation two people walk off at the same time in different directions. One walks due north at the constant speed of 3 miles per hour and the other walks due east at the constant speed of 4 miles per hour. How fast does the distance between them increase?

Answer: He is $3t$ miles north and she is $4t$ miles east of the intersection after t hours. • D = [Distance between them] $= 5t$ • $\frac{dD}{dt} = 5$ miles per hour