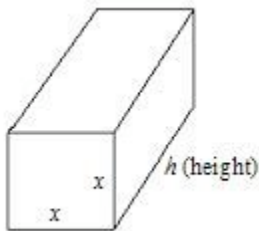


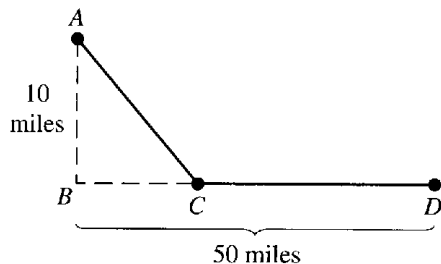
## Math120 Word Problems

### Equation Building

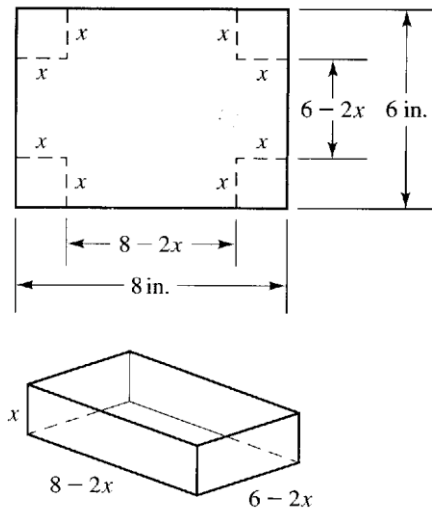
1. A piece of wire 14 in. long is cut into two pieces. The first is bent into a circle, the second into a square. Express the combined total area of the circle and the square as a function of  $c$ , where  $c$  represents the length of the wire that is used for the circle.
2. The volume of a right circular cone is given by the formula  $V = \frac{1}{3}\pi r^2 h$ . If the volume of a right circular cone is  $12\pi \text{ cm}^3$ ,
  - a) Express the height as a function of the radius.
  - b) Express the radius as a function of the height.
3. A line is drawn from the origin  $O$  to a point  $P(x, y)$  in the first quadrant on the graph of  $y = \frac{1}{x}$ . From point  $P$ , a line is drawn perpendicular to the  $x$ -axis, meeting the  $x$ -axis at the point  $B$ . Express the perimeter of the  $\triangle OPB$  as a function of  $x$ .
4. An equilateral triangle of side  $s$  is inscribed in a circle. Express the area of the circle as a function of  $s$ .
5. A rectangular box with a square bottom has a fixed volume  $15 \text{ ft}^3$ . It must be constructed from 2 different kinds of materials. The material used for the 4 sides costs  $\$1.28 \text{ ft}^2$  and the bottom and top material costs  $\$3.39 \text{ ft}^2$ . Write a function for the total cost of this box as a function of one of the sides of the square bottom.



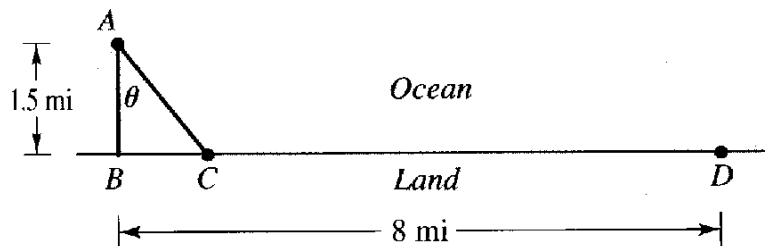
6. An offshore oil rig is located at point  $A$ , which is 10 miles out to sea. An oil pipeline is to be constructed from point  $A$  to a point  $C$  on the shore and then to a point  $D$ , farther up the coast. If it costs  $\$8$  million per mile to lay the pipeline in the sea and  $\$2$  million per mile on land, express the cost of laying the pipeline in terms of  $x$ , where  $x$  is the distance from  $B$  to  $C$ .



7. An open top box is constructed from a 6-by-8-inch rectangular sheet of tin by cutting out equal squares at each corner and then folding up the flaps, as shown in the figure. Express the volume of the box as a function of  $x$ , the length of the side of each cutout square.

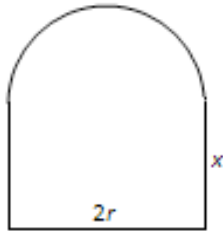


8. An offshore oil rig is located at point A, which is 1.5 miles out to sea. An oil pipeline is to be constructed from point A to a point C on the shore and then to an oil refinery at point D, farther up the coast. It costs \$3 million per mile to lay the pipeline at sea and \$1 million per mile on land. Express the cost of laying the pipeline in terms of the angle  $\theta$  shown in the picture.

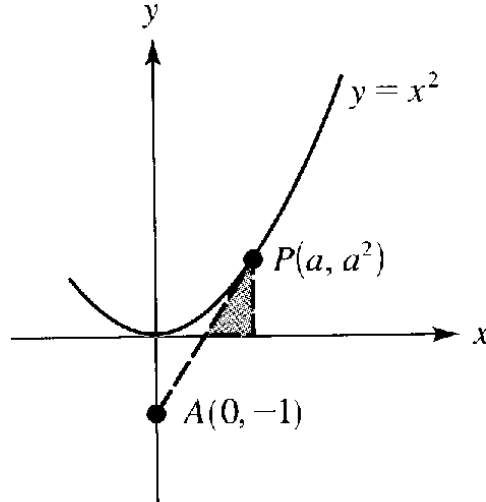


9. Assume that the operating cost of a truck is  $12 + \frac{x}{6}$  cents per mile when the truck travels at  $x$  mph. If the driver earns \$6 per hour, write an equation for the total cost (cost of the truck + cost of the driver) to drive the truck 400 miles as a function of the speed  $x$ . Hint: convert both costs to dollars.
10. A Florida citrus grower has determined that if 60 orange trees are planted per acre, then the average yield per tree will be 400 oranges. The average yield per tree has been found to decrease by 4 oranges per tree for each additional tree planted on the same acreage. Write an equation for the total yield per acre. Hint: Let  $x$  = number of additional trees planted.

11. A window in the shape of a rectangle topped by a semicircle is to have a fixed perimeter of  $P$ . Write an equation for the area of the window in terms of  $r$ , the radius of the semicircle. Your equation will contain  $P$ .



12. Consider the equation  $y = x^2$  and the line joining the points  $A$  and  $P$  drawn below:
- Write an expression for the slope of the line segment  $AP$
  - Write an equation for the line segment  $AP$ .
  - Calculate the  $x$  coordinate of the line segment  $AP$ .
  - Write an equation for the area of the shaded triangle.



13. The Can-O-Rad Company manufactures cylindrical barrels to hold nuclear waste. The top and bottom of the barrels are made with material that costs \$10 per square foot and the rest is made with material that costs \$8 per square foot. If each barrel is to hold 5 cubic feet, write an equation for the cost of the barrel in terms of  $r$ , the radius of the top.