Name _____

LEARNING OUTCOMES

- **I can factor a quadratic equation in order to reveal its zeros, and use the zeros to graph the equation.**

Lesson 9: Graphing Quadratic Equations From Factored Form

Example 1

Consider the equation $y = x^2 + 6x - 40$.

a. Given this quadratic equation, find the point(s) where the graph crosses the x-axis.

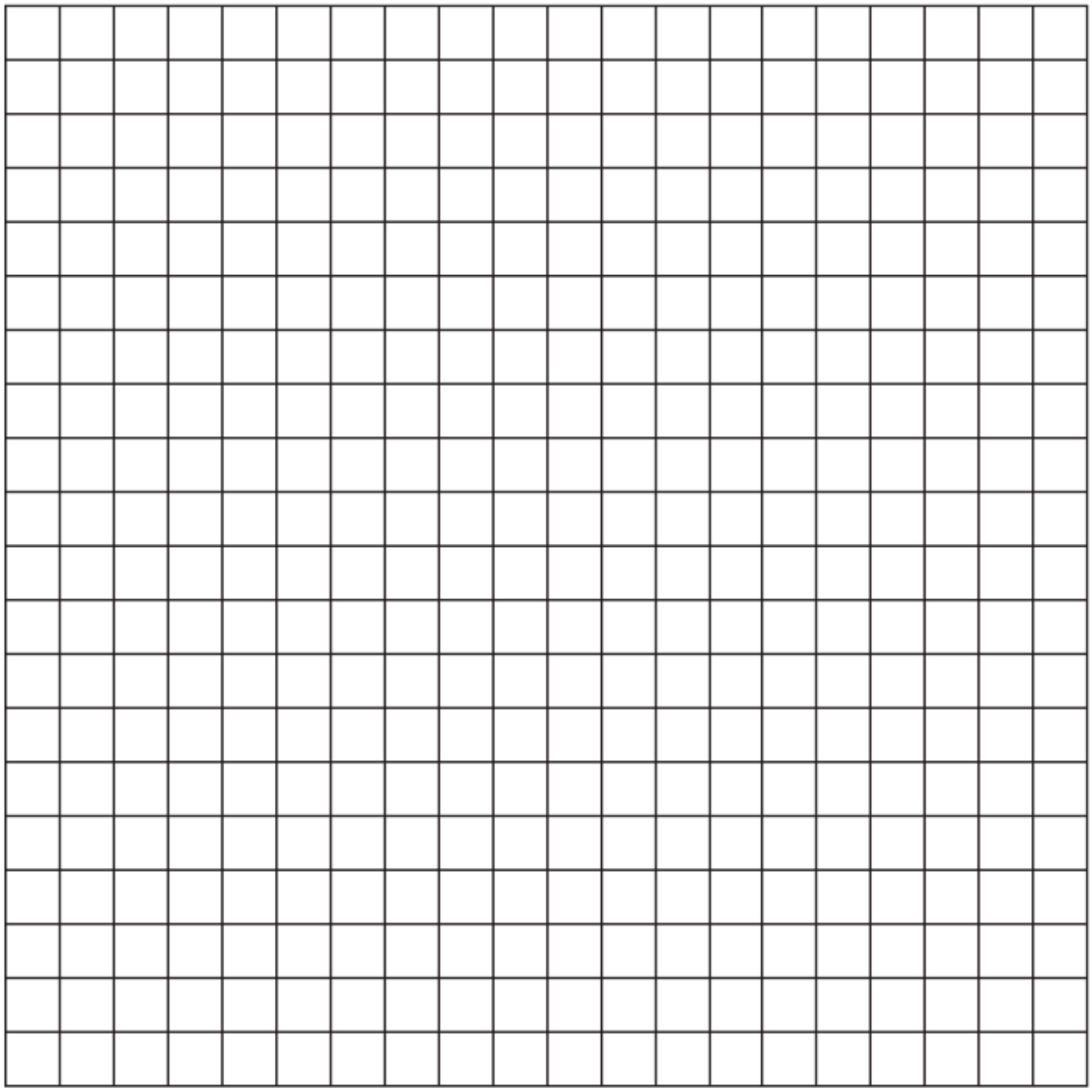
b. How can we write a corresponding quadratic equation if we are given a pair of roots?

c. Use the symmetrical nature of the graph of a quadratic function to find the vertex for the graph.

d. Find the y-intercept (where the graph crosses the y-axis and where $x = 0$).

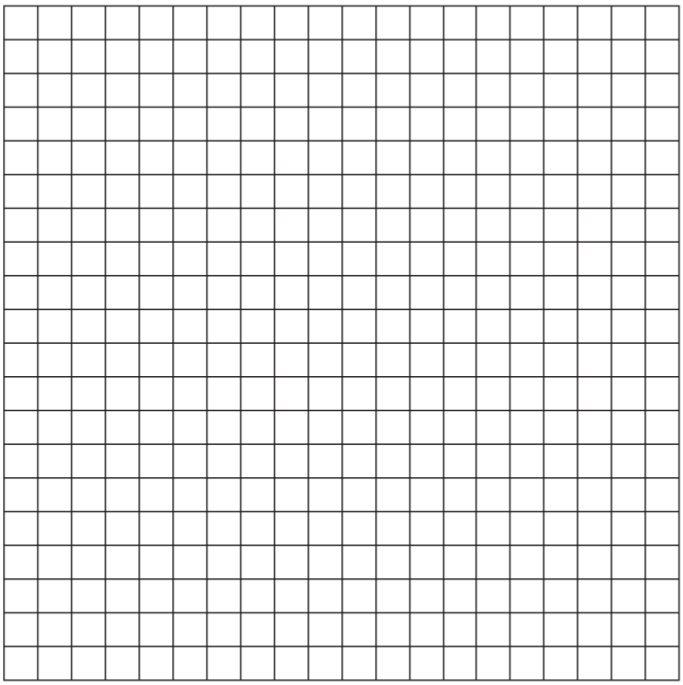
e. What else can we say about the graph based on our knowledge of the symmetrical nature of the graph of a quadratic function? Can we determine the coordinates of any other points?

f. Plot the points you know for this equation and connect them to show the graph of the equation $y = x^2 + 6x - 40$.

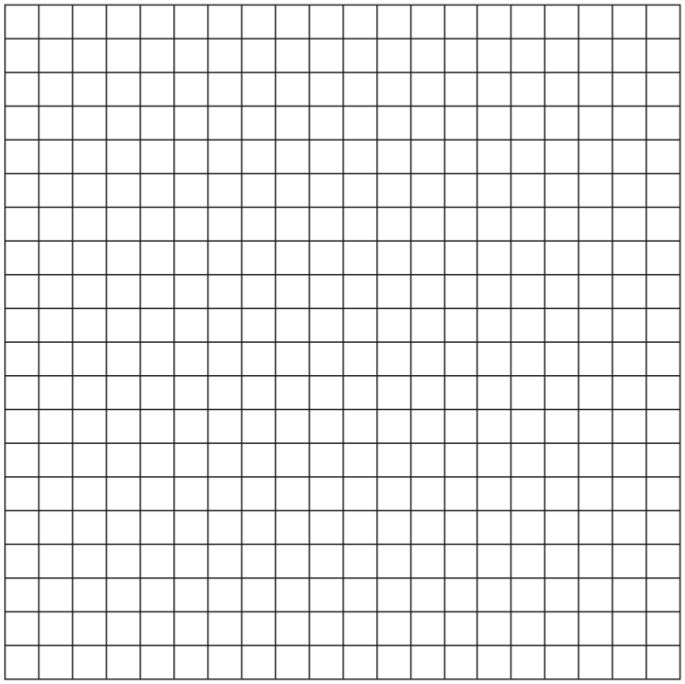


Exercise 1: Graph the following functions and identify the vertex, x-intercept, and y-intercept.

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



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



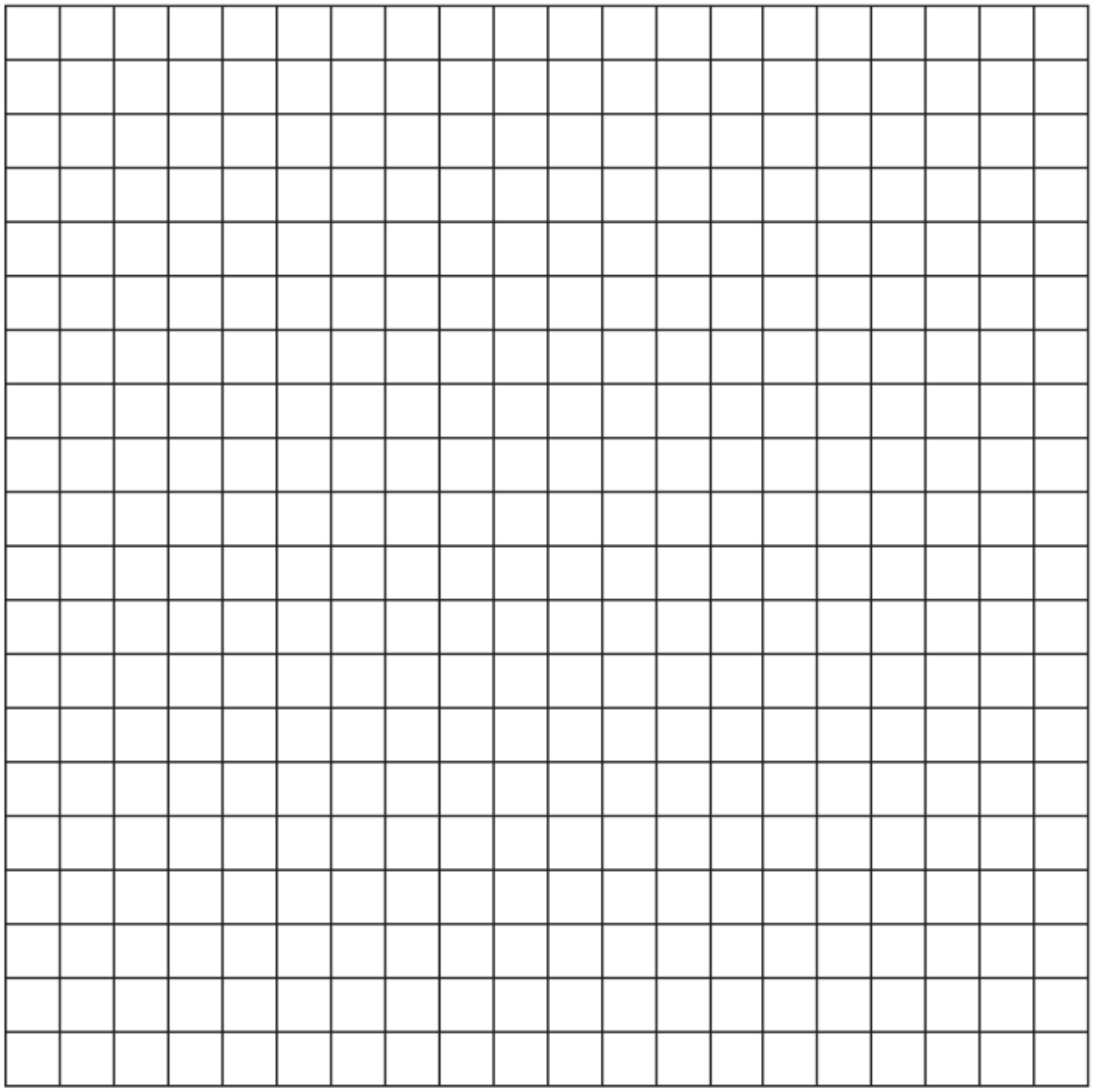
Example 2

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, the height, in feet, of the ball above the ground.

a. Graph the function.



b. Using the graph, at what time does the ball hit the ground?

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

d. Using the graph, what is the maximum height the ball reaches?

Name _____ CW/Homework

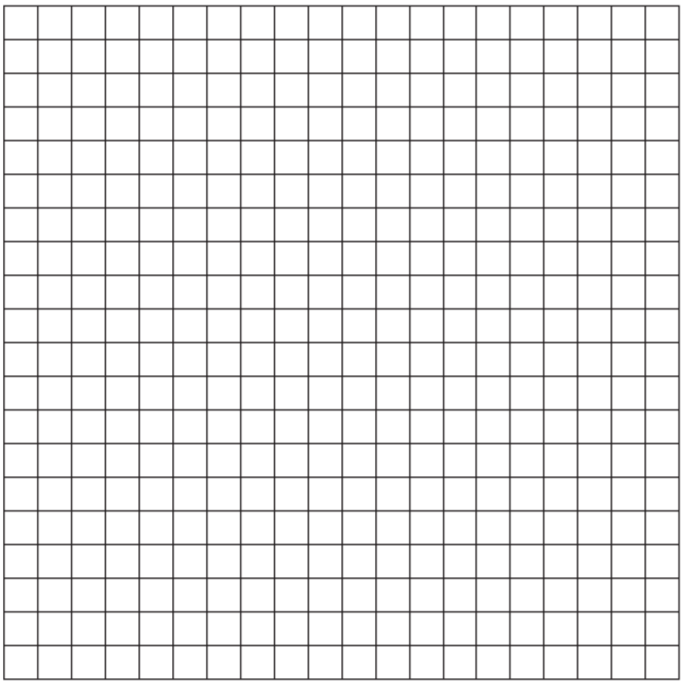
Lesson 9: Graphing Quadratic Equations From Factored Form

Graph the following functions and identify **the vertex, x-intercept, and y-intercept.**

a. $f(x) = 5(x-2)(x-3)$

b. $t(x) = x^2 + 8x - 20$

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



Name _____

LEARNING OUTCOMES

- **I can factor a quadratic equation in order to reveal its zeros.**

Lesson 9: Roots of Quadratics (Extra Practice)

Show all your work!

1. What are the roots of the equation $x^2 - 10x + 21 = 0$?

2. What are the roots of the equation $x^2 - 5x + 6 = 0$?

3. What are the roots of the equation $x^2 - 7x + 6 = 0$?

4. One of the roots of the equation $x^2 + 3x - 18 = 0$ is 3. What is the other root?

a) 15

b) 6

c) -6

d) -21

5. The larger root of the equation $(x + 4)(x - 3) = 0$ is

a) -4

b) -3

c) 3

d) 4

6. Find the roots of the equation $x^2 - x = 6$ algebraically.

7. Find the roots of the equation $x^2 = 30 - 13x$ algebraically.

8. Which equation has roots of -3 and 5?

a) $x^2 + 2x - 15 = 0$

B $x^2 - 2x - 15 = 0$

c) $x^2 + 2x + 15 = 0$

d) $x^2 - 2x + 15 = 0$

9. Which equation has the solution set $\{1,3\}$?

a) $x^2 - 4x + 3 = 0$

b) $x^2 - 4x - 3 = 0$

c) $x^2 + 4x + 3 = 0$

d) $x^2 + 4x - 3 = 0$

10. For which equation is the solution set $\{-5, 2\}$?

a) $x^2 + 3x - 10 = 0$

b) $x^2 - 3x = 10$

c) $x^2 + 3x = -10$

d) $x^2 - 3x + 10 = 0$

11. Form the quadratic equation whose roots are -5 and $+7$.

12. The two roots of an equation are -4 and $+3$. Form the equation.

ALGEBRA I

LEARNING OUTCOMES

- **I can interpret quadratic equations graphically and algebraically.**

Name _____

Lesson 10: Interpreting Quadratic Functions From Graphs and Tables

Example

The table below represents the value of Andrew's stock portfolio, with V representing the value of the portfolio, in hundreds of dollars, and t is the time, in months, since he started investing. Answer the following questions based on the table of values:

t (months)	*$V(t)$ (hundreds of dollars)*
2	325
4	385
6	405
8	385
10	325
12	225
14	85
16	-95
18	-315

a. What kind of function do you think this table represents? How do you know?

b. Assuming this data is in fact quadratic, how much did Andrew invest in his stock initially? Explain how you arrived at this answer.

c. What is the maximum value of his stock and how long did it take to reach the maximum value?

d. If the pattern continues to follow the quadratic trend shown above, do you advise Andrew to sell or keep his stock portfolio? Explain why.

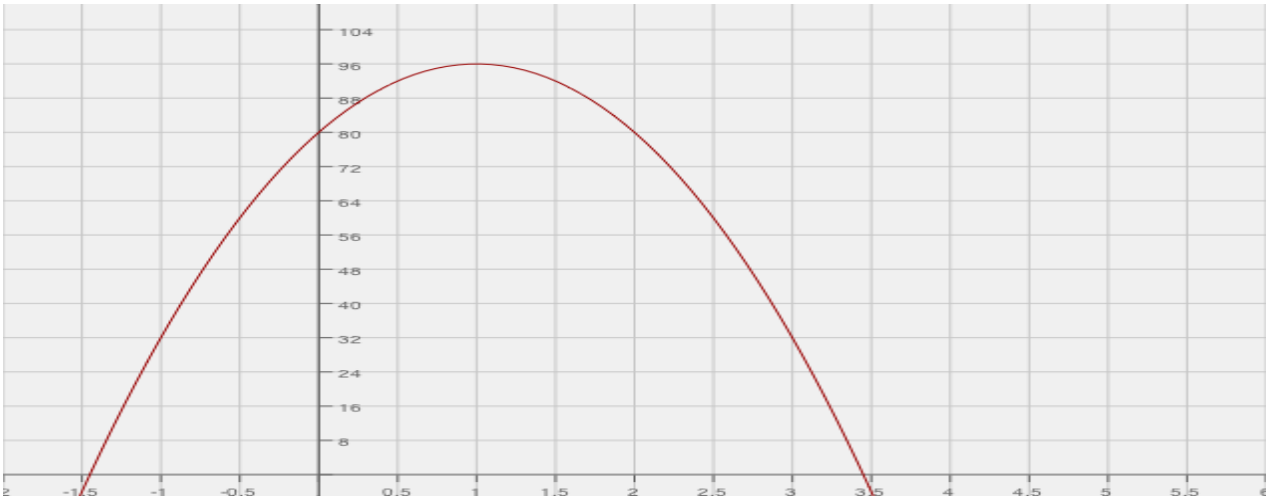
e. How fast is Andrew's stock value decreasing between $[10, 12]$? Find another two-month interval where the average rate of change is faster than $[10, 12]$ and explain why.

f. Are there other two-month intervals where the rate of change is same as $[10, 12]$? Explain your answer.

Name _____ CW/Homework

Lesson 10: Interpreting Quadratic Functions From Graphs and Tables

Pettitte and Ryu each threw a baseball into the air. The vertical height of Pettitte's baseball is represented by the graph $P(t)$ below. P represents the vertical distance of the baseball from the ground in feet and t represents time in seconds.



The vertical height of Ryu's baseball is represented by the table values $R(t)$ below. $R(t)$ represents the vertical distance of the baseball from the ground in feet and t represents time in seconds.

t	$R(t)$
0	86
0.5	98
1	102
1.5	98
2	86
2.5	66
3	38
3.52	0

Use the above functions to answer the following questions.

a. Whose baseball reached the highest? Explain your answer.

b. Whose ball reached the ground fastest? Explain your answer.

c. Pettitte claims that his ball reached its maximum faster than Ryu's? Is his claim correct or incorrect? Explain your answer.

d. Find $P(0)$ and $R(0)$ values and explain what it means in the problem. What conclusion can you make based on these values? Did they throw the ball from the same place? Explain your answer.

e. Ryu claims that he can throw the ball higher than Pettitte. Is his claim correct or incorrect? Explain your answer.

LEARNING OUTCOMES

- I can complete the square to show extreme values and symmetry.

Name _____

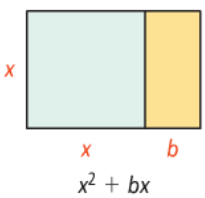
Lesson 11/12: Completing the Square

Example 1

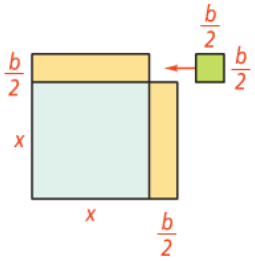
Rewrite the following standard form quadratic expressions as perfect squares.

STANDARD FORM	FACTORED FORM
$x^2 + 12x + 36$	
$x^2 - 12x + 36$	
$x^2 + 20x + 100$	
$x^2 - 3x + \frac{9}{4}$	
$x^2 + 100x + 2{,}500$	
$x^2 + 8x + 3$	

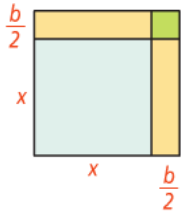
If $x^2 + bx$ is not part of a perfect square trinomial, you can use the coefficient b to find a constant c so that $x^2 + bx + c$ is a perfect square. When you do this, you are **completing the square**. The diagram models this process.



$x^2 + bx$



$x^2 + bx + \left(\frac{b}{2}\right)^2$



$\left(x + \frac{b}{2}\right)^2$

take note

Key Concept Completing the Square

You can form a perfect square trinomial from $x^2 + bx$ by adding $\left(\frac{b}{2}\right)^2$.

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$$

Example 2

Find an expression equivalent to $x^2 + 8x + 3$ that includes a perfect square binomial.

Exercises

Rewrite each expression by completing the square:

1. $a^2 - 4a + 15$

2. $n^2 - 2n - 15$

3. $c^2 + 20c - 40$

4. $y^2 - 3y + 10$

5. $k^2 + 7k + 6$

Example 3

Now complete the square for:

$$2x^2 + 16x + 3$$

Exercises

Rewrite each expression by completing the square.

6. $3x^2 + 12x - 8$

7. $4p^2 - 12p + 13$

8. $\frac{1}{2}y^2 + 3y - 4$

9. $\mathbf{-2x^2 + 8x + 5}$

Name _____ CW/Homework

Lesson 11/12: Completing the Square

Rewrite each expression by completing the square:

1. $q^2 + 12q + 32$

2. $m^2 - 4m - 5$

3. $x^2 - 7x + 6.5$

4. $2x^2 - 5x - 8$ (Source: http://www.sosmath.com/algebra/factor/fac07/fac07.html)

5. $2p^2 + 20 = 6p$ (Source: http://www.regentsprep.org/Regents/math/algtrig/ATE12/completesqlesson.htm)

6. $3k^2 + 18k + 15$ (Source: http://www.algebrahelp.com/worksheets/view/equation/completingthesquare.quiz)

7. $8y^2 + 10y - 3$ (Source: http://www.algebrahelp.com/worksheets/view/equation/completingthesquare.quiz)