Assignment

Write

Provide an example of each key term.

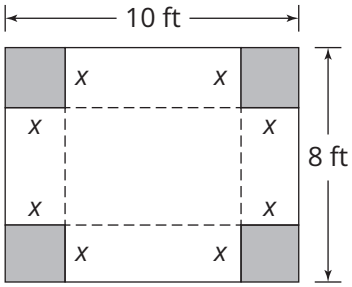
1. relative minimum
2. relative maximum
3. cubic function

Remember

A cubic function is a polynomial function of degree 3 that can be written in the form $f(x) = ax^3 + bx^2 + cx + d$, where $a \neq 0$. The graph has 2 general shapes.

Practice

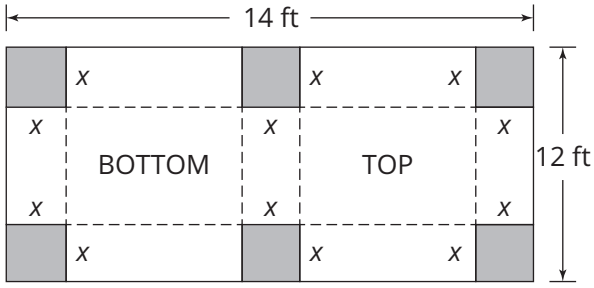
1. Cynthia is an engineer at a manufacturing plant. Her boss asks her to use rectangular metal sheets to build storage bins with the greatest possible volume. Each rectangular sheet is 8 feet by 10 feet. Cynthia's sketch shows the squares to be removed from the corners of each sheet. The dashed lines indicate where the metal sheets will be folded before they are welded to form the prism-shaped storage bins without tops.



   a. Write a function $V(x)$ to represent the volume of a bin in terms of the side length, x, of the removed squares. Explain your reasoning.
   b. Represent the function $V(x)$ using technology. Determine the domain and range of the function. Determine the domain and range of the function as they relate to this problem situation. Explain your reasoning.
   c. Determine the maximum volume of a bin. What are the dimensions of a bin with the maximum volume?
   d. Determine any relative maximums or relative minimums of $V(x)$. Then, determine the intervals over which the function is increasing and decreasing.
   e. Determine the x- and y-intercepts of the graph of $V(x)$. What do they represent in this problem situation?
   f. Cynthia's boss asks her to make several bins with volumes of exactly 40 cubic feet. Determine the bin dimensions that will work.

Stretch

1. Nikki is an engineer at a manufacturing plant. Her boss asks her to use rectangular sheets of metal to build storage bins with the greatest possible volume. Each rectangular sheet is 14 feet by 12 feet. Nikki's sketch shows the squares to be removed from each sheet. The dashed lines indicate where the metal sheets will be folded before they are welded to form the prism-shaped storage bins with tops.



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   b. Represent the function $V(x)$ using technology. Determine the domain and range of the function. Determine the domain and range of the function as they relate to this problem situation. Explain your reasoning.

c. Determine the maximum volume of a bin. What are the dimensions of a bin with the maximum volume?

d. Determine any relative maximums or relative minimums of $V(x)$. Then, determine the intervals over which the function is increasing and decreasing.

e. Determine the x- and y-intercepts of the graph of $V(x)$. What do they represent in this problem situation?

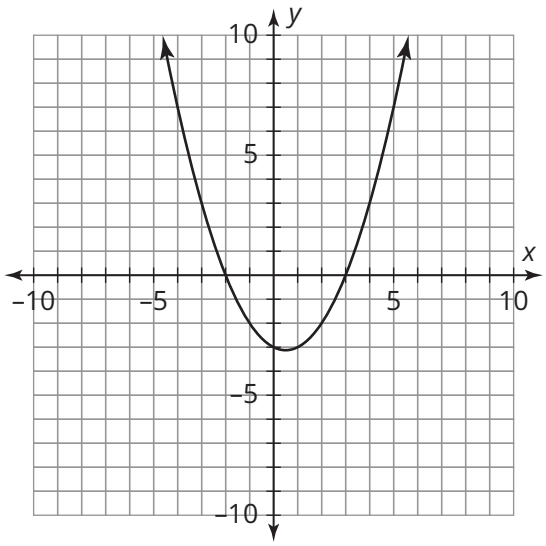
f. Nikki's boss asks her to make several bins with volumes of exactly 40 cubic feet. Determine the bin dimensions that will work.

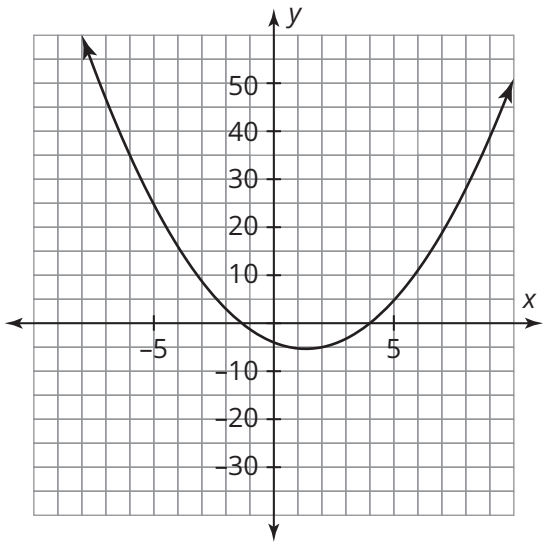
Review

1. Dilate each function by the given factor to create a new function of higher degree. Sketch the graph and then identify the zeros of the new function.

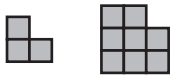
   a. $f(x) = \left(\frac{1}{2}x + 1\right)(x - 3)$
   Sketch $(x + 1) \cdot f(x)$.

   b. $g(x) = (3x + 4)\left(\frac{1}{4}x + 2\right)$
   Sketch $(x - 1) \cdot f(x)$.





2. The figures shown represent a visual pattern of tiles.



   a. Create a table to display the number of squares used in each of the first 6 figures.

   b. Create a graph of the data points in your table on the coordinate plane shown. Draw a smooth curve to connect the points.

   c. Describe the pattern as linear, exponential, quadratic, or none of these. Explain your reasoning.

3. Solve the equation $x^2 - 6x + 35 = 10$.