

EMT111 – Problem Set VII

December 5, 2010

1. A spherical balloon is inflated so that its volume is increasing at the rate of 3 cu.ft /min. How fast is the diameter of the balloon increasing when the radius is 1 ft?
2. To create a computer design for a funnel, an engineer revolves the region bounded by the lines $y = 3 - x$, $y = 0$ and $x = 0$ about the y -axis, where x and y are measured in feet. Find the volume of the funnel.
3. A population of bacteria is growing at the rate of $\frac{dP}{dt} = \frac{3000}{1+0.25t}$, where t is the time in days. When $t = 0$, the population is 1000.
 - (a) Write an equation that models the population P in terms of the time t .
 - (b) What is the population after 3 days?
 - (c) After how many days will the population be 12,000 ?
4. An aircraft is climbing at a 30° angle to the horizontal. How fast is the aircraft gaining altitude if its speed is 500 mph ?
5. An open box is to be made from a 3-ft by 8-ft rectangular piece of sheet metal by cutting out squares of equal size from the four corners and bending up the sides. Find the maximum volume that the box can have.
6. A plank is used to reach over a fence 8 ft high to support a wall that is 1 ft behind the fence. What is the length of the shortest plank that can be used?
7. Use the method of disks to verify that the volume of a right circular cone is $\frac{1}{3}\pi r^2 h$, where r is the radius of the base and h is the height.
8. To create a part for an engine, a manufacturer drills a hole through the centre of a metal sphere whose radius is 1 inch. The hole has a diameter of $1/2$ inch. What is the volume of the resulting ring?
9. A pond is to be stocked with a species of fish. The food supply in 500 cubic feet of pond water can adequately support one fish. The pond is nearly circular, is 20 feet deep at its center, and has a radius of 200 feet. The bottom of the pond can be modeled by $y = 20[(0.005x)^2 - 1]$.
 - (a) How much water is in the pond?
 - (b) Estimate the maximum number of fish the pond can support.