Name_____Date_____Pd_____

AP Calculus AB Related Rates

1) A circle grows at a rate of 8π in^2/sec. At what rate is the radius growing when the radius is 2 inches?

2) The radius of a spherical balloon is increasing at a rate of 2 in/sec. How fast is the volume changing when the radius is 4 inches?

3) Gas is escaping a spherical balloon at a rate of 4 cm^3 per minute. How fast is the surface area shrinking when the radius is 24 cm? (Hint: $V = \frac{4}{3}\pi r^3$ and $S = 4\pi r^2$).

4) 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?

5) A boat is pulled into a dock by rope attached to it and passing through a pulley on the dock positions 5 meters higher than the boat. If the rope is being pulled in a rate of 2 m/s, how fast is the boat approaching the dock when it is 12 meters away from the dock?

6) 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?

7) Ship A is traveling due west toward Lighthouse Rock at a speed of 15 km/hr. Ship B is traveling due north away from Lighthouse Rock at a speed of 10 km/hr. Find the rate of change of the distance between the ships when Ship A is 4 km and Ship B is 3 km away from Lighthouse Rock.

8) A conical tank whose radius at the top is 4 feet and whose depth is 10 feet is being filled with water at a rate of 2 cubic feet per minute. How fast is the water level rising when the depth of the water is 5 feet?

9) 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 2.4 meters per second.
   a. When he is 2 meters from the lamp-post, how fast is the length of his shadow decreasing?
   b. How fast is the tip of the shadow moving?

1) A ladder 25 feet long is leaning against 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 walk when the base of the ladder is 12 feet from the wall?
    b. Consider the triangle formed by the side of the house, the ladder, and the ground. Find the rate at which the area of the triangle is changing when the base is 12 feet from the wall.
    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 12 feet from the wall.