

## Keeper 5.2 Virtual Problems Day 1

1. A pebble is thrown into a pond forming ripples whose radius increases at the rate of 4 in/sec. How fast is the area of the ripple changing when the radius is one foot?
2. The radius of a circle is increasing at the rate of 2 in/sec. At what rate is the area increasing when the circumference of the circle is  $12\pi$  in.?
3. A circular cotton doily with radius 22 cm is inadvertently thrown in the dryer and starts shrinking so that the radius is decreasing at a rate of 2 cm/min. At what rate is the area enclosed by the circle decreasing 5 minutes after the doily is thrown the dryer?
4. A spherical balloon is filled with air at the rate of  $8 \text{ in}^3/\text{sec}$ . How fast is the diameter of the balloon increasing when the volume of the balloon is  $36\pi \text{ in}^3$ ?
5. Air is escaping from a spherical balloon at the rate of  $2 \text{ cm}^3$  per minute. How fast is the surface area shrinking when the radius is 1 cm?

6. An airplane is flying towards a radar station at a constant height of 6 km above the ground. If the distance  $s$  between the airplane and the radar station is decreasing at a rate of 400 km per hour when  $s = 10$  km, what is the horizontal speed of the plane?
  
  
  
  
  
  
  
  
  
  
7. A girl is flying a kite on a string. The kite is 120 ft above the ground and the wind is blowing the kite horizontally away from her at 6 ft/sec. At what rate must she let out the string when 130 ft of string has been let out?
  
  
  
  
  
  
  
  
  
  
8. The radius of a right circular cylinder is increasing at the rate of 4 cm/sec but its total surface area remains constant at  $600\pi$  cm<sup>2</sup>. At what rate is the height changing when the radius is 10 cm?
  
  
  
  
  
  
  
  
  
  
9. A 20 foot ladder is leaning against a house. The foot of the ladder begins to slide away from the house at a rate of 2 feet/second. How fast is the top of the ladder sliding down the wall when the foot of the ladder is 12 feet from the house?
  
  
  
  
  
  
  
  
  
  
10. A 10-ft ladder leans against a house on flat ground. The house is to the left of the ladder. The base of the ladder starts to slide away from the house at 2 ft/s. At what rate is the angle between the ladder and the ground changing when the base is 8 ft from the house?

## Keeper 5.2 Virtual Problems Day 2

1. A block of ice, in the shape of a right circular cone, is melting in such a way that both its height and its radius are decreasing at the rate of 1 cm/hr. How fast is the volume decreasing when  $r = h = 10$  cm?
2. Assume that sand allowed to pour onto a level surface will form a pile in the shape of a cone, with height equal to the diameter of the base. If sand is poured at 2 cubic meters per second, how fast is the height of the pile increasing when the base is 8 meters in diameter?
3. A light is on the ground 20 m from a building. A man 2 m tall walks from the light directly toward the building at 1 m/s. How fast is the length of his shadow on the building changing when he is 14 m from the building?
4. A conical cup is 4 cm across and 6 cm deep. Water leaks out of the bottom at the rate of  $2$   $\text{cm}^3/\text{sec}$ . How fast is the water level dropping when the height of the water is 3 cm?
5. A person 2 m tall walks towards a lamppost on level ground at a rate of 0.5 m/sec. The lamp on the post is 5 m high. How fast is the length of the person's shadow decreasing when the person is 3 m from the post?

6. A funnel in the shape of an inverted cone is 30 cm deep and has a diameter across the top of 20 cm. Liquid is flowing out of the funnel at the rate of  $12 \text{ cm}^3/\text{sec}$ . At what rate is the height of the liquid decreasing at the instant when the liquid in the funnel is 20 cm deep?
7. Jim, who is 180 cm tall, is walking towards a lamp-post which is 3 meters high. The lamp casts a shadow behind him. He notices that his shadow gets shorter as he moves closer to the lamp. He is walking at 2.4 meters per second. A) When he is 2 meters from the lamppost, how fast is the length of his shadow decreasing? B) How fast is the tip of his shadow moving
8. A trough is 12 feet long and 3 feet across. Its ends are isosceles triangles with altitude of 3 feet.
- If water is being pumped into the trough at 2 cubic feet per minute, how fast is the water level rising when it is 1 foot deep?
  - If the water is rising at a rate of  $\frac{3}{8}$  inches per minute when  $h = 2$ , determine the rate at which water is being pumped into the trough.
9. A particle moves along the curve  $y = \sqrt{1 + x^3}$ . As it reaches the point (2, 3), the y-coordinate is increasing at the rate of 4cm/s. How fast is the x-coordinate of the point changing at that instant?
10. A particle is moving along the curve  $y = \frac{x}{x^2+1}$ . Find all values of x at which the rate of change of x with respect to time is three times that of y.