SM 3H

2023-2024

2.3 Mathematical Models: Building Functions

SCORE: /

Name _____ **Date** _____ **Period** _____

1. Let $P = (x, y)$ be a point on the graph of $y = x^2 - 8$.

a) Express the distance d from P to the point (0, -1) as a function of x.

b) What is d if $x = 0$?

c) What is d if $x = -1$? Round to the nearest hundredth.

d) Use a graphing utility to graph $d = d(x)$. Sketch the graph.

e) For what values of x is d smallest? Round to the nearest hundredth.

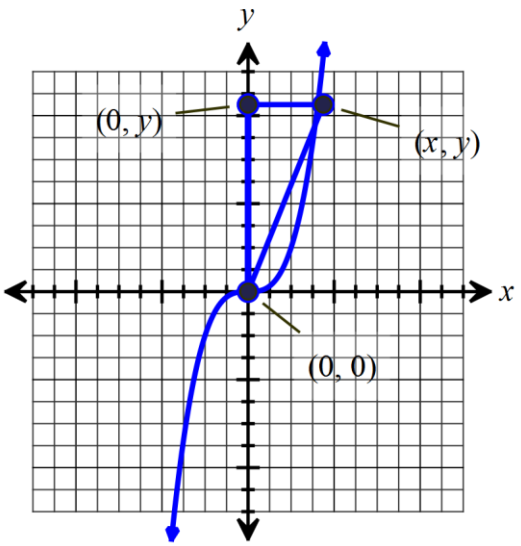
2. Let $P = (x, y)$ be a point on the graph of $y = \sqrt{x}$.

a) Express the distance d from P to the point (1, 0) as a function of x.

b) Use a graphing utility to graph $d = d(x)$. Sketch the graph.

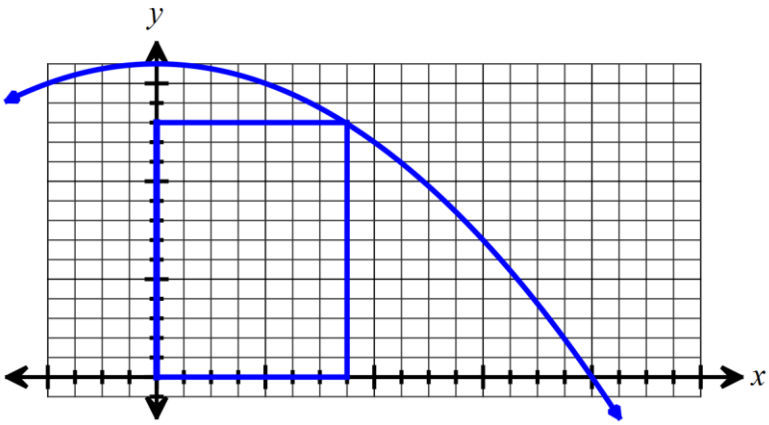
c) For what values of x is d smallest? Round to the nearest tenth.

3. 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 as a function of x.



4. 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*.

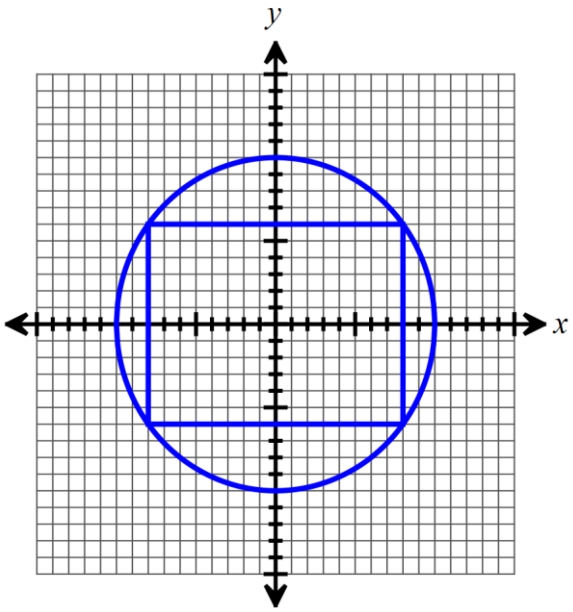


b) What is the domain of A?

c) Graph A = A(*x*). For which value of *x* is A largest? Round to the nearest tenth.

5. A rectangle is inscribed in a circle of radius 2. See figure. Let $P = (x, y)$ be the point in quadrant I that is the vertex of the rectangle and is on the circle. Equation of a circle is $(x - h)^2 + (y - k)^2 = r^2$.

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) Graph *A* = *A*(*x*). For what value of *x* is *A* largest? Round to the nearest hundredth.

d) Graph *p* = *p*(*x*). For what value of *x* is *p* largest? Round to the nearest hundredth.

6. Squares of width x are removed from a 10 cm by 25 cm piece of cardboard, and the resulting edges are folded up to form a box with no top. Determine all values of x so that the volume of the resulting box is at most 175 cm^3. Round to the nearest hundredths. Write your answer in interval notation.

7. The function $V(x) = 2666x - 210x^2 + 4x^3$ represents the volume of a box that has been made by removing squares of width x from each corner of a rectangular sheet of material and then folding up the sides. What values are possible for x? Round to the nearest hundredths.

8. Peterson Packaging Company has contracted with another firm to design boxes with a volume of at least 600 in^3. Squares are to be cut from the corners of a 20-in. by 25-in. piece of cardboard, with the flaps folded up to make an open box. What size squares should be cut from the cardboard? Round to the nearest hundredths. Write your answer in interval notation.

Review

9. The electric company charges $25.00 per service call plus $18.00 per hour for home repair work. How long did an electrician work if the charge was less than $100? Round to the nearest hundredths.

10. Bingham Sports Apparel has found that it needs to sell BHS flags for $2.75 each in order to be competitive. It costs $2.12 to produce each flag, and has a weekly overhead cost of $3000.

a) Let x be the number of flags produced each week. Express the cost (including overhead costs) of producing x flags as a function of x.

b) Express the total revenue of producing x flags as a function of x.

c) Create a profit function. (revenue – cost = profit)

d) Solve to find the number of flags that must be sold each week to make a profit.

e) How many flags must be sold to make a profit of $1000 in 1 week? Explain your answer.

f) Let x be the number of flags produced each week. Express the average cost (including overhead costs) of producing one flag as a function of x.