Printout

Friday, February 28, 2020 8:00 AM

Algebra 1 Ch 8 Notes: Quadratics in Vertex Form 2020

Name______________________________ **Period**______________

Day	Date	Assignment (Due the next class meeting)
Wednesday Thursday	2/26/20 (A) 2/27/20 (B)	8.1 Worksheet Simplifying and Multiplying Radicals
Friday Monday	2/28/20 (A) 3/02/20 (B)	8.2 Worksheet Graphing Quadratics in Vertex Form
Tuesday Wednesday	3/03/20 (A) 3/04/20 (B)	8.3 Worksheet Completing the Square
Thursday Friday	3/05/20 (A) 3/06/20 (B)	8.4 Worksheet Solving by Square Rooting
Monday Tuesday	3/09/20 (A) 3/10/20 (B)	Ch 8 Practice Test
Wednesday Thursday	3/11/20 (A) 3/12/20 (B)	Ch 8 Test Ch 8 Spiral Review Worksheet
Friday Monday	3/13/20 (A) 3/30/20 (B)	Test Corrections, Test Redos EOC Review, TBD

- 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: Simplifying and Multiplying Radicals

Lesson Objectives

1. **Simplify square roots and cube roots with numbers and variable.**
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	1	6	36	11	121
	2	4	7	49	12	144
	3	9	8	64	13	169
	4	16	9	81	14	196
	5	25	10	100	15	225
	n	n^3 (Perfect Cubes)	n	n^3 (Perfect Cubes)		
	1	1	4	64		
	2	8	5	125		
	3	27	6	216		

Example 1: Simplify each expression.

1. $\sqrt{49} = \sqrt{7 \cdot 7}$
   $= \boxed{7}$
2. $\sqrt{64} = \sqrt{8 \cdot 8}$
   $= 8$
3. $\sqrt{81} = \sqrt{9 \cdot 9}$
   9
4. $\sqrt[3]{64} = 4$
5. $\sqrt[3]{8}$
   2
6. $3\sqrt{16}$
   $3 \cdot 4 = 12$
7. $-7\sqrt{25}$
   $-7 \cdot 5 = -25$
8. $5\sqrt{36}$
   $5 \cdot 6 = 30$

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

$$l \cdot l = 144$$
$$l^2 = 144$$
$$l = \sqrt{144} = 12$$

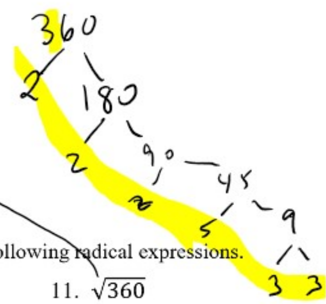
Simplest Form of a Radical Expression: A radical expression is in simplest form if:

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

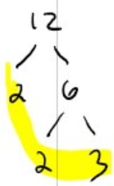
b) no radicals are in the denominator of a fraction.

Simplifying Radicals

$$\sqrt{36 \cdot 10}$$



Examples 10 – 16: Simplify each of the following radical expressions.

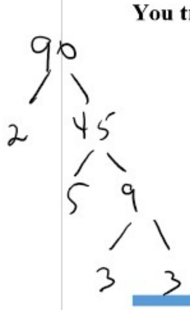


10. $\sqrt{12} = \sqrt{2 \cdot 2 \cdot 3}$ $\boxed{2\sqrt{3}}$

11. $\sqrt{360}$ $= \sqrt{2 \cdot 2 \cdot 2 \cdot 5 \cdot 3 \cdot 3}$ $2 \cdot 3\sqrt{10}$ $\boxed{6\sqrt{10}}$

12. $-5\sqrt{24}$ $= -5\sqrt{2 \cdot 2 \cdot 2 \cdot 3}$ $= -5 \cdot 2\sqrt{6}$ $= \boxed{-10\sqrt{6}}$

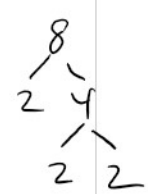
You try #13 – 15!



13. $\sqrt{90} = \sqrt{2 \cdot 5 \cdot 3 \cdot 3}$ $\boxed{3\sqrt{10}}$

14. $\sqrt{600}$ $\sqrt{100 \cdot 6}$ $\boxed{10\sqrt{6}}$

15. $4\sqrt{8}$ $4\sqrt{2 \cdot 2 \cdot 2}$ $4 \cdot 2\sqrt{2}$ $\boxed{8\sqrt{2}}$



Simplifying Radicals with Variables:

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

16) $\sqrt{x^5} = \sqrt{x \cdot x \cdot x \cdot x \cdot x}$

$x \cdot x \sqrt{x}$

$x^2\sqrt{x}$

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

$2x^5 y^2 \sqrt{10 \, x \cdot x \cdot x \cdots x \cdot x}$

$2x^5y^2\sqrt{10x}$

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

$-3\sqrt{2 \cdot 25 \, b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b}$

$-3 \cdot 5b^3\sqrt{2b}$

$\boxed{-15b^3\sqrt{2b}}$

You try #19 – 21!

19) $\sqrt[3]{a^9b^{14}}$

$\sqrt{a \cdot a \cdot a \; a \cdot a \cdot a \; a \cdot a \cdot a}$

$\boxed{a^3b^4\sqrt{b^2}}$

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

$2\sqrt{2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y}$

$3 \cdot 2x \cdot y \cdot y\sqrt{2xy}$

$\boxed{6xy^2\sqrt{2xy}}$

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

$\boxed{= 6x^2y^5}$

Simplifying Cube Roots

$\sqrt[3]{8} = 2$

$2^3 = 8$

Examples 22 – 25: Simplify each expression.

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

$\sqrt[3]{2 \cdot 3 \cdot 3 \cdot 3}$

$\boxed{3\sqrt[3]{2}}$

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

$-10 \quad \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 5}$

$-10 \cdot 2\sqrt[3]{5} = \boxed{-20\sqrt[3]{5}}$

You try #24 – 25: 24) $\sqrt[3]{80}$

$= \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 10}$

$\boxed{= 2\sqrt[3]{10}}$

25) $15\sqrt[3]{270}$

$15\sqrt[3]{5 \cdot 2 \cdot 3 \cdot 3 \cdot 3}$

$15 \cdot 3\sqrt[3]{10}$

$45\sqrt[3]{10}$

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

$-10a^2b \cdot 2ab^2\sqrt[3]{3} = \boxed{-20a^3b^3\sqrt[3]{3}}$

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

For Examples 27 – 29, simplify each expression.

27) $98^{\frac{1}{2}} = \sqrt[2]{98}$

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

29) $250^{\frac{1}{3}} = \sqrt[3]{250}$

$\sqrt[3]{2\cdot 5\cdot 5\cdot 5}$

$\boxed{5\sqrt[3]{2}}$

250
2 125
5 25
5 5

Multiplying Radicals

$\sqrt{2\cdot 2\cdot 3}$

For Examples 30 – 35: Simplify each expression.

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

$2\cdot\sqrt{3\cdot 3}$

$2\cdot 3 = \boxed{6}$

31) $\sqrt{8\cdot 20} = \sqrt{160}$

$\sqrt{2\cdot 2\cdot 2\cdot 2\cdot 2\cdot 5}$

$2\cdot 2\sqrt{2\cdot 5}$

$4\sqrt{10}$

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

2 5 2 7

$-10\sqrt{2\cdot 5\cdot 2\cdot 7}$

$-10\cdot 2\sqrt{35}$

$-20\sqrt{35}$

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

$=\sqrt{5\cdot 7\cdot 7\cdot 3}$

$=7\sqrt{15}$

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

$=\sqrt{7}\cdot 3\sqrt{3\cdot 7}$

$=\sqrt{7}\cdot\sqrt{7}\cdot 3\cdot\sqrt{3}$

$=7\cdot 3\cdot\sqrt{3}$

$\boxed{=21\sqrt{3}}$

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

$=3\cdot 4\cdot\sqrt{6}\cdot\sqrt{2}$

$=12\cdot\sqrt{2\cdot 3}\cdot\sqrt{2}$

$=12\cdot 2\cdot\sqrt{3}$

$\boxed{=24\sqrt{3}}$

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

$-3x\cdot xy^2\sqrt{3\cdot 5\cdot y}\cdot 2x^2y\cdot y\sqrt{3\cdot 3\cdot 5\cdot x\cdot y}$

$= -3x^2y^2\cdot 3\cdot 5\cdot y\cdot 2x^2y^2\cdot\sqrt{3x} = \boxed{-18x^4y^5\sqrt{3x}}$

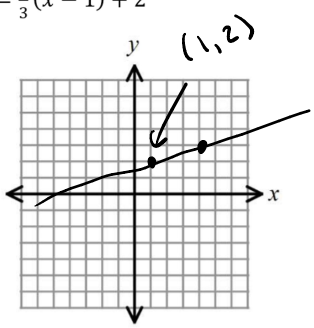
8.2 Notes: Graphing Quadratics in Vertex Form

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.**

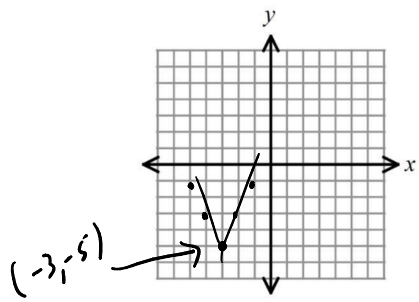
Warm-Up: Graph each function. Identify the (h,k) point that you know is on the graph.

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



LINEAR FUNCTION

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



ABSOLUTE VALUE FUNTION

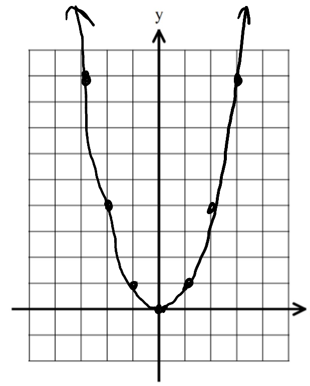
Quadratic Functions:

The Parent Function of the Quadratic: $y = x^2$

x	$y = x^2$
-3	9
-2	4
-1	$(-1)^2 = 1$
0	$0^2 = 0 \cdot 0 = 0$
1	1
2	4
3	9

4^0 2^0

-1^2



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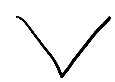
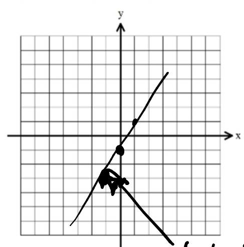
$y = |x|$

-2	2
-1	1
0	0
1	1
2	2



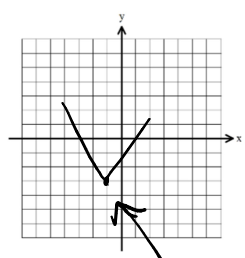
Exploration: Graph the following functions:

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



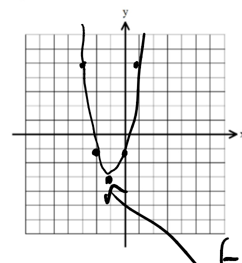
(-1,-3)

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



(-1,-3)

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



(-1,-3)

Use DESMOS for this one

How are they the same?

How are they different?

left/right

up down

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

***h* will cause the parent function to** right / left

***k* will cause the parent function to** up down

$|a| > 1$ will stretch **the graph, $|a| < 1$ will** shrink **the graph**

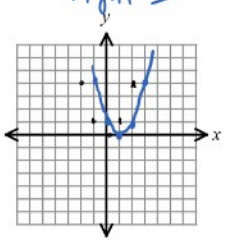
2^x

$2^{x-4} + 8$

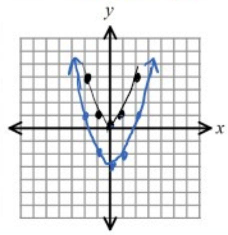
Example 1: Sketch each quadratic function. Include the vertex.

$y = x^2$

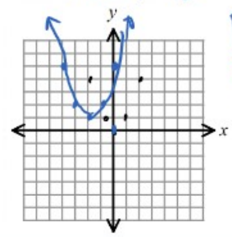
a) $y = (x-1)^2$
Vertex: (1,0) highest/lowest
Transformation from $y = x^2$
right 1



b) $f(x) = x^2 - 3$
Vertex: (0,-3)
Transformation from $y = x^2$
down 3



c) $g(x) = (x+2)^2 + 1$
Left 2 up 1
Vertex: (-2,1)
Transformation from $y = x^2$
left 2, up 1



Domain: All reals
Range: $y \geq 1$

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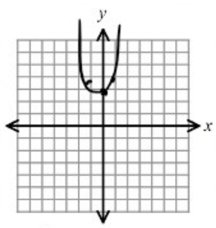
2) Sketch the graph of the quadratic function and find the requested information: $y = x^2 + 3$.

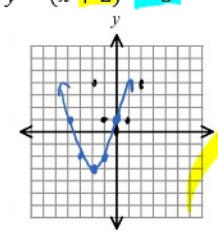
Vertex: (0,3)
Domain: R
Range: $y \geq 3$
Transformation from $y = x^2$
↑3



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: (-2,-3)
Domain: all reals
Range: $y \geq -3$
Transformation from $y = x^2$
left 2 down 3



Does the function have a max or min?
minimum (lowest value)

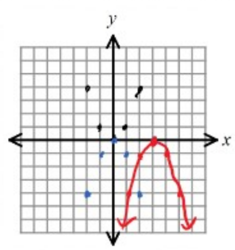
Reflections in the *x*-axis:

NOTE: Be sure to reflect at the proper time using PEMDAS

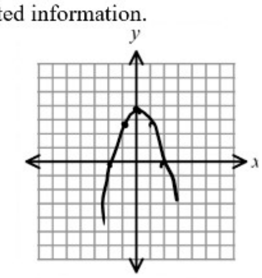
flip in x-axis

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

4) $y = -(x-3)^2$
Vertex: (3,0) — max!
opens up or down?
Domain: all real #
Range: $y \leq 0$
Transformations from $y = x^2$
flip in x-axis, right 3



You try! 5) $y = -x^2 + 4$
Vertex: (0,4)
Opens up or down? ↓
Domain: R
Range: $y \leq 4$
Transformations ↑4 from $y = x^2$



Vertical Stretch/Compress for a Quadratic Function:

$(2x)^3 = 2^3 x^3$ $\nearrow \neq 2(x^2-3^2)-5$ $\nearrow \neq (2x-6)^2-5$

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

6) $y = \underline{2}(x-3)^2 - 5$

Vertex: (3, −5) min!

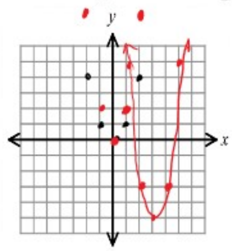
Domain: all R

Opens up or down? up

Range: $y \geq -5$

Transformation from $y = x^2$

stretch 2, right 3, down 5



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

Vertex:

opens up or down?

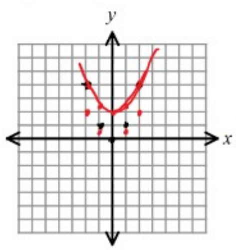
Domain:

Range:

Transformations

from $y = x^2$

shrink $\frac{1}{2}$



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

Vertex: (−2, 0)

Opens up or down?

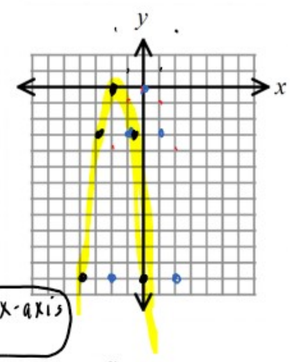
Domain: all real

Range: $y \leq 0$

Transformations

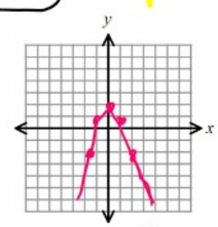
from $y = x^2$

stretch 3, flip over x-axis left 2

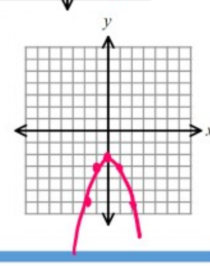


Exploration: DOES ORDER MATTER?

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?

Yes!

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

11) $y = x^2 - 1$ D

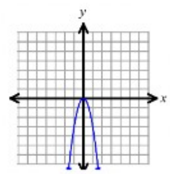
12) $y = -x^2 + 3$ C

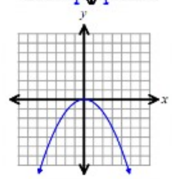
13) $y = 3x^2$ E

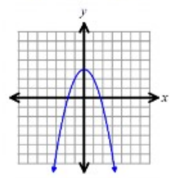
14) $y = -3x^2$ A

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

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

A)


B)


C)


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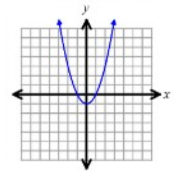

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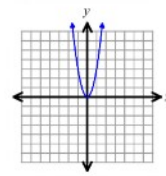
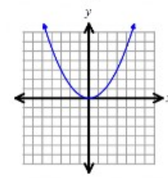
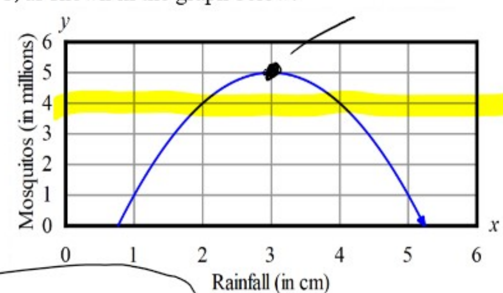


F)


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?

either 2 or 4

18) What is the maximum number of mosquitos?

5 million

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

3 cm

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

$= (x-4)^2$

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

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

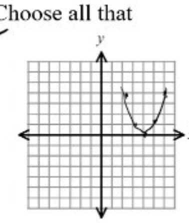
C) $g(x)$ is moved up 4 units.

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: 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**
3. **Graph a quadratic function in vertex form and identify the min/max, domain, range, and vertex.**

Warm up:

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

	x	-3
x	x^2	$-3x$
-3	$-3x$	$+9$

x^2-6x+9

x^2-9 x^2+9

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

x^2+4x+4

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

$(x+5)^2$

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

$(2x-3)^2$

	$2x$	-3
$2x$	$4x^2$	$-6x$
-3	$-6x$	9

36

-6 | -6

perfect squares!

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) $x^2 + 6x +$ 9

3^2

$\frac{1}{2}(6) = 3$

$(x + 3)^2$

2) $x^2 - 10x +$ 25

$(-5)^2$

$\frac{1}{2}(-10) = -5$

$(x - 5)^2$

3) $x^2 + 8x +$ 16

4^2

$\frac{1}{2}(8) = 4$

$(x + 4)^2$

Completing the Square

__________ ______ __________ is a process that allows us to rewrite a quadratic equation from standard form $\boldsymbol{y = ax^2 + bx + c}$ into vertex form, which is also known as (h, k) form: $\boldsymbol{y = a(x - h)^2 + k}$. This will allow us to easily find the Vertex!.

Steps for Completing the Square:

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

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

$y = \underbrace{x^2 + 4x + \underline{4}}\ + 10 + \underline{-4}$

$\frac{4}{2} = 2 \rightarrow 2^2$

$\boxed{y = (x + 2)^2 + 6}$ Vertex form

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

STEP 1 move −2

$y = x^2 - 6x + \underline{9} - 2 + \underline{-9}$

$\frac{1}{2}(-6) = -3$

$\boxed{y = (x - 3)^2 - 11}$ Vertex $(3, -11)$

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

Step 1: $y = 3(x^2 - 8x + \underline{16}) + 10 + \underline{-48}$

$\frac{-8}{2} = -4 \quad (-4)^2$

$\boxed{y = 3(x - 4)^2 - 38}$

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

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

$\frac{2}{2} = 1 \quad 1^2$

$\boxed{y = -4(x + 1)^2 + 17}$

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.

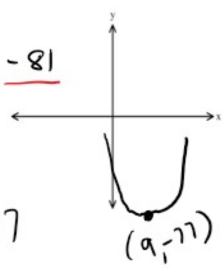
8) $y = x^2 - 18x + 4$

$-9^2 = -81$

$y = (x^2 - 18x + \underline{81}) + 4 \ \underline{-81}$

$\div 2 = -9 \quad (-9)^2$

$y = (x - 9)^2 - 77$



Vertex: $(9, -77)$

Domain: All real

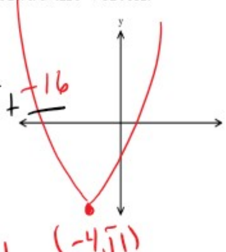
Range: $y \geq -77$

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

$y = x^2 + 8x + \underline{16} + 5 + \underline{-16}$

$\frac{1}{2}(8) = 4 \quad 4^2$

$(x + 4)^2 - 11$



Vertex: $(-4, -11)$

Domain: all real

Range: $y \geq -11$

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

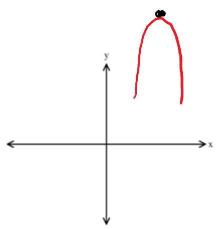
Step 1: $y = -2(x^2 - 10x + \underline{25}) + 6 + \underline{50}$

$y = -2(x-5)^2 + 56$

Vertex: (5, 56)

Domain: all real

Range: $y \le 56$



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

Step 1: $y = 3(x^2 - 6x + \underline{9}) - 2 + \underline{-27}$

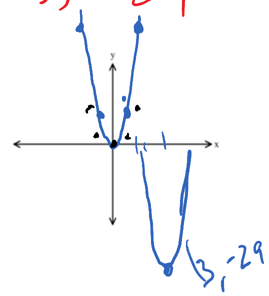
$\div 2 = -3$ $(-3)^2$

$y = 3(x-3)^2 - 29$

Vertex: (3, -29)

Domain: All real

Range: $y \ge -29$



x	$y=x^2$	
-2	4	12
-1	1	3
0	0	0
1	1	3
2	4	12

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

Step 1: Factor out the negative!

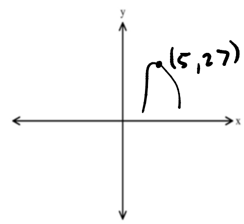
$y = -(x^2 - 10x + \underline{25}) + 2 + \underline{25}$

$y = -(x-5)^2 + 27$

Vertex: (5, 27)

Domain: $\mathbb{R}$

Range: $y \le 27$



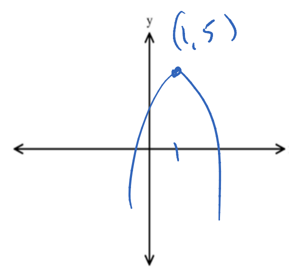
Examples 13 – 14) A football is kicked in the air, and the height of the football can be modeled by the equation $y = -x^2 + 2x + 4$, where x is the number of seconds after the ball is kicked.

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

$y = -(x^2 - 2x + \underline{1}) + 4 \underline{+1}$

$\div 2 = -1$ $(-1)^2$

$-(x-1)^2 + 5$



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

1 sec

ALTERNATIVE APPROACH

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

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.

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

$x = -\frac{b}{2a} = \frac{-(-24)}{2(3)} = 4$

$y = 3(4)^2 - 24(4) + 10 = 38$

$y = 3(x-4)^2 + 10$

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

$x = -\frac{b}{2a} = \frac{-(-18)}{2(1)} = 9$

$y = 9^2 - 18(9) + 4 = -77$

$y = (x-9)^2 - 77$

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

$x = \frac{-(-8)}{2(-4)} = -1$

$y = -4(-1)^2 - 8(-1) + 13 = 17$

$y = 4(x-1)^2 + 17$

$\boxed{y = -4(x+1)^2 + 17}$

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

$x = -\frac{b}{2a} = \frac{-8}{2(1)} = -4$

$y = (-4)^2 + 8(-4) + 5 = -11$

$y = (x - -4)^2 - 11$

$y = (x+4)^2 - 11$

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 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) $\frac{20}{9}$

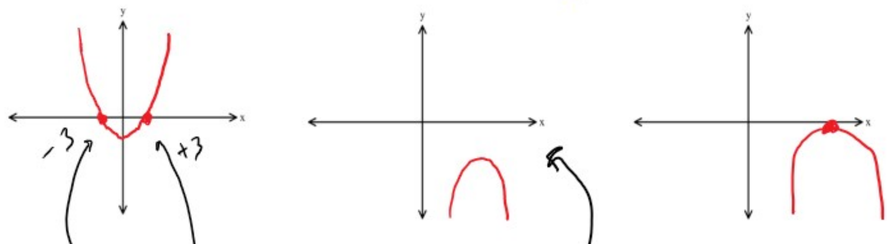
$\frac{5}{3} \cdot \frac{3}{5}w = \frac{4}{3} \cdot \frac{5}{3}$

$w = \frac{20}{9}$

Solving Quadratics by Square Rooting

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

- Step 1: ISOLATE the variable or variable expression squared (variable $\pm h$)^2 by using inverse operations. x^2 $(x+3)^2$
- Step 2: Square root both sides. **PLUS OR MINUS!** Simplify radical answers.
- Note: When a variable^2 or ( )^2 is isolated, it **cannot** equal a negative number. (If it does, then there is no solution.)
- We can have 2 solution, 0 solution, or 1 solutions.



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

1) $z^2 - 5 = 4$

$z^2 = 9$

$z = \pm\sqrt{9}$

$z = \pm 3$

2) $r^2 + 7 = 4$

$-7 \quad -7$

$r^2 = -3$

$r = \pm\sqrt{-3}$

no solution

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

$4x^2 = 0$

$x^2 = 0$

$x = 0$

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

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

$-4 \quad -4$

$\frac{-3x^2}{-3} = \frac{-27}{-3}$

$x^2 = 9$

$x = \pm\sqrt{9}$

$x = 3, \text{or } -3$

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

$-17 \quad -17$

$\frac{4t^2}{4} = \frac{0}{4}$

$t^2 = 0$

$t = 0$

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

$4p^2 = -8$

$p^2 = -2$

No solution

A squared # ≠ neg

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

$\frac{5(x+1)^2}{5} = \frac{80}{5}$

$(x+1)^2 = 16$

~~$(B/ab)^2 = 16$~~

$x + 1 = \pm 4$

$-1 \quad -1$

$x = -1 \pm 4 \rightarrow -1+4 = 3,\ -1-4 = -5$

$\boxed{x = 3 \text{ or } -5}$

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

$+8 \quad +8$

$\frac{4(a-3)^2}{4} = \frac{8}{4}$

$(a-3)^2 = 2$

$a - 3 = \pm\sqrt{2}$

$+3 \quad +3$

$a = 3 \pm \sqrt{2}$

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) $2x^2 - 7 = -9$

$+7 \quad +7$

$2x^2 = -2$

$x^2 = -1$

b) $3(m - 4)^2 = 12$

$\frac{3(m-4)^2}{3} = \frac{12}{3}$

$(m-4)^2 = 4$

c) $4(a - 3)^2 - 40 = -20$

$+40 \quad +40$

$\frac{4(a-3)^2}{4} = \frac{20}{4}$

$2x^2=-2$

$x^2=-1$

NO solution!

$(m-4)^2=4$

$m-4=\pm\sqrt{4}$

$m-4=\pm 2$

$+4 \quad +4$

$m=4\pm 2$

$4+2=6$

$4-2=2$

$\frac{4(a-3)^2}{4}=\frac{20}{4}$

$(a-3)^2=5$

$a-3=\pm\sqrt{5}$

$+3 \quad +3$

$a=3\pm\sqrt{5}$

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

10) $3x^2-8=28$

$+8 \quad +8$

$\frac{3x^2}{3}=\frac{36}{3}$

$x^2=12$

$12 = 2 \cdot 6 = 2 \cdot 2 \cdot 3$

$x=\pm\sqrt{12}$

$\boxed{x=\pm 2\sqrt{3}}$

11) $-2x^2+14=-34$

$-14 \quad -14$

$\frac{-2x^2}{-2}=\frac{-48}{-2}$

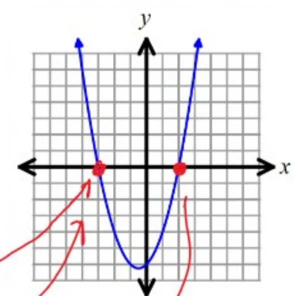
$\sqrt{x^2}=\sqrt{24}$

$\sqrt{6\cdot 4}$

$x=\pm\sqrt{24}$

$x=\pm 2\sqrt{6}$

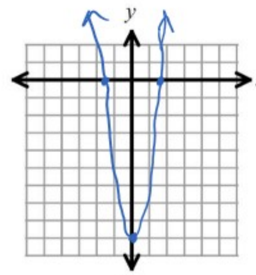
Solving for *x*-intercepts of a quadratic function:



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

1) zeros
2) roots
3) x-intercepts

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.



$y = 3x^2 - 9$

$0 = 3x^2 - 9$

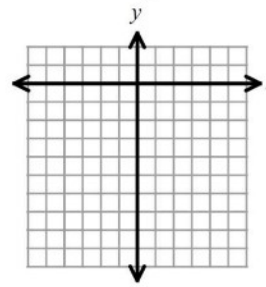
$9 = 3x^2$

$\frac{9}{3} = \frac{3x^2}{3}$

$\sqrt{x^2} = \sqrt{3}$

$x = \pm\sqrt{3}$

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.



at x-intercept $y = 0$

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

$0 = 2(x-3)^2 - 8$

$+8 \qquad +8$

$\frac{8}{2} = \frac{2(x-3)^2}{2}$

$\sqrt{(x-3)^2} = \sqrt{4}$

$x - 3 = \pm 2$

$+3 \quad +3$

$x = 3 \pm 2$

$\boxed{x = 5,\ x = 1}$

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

a) $y = x^2 - 25$

$0 = x^2 - 25$

$25 = x^2$

$\sqrt{25} = x$

$\boxed{\pm 5 = x}$

b) $f(x) = -3x^2 + 12$

$0 = -3x^2 + 12$

$-12 \qquad -12$

$\frac{-12}{-3} = \frac{-3x^2}{-3}$

$\sqrt{4} = \sqrt{x^2}$

$\boxed{\pm 2 = x}$

c) $g(x) = 5(x-1)^2 - 20$

0

$+20 \qquad +20$

$20 = 5(x-1)^2$

$\sqrt{4} = \sqrt{(x-1)^2}$

$\pm 2 = x - 1$

2 ± 6

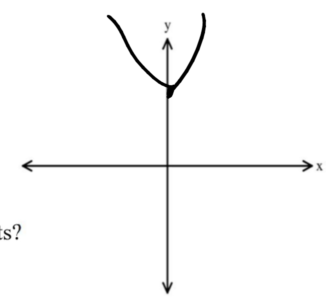
$+1 \qquad +1$

$1 \pm 2 = x$

$\boxed{-1, 3 = x}$

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

a) What is the vertex for this function? $(0, 27)$



b) Will this function open up or down? ↑

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

None!

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

$0 = 3x^2 + 27$

$-27 = 3x^2$ → $\sqrt{-9} = x^2$

cannot take $\sqrt{\ }$ neg!

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

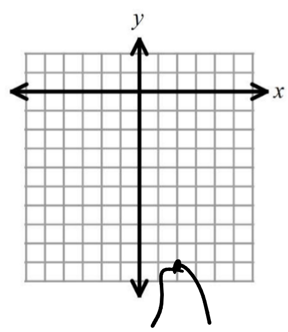
A) The range is $y \leq -9$. ✓

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

C) The function opens downward. ✓

D) The x-intercepts are at $2 \pm \sqrt{3}$. F (none)

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

$X^2 + 3x = 10$