1.(1 pt) Let

$$xy = 5$$

and let

$$\frac{dy}{dt} = 3$$

Find $\frac{dx}{dt}$ when $x = 2$.

2.(1 pt) Let A be the area of a circle with radius r. If $\frac{dr}{dt} = 2$, find $\frac{dA}{dt}$ when $r = 4$. ______

3.(1 pt) A spherical snowball is melting in such a way that its diameter is decreasing at rate of 0.2 cm/min. At what rate is the volume of the snowball decreasing when the diameter is 17 cm. (Note the answer is a positive number).

4.(1 pt) The altitude of a triangle is increasing at a rate of 1.000 centimeters/minute while the area of the triangle is increasing at a rate of 1.000 square centimeters/minute. At what rate is the base of the triangle changing when the altitude is 8.000 centimeters and the area is 93.000 square centimeters?

5.(1 pt) The altitude of a triangle is increasing at a rate of 1.500 centimeters/minute while the area of the triangle is increasing at a rate of 3.500 square centimeters/minute. At what rate is the base of the triangle changing when the altitude is 11.000 centimeters and the area is 83.000 square centimeters?

Note: The "altitude" is the "height" of the triangle in the formula "Area=(1/2)*base*height". Draw yourself a general "representative" triangle and label the base one variable and the altitude (height) another variable. Note that to solve this problem you don't need to know how big nor what shape the triangle really is.

6.(1 pt) When air expands adiabatically (without gaining or losing heat), its pressure P and volume V are related by the equation $PV^{1.4} = C$ where C is a constant. Suppose that at a certain instant the volume is 520 cubic centimeters and the pressure is 95 kPa and is decreasing at a rate of 15 kPa/minute. At what rate in cubic centimeters per minute is the volume increasing at this instant? ______

(Pa stands for Pascal – it is equivalent to one Newton/(meter squared); kPa is a kiloPascal or 1000 Pascals.)

7.(1 pt) At noon, ship A is 40 nautical miles due west of ship B. Ship A is sailing west at 25 knots and ship B is sailing north at 23 knots. How fast (in knots) is the distance between the ships changing at 7 PM? (Note: 1 knot is a speed of 1 nautical mile per hour.)

8.(1 pt) At noon, ship A is 10 nautical miles due west of ship B. Ship A is sailing west at 18 knots and ship B is sailing north at 15 knots. How fast (in knots) is the distance between the ships changing at 7 PM? (Note: 1 knot is a speed of 1 nautical mile per hour.)

Note: Draw yourself a diagram which shows where the ships are at noon and where they are "some time" later on. You will need to use geometry to work out a formula which tells you how far apart the ships are at time t, and you will need to use "distance = velocity * time" to work out how far the ships have travelled after time t.

9.(1 pt) Gravel is being dumped from a conveyor belt at a rate of 10 cubic feet per minute. It forms a pile in the shape of a right circular cone whose base diameter and height are always the same. How fast is the height of the pile increasing when the pile is 11 feet high? Recall that the volume of a right circular cone with height h and radius of the base r is given by $V = \frac{1}{3}\pi r^2 h$.

10.(1 pt) Gravel is being dumped from a conveyor belt at a rate of 20 cubic feet per minute. It forms a pile in the shape of a right circular cone whose base diameter and height are always the same. How fast is the height of the pile increasing when the pile is 18 feet high?
Recall that the volume of a right circular cone with height h and radius of the base r is given by

$$V = \frac{1}{3}\pi r^2 h$$

Note: See number 21 on pg 258 for a picture of this.

11.(1 pt) A street light is at the top of a 19 ft tall pole. A woman 6 ft tall walks away from the pole with a speed of 7 ft/sec along a straight path. How fast is the tip of her shadow moving when she is 30 ft from the base of the pole?

12.(1 pt) A street light is at the top of a 20 ft tall pole. A woman 6 ft tall walks away from the pole with a speed of 5 ft/sec along a straight path. How fast is the tip of her shadow moving when she is 35 ft from the base of the pole?

Note: You should draw a picture of a right triangle with the vertical side representing the pole, and the other end of the hypotenuse representing the tip of the woman's shadow. Where does the woman fit into this picture? Label her position as a variable, and label the tip of her shadow as another variable. You might like to use similar triangles to find a relationship between these two variables.

13.(1 pt) A plane flying with a constant speed of 4 km/min passes over a ground radar station at an altitude of 6 km and climbs at an angle of 35 degrees. At what rate, in km/min is the distance from the plane to the radar station increasing 2 minutes later?

14.(1 pt) Water is leaking out of an inverted conical tank at a rate of 11100.000 cubic centimeters per min at the same time that water is being pumped into the tank at a constant rate. The tank has height 12.000 meters and the diameter at the top is 4.000 meters. If the water level is rising at a rate of 20.000 centimeters per minute when the height of the water is 5.000 meters, find the rate at which water is being pumped into the tank in cubic centimeters per minute. ______

15.(1 pt) Water is leaking out of an inverted conical tank at a rate of 10300.0 cubic centimeters per min at the same time that water is being pumped into the tank at a constant rate. The tank has height 11.0 meters and the diameter at the top is 7.0 meters. If the water level is rising at a rate of 21.0 centimeters per minute when the height of the water is 2.5 meters, find the rate at which water is being pumped into the tank in cubic centimeters per minute. ______

Note: Let "R" be the unknown rate at which water is being pumped in. Then you know that if V is volume of water, $\frac{dV}{dt} = R - 10300.0$. Use geometry (similar triangles?) to find the relationship between the height of the water and the volume of the water at any given time. Recall that the volume of a cone with base radius r and height h is given by $\frac{1}{3}\pi r^2 h$.