IVA'S CALCULUS I: Homework based on Monday 3/3 and Tuesday 3/4 lectures

Purpose

The main purpose of this assignment is to have you practice working with RELATED RATES. In your textbook this topic is explained in Section 3.8.

Due date

Thursday 3/6/2014, by 5pm.

Problems

1. Suppose a forest fire spreads in a circle with radius changing at a rate of 5 feet per minute. When the radius reaches 200 feet, at what rate is the area of the burning region increasing?

2. The length l of a rectangle is decreasing at the rate of 2 $\frac{\text{cm}}{\text{sec}}$ while the width w is increasing at the rate of 2 $\frac{\text{cm}}{\text{sec}}$. When $l = 12$ cm and $w = 5$ cm, find the rates of change of

   (a) the area;

   (b) the perimeter;

   (c) the lengths of the diagonals of the rectangle.

3. A man 6 ft tall walks at the rate of 5 feet per second toward a streetlight that is 16 feet above the ground.

   (a) At what rate is the tip of the shadow moving?

   (b) At what rate is the length of his shadow changing?

4. A dock is 6 feet above the water. Suppose you stand on the edge of the dock and pull a rope attached to a boat at the constant rate of 2 feet per second. Assume that the boat remains at water level. At what speed is the boat approaching the dock when it is:

   (a) 20 feet from the dock?

   (b) 10 feet from the dock?

5. If a snowball melts so that its volume[1] decreases at a rate of 4 cm^3 per minute, find the rate at which

   (a) the diameter of the snowball decreases

   (b) the surface area[2] of the snowball decreases

at the moment when the volume of the snowball is 36π cm^3.

6. A police officer stands 50 ft from the edge of a straight highway while a car speeds down the highway. Using a radar gun, the officer ascertains that at a particular instant the car is 500 ft from him and that the distance between himself and the car is changing at a rate of 120 feet per second. At that moment, how fast is the car traveling down the highway?

7. The length l of a rectangular box decreases at the rate of 2 cm per minute, the width w increases at the rate of 3 cm per minute, and the height h decreases by 1 cm per minute. At what rate is

   (a) the surface area of the box

   (b) the volume of the box

increasing at the moment when the box has dimensions $l = w = 20$ cm and $h = 30$ cm?

8. A 10-ft ladder leans against the side of the building. If the top of the ladder begins to slide down the wall at the rate of 2 feet per second, how fast is the bottom of the ladder sliding away from the wall when the top of the ladder is 8 feet off the ground?

---

[1] It may help to know that the volume of the ball of radius r cm is $\frac{4\pi r^3}{3}$ cm^3.
[2] Recall that the surface area of a ball of radius r cm is $4\pi r^2$ cm^2.