Related Rates   Name_____

Problem Set 2016

1. Air is being pumped into a spherical balloon at a rate of 4.5 cubic inches per minute. Find the rate of change of the radius when the radius is 2 inches long.

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2. An airplane is flying at an elevation of 6 miles on a flight path that is directly over a   radar tracking station. If the distance between the radar station and the plane is decreasing at a rate of 400 miles per hour when the plane is 10 miles form the radar station, what is the velocity of the plane?

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3. Gravel is falling into a conical pile at a rate of 100 cubic feet per minute.   If the radius always remains equal to the height, find the rate of change of the height of the pile when it is 10 feet high.

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4. A television crew at ground level is filming lift off of space shuttle hat is rising vertically according to the position equation $s = 50t^2$, where s is measured in feet and t is measured in seconds. The camera is 2000 feet from the launch pad. Find the rate of change in the distance between the camera and the base of the shuttle 10 seconds after lift off.

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5. A man six feet tall walks at a rate of 5 feet per second away from a light that is 15 feet above the ground. When he is 10 feet from the base of the light,

    a. At what rate is the length of his shadow changing?   _____

    b. At what rate of is the tip of his shadow moving?   _____

6. Water is pouring into a conical cistern at the rate of 8 cubic feet per minute. If the height of the inverted cone is 12 feet and the radius of its circular opening is 6 feet, how fast is the water level rising when the water is 4 feet deep?

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7. A balloon is released at a point 150 feet away from a person who is on level ground. If the balloon goes up at a rate of 6 feet per second, how fast is the distance from the balloon to the person increasing when the balloon is 50 feet high?

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8. A plane flying north at a rate of 640 miles per hour passes over Apex at noon, and a second plane going east at 600 miles per hour passes over Apex 15 minutes later. If the planes are flying at same altitude how fast are they separating at 1:15pm?

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9. An edge of a variable cube is increasing at the rate of 3 inches per second. How fast is the volume of the cube increasing when an edge is 10 inches long?

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10. If a soap bubble retains its spherical shape as it expands, how fast is its radius increasing when its radius is 2 inches, if air is blown into it at 4 cubic inches per second?

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11. A trough is 12 feet long and 3 feet across the top. Its ends are isosceles triangles with altitudes 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?

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12. A boat is pulled into a dock by means of a rope with one end attached to the bow of the boat, and the other end passing through a ring attached to the dock 4 feet above the bow of the boat. If the rope is pulled in at a rate of 2 feet per second, how fast is the boat approaching the dock when 10 feet of rope is out?

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13. A light is at the top of a pole 50 feet high. A ball is dropped from 50 feet high and 30 feet away from the light. How fast ids the shadow of the ball moving across the ground ½ second later. (Assume the ball falls a distance of $16\ t^2$ feet in t seconds)

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14. A spherical ball 8 inches in diameter is coated with a layer of ice of uniform thickness. If the ice melts at a rate of 10 cubic inches per minute, how fast is the thickness of the ice decreasing when it is 2 inches thick? At the same rate of melting, how fast is the outer surface area of ice changing?

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15. A student is using a straw to drink form a conical paper cup at a rate of 3 cubic inches a second. If the height of the cup is 10 inches and the diameter of its opening is 6 inches, how fast is the level of the liquid (either Gatorade or water) falling when the depth of the liquid is 5 inches?

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16. A man on a dock is pulling in a rope that is fastened to the bow of a boat. If the mans hands are 12 feet higher than the point where the rope is attached to the boat, and if he is retrieving the rope at a rate of 3 feet per second, how fast is the boat approaching the dock when 20 feet of rope are still out?

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17. A 20 foot ladder is leaning against a wall. If the bottom is pulled away from the wall at 2 feet per second, how fast is the top of the ladder moving down the wall when the foot of the ladder is 4 feet from the wall?

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18. Two ships sail from the same island, one going north at 24 knots and the other east at 30 knots. The northbound ship leaves at 9 am and the eastbound ship at 11 am. How fast is the distance between them changing at 2 pm?

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