Name_____Date_____Pd_____

AP Calculus AB Related Rates **Day 1 Notes**

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) A rectangle has a length of 6 inches and a width of 5 inches whose sides are changing. The length is decreasing by 10 in/sec and the width is growing at 3 in/sec. What is the rate of change of the area?

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) 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.

7) A coffeepot has the shape of a cylinder with a radius of 5 inches. Let h be the depth of the coffee in the pot, measured in inches. The volume of the coffee in the pot is decreasing at a rate of -5π cubic inches per second. Find the rate of change of the height of the coffee.

Name_____Date_____P d_____

AP Calculus AB Related Rates **Day 1 Homework**

1) 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?

2) 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?

3) A spherical container is deflated such that its volume is decreasing at a constant rate of $3\ cm^3/min$.
   a. At what rate is the radius changing when the radius is 5 cm?

   b. At the same moment, how fast is the surface area changing?

4) A pebble is dropped into a still pool and sends out a circular ripple whose radius increases at a constant rate of 4 feet per second. How fast is the area of the region enclosed by the ripple increasing at 8 seconds?

5) Cars A and B leave a town at the same time. Car A heads due south at a rate of 80 km per hour and car B heads due west at a rate of 60 km per hour. How fast is the distance between the cars increasing after 3 hours?

6) A cylindrical tank with a radius of 6 meters is filling with fluid at a rate of 108π cubic meters per second. How fast is the height increasing?

7) A rectangle has a length of 11 inches and a width of 5 inches whose sides are changing. The length is increasing by 9 in/sec and the width is shrinking at 6 in/sec. What is the rate of change of the area?

Name_____Date_____Pd_____

AP Calculus AB Related Rates **Day 2 Notes**

1) The voltage, V, in an electrical circuit is related to the current, I, and the resistance, R, by the equation V=IR. The current is changing at -4 amps per second as the resistance changes at 20 ohms per second. How fast is the voltage changing when the voltage is 100 volts and the current is 20 amps?

2) 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?

3) 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?

4) 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.

Name_____Date_____Pd_____

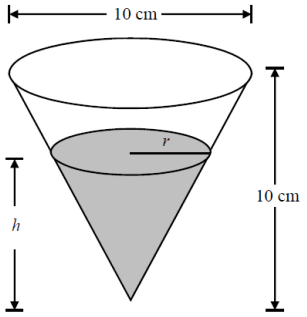
AP Calculus AB Related Rates **Day 2 Homework**

1. A 14 ft ladder is leaning again a wall. The top of the ladder is slipping down the wall at a rate of 2 ft/second.
   a. How fast will the end of the ladder be moving away from the wall when the top is 6 feet above the ground?

   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 at the same time.

   c. At the same time, how fast is the angle between the ground and the ladder changing?

2. A container has the shape of an open right circular cone, as shown in the figure. The height of the container is 10 cm and the diameter of the opening is 10 cm. Water in the container is evaporation so the its depth h is changing at a constant rate of $-\frac{3}{10}$ cm per hour. Find the rate of change of the volume of water in the container, with respect to time, when the height is of the water is 5 cm.



3. Oil spilled from a tanker spreads in a circle whose circumference increases at a rate of 40 ft/second. How fast is the area of the spill increasing when the circumference of the circle is 100π feet?

4. A boat is being pulled toward a dock by a rope attached to its bow through a pulley on the dock 7 feet about the bow. If the rope is hauled in a rate or 4 feet per second, how fast is the boat approaching the dock when 25 feet of rope is out?

5. A 6-foot-tall person is walking at the rate of 4 feet per second away from a street lamp that is 24 feet tall. How fast is the length of their shadow changing?