Related Rates: Examples

1. A pebble is thrown into the middle of a lake creating a ripple that moves out at a rate of 5 in/sec. How fast is the area enclosed by the ripple increasing after 4 seconds?

2. Suppose a spherical balloon is being inflated. If the radius of the balloon increases at a constant rate of 3 cm/s, how fast is the volume of the balloon increasing when the radius is 20 cm?

3. A camera is set up 16 m from point P on a road. It is pointed towards a car that is driving on the road at a speed 12 m/sec. How fast is the angle of the camera changing when the car is one second from P?

4. M&M's are being dumped into a pile at a rate of 45 cm^3/min, and forms a pile in the shape of a cone whose base diameter is double the height. How fast is the diameter increasing when the pile is 15 cm high?

5. A 12 foot ladder leans against a wall. The base of the ladder slides horizontally away from the wall at 2 feet per second. As a result, the angle between the bottom of the ladder and the ground decreases. How fast is the angle decreasing when the bottom of the ladder is 6 feet from the wall?

6. You throw a ball and its path follows the arc $y = 20x - x^2$, where x and y are measured in feet, and you are standing at the origin. Suppose that the ball is traveling with a horizontal rate of change of 3 ft/sec. How fast is the distance between you and the ball changing when the ball is 100 feet in the air?

7. A girl starts at a point A and runs east at a rate of 10 ft/sec. One minute later, another girl starts at A and runs north at a rate of 8 ft/sec. At what rate is the distance between them changing 1 minute after the second girl starts.

8. An airplane is flying east at a speed of 550 mph, parallel to the ground, at an altitude of 6 miles. It passes over a car that is also traveling east at a speed of 65 mph. How fast is the distance between the two changing 6 minutes later?

9. An airplane at an altitude of 10,000 feet is flying at a constant speed on a line that will take it directly over an observer on the ground. If, at a given instant, the observer notes that the angle of elevation of the airplane is 60° and is increasing at a rate of 1° per second, find the speed of the airplane.

10. Two boys begin running from the same location. One runs north at 8 ft/sec and the other runs at a bearing of 60° with a speed of 5 ft/sec. How fast is the distance between them increasing after 3 seconds?