

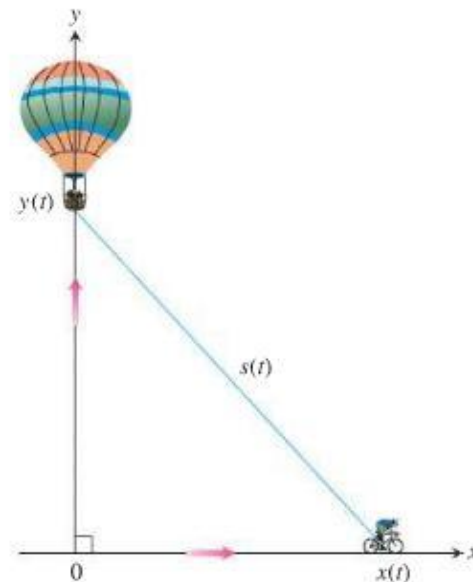
Problem Set #3: Read each question carefully and show ALL work.

- 1) A small balloon is released at a point 150 feet from an observer, who is on level ground. If the balloon goes straight up at a rate of 8 feet per second, how fast is the distance from the observer to the balloon increasing when the balloon is 50 feet high?
- 2) An observer stands 700 *ft* away from a launch pad to observe a rocket launch. The rocket blasts off and maintains a velocity of 900 *ft/sec*. Assume the scenario can be modeled as a right triangle. How fast is the distance between the observer and the rocket changing when the rocket is 2400 *ft* from the ground?

3) A right triangle whose sides are changing has sides of 30 and 40 inches at a particular instant. If the shorter of these two sides is increasing at 3 in/sec and the longer side is decreasing at 5 in/sec, how fast is the (a) area and (b) hypotenuse changing?

4) A 13 *ft* ladder is leaning against a wall and sliding towards the floor. The top of the ladder is sliding down the wall at a rate of 7 *ft/sec*. How fast is the base of the ladder sliding away from the wall when the base of the ladder is 12 *ft* from the wall?

- 5) A balloon is rising vertically above a level, straight road at a constant rate of 1 ft/sec . Just when the balloon is 65 ft above the ground, a bicycle moving at a constant rate of 17 ft/sec passes under it. How fast is the distance between the bicycle and balloon increasing 3 sec later?



- 6) Two cars are riding on two different roads that meet at a 90 degree angle. Car A is 3 miles south of the intersection traveling north at 40 mph , and car B is 2 miles east of the intersection traveling east at 50 mph . How fast is the distance between the two cars changing at this moment?

7) A train, starting at 11am, travels east at 45 mph while another, starting at noon from the same point, travels south at 60 mph. How fast are they separating at 3pm?

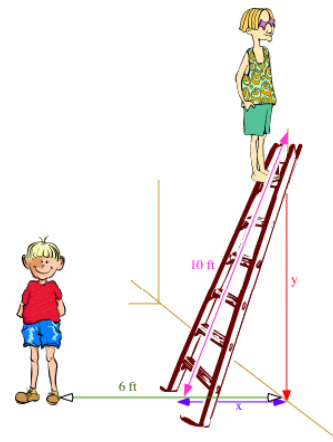
Answer Key:

1) 2.5 ft/sec	2) 864 ft/sec
3) a) $-15 \text{ in}^2/\text{sec}$ b) $-\frac{11}{5} \text{ in/sec}$	4) $\frac{35}{12} \text{ ft/sec}$
5) 11 ft/sec	6)
7) 74.25 mph	

Warm Up #4:

A 10-foot ladder is leaning against a vertical wall. The lower end of the ladder is being pulled away from the wall at a rate of 2 feet per second. When the lower end of the ladder is 6 feet away from the wall

- a) How fast is the ladder sliding down the wall?

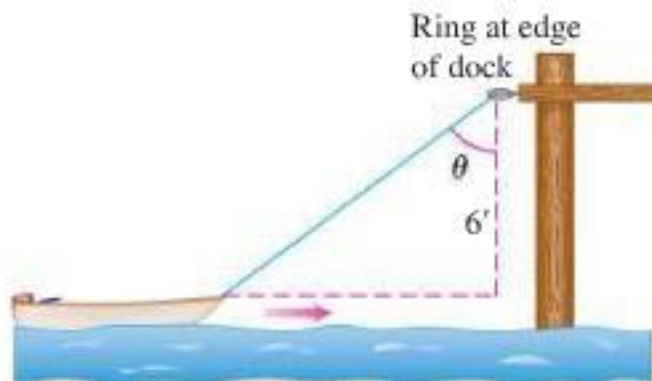


- b) How fast is the angle between the ground and the ladder changing?

- c) How fast is the area of the triangle formed by the ladder and the two walls changing?

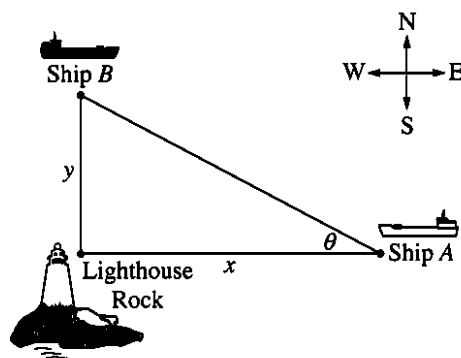
Problem Set #4: Read each question carefully and show ALL work.

- 8) A dinghy is pulled toward a dock by a rope from the bow through a ring on the dock 6 ft above the bow. The rope is hauled in at rate of 2 ft/sec.
- How fast is the boat approaching the dock when 10 ft of rope are out?
 - At what rate is the angle θ changing at this instant?



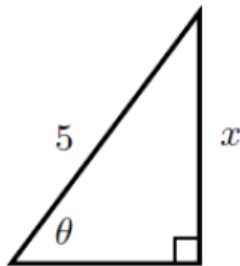
9)

Ship A is traveling due west toward Lighthouse Rock at a speed of 15 kilometers per hour (km/hr). Ship B is traveling due north away from Lighthouse Rock at a speed of 10 km/hr. Let x be the distance between Ship A and Lighthouse Rock at time t , and let y be the distance between Ship B and Lighthouse Rock at time t , as shown in the figure above.



- (a) Find the distance, in kilometers, between Ship A and Ship B when $x = 4$ km and $y = 3$ km.
- (b) Find the rate of change, in km/hr, of the distance between the two ships when $x = 4$ km and $y = 3$ km.
- (c) Let θ be the angle shown in the figure. Find the rate of change of θ , in radians per hour, when $x = 4$ km and $y = 3$ km.

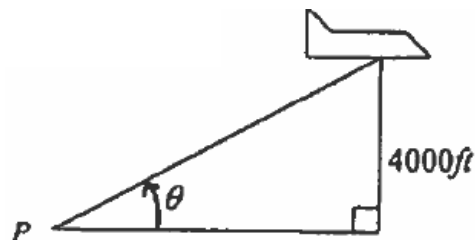
- 10) In the right-triangle shown at right, the angle θ is increasing at a constant rate of 2 radians per hour. At what rate is the side length of x increasing when $x = 4$ feet?



- 11) Two sides of a triangle have lengths of 12m and 15m. The angle between them is increasing at a rate of $2^\circ/\text{min}$. How fast is the area of the triangle increasing when the angle between the sides of fixed length is 60° ?

12) An aircraft is flying horizontally at a constant height of 4000 ft above a fixed observation point a certain instant the angle of elevation, θ , is 30° and decreasing, and the speed of the aircraft is 300 mi/hr. (Use 1 mile = 5280 feet)

a) How fast is θ decreasing at this instant?



b) How fast is the distance between the aircraft and the observation point changing at this instant?

Answer Key:

8) a) $\frac{5}{2}$ ft/sec b) $-\frac{3}{20}$ radian/sec	9) a) 5 km b) -6 km/hr c) $\frac{17}{5}$ radians/hr
10) 6 ft/hr	11) 1.575 m ² /min
12) a) 0.0275 rad/sec b) 260 mph	