Related Rates

1. If $x^2 + 3xy + y^2 = 1$ and $dy/dt = 2$, find dx/dt when $y = 1$.

2. A spherical snowball is melting in such a way that its volume is decreasing at a rate of $1 cm^3/min$. At what rate is the diameter decreasing when the diameter is 10 cm?

3. If a snowball melts so that its surface area decreases at a rate of 1cm3/min, find the rate at which the diameter decreases when the diameter is 10 cm.

4. Two cars start from the same point. One travels south at 60mi/hr and the other travels west at 25mi/hr. At what rate is the distance between them increasing two hours later?

5. At noon, ship A is 150 km west of ship B. Ship A is sailing east at 35km/hr and ship B is sailing north at 25 km/hr. How fast is the distance changing between them at 4:00 pm?

6. A man starts walking north at 4 ft/s from point A. Five minutes later a woman starts walking south at 5 ft/s from a point 500 feet due east of A. At what rate are they separating 15 minutes after the woman starts?

7. A trough is 10 feet long and its ends are in the shape of isosceles triangles that are 3 feet across at the top and have a height of 1 foot. If the trough is filled with water at a rate of 12 ft^3/min, find how fast the water level is rising when the water is 6 inches deep.

8. Gravel is being dumped from a conveyor belt at a rate of 30 ft^3/min and its coarseness is such that it forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 10 feet high?

9. Two people start from the same point. One walks east at 3 mi/hr and the other walks south at 2 mi/hr. How fast is the distance between them changing after 15 minutes?

10. A 10 foot long ladder rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed of 2 ft/se, how fast is the angle between the top of the ladder and the wall changing when the angle is 45 degrees?

11. The width of a rectangle is increasing at a rate of 2 cm/sec and its length is increasing at a rate of 3 cm/s. At what rate is the area of the rectangle increasing when its width is 4 cm and its length is 5cm?

12. An airplane, flying east at 400 mph, goes over a certain town at 11:30 am and a second plane, flying northeast at 500 mph, goes over the same town at noon. How fast are they separating at 1:00 pm.