WS #6

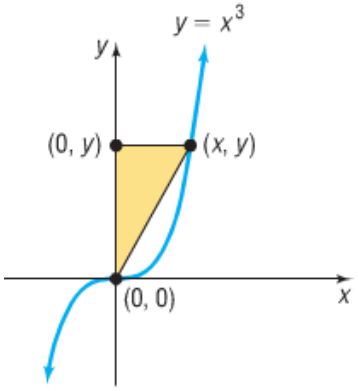
Precalculus - Modeling Functions section 1.7

Name_____ Date_____ Per_____

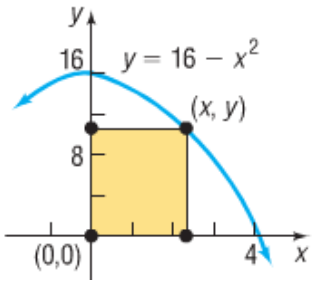
Do this homework on a separate sheet of paper!

1. Let $P(x, y)$ be a point on the graph of $y = \sqrt{x}$.
   a) Express the distance d from P to the point $(1, 0)$ as a function of x.
   b) Use a graphing utility to graph $d = d(x)$. For what values of x is d the smallest?

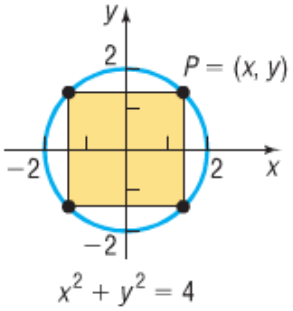
2. A right triangle has one vertex on the graph of $y = x^3$, $x > 0$, at (x, y), another at the origin, and the third on the positive y-axis at $(0, y)$, as shown in the figure. Express the area A of the triangle of a function of x.



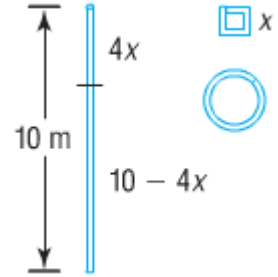
3. A rectangle has one corner in quadrant I on the graph of $y = 16 - x^2$, another at the origin, a third on the positive y-axis, and the fourth on the positive x-axis. See the figure.
   a) Express the area A of the rectangle as a function of x.
   b) What is the domain of A?
   c) Use a graphing utility to graph $A = A(x)$. For what value of x is A largest?



4. A rectangle is inscribed in a circle of radius 2 with a center at the origin. See the figure. Let $P(x, y)$ be the point in quadrant I that is a vertex of the rectangle and is on the circle.
   a) Express the area A of the rectangle as a function of x.
   b) Express the perimeter p of the rectangle as a function of x.
   c) Use a graphing utility to graph $A = A(x)$. For what value of x is A largest?
   d) Use a graphing utility to graph $p = p(x)$. For what value of x is p largest?



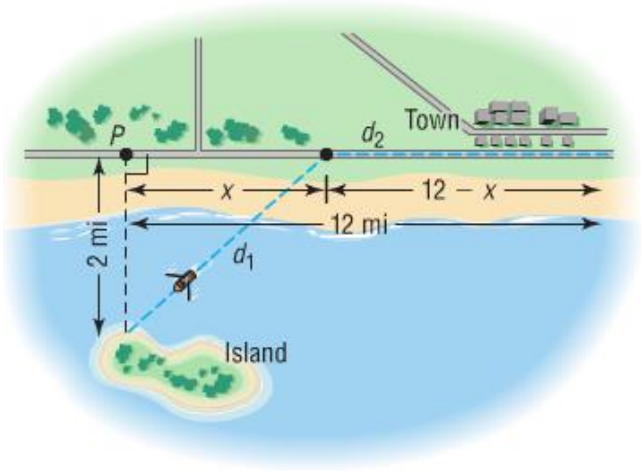
5. A wire 10 meters long is to be cut into two pieces. One piece will be shaped as a square, and the other piece will be shaped as a circle. See the figure.



   a) Express the total area A enclosed by the pieces of wire as a function of the length x of the side of the square. (Hint: Area of square $= x^2$, area of circle $= \pi r^2$, circumference of circle $= 2\pi r$)
   b) What is the domain of A?
   c) Use a graphing utility to graph $A = A(x)$. For what value of x is A smallest?

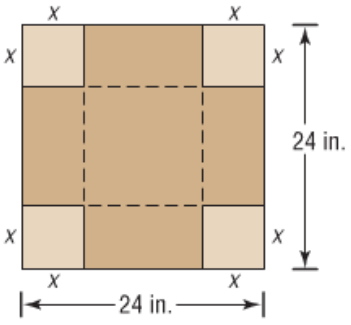
6. Two cars are approaching an intersection. One is 2 miles south of the intersection and is moving at a constant speed of 30 miles per hour. At the same time, the other car is 3 miles east of the intersection and is moving at a constant speed of 40 miles per hour.
   a) Build a model that expresses the distance d between the cars as a function of time t.
   b) Use a graphing utility to graph $d = d(t)$. For what value of t is d smallest? (Hint: Remember that you are measuring time in hours in this question, and it isn't going to take hours for the cars to reach the intersection. Take that into account when setting up your window on the calculator.)

7. An island is 2 miles from the nearest point P on a straight shoreline. A town is 12 miles down the shore from P. See the illustration.



   a) If a person can row a boat at an average speed of 3 miles per hour and the same person can walk 5 miles per hour, build a model that expresses the time T that it takes to go from the island to town as a function of the distance x from P to where the person lands the boat.
   b) What is the domain of T?
   c) How far should the person land from P in order to minimize the amount of time it takes to get to town? What is the minimum amount of time it takes to get to town?

8. An open box with a square base is to be made from a square piece of cardboard 24 inches on a side by cutting out a square from each corner and turning up the sides. See the figure.



   a) Express the volume V of the box as a function of the length x of the side of the square cut from each corner.
   b) What is the domain of V?
   c) Use a graphing utility to graph $V = V(x)$? For what value of x is V largest?