Name:_____

Algebra 1B

Unit 10: Graphing Quadratics

Priority Standard: F-IF.8A: Use the process of factoring and using the quadratic formula in a quadratic function to show zeros, extreme values and symmetry of the graph and interpret these in terms of a context.

Unit 10 "I can" Statements:

1. I can identify key features of a parabola (vertex, axis of symmetry, x and y intercepts, domain and range).
2. I can represent a quadratic equation in two variables graphically and recognize the symmetry of the graph.
3. I can graph quadratic functions using the x-intercepts.
4. I can graph quadratic functions from the form $y = ax^2 + bx + c$.
5. I can interpret real-world quadratic situations.

Quadratic Graphs and their Properties

Warm-Up:

1. Solve by using the quadratic formula. $3x^2 - 13x + 4 = 0$

2. Solve by factoring. $x^2 - 8 = -7x$

Quadratic Function: a function that can be written in the form _____ (standard form) where $a \neq 0$.

Parabola: _____-shaped graph. A parabola can open _____ or _____ (you can tell this by the "a" value).

Vertex: it's the _____ or _____ point.

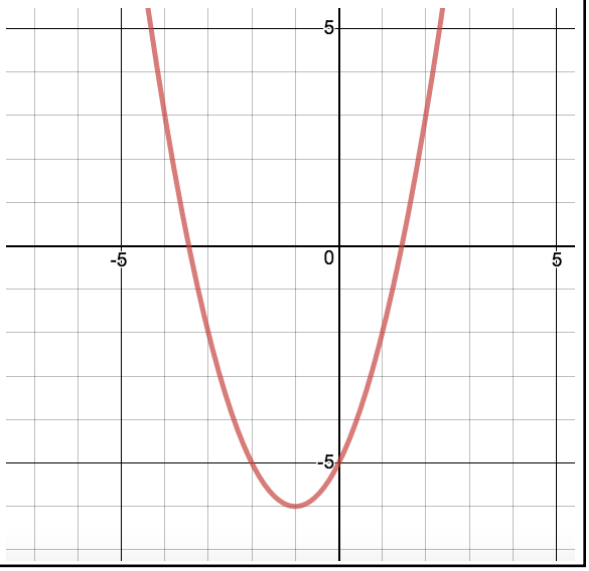
Axis of Symmetry: a line that divides the parabola into two _____ halves.

x-intercept:

y-intercept:

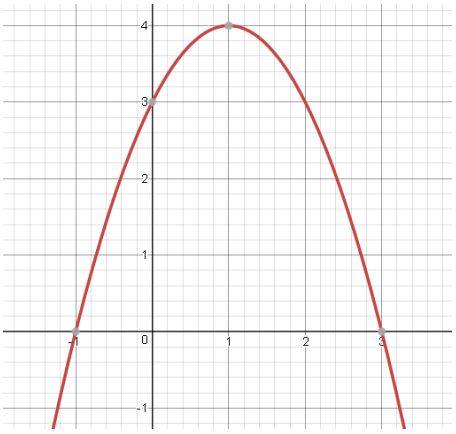
Domain: The possible values for the input of a function.

Range: The possible values for the output of a function



Answer the following question given the graph provided.

1.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

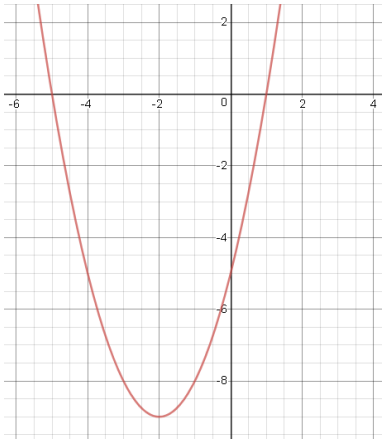
Domain:_____

Range:_____

How many x-intercepts:_____

How many y-intercepts:_____

2.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

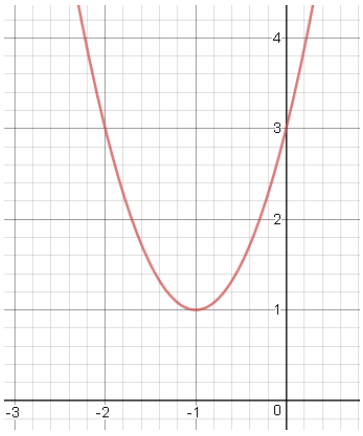
Domain:_____

Range:_____

How many x-intercepts:_____

How many y-intercepts:_____

3.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

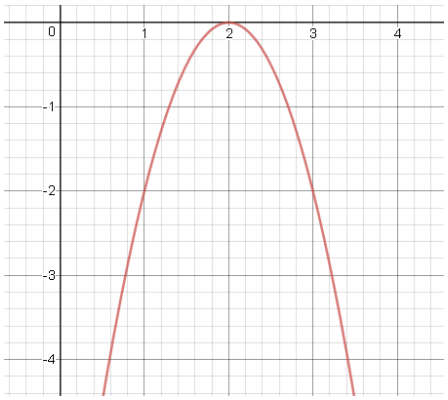
Domain:_____

Range:_____

How many x-intercepts:_____

How many y-intercepts:_____

4.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

Domain:_____

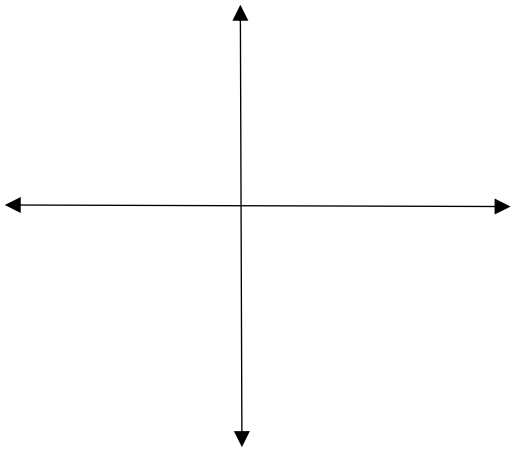
Range:_____

How many x-intercepts:_____

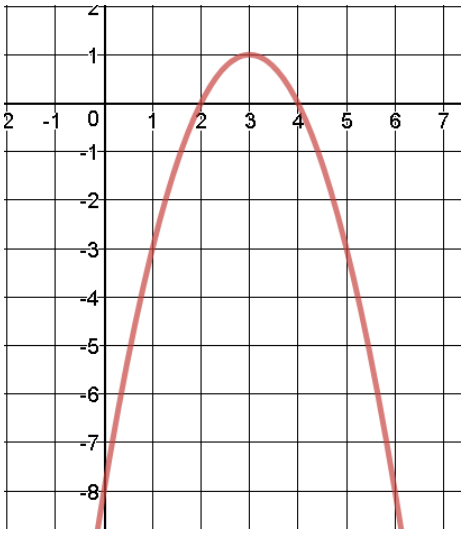
How many y-intercepts:_____

Concept Check:

1. Draw a parabola and label the vertex, axis of symmetry, x-intercept(s), and y-intercept.



2.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

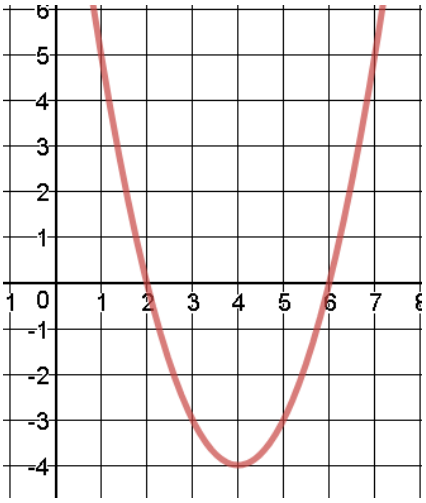
Domain:_____

Range:_____

How many x-intercepts:_____

How many y-intercepts:_____

3.



Vertex:_____

Minimum or Maximum:_____

Axis of Symmetry:_____

Domain:_____

Range:_____

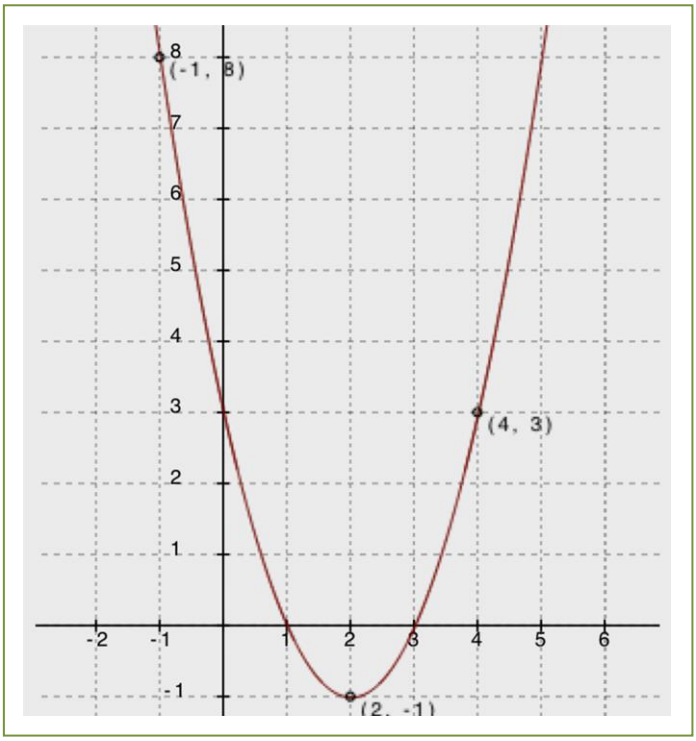
How many x-intercepts:_____

How many y-intercepts:_____

Exploring the Symmetry in the Graphs of Quadratic Functions

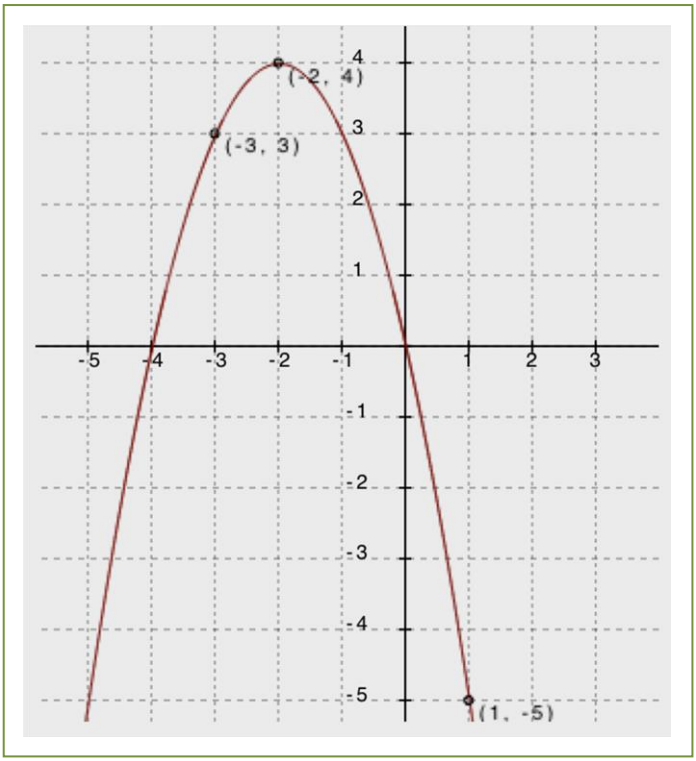
Use the graphs of quadratic functions (Graph A and Graph B) to fill in the table and answer the questions on the following page.

Graph A



x	$f(x)$
-1	8
2	-1
4	3

Graph B



x	$f(x)$
-3	3
-2	4
1	-5

Use your graphs and tables of values from the previous page to fill in the blanks or answer the questions for each below.

		Graph A		Graph B	
1	x-Intercepts				
2	Vertex				
3	Axis of Symmetry				
4	Sign of the Leading Coefficient ("a" Value)				
5	Vertex Represents a Minimum or Maximum?				
6	y - intercept				
7	Domain (x – values)				
8	Range (y – values)				

Finding the vertex and axis of symmetry (Look at rows 1 and 2 of the chart.)

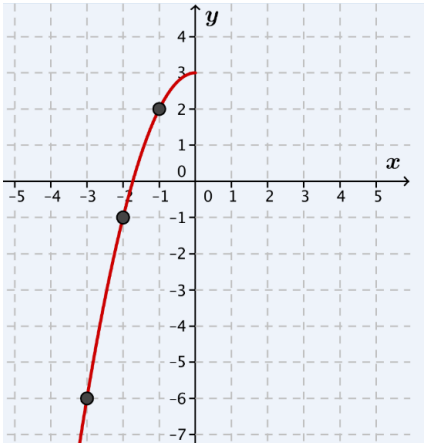
a.) How can we know the x-coordinate of the vertex by looking at the x-coordinates of the zeros (or any pair of symmetric points)?

b.) How can we know whether a graph of a quadratic function opens up or down?

c.) Can you graph a quadratic function if you don't know the vertex? Can you graph a quadratic function if you only know the x-intercepts?

d.) What is the minimum number of points needed to identify a unique quadratic function? Explain why.

Below you see only one side of the graph of a quadratic function. Complete the graph by plotting three additional points of the quadratic function. Explain how you found these points, and then fill in the table on the right.



x	$f(x)$

a.) What are the approximate coordinates of the x-intercepts?

b.) What are the coordinates of the y-intercept?

c.) What are the coordinates of the vertex? Is it a minimum or a maximum?

d.) If we knew the equation for this curve, what would the sign of the leading coefficient be?

Graphing Quadratics

Quadratic Equation: $\boldsymbol{ax^2 + bx + c = 0}$ where $a \neq 0$.

Its related quadratic function is _____

To solve:

1. Make sure the equation is set equal to _____.
2. _____ the related quadratic function or use the _____ formula.
3. The solutions of the quadratic equation are the x-intercepts, where the graph crosses the _____.

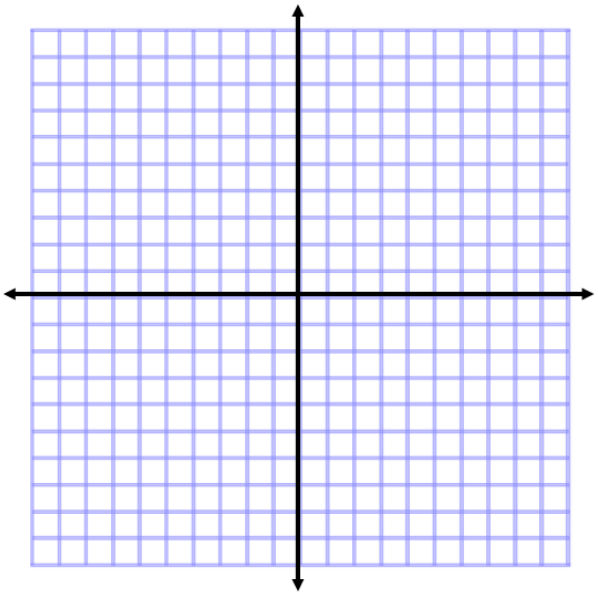
Notes:

A linear equation has _____solution.

A quadratic equation can have _____, _____, or _____ real-number solutions.

The solutions of a quadratic equation are the x-intercepts of the function and are often called _____ or _____.

1. Solve the following equation: $x^2 + 6x - 40 = 0$



a.) Given the above quadratic equation, can you find the point(s) where the graph crosses the x-axis?

b.) In the last lesson, we learned about the symmetrical nature of the graph of a quadratic function. How can we use that information to find the vertex for the graph?

c.) How could we find the y-intercept (where the graph crosses the y-axis and where $x = 0$)?

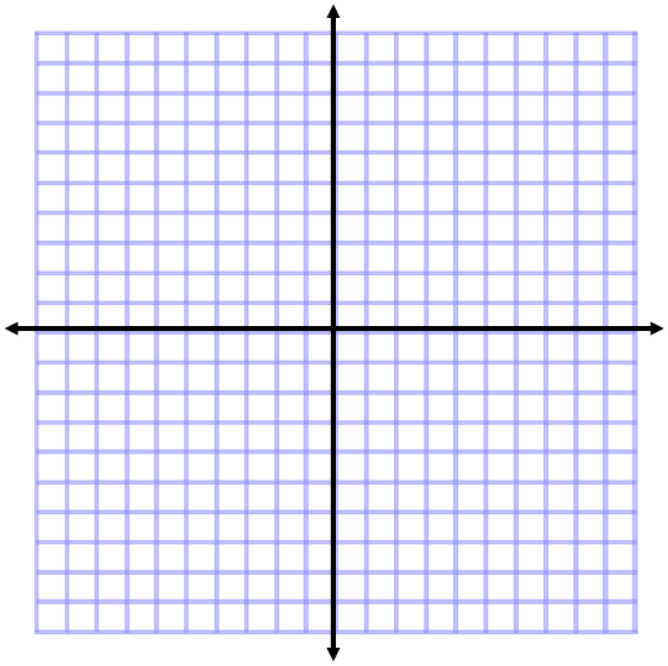
d.) What else can we say about the graph based on our knowledge of the symmetrical nature of the graph of a quadratic function? Can we determine the coordinates of any other points?

Graph the following functions and identify key features of the graph.

2. $h(x) = 5(x-2)(x-3)$

a.) x-intercepts: _____ _____ b.) vertex: _____

c.) y-intercept: _____



d.) Equation of the axis of symmetry: _____

e.) Maximum or Minimum

f.) a-value: _____

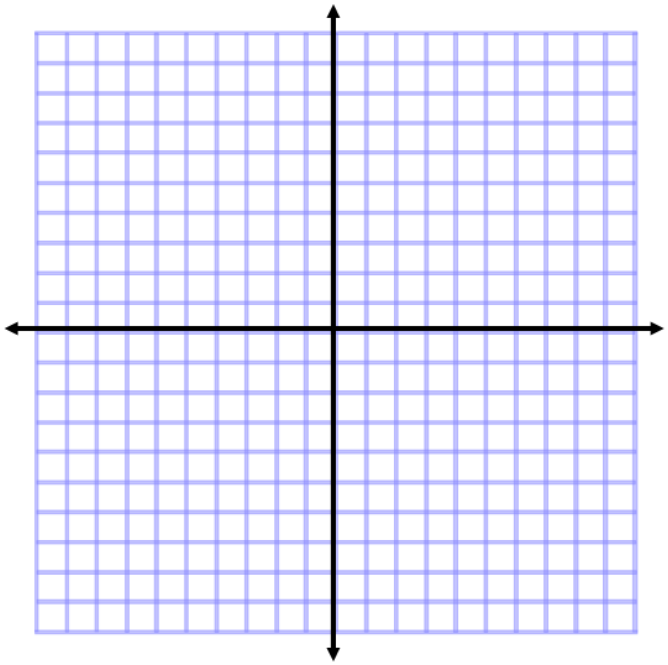
e.) Domain: _____

f.) Range: _____

3. $g(x) = x^2 - 5x - 24$

a.) x-intercepts: _____ _____ b.) vertex: _____

c.) y-intercept: _____



d.) Equation of the axis of symmetry: _____

e.) Maximum or Minimum

f.) a-value: _____

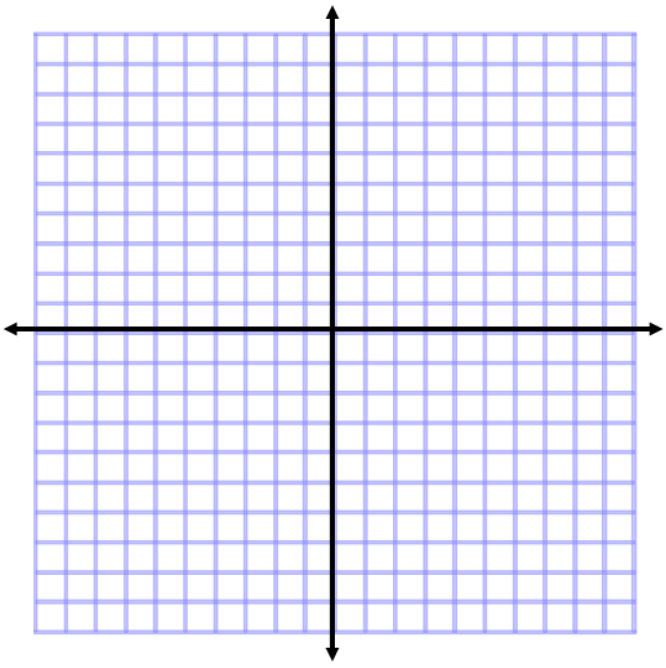
e.) Domain: _____

g.) Range: _____

4. $f(x) = -(x+2)(x-5)$

a.) x-intercepts: _____ _____ b.) vertex: _____

c.) y-intercept: _____



d.) Equation of the axis of symmetry: _____

e.) Maximum or Minimum

f.) a-value: _____

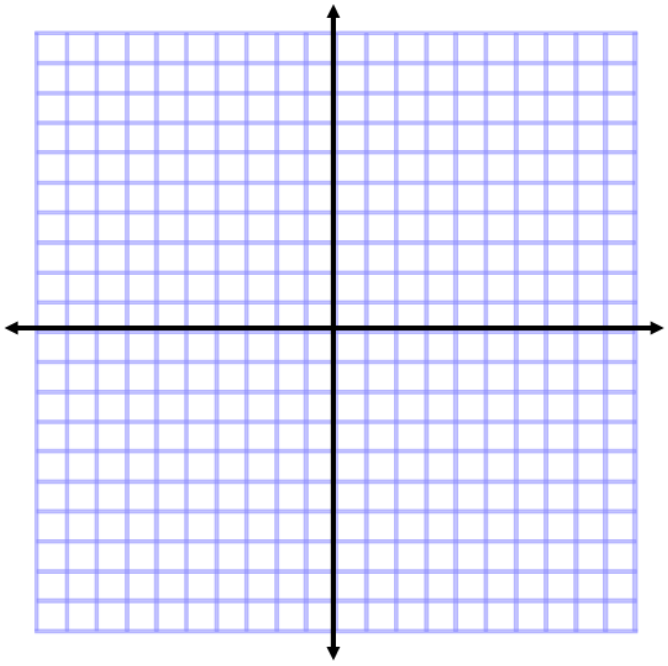
e.) Domain: _____

h.) Range: _____

5. $p(x) = -6x^2 + 42x - 60$

a.) x-intercepts: _____ _____ b.) vertex: _____

c.) y-intercept: _____



d.) Equation of the axis of symmetry: _____

e.) Maximum or Minimum

f.) a-value: _____

e.) Domain: _____

i.) Range: _____

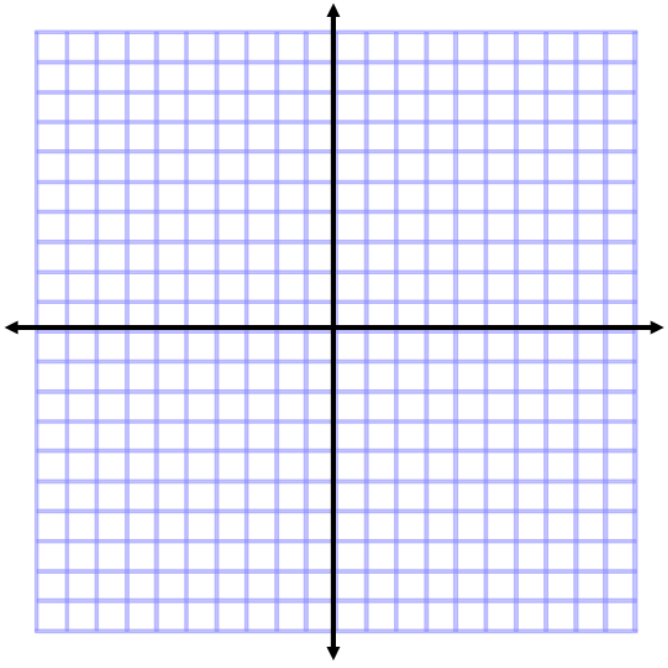
Concept Check:

1. Graph the following functions and identify key features of the graph.

$f(x) = x^2 - 8x + 12$

a.) x-intercepts: _____ _____ b.) vertex: _____

c.) y-intercept: _____



d.) Equation of the axis of symmetry: _____

e.) Maximum or Minimum

f.) a-value: _____

e.) Domain: _____

j.) Range: _____

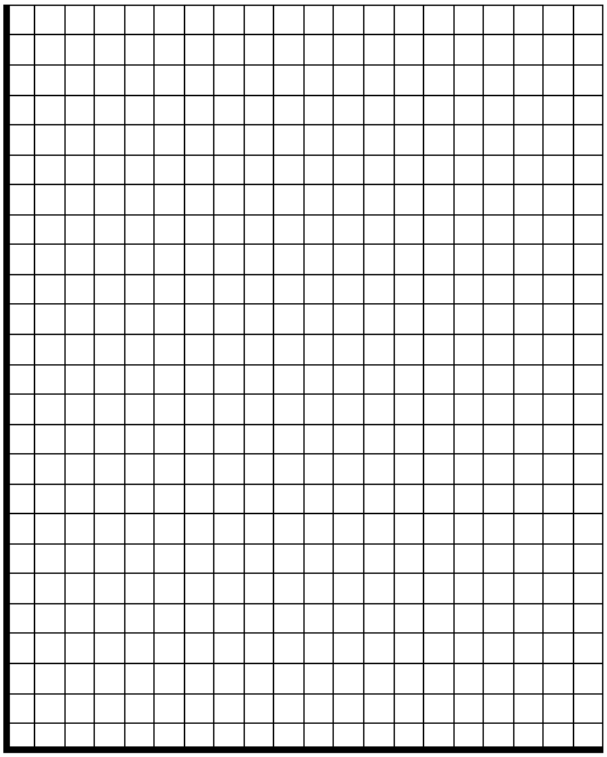
Modeling with Quadratic Functions

1. In a physics class demonstration, a ball is dropped from the roof of a building, 72 feet above the ground. The height h (in feet) of the ball above the ground is given by the function $h = -16t^2 + 72$, where t is the time in seconds.

a.) Complete the following table of values. Use the completed table to graph the function.

b.) Graph the function.

t	$h = -16t^2 + 72$	(t, h)
0		
1		
2		
3		



c.) How far has the ball fallen from the time $t = 0$ to $t = 1$?

d.) Does the ball fall the same distance from time $t = 1$ to $t = 2$ as it does from $t = 0$ to $t = 1$? Explain.

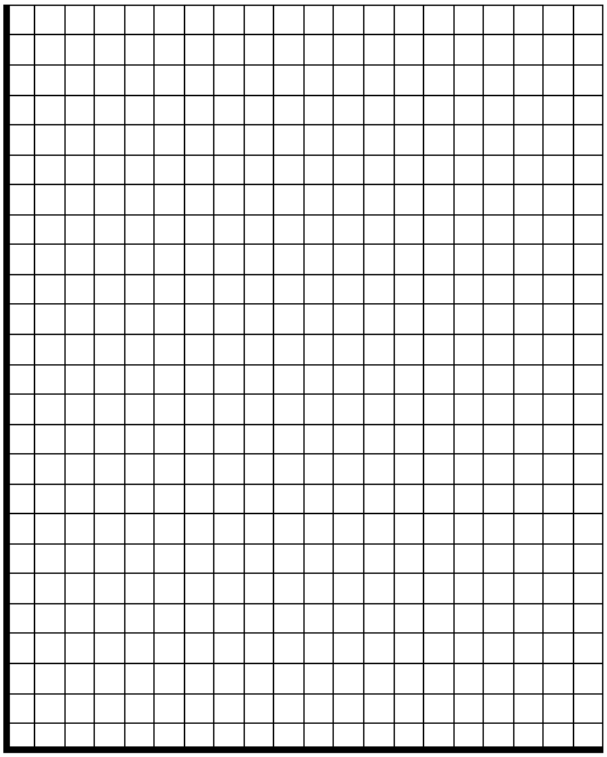
e.) When does the ball hit the ground?

2. A science class designed a ball launcher and tested it by shooting a tennis ball straight up from the top of a 15-story building. They determined that the motion of the ball could be described by the function:

$$h(t) = -16t^2 + 144t + 160,$$

where t represents the time the ball is in the air in seconds and $h(t)$ represents the height, in feet, of the ball above the ground at time t. What is the maximum height of the ball? At what time will the ball hit the ground?

a.) What is the maximum height of the ball?



b.) At what time does the ball hit the ground?

c.) Over what domain is the ball rising? Over what domain is the ball falling?

3. A model rocket is launched from the roof of a building. It's flight path is modeled by $h = -5t^2 + 30t + 10$ where h is the height of the rocket above the ground in meters and t is the time after the launch in seconds. .

a.) At what time does the rocket land on the ground?

b.) What is the maximum height of the rocket?

c.) How tall is the building that the rocket is being launched from?