

3.6 Mathematical Models: Building Models

▼ Smallest Distance

Let $P = (x, y)$ be a point on the graph of $y = x^2 - 10$

a) Express the distance d from P to the origin as a function of x .

b) What is the distance if $x = 0$?

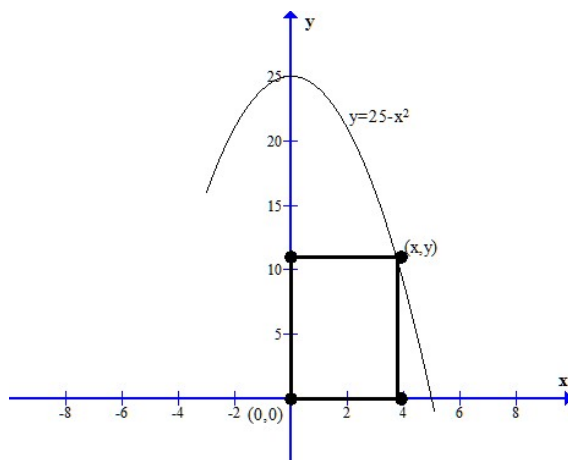
c) What is the distance if $x = 3$?

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

e) For what values of x is d the smallest?

▼ Largest Area

A rectangle has one corner on quadrant 1 on the graph of $y = 25 - x^2$, another at the origin, a third on the positive y -axis, and a fourth on the positive x -axis.



a) Express the area of the rectangle as a function of x .

b) What is the domain of A ?

c) Use a graphing utility to graph $A = A(x)$.

d) For what value of x is A largest?

▼ Modeling Perimeter and Area

A wire of length x is bent into the shape of a square.

a) Express the perimeter P of the square as a function of x .

b) Express the area A of the square as a function of x .

▼ Smallest Distance

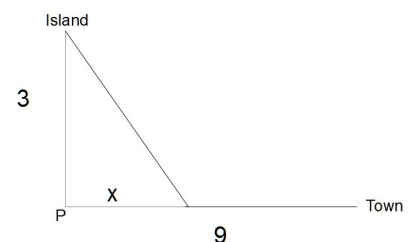
Two cars are approaching an intersection. One is 3 miles west of the intersection and is moving at a constant speed of 35 miles per hour. At the same time, the other car is 4 miles north of the intersection and is moving at a constant speed of 40 miles per hour.

a) Build a model that expresses the distance d between the cars as a function of time.

b) Use a graphing utility to graph $d = d(x)$. For what value of t is d the smallest.

▼ Modeling Time

An island is 3 miles to the nearest point P on a straight shoreline. A town is 9 miles down the shore from P .



a) If a person can row a boat at an average speed of 2 miles per hour and the same person can walk 4 miles per hour, build a model that expresses the time T that it takes to go from the island to the 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 long will it take to travel from the island to the town if the person lands the boat 2 miles from P ?

d) How long will it take if the person lands the boat 6 miles from P ?

▼ Largest Volume

An open box with a square base is to be made from a piece of cardboard 32 inches on a side by cutting out a square from each corner and turning up the sides.

a) Express the volume V of a box as a function of the length x of the side of the square cut from each corner.

b) What is the volume if a 2-inch square is cut out?

c) What is the volume if a 8-inch square is cut out?

d) Graph $V = V(x)$. For what value of x is V the largest?