Name______________________________ **Period**______________

Day	**Date**	**Assignment (Due the next class meeting)**
		8.1: Simplifying and Multiplying Radicals
		8.2: Graphing Quadratics in Vertex Form
		8.3: Completing the Square
		8.4: Solving by Square Rooting
		Ch 8 Practice Test
		Chapter 8 Test

- Be prepared for daily quizzes.
- **Every student is expected to do every assignment for the entire unit.**
- Students with 100% HW completion at the end of the semester will be rewarded with a 2% grade increase. Students with no late or missing HW will get a free pizza lunch.

HW reminders:

- If you cannot solve a problem, get help **before** the assignment is due.
- Extra Help? Visit www.mathguy.us or www.khanacademy.com.

Do you need a worksheet or a copy of the teacher notes?

Go to www.washoeschools.net/DRHSmath

8.1 Notes: Simplifying and Multiplying Radicals

Lesson Objectives

1. **Simplify square roots and cube roots with numbers and variables.**
2. **Multiply two radical expressions.**
3. **Recognize powers of $\frac{1}{2}$ and $\frac{1}{3}$ to be square and cube roots, respectively.**

WARM UP Complete table without a calculator.

n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)	n	n^2 (Perfect Squares)
1		6		11	
2		7		12	
3		8		13	
4		9		14	
5		10		15	

n	n^3 (Perfect Cubes)	n	n^3 (Perfect Cubes)
1		4	
2		5	
3		6	

Examples #1 – 8: Simplify each expression.

1. $\sqrt{49}$
2. $\sqrt{64}$
3. $\sqrt{81}$
4. $\sqrt[3]{64}$
5. $\sqrt[3]{8}$
6. $3\sqrt{16}$
7. $-7\sqrt{25}$
8. $5\sqrt{36}$

9. A square television set has an area of 144 square inches. Find the length of one side.

Simplest Form of a Radical Expression: A radical expression is in simplest form if:

a) no perfect squares are factors of the value inside the radical

b) no radicals are in the denominator of a fraction.

Simplifying Radicals

Examples #10 – 15: Simplify each of the following radical expressions.

10. $\sqrt{12}$

11. $\sqrt{360}$

12. $-5\sqrt{24}$

You try #13 – 15!

13. $\sqrt{90}$

14. $\sqrt{600}$

15. $4\sqrt{8}$

Simplifying Radicals with Variables:

Examples 16 – 21: Simplify each radical expression. Assume all variables are positive.

16) $\sqrt{x^5}$

17) $\sqrt{40x^{11}y^4}$

18) $-3\sqrt{50b^7}$

You try #19 – 21!

19) $\sqrt{a^9b^{14}}$

20) $2\sqrt{18x^3y^5}$

21) $\sqrt{36x^4y^{10}}$

Simplifying Cube Roots

Examples 22 – 25: Simplify each expression.

22) $\sqrt[3]{54}$

23) $-10\sqrt[3]{40}$

You try #24 – 25: 24) $\sqrt[3]{80}$ 25) $15\sqrt[3]{270}$

Challenge: 26) Simplify the expression: $-10a^2b \cdot \sqrt[3]{24a^3b^6}$ **Assume all variables are positive.**

Special Powers: $x^{\frac{1}{2}} = \sqrt{x}$ $x^{\frac{1}{3}} = \sqrt[3]{x}$

For Examples 27 – 29, simplify each expression.

27) $98^{\frac{1}{2}}$

28) $45^{\frac{1}{2}}$

29) $250^{\frac{1}{3}}$

Multiplying Radicals

For Examples 30 – 35: Simplify each expression.

30) $\sqrt{3}(2\sqrt{3})$

31) $\sqrt{8 \cdot 20}$

32) $-2\sqrt{10} \cdot 5\sqrt{14}$

You try! 33) $\sqrt{35 \cdot 21}$

34) $\sqrt{7}(3\sqrt{21})$

35) $3\sqrt{6} \cdot 4\sqrt{2}$

Challenge! 36) Simplify: $-3x\sqrt{15x^2y^5} \cdot 2x^2y\sqrt{45xy^3}$ **Assume all variables are positive.**

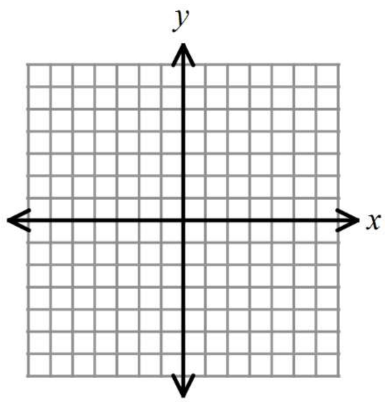
8.2 Notes: Graphing Quadratics in Vertex Form

Lesson Objectives

1. **Create a table of values for the parent function y = x^2**
2. **Graph quadratic functions in vertex form: $y = a(x - h)^2 + k$**
3. **Identify the vertex, domain, range and transformations of quadratic functions.**

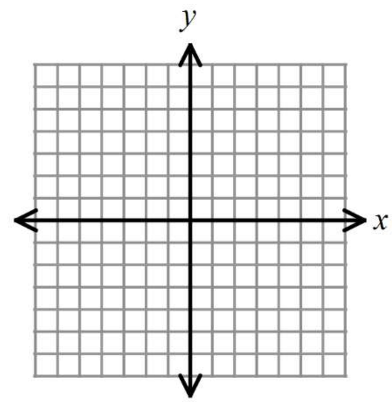
Warm-Up: Graph each function. Identify the (h,k) point that you know is on the graph.

1) $y = \frac{1}{3}(x - 1) + 2$



LINEAR FUNCTION

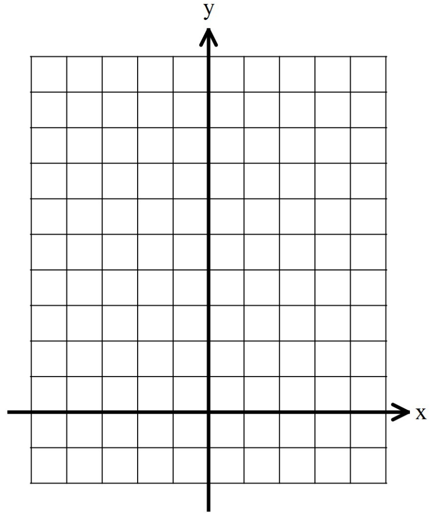
2) $f(x) = 2|x + 3| - 5$



ABSOLUTE VALUE FUNTION

<u>Quadratic Functions:</u> The Parent Function of the Quadratic is $y = x^2$

x	$y = x^2$
-3	
-2	
-1	
0	
1	
2	
3	



Vertex:

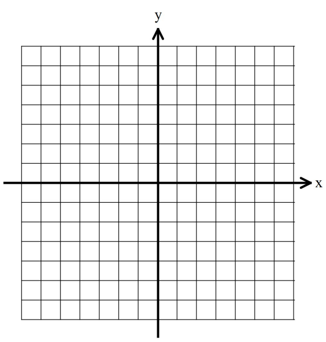
Domain:

Range:

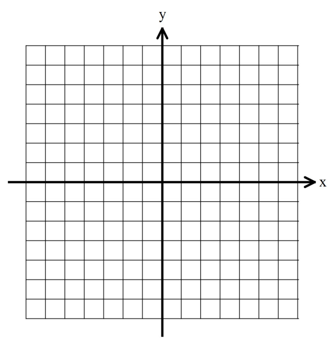
Max or Min?

Exploration: Graph the following functions:

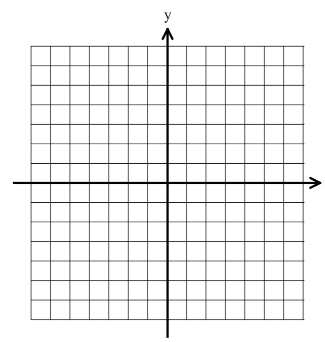
$y = 2(x+1) - 3$



$y = 2|x+1| - 3$



$y = 2(x+1)^2 - 3$



Use DESMOS for this one

How are they the same? How are they different?

Graphing Vertex Form of a quadratic function: $y = a(x-h)^2 + k$

h will cause the parent function to ______________________

k will cause the parent function to ______________________

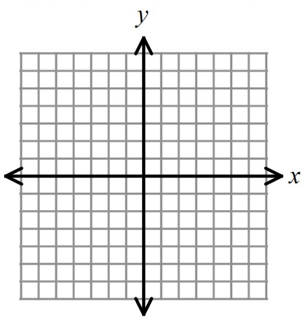
$|a| > 1$ will ________________ the graph, $|a| < 1$ will ____________________ the graph

Example 1: Sketch each quadratic function. Identify the vertex and transformations.

a) $y = (x-1)^2$

Vertex:

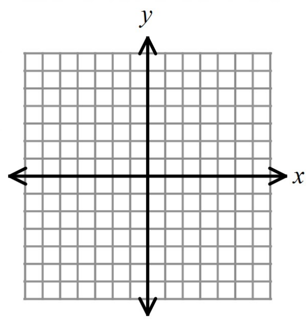
Transformation from $y = x^2$



b) $f(x) = x^2 - 3$

Vertex:

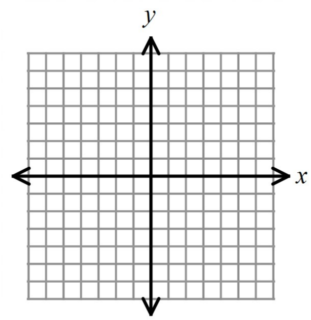
Transformation from $y = x^2$



c) $g(x) = (x+2)^2 + 1$

Vertex:

Transformation from $y = x^2$



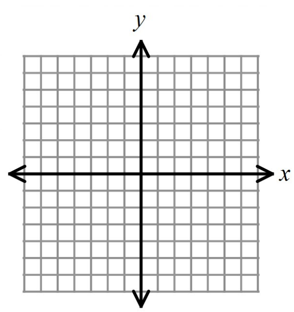
2) Sketch the graph of the quadratic function and find the requested information: $y = x^2 + 3$.

Vertex:

Domain:

Range:

Transformation from $y = x^2$



Does the function have a max or min?

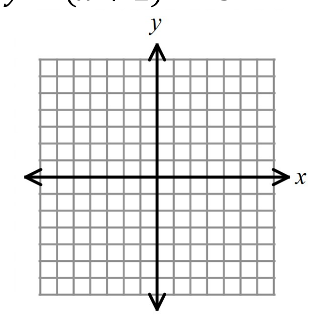
3) **You try!** Sketch the graph of the quadratic function and find the requested information: $y = (x+2)^2 - 3$

Vertex:

Domain:

Range:

Transformation from $y = x^2$



Does the function have a max or min?

Reflections in the *x*-axis: NOTE: Be sure to reflect at the proper time using PEMDAS

Examples #4 – 5: For the quadratic function, sketch the graph, and then find the requested information.

4) $y = -(x-3)^2$

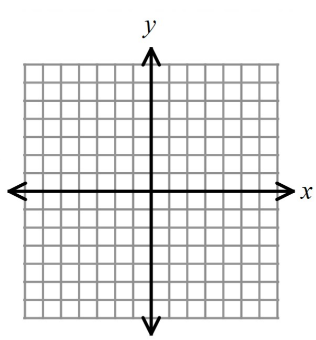
Vertex:

Opens up or down?

Domain:

Range:

Transformations from $y = x^2$



You try! 5) $y = -x^2 + 4$

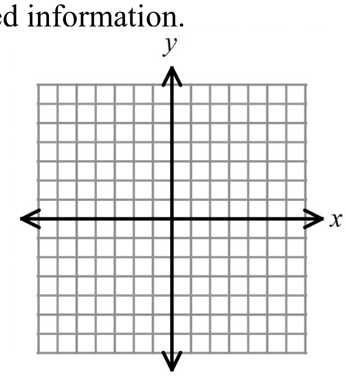
Vertex:

Opens up or down?

Domain:

Range:

Transformations from $y = x^2$



Vertical Stretch/Compression for a Quadratic Function:

Examples 6 – 8: For each quadratic function, sketch the graph, and then find the requested information.

6) $y = 2(x-3)^2 - 5$

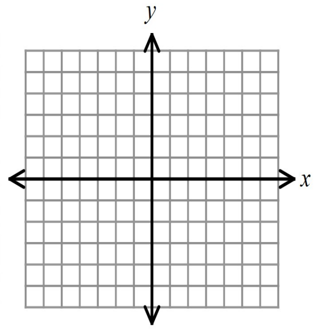
Vertex:

Domain:

Opens up or down?

Range:

Transformation from $y = x^2$



7) $y = \frac{1}{2}x^2 + 2$

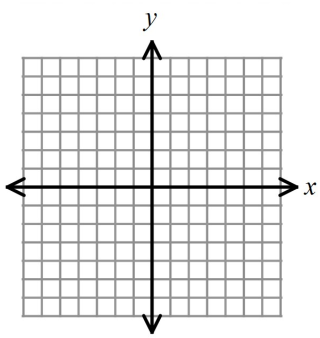
Vertex:

opens up or down?

Domain:

Range:

Transformations from $y = x^2$



8) $y = -3(x+2)^2$

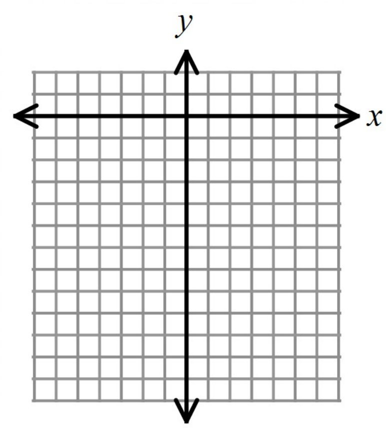
Vertex:

Opens up or down?

Domain:

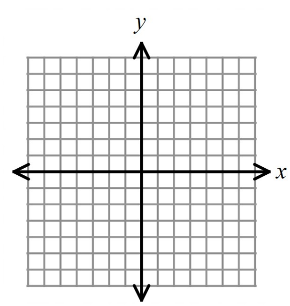
Range:

Transformations from $y = x^2$

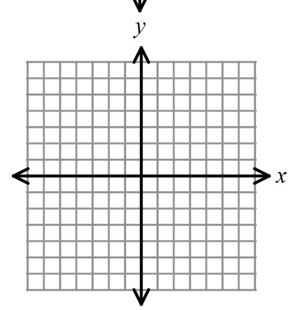


Exploration: DOES ORDER MATTER?

9) If $h(x) = x^2$ is reflected in the x-axis and then translated up 2 units, what would be its new graph and equation?



10) If $g(x) = x^2$ translated up 2 units and then is reflected in the x-axis, what would be its new graph equation?



Answer the question: Does the order of transformations matter?

Activity: Work with a partner to match each graph to its equation below.

11) $y = x^2 - 1$

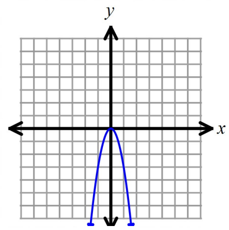
12) $y = -x^2 + 3$

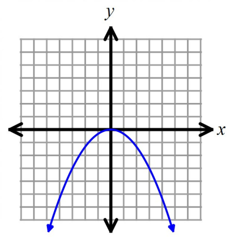
13) $y = 3x^2$

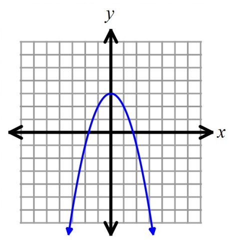
14) $y = -3x^2$

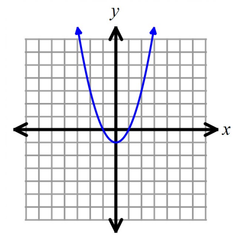
15) $y = \frac{1}{3}x^2$

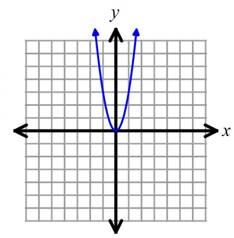
16) $y = -\frac{1}{3}x^2$

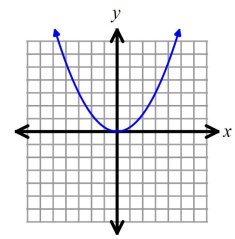
A)


B)


C)


D)


E)


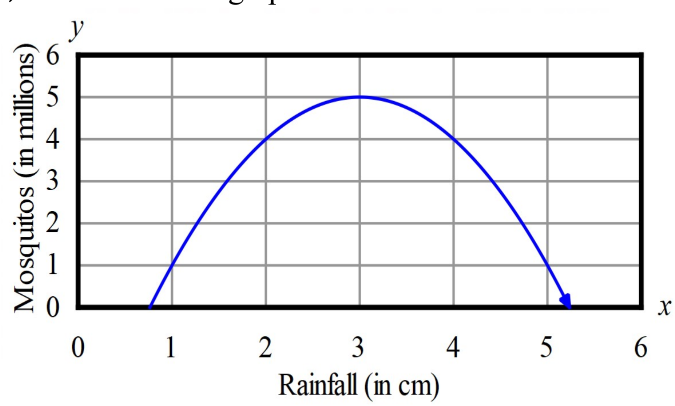
F)


Examples 17– 19: The number of mosquitoes is Anchorage, Alaska (in millions of mosquitoes) is a function of rainfall (in cm) is modeled by $m(x) = -(x-3)^2 + 5$, as shown in the graph below.

17) How many cm of rainfall would result in 4 million mosquitos?

18) What is the maximum number of mosquitos?

19) How many cm of rainfall would result in the maximum number of mosquitos?



20) Which statement(s) are true for $g(x) = x^2$ after the transformation $g(x-4)$ is applied? **Choose all that apply.**

A) $g(x)$ is moved to the left 4 units.

B) $g(x)$ is moved to the right 4 units.

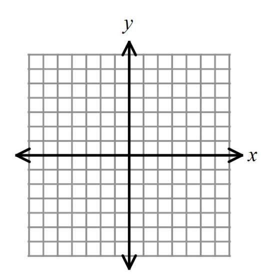
C) $g(x)$ is moved up 4 units.

D) The range of the function is $y \leq -4$.

E) The domain of the function is all real numbers.

F) The maximum of the function is 4.

G) The minimum of the function is 0.



8.3 Notes: Completing the Square

Lesson Objectives

1. **Complete the square to make a perfect square trinomial**
2. **Convert quadratic functions to vertex form by completing the square**
   Note: Optional to use x = -b/2a approach should time allow.
3. **Graph a quadratic function in vertex form and identify the min/max, domain, range, and vertex.**

Warm up:

1. Multiply: $(x-3)^2$

2. Simplify: $(x+2)^2$

3. Factor: $x^2 + 10x + 25$

4. Factor: $4x^2 - 12x + 9$

Trinomials that are Perfect Squares when factored:

Examples: Find the missing value that would make the trinomial a perfect square. Then factor each trinomial.

1) $x^2 + 6x +$ ______ 2) $x^2 - 10x +$ ______ 3) $x^2 + 8x +$ _____

$(\boldsymbol{x} \quad\quad)^2$ $(\boldsymbol{x} \quad\quad)^2$ $(\boldsymbol{x} \quad\quad)^2$

Completing the Square

Completing the Square is a process that allows us to ________________ a quadratic equation from __________________ form $\boldsymbol{y = ax^2 + bx + c}$ into ____________ form, which is also known as (h, k) form: $\boldsymbol{y = a(x - h)^2 + k}$. This will allow us to easily find the ____________.

Steps for Completing the Square:

Examples 4 – 7: Complete the square to rewrite the equation in vertex form, and then identify the vertex.

4) $y = x^2 + 4x + 10$

You try! 5) $y = x^2 - 6x - 2$

6) $y = 3x^2 - 24x + 10$

Step 1: $y = 3(x^2 - 8x + \_\_\_) + 10 - \_\_\_\_$

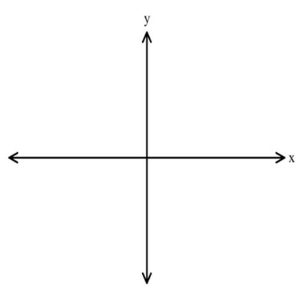
You try! 7) $y = -4x^2 - 8x + 13$

Step 1: $y = -4(x^2 + 2x + \_\_\_) + 13 - \_\_\_\_$

Vertex Form of a Quadratic Function:

For Examples 8 – 12: Write each function in vertex form, and then sketch the function. Include the vertex. Identify the domain and range of each.

8) $y = x^2 - 18x + 4$

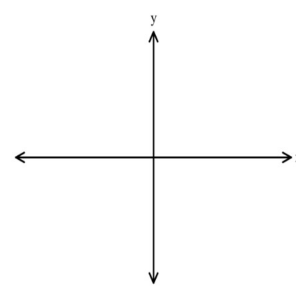


Vertex:

Domain:

Range:

9) **You try!** $y = x^2 + 8x + 5$



Vertex:

Domain:

Range:

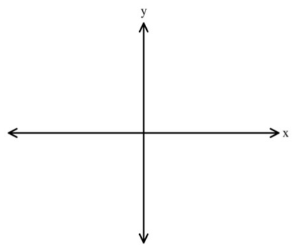
10) $y = -2x^2 + 20x + 6$

Step 1: $y = -2(x^2 - 10x + \_\_\_) + 6 - \_\_\_\_$

Vertex:

Domain:

Range:



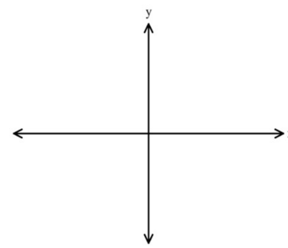
11) **You try!** $y = 3x^2 - 18x - 2$

Step 1: $y = 3(x^2 - 6x + \_\_\_) - 2 - \_\_\_\_$

Vertex:

Domain:

Range:



12) $y = -x^2 + 10x + 2$

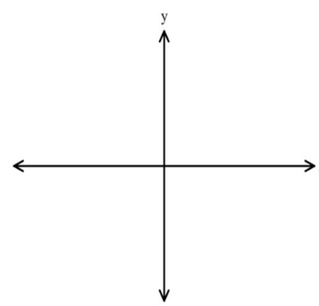
Step 1: Factor out the negative!

$y = -(x^2 - 10x + \_\_\_) + 2 - \_\_\_\_$

Vertex:

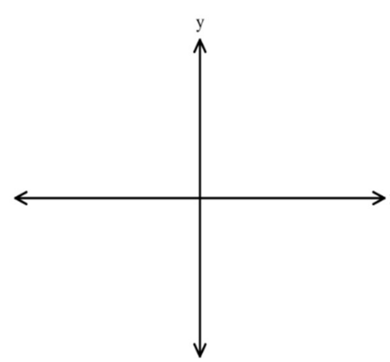
Domain:

Range:



Examples 13 – 14: A football is kicked in the air, and the height of the football can be modeled by the equation $y = -x^2 + 2x + 4$, where x is the number of seconds after the ball is kicked.

13) Find the maximum height of the football. Hint: Be sure to factor out the negative to start!



14) After how many seconds does the football reach its maximum height?

ALTERNATIVE APPROACH

Finding the vertex directly from standard form $\boldsymbol{y = ax^2 + bx + c}$

Step 1: Calculate $\boldsymbol{x = -\frac{b}{2a}}$ **(this is h, the *x*-coordinate of the vertex)**

Step 2: Plug this x-value from step 1 into $\boldsymbol{y = ax^2 + bx + c}$ **to find k, the *y*-value of vertex.**

15) Use the alternative approach above to find the vertex of each quadratic.

$a)\ y = 3x^2 - 24x + 10$ compare your answer with Example 6

$b)\ y = x^2 - 18x + 4$ compare your answer with Example 8

You try! Use the alternative approach above to find the vertex of each quadratic.

$c)\ y = -4x^2 - 8x + 13$ compare your answer with Example 7

$d)\ y = x^2 + 8x + 5$ compare your answer with Example 9

8.4 Notes: Solving Quadratics by Square Rooting

Lesson Objectives

1. **Solve basic quadratic equations by taking square roots of each side of an equation.**
2. **Find x-intercepts (roots, solutions) to a quadratic functions by setting y = 0.**

Warm Up:

1) When a number is squared, the result is 25.
What could the original have as its value?
(Hint: there are two answers.)

2) If $\frac{3}{5}w = \frac{4}{3}$, what is the value of w ?

A) $\frac{9}{20}$

B) $\frac{4}{5}$

C) $\frac{5}{4}$

D) $\frac{20}{9}$

Solving Quadratics by Square Rooting

***Use this strategy when a function is in vertex form, or if there is not a *b* term.**

Note: When a variable^2 or ( )^2 is isolated, it **cannot** equal a ____________________ number.

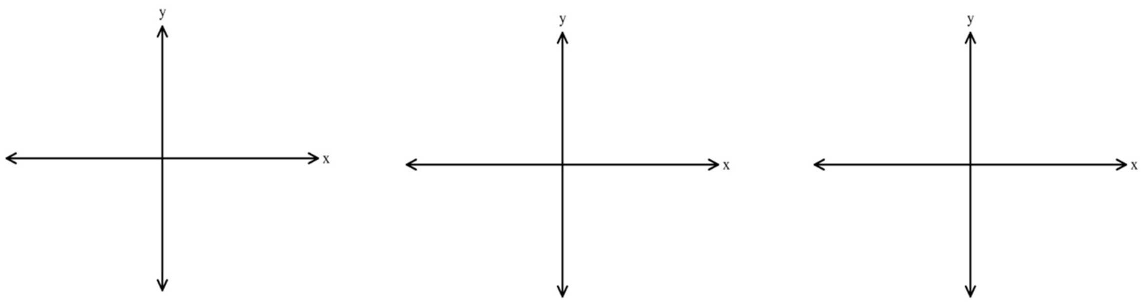
If it does, then there is ____ solution.

Step 1: ISOLATE the variable or variable expression squared (variable $\pm h)^2$ by using inverse operations.

Step 2: Square root both ____________.

PLUS OR MINUS ± ! Simplify radical answers.

We can have _______ solution, ______ solution, or ______ solutions.



Examples 1 – 3: Solve each equation for the variable by square rooting.

1) $z^2 - 5 = 4$

2) $r^2 + 7 = 4$

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

You try #4 – 6! Solve each equation for the variable by square rooting.

4) $-3x^2 + 4 = -23$

5) $4t^2 + 17 = 17$

6) $4p^2 + 8 = 0$

Example 7: Solve for x: $5(x+1)^2 = 80$

Example 8: Solve for a: $4(a-3)^2 - 8 = 0$

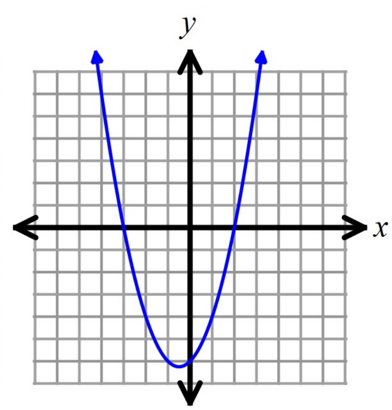
Example 9: Pick one of the following problems to find the solutions. The problems go in order from easiest to more challenging from left to right.

a) $2x^2 - 7 = -9$ b) $3(m - 4)^2 = 12$ c) $4(a - 3)^2 - 40 = -20$

Examples 10 – 11: Solve each equation for the variable. Simplify any radical answers.

10) $3x^2 - 8 = 28$ 11) $-2x^2 + 14 = -34$

Solving for *x*-intercepts of a quadratic function:



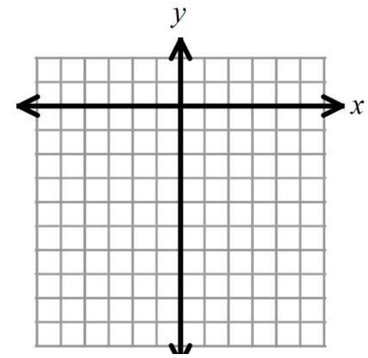
Terms that are also used to describe *x*-intercepts of a function:

1)

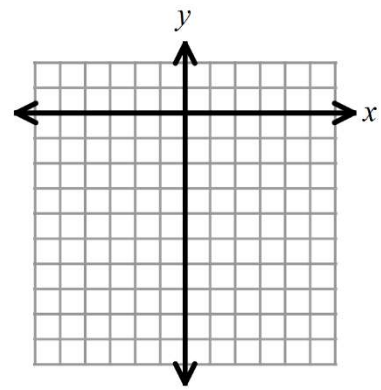
2)

3)

Example 12: Find the zeros (x-intercepts) of $f(x) = 3x^2 - 9$, if possible. If needed, write your answer as a simplified radical. Then draw a sketch of the quadratic function. Include the roots (x-intercepts) and vertex.



Example 13: Find the roots (x-intercepts) of $f(x) = 2(x-3)^2 - 8$, if possible. If needed, write your answer as a simplified radical. Then draw a sketch of the quadratic function. Include the vertex and x-intercepts.

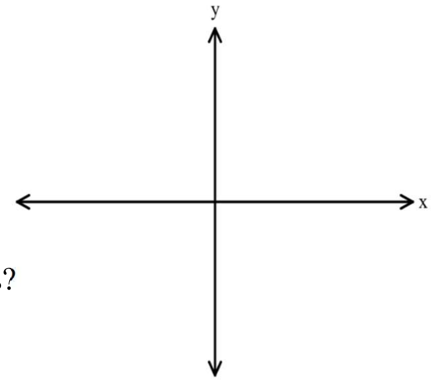


Example 14: Find the x-intercepts for *one* quadratic function below. The options go from easiest to hardest.

a) $y = x^2 - 25$ b) $f(x) = -3x^2 + 12$ c) $g(x) = 5(x-1)^2 - 20$

Example 15: Consider the function $f(x) = 3x^2 + 27$.

a) What is the vertex for this function?



b) Will this function open up or down?

c) Draw a sketch of this function. What do you notice about the *x*-intercepts?

d) Solve $f(x)$ for the zeros (*x*-intercepts.) Does your solution support your conclusion from part

Example 16: What is true for the function $f(x) = -3(x-2)^2 - 9$? **Select all that apply**.

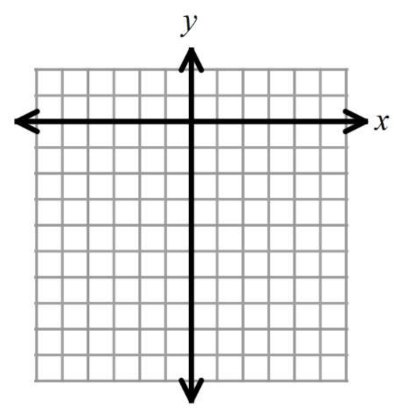
A) The range is $y \leq -9$.

B) The vertex is at $(-2, -9)$.

C) The function opens downward.

D) The *x*-intercepts are at $2 \pm \sqrt{3}$.

E) There are no *x*-intercepts.



Ch 8 Study Guide

Graphing Quadratics

Form	What it tells us	Read about it in your notes!
Vertex Form $y = a(x-h)^2 + k$	• Vertex at (h, k) • Domain is all real numbers • Opens up if a is positive (range is $y > k$) • Opens down if a is negative (range is $y < k$) • Vertical stretch if $\|a\| > 1$ • Vertical compression of $0 < \|a\| < 1$ • Find the x-intercepts by setting the function equal to 0, and solve by square rooting.	Section 8.2 Section 8.4

Standard Form $y = ax^2 + bx + c$	• Complete the square to put into vertex form.
	• Once the function is in vertex form, you can find the vertex by looking for (h, k).
	• Alternative approach:
	  ○ Step 1: Calculate $x = -\frac{b}{2a}$
	  ○ Step 2: Plug this x-value from step 1 into $y = ax^2 + bx + c$ to find y-value of vertex.
		Section 8.3

Solving Quadratic Equations

Technique	Hints and Steps	Read about it in your notes!
Solving by Square Rooting $0 = a(x-h)^2 + k$ $0 = ax^2 + c$	• Isolate $variable^2$ or $(\text{variable} \pm h)^2$ • Square root each side - **use ($\pm$).** • Simplify any radicals.	Section 8.4