SECTION 4.6

4.6.1 A shark, looking for dinner, is swimming parallel to a straight beach and 90 feet offshore. The shark is swimming at the constant speed of 30 feet per second. At time $t = 0$, the shark is directly opposite a lifeguard station. How fast is the shark moving away from the lifeguard station when the distance between them is 150 feet?

4.6.2 A ladder 13 feet long is leaning against a wall. If the base of the ladder is moving away from the wall at the rate of 1/2 foot per second, at what rate will the top of the ladder be moving when the base of the ladder is 5 feet from the wall?

4.6.3 A spherical balloon is inflated so that its volume is increasing at the rate of 3 cubic feet per minute. How fast is the radius of the balloon increasing at the instant the radius is 1/2 foot?

$$\left[V = \frac{4}{3}\pi r^3 \right]$$

4.6.4 Sand is falling into a conical pile so that the radius of the base of the pile is always equal to one half its altitude. If the sand is falling at the rate of 10 cubic feet per minute, how fast is the altitude of the pile increasing when the pile is 5 feet deep?

$$\left[V = \frac{1}{3}\pi r^2 h \right]$$

4.6.5 A metal cone contracts as it cools. Assume the height of the cone is 16 cm and the radius at the base of the cone is 4 cm. If the height of the cone is decreasing at 4.0×10^{-5} cm per second, at what rate is the volume of the cone decreasing when its height is 15 cm?

$$\left[V = \frac{1}{3}\pi r^2 h \right]$$

4.6.6 A spherical balloon is inflated so that its volume is increasing at the rate of 20 cubic feet per minute. How fast is the surface area of the balloon increasing when the radius is 4 feet? [Use $V = \frac{4}{3}\pi r^3$ and $S = 4\pi r^2$.]

4.6.7 Two ships leave port at noon. One ship sails north at 6 miles per hour and the other sails east at 8 miles per hour. At what rate are the two ships separating 2 hours later?

4.6.8 A conical funnel is 14 inches in diameter and 12 inches deep. A liquid is flowing out at the rate of 40 cubic inches per second. How fast is the depth of the liquid falling when the level is 6 inches deep?

$$\left[V = \frac{1}{3}\pi r^2 h \right]$$

4.6.9 A baseball diamond is a square 90 feet on each side. A player is running from home to first base at the rate of 25 feet per second. At what rate is his distance from second base changing when he has run half way to first base?

4.6.10 A ship, proceeding southward on a straight course at the rate of 12 miles/hr is, at noon, 40 miles due north of a second ship, which is sailing west at 15 miles/hr.

(a) How fast are the ships approaching each other 1 hour later?

(b) Are the ships approaching each other or are they receding from each other at 2 o'clock and at what rate?