Name Key Period ______

Day	Date	Assignment (Due the next class meeting)
Tuesday Wednesday	4/9/19 (A) 4/10/19 (B)	9.1 Worksheet Dividing Radicals
Thursday Friday	4/11/19 (A) 4/12/19 (B)	9.2 Worksheet Solving by Factoring
Monday Tuesday	4/15/19 (A) 4/16/19 (B)	9.3 Worksheet Graphing in Intercept Form
Wednesday Thursday	4/17/19 (A) 4/18/19 (B)	9.4 Worksheet The Quadratic Formula
Friday Monday	4/19/19 (A) 4/22/19 (B)	9.5 Worksheet Classifying and Converting Functions
Tuesday Wednesday	4/23/19 (A) 4/24/19 (B)	9.6 Worksheet Modeling with Quadratics
Thursday Friday	4/25/19 (A) 4/26/19 (B)	**Ch 9 Practice Test**
Monday Tuesday	4/29/19 (A) 4/30/19 (B)	**Ch 9 Test**
Wednesday Thursday	5/01/19 (A) 5/02/19 (B)	3ACTS Math, Test Corrections, Test Redos

NOTE: You should 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.

Do you need a worksheet or a copy of the teacher notes?
Go to www.washoeschools.net/DRHSmath

Key

9.1 Notes: Dividing Radicals

Warm-Up: Simplify each expression.

1) Which of the following expressions are equal to 3? Choose all that apply.
   a. $\sqrt{9}$
   b. $\sqrt{3} \cdot \sqrt{3}$ $= \sqrt{9} = 3$
   c. $\sqrt{3^2}$ $= \sqrt{9} = 3$
   d. $\frac{24}{8}$ $= 3$

2) Simplify: $\sqrt{7} \cdot \sqrt{7}$ $= \sqrt{49} = \boxed{7}$

3) Simplify: $2\sqrt{5} \cdot \sqrt{5}$ $= 2\sqrt{5 \cdot 5}$
$= 2\sqrt{25} = 2 \cdot 5 = \boxed{10}$

Quotient Property of Radicals: The square root of a quotient equals the quotient of the square root of the numerator and denominator.

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \text{ where } a \geq 0 \text{ and } b > 0.$$

Example: $\sqrt{\frac{50}{72}}$

1. Reduce the fraction, if possible.
2. Square root the numerator and the denominator.

For Examples #1 – 8: Simplify each of the radical expressions.

1. $\frac{\sqrt{9}}{\sqrt{4}} = \frac{3}{2}$ $\boxed{\frac{3}{2}}$

2. $\sqrt{\frac{2}{98}} = \sqrt{\frac{1}{49}} = \frac{\sqrt{1}}{\sqrt{49}} = \frac{1}{7} = \boxed{\frac{1}{7}}$
reduce

3. $\frac{\sqrt{10}}{\sqrt{8}} = \frac{\sqrt{5}}{\sqrt{4}} = \frac{\sqrt{5}}{2}$ $\boxed{\frac{\sqrt{5}}{2}}$
can't simplify
Reduce

4. $\sqrt{\frac{14x^3}{18x^2}} = \sqrt{\frac{7x}{9}} = \frac{\sqrt{7x}}{\sqrt{9}} = \boxed{\frac{\sqrt{7x}}{3}}$
can't

① Reduce

② $\sqrt{\frac{\ }{\ }} \Rightarrow \frac{\sqrt{\ }}{\sqrt{\ }}$

③ $\frac{\sqrt{\ }}{\sqrt{\ }}$ Simplify Simplify

You try!

5. $\sqrt{\frac{27}{12}} = \sqrt{\frac{9}{4}} = \frac{\sqrt{9}}{\sqrt{4}} = \boxed{\frac{3}{2}}$

6. $\frac{\sqrt{100}}{\sqrt{81}} = \boxed{\frac{10}{9}}$

7. $\sqrt{\frac{3x^3}{12x^2}} = \sqrt{\frac{x}{4}} = \frac{\sqrt{x}}{\sqrt{4}} = \boxed{\frac{\sqrt{x}}{2}}$

8. $\frac{\sqrt{21}}{\sqrt{75}} = \frac{\sqrt{7}}{\sqrt{25}} = \boxed{\frac{\sqrt{7}}{5}}$

****Note: All of the examples above simplified to a whole number on the denominator. Sometimes that will not be the case. When the denominator is not a whole number, we have to "rationalize the denominator."

$\sqrt{3} \cdot \sqrt{3} = \sqrt{9} = 3$

$\sqrt{5} \cdot \sqrt{5} = \sqrt{25} = 5$

$\sqrt{9} \cdot \sqrt{9} = \sqrt{81} = 9$

$\sqrt{2785} \cdot \sqrt{2785} = 2785$

$\frac{3}{\sqrt{2}} \cdot \frac{?}{?} = \frac{}{2}$

$\sqrt{2}$

For examples # 9 – 20, simplify each expression by rationalizing the denominator.

9) $\frac{1}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \boxed{\frac{\sqrt{5}}{5}}$

10) $\frac{3}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \boxed{\frac{3\sqrt{7}}{7}}$

11) $\sqrt{\frac{14}{3}} = \frac{\sqrt{14}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{\sqrt{42}}{3}}$

12) $\sqrt{\frac{16}{13}} = \frac{\sqrt{16}}{\sqrt{13}} = \frac{4}{\sqrt{13}} \cdot \frac{\sqrt{13}}{\sqrt{13}} = \boxed{\frac{4\sqrt{13}}{13}}$

You try #13 – 16!

13) $\frac{-2}{\sqrt{17}} \cdot \frac{\sqrt{17}}{\sqrt{17}} = \boxed{\frac{-2\sqrt{17}}{17}}$

14) $\frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \boxed{\frac{\sqrt{2}}{2}}$

15) $\sqrt{\frac{121}{15}} = \frac{\sqrt{121}}{\sqrt{15}} = \frac{11}{\sqrt{15}}$

$\frac{11}{\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}} = \boxed{\frac{11\sqrt{15}}{15}}$

16) $\sqrt{\frac{5}{7}} \quad \frac{\sqrt{5}}{\sqrt{7}} = \frac{\sqrt{5}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \boxed{\frac{\sqrt{35}}{7}}$

17) $\frac{1}{2\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{2 \cdot 5} = \boxed{\frac{\sqrt{5}}{10}}$

5

18) $\frac{-4}{3\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{-4\sqrt{7}}{3 \cdot 7} = \boxed{\frac{-4\sqrt{7}}{21}}$

19) $\frac{11}{4\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{11\sqrt{3}}{4 \cdot 3} = \boxed{\frac{11\sqrt{3}}{12}}$

20) $\frac{-5}{4\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{-5\sqrt{5}}{4 \cdot 5} = \frac{-5\sqrt{5}}{20} = \boxed{\frac{-\sqrt{5}}{4}}$

Rationalizing the Denominator: The process of removing a radical from an expression's denominator.

$\sqrt{\frac{4}{11}} = \frac{2}{\sqrt{11}}$ We cannot leave the radical in the denominator so we must rationalize!

To rationalize the denominator:

Multiply the numerator *and* the denominator by the **same radical.**

Choose a radical that will create a perfect square on the denominator.

Example 21: Simplify: $\frac{\sqrt{32}}{\sqrt{24}} = \frac{\overset{2}{\cancel{\sqrt{4}}}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{2\sqrt{3}}{3}}$

1. Reduce the fraction
2. Simplify any radicals
3. Rationalize the Denominator

Examples: Simplify each radical expression; make sure to rationalize the denominator, if needed.

21. $\sqrt{\frac{50}{14}} = \sqrt{\frac{25}{7}} = \frac{\sqrt{25}}{\sqrt{7}} = \frac{5}{\sqrt{7}} \frac{\sqrt{7}}{\sqrt{7}} = \boxed{\frac{5\sqrt{7}}{7}}$

22. $\frac{\sqrt{9}}{\sqrt{36}} = \frac{\sqrt{1}}{\sqrt{4}} = \boxed{\frac{1}{2}}$

23. $\frac{\overset{2}{\cancel{8}}\sqrt{\cancel{7}}^{\,1}}{\cancel{4}\sqrt{\cancel{14}}_{\,2}} = \frac{2\sqrt{1}}{1\sqrt{2}} = \frac{2}{\sqrt{2}} = \frac{2\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{\cancel{2}\sqrt{2}}{\cancel{2}} = \boxed{\sqrt{2}}$

You try #24 – 26!

24. $\sqrt{\frac{16}{3}} = \frac{\sqrt{16}}{\sqrt{3}} = \frac{4}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \boxed{\frac{4\sqrt{3}}{3}}$

25. $\frac{\cancel{6}^{2}\sqrt{1\cancel{0}}}{\cancel{9}_{3}\sqrt{3\cancel{0}}} = \frac{2\sqrt{1}}{3\sqrt{3}} = \frac{2}{3\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3\cdot 3} = \boxed{\frac{2\sqrt{3}}{9}}$

26. $\sqrt{\frac{15}{12}} = \frac{\sqrt{5}}{\sqrt{4}} = \boxed{\frac{\sqrt{5}}{2}}$

You try #28!

27. $\frac{4\sqrt{5\cancel{0}}}{\sqrt{12\cancel{0}}} = \frac{4\sqrt{5}}{\sqrt{12}} = \frac{4\sqrt{5}}{2\sqrt{3}} = \frac{4\sqrt{5}\sqrt{3}}{2\sqrt{3}\sqrt{3}} = \frac{4\sqrt{15}}{2\cdot 3} = \boxed{\frac{4\sqrt{15}}{6}}$

28. $\frac{-3\sqrt{\cancel{2}}^{\,1}}{\sqrt{\cancel{48}}_{24}} = \frac{-3\sqrt{1}}{\sqrt{24}} = \frac{-3}{2\sqrt{6}} = \frac{-3\sqrt{6}}{2\sqrt{6}\sqrt{6}} = \frac{-\cancel{3}^{1}\sqrt{6}}{2\cdot\cancel{6}_{2}} = \boxed{\frac{-\sqrt{6}}{4}}$

29. Challenge: $\frac{5x}{\sqrt{3x}} \cdot \frac{\sqrt{3x}}{\sqrt{3x}} = \frac{5\cancel{x}\sqrt{3x}}{3\cancel{x}} = \boxed{\frac{5\sqrt{3x}}{3}}$

9.2 Notes: Solving Quadratics By Factoring

Warm-Up: Factor each expression.

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

$3x^3(2x-3)$

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

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

Exploration: Given that $ab = 0$. What must be true about a and/or b?

either $a=0$ or $b=0$
or both

Given that $(x-2)(x+5) = 0$. What would x have to equal in order for this equation to be true?

either 2 or -5

Zero-Product Property	Let a and b be real numbers. If $ab = 0$, then a = 0 and/or b = 0.

Quadratic Equations:

For #1 – 4: Solve each equation for x.

1) $x(x-6) = 0$

$\boxed{x = 0, 6}$

2) $-2.5x(x+1) = 0$

$\boxed{x = 0, -1}$

3) $3(x-2)\left(\frac{\cancel{5}x}{\cancel{5}} + \frac{2}{5}\right) = \frac{0}{5}$

$\boxed{x = 2, -2/5}$

4) $4x\left(\frac{2x}{2} - \frac{3}{2}\right)(x-100) = \frac{0}{2}$

$4x(x - 3/2)(x-100) = 0$

$\boxed{x = 0, 3/2, 100}$

Steps for Solving Quadratic Equations by factoring:

1) Get a zero on one side of the equation.
2) Factor.
3) Set each factor equal to zero and solve. The solutions are also called **roots, x-intercepts, solutions, or zeros.**

Examples 5 – 10: Solve each equation for the variable by factoring.

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

$(x+5)(x-2) = 0$

$\boxed{x = -5, 2}$

6) $0 = x^2 - 9$

$0 = (x+3)(x-3)$

$\boxed{x = \pm 3}$

7) $-9x^2 + 6x = 0$

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

$\frac{3}{3} \quad \frac{\;}{3} \quad \frac{\;}{3}$

$-3x(x - 2/3) = 0$

$\boxed{x = 0, 2/3}$

You try #8 – 10!

8) $x^2 - 49 = 0$

$(x+7)(x-7) = 0$

$\boxed{x = \pm 7}$

9) $15x^2 + 3x = 0$

$3x(5x+1) = 0$

$\frac{\;}{5} \quad \frac{\;}{5}$

$3x(x + 1/5) = 0$

$\boxed{x = 0, -1/5}$

10) $0 = x^2 + 4x - 12$

$0 = (x+6)(x-2)$

$\boxed{x = -6, 2}$

Example 11: Solve for a by factoring: $3a^2 - 10a - 8 = 0$

$(3a + 2)(a - 4) = 0$

$(a + 2/3)(a - 4) = 0$

$\boxed{a = -2/3, 4}$

Examples 12 – 15: Solve each equation for the variable by factoring.

12) $0 = 2x^2 + 11x + 15$

$0 = (2x + 5)(x + 3)$

$0 = (x + 5/2)(x + 3)$

$\boxed{x = -5/2, -3}$

13) $4b^2 - 49 = 0$

$(2b + 7)(2b - 7) = 0$

$\boxed{b = \pm \frac{7}{2}}$

You try #14 – 15:

14) $0 = 25y^2 - 81$

$0 = (5y + 9)(5y - 9)$

$\boxed{y = \pm 9/5}$

15) $5x^2 + 9x - 2 = 0$

$(5x - 1)(x + 2) = 0$

$\boxed{x = 1/5, -2}$

Hints for solving equations by factoring:

1. Get a 0 on one side of the equal sign.
2. Put the terms in descending order.
3. It is usually easiest to factor if the leading coefficient is (+). If needed, move the terms to the other side of the equal sign in order to change their signs.

Example 16: Solve the equation by factoring: $-2x^2 + 16x = 14$.

set = to 0 1st

$$-2x^2 + 16x - 14 = 0$$
$$-2(x^2 - 8x + 7) = 0$$
$$-2(x - 7)(x - 1) = 0$$
$$\boxed{x = 7, 1}$$

For #17 – 20: Solve the following equations.

17) $x^2 - 30 = x$

$\quad -x \quad -x$

set = 0

$$x^2 - x - 30 = 0$$
$$(x - 6)(x + 5) = 0$$
$$\boxed{x = 6, -5}$$

18) $-3a^2 + 18a + 45 = -3$

$\quad +3 \quad +3$

$$-3a^2 + 18a + 48 = 0$$
$$-3(a^2 - 6a - 16) = 0$$
$$-3(a - 8)(a + 2) = 0$$
$$\boxed{a = 8, -2}$$

You try #19 – 20:

19) $10 = 9a^2 + 9$

$-10 \quad -10$

$0 = 9a^2 - 1$

$0 = (3a+1)(3a-1)$

$\boxed{x = \pm 1/3}$

20) $-4x^2 + 12 = 8x$

$-8x \quad -8x$

$-4x^2 - 8x + 12 = 0$

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

$-4(x+3)(x-1) = 0$

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

21) $3x^2 + 28x - 55 = 0$

$(3x-5)(x+11) = 0$

$\boxed{x = 5/3, -11}$

Challenge: 22) $-4x^2 - 2x = -6$

$+6 \quad +6$

$-4x^2 - 2x + 6 = 0$

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

$-2(2x+3)(x-1) = 0$

$\boxed{x = -3/2, 1}$

23) Solve the equation for *x*: $6x + Cx = 11$

$(6+c)x = 11$

$\frac{\cancel{(6+c)}x}{\cancel{6+c}} = \frac{11}{6+c}$

$\boxed{x = \frac{11}{6+c}}$

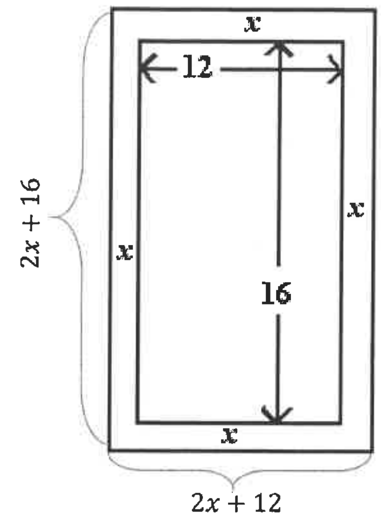
You try #24!

24) Solve for *y*: $5y - Dy = 14$

$\frac{(5-D)y}{(5-D)} = \frac{14}{(5-D)}$

$\boxed{y = \frac{14}{5-D}}$

Challenge: 25) A garden measuring 12 ft by 16 ft has a walkway installed all around it. Including the walkway, the total area of the region is 396 ft^2. What is the width x of the walkway?



$A = w \cdot l$

$396 = (2x+12)\cdot(2x+16)$

$396 = 4x^2 + 32x + 24x + 192$

$-396 \qquad\qquad -396$

$0 = 4x^2 + 56x +$

$0 = 4(x^2 + 14x + 51)$

$0 = 4(x+17)(x-3)$

$x = \cancel{-17}, 3$ $\boxed{x=3}$

Challenge: 26) Given $(x + 4)$ is a factor of $2x^2 + 11x + 2m$, determine the value of m.

$2x^2 + 11x + 2m$

$(x+4)(2x+3) \Rightarrow$

$8x$

$3x$

$11x$

$x^2 + 3x$
$+ 8x + 12$

$x^2 + 11x + 12$

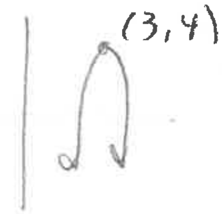
$2m$ so

$\boxed{m=6}$

9.3: Graphing Quadratics in Intercept Form

1) Which of the following statements is true for $y = -2(x-3)^2 + 4$? Choose all that apply.

$(3,4)$



~~A) The vertex is at (-3,-4).~~

B) The function opens downward. ✓

C) The function is a parabola.

D) The vertex is at (3, 4).

2. Which of the following is a factor of the polynomial $2x^2 - 3x - 5$?

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

F) $x - 1$

G) $2x - 3$

H) $2x - 5$

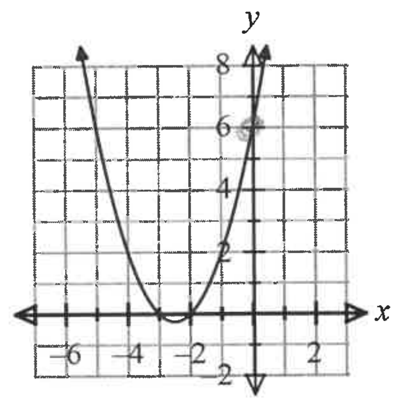
J) $x + 3$

Exploration 1: Given the quadratic equation: $x^2 + 5x + 6 = 0$

a) Use factoring to solve for x.

$(x+2)(x+3) = 0$

$x = -2, -3$



Consider the graph of $f(x) = x^2 + 5x + 6$, as shown to the right.

b) Where is the y-intercept for $f(x)$? Compare this to the equation for $f(x)$. What do you notice? $f(0) = 0^2 + 5(0) + 6 = 6$

$\boxed{(0,6)}$

c) Where are the x-intercepts for $f(x)$? Compare this to your solutions from part **a)**. What do you notice?

$x = -2, 3$

or $\boxed{(-2,0), (3,0)}$

Standard Form of a Quadratic Function:

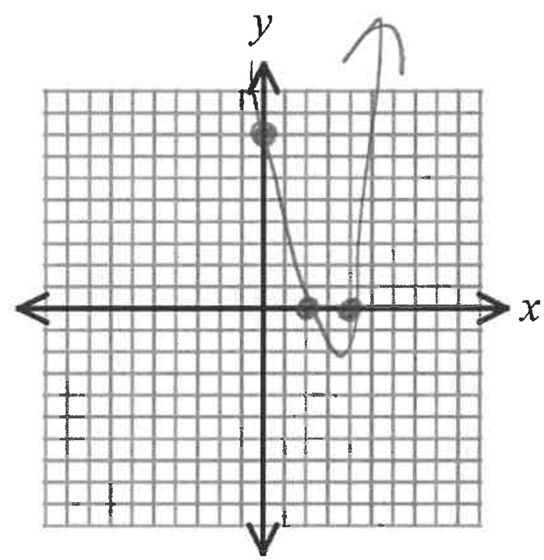
$$y = ax^2 + bx + c$$

Finding the y-intercept of a quadratic function:

- **In Standard Form: $y = ax^2 + bx + c$**
- **In any other form:**

plug in 0 for x every time.

Exploration 2: Consider the quadratic function $y = x^2 - 6x + 8$.



- What is the y-intercept of this quadratic?

  $y = 0^2 - 6(0) + 8$ $\boxed{(0,8)}$

- Does this function open up or down? How do you know?

  up – leading coefficient is +

- Solve for x: $0 = x^2 - 6x + 8$.

  $0 = (x-4)(x-2)$

  $x = 4, 2 \rightarrow \boxed{(4,0), (2,0)}$

- Draw a sketch of this function by using the x- and y-intercepts.

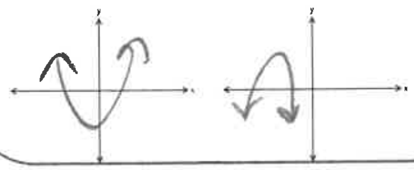
- **Challenge:** Where do you think the vertex would be for this quadratic function?

  at ~~(3, something)~~

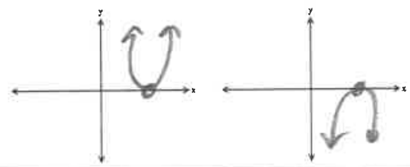
  $(3, -1)$

Intercept Form of a Quadratic Function: $y = a(x-p)(x-q)$

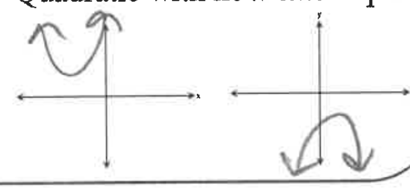
Quadratic with two x-intercepts



Quadratic with one x-intercept



Quadratic with no x-intercepts



Examples #1 – 6: Sketch each quadratic function. Include the y-intercept and any x-intercepts.

1) $y = x^2 + 7x - 18$

y-int

$y = 0^2 + 7(0) - 18$

$y = -18$

$\boxed{(0,-18)}$

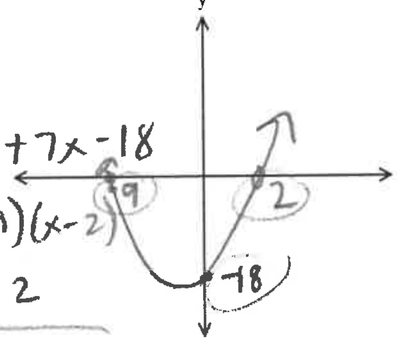
x-int

$0 = x^2 + 7x - 18$

$0 = (x+9)(x-2)$

$x = -9, 2$

$\boxed{(-9,0)\ (2,0)}$



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

y-int

$y = -2(0)^2 - 8(0) = 0$

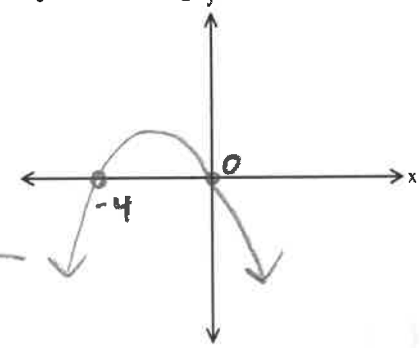
$\boxed{(0,0)}$

x-int

$-2x^2 - 8x = 0$

$-2x(x+4) = 0$

$x = 0, -4$ $\boxed{(0,0), (-4,0)}$



You try #3 – 4!

3) $h(x) = 2x^2 - 10x$

y-int

$y = 2(0)^2 - 10(0) = 0$

$\boxed{(0,0)}$

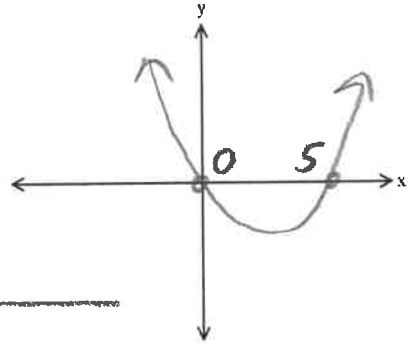
x-int

$0 = 2x^2 - 10x$

$0 = 2x(x-5)$

$x = 0, 5$

$\boxed{(0,0)}$ $\boxed{(5,0)}$



4) $y = x^2 + 8x + 16$

y-int

$y = 0^2 + 8(0) + 16$

$y = 16$

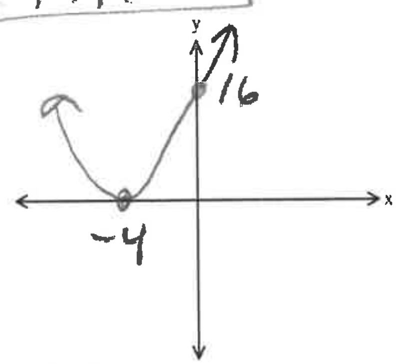
$\boxed{(0,16)}$

x-int

$0 = x^2 + 8x + 16$

$0 = (x+4)(x+4)$

$x = -4$ $\boxed{(-4,0)}$



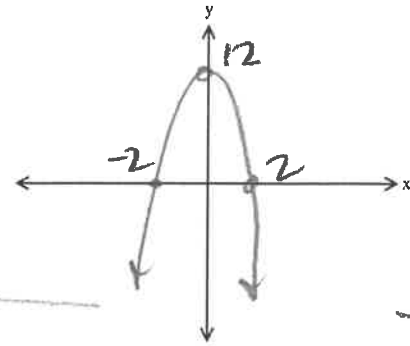
5) $g(x) = -3x^2 + 12$

y-int

$g(0) = -3(0)^2 + 12$

$g(0) = 12$

$\boxed{(0,12)}$



x-int

$0 = -3x^2 + 12$

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

$0 = -3(x+2)(x-2)$

$x = \pm 2$ $\boxed{(2,0)\ (-2,0)}$

You try #6!

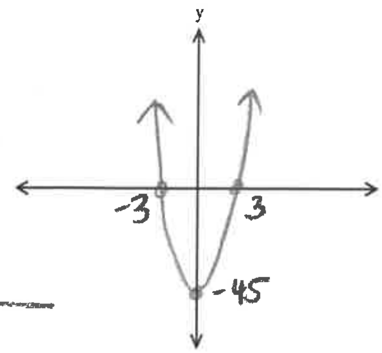
6) $a(x) = 5x^2 - 45$

y-int

$a(0) = 5(0)^2 - 45$

$a(0) = -45$

$(0, -45)$



x-int

$0 = 5x^2 - 45$

$0 = 5(x^2 - 9)$

$0 = 5(x+3)(x-3)$

$x = \pm 3$ $\boxed{(3,0)\ (-3,0)}$

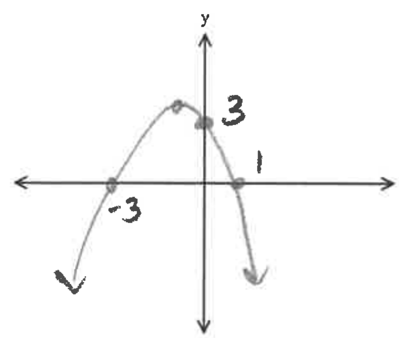
Example #7: Sketch the graph of $\cancel{y} = -(x+3)(x-1)$. Include the x-intercepts and the y-intercept.

xint 0

$x = -3, 1$

yint $y = -(0+3)(0-1)$

$y = -(3)(-1) = 3$

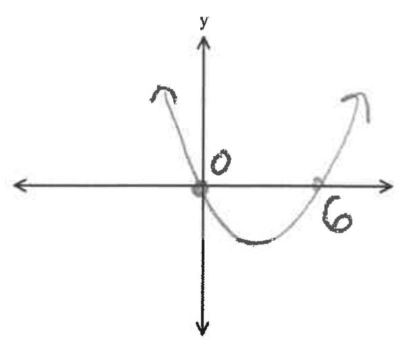


You Try! 8) Sketch the graph of $\cancel{y} = 2x(x-6)$. Include the x-intercepts and the y-intercept.

0

$x = 0, 6$

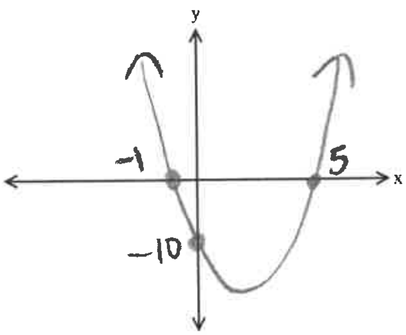
y-int same as x-int @ $(0,0)$



You Try! 9) Which of the following are terms for x-intercepts?

A) zeros B) roots C) solutions D) all of these are correct

Example 10) Given the quadratic function $y = 2x^2 - 8x - 10$. Sketch a graph. Include all intercepts.



y-int : $y = 2(0)^2 - 8(0) - 10 = -10$

$\boxed{(0, -10)}$

x-int : $0 = 2x^2 - 8x - 10$

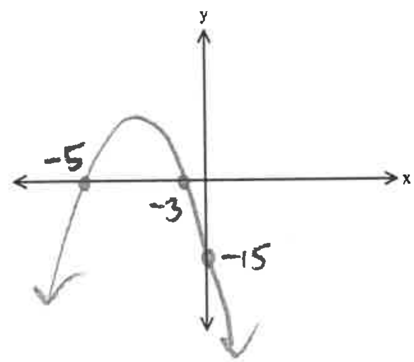
$0 = 2(x - 4x - 5)$

$0 = 2(x-5)(x+1)$

$x = 5, -1$

$\boxed{(5,0), (-1,0)}$

Example 11) You try! Given the quadratic function $y = -x^2 - 8x - 15$.
Sketch a graph. Include all intercepts.



y-int : $y = -(0)^2 - 8(0) - 15 = -15$

$\boxed{(0, -15)}$

x-int . $0 = -x^2 - 8x - 15$

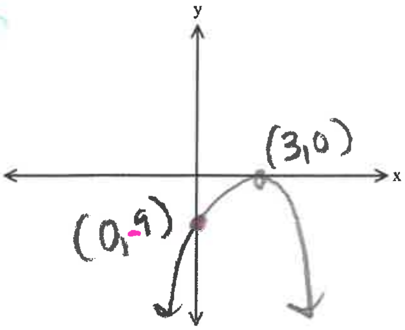
$0 = -(x^2 + 8x + 15)$

$0 = -(x+5)(x+3)$

$x = -5, -3$

$\boxed{(-5,0), (-3,0)}$

Example 12) Given the quadratic function $y + 9 = -x^2 + 6x$. Sketch a graph. Include the intercepts.



$y = -x^2 + 6x - 9$

y-int $y = -0^2 + 6(0) - 9 = -9 \Rightarrow (0,-9)$

x-int $0 = -x^2 + 6x - 9$

$0 = -(x^2 - 6x + 9)$

$0 = -(x-3)(x-3)$

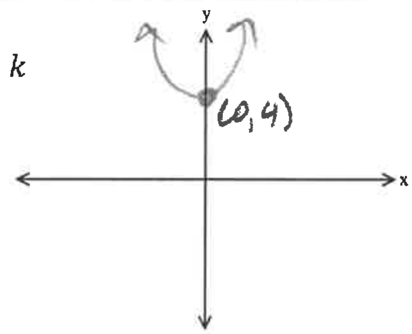
$x = 3 \Longrightarrow \boxed{(3,0)}$

What do you notice about this graph?

Example 13) Given the quadratic function $g(x) = x^2 + 4$, sketch a graph.
Include the intercepts and vertex. Reminder for vertex form: $y = a(x-h)^2 + k$

$g(x) = (x-0)^2 + 4$

$(0,4)$



What do you notice about the x-intercepts for this graph? Why does this happen?

no x-intercepts

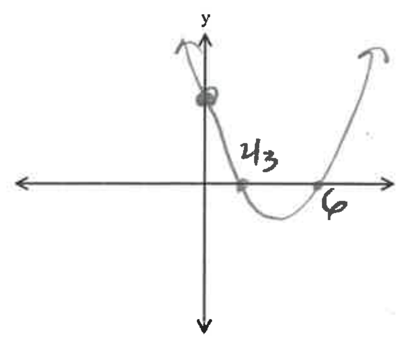
Example 14) Given the quadratic function $y = 3x^2 - 20x + 12$, sketch a graph.
Include the intercepts.

y-int: $y = 3(0)^2 - 20(0) + 12 = 12$

x-int: $0 = 3x^2 - 20x + 12$

$0 = (3x-2)(x-6)$

$x = \frac{2}{3}, 6$



You try #15 – 16!

15) Find the x-intercept(s): $x^2 + 6x + 9 = \cancel{y}\ 0$

$(x+3)(x+3) = 0$

$x = -3$

A) (3, 0)

B) (-3, 0)

C) (3, 0) and (-3, 0)

D) (3, 0) and (6, 0)

16) Find the x-intercept(s): $\cancel{f(x)} = 4x^2 + 20x + 25$

$0 = (2x+5)(2x+5)$

$x = -5/2$

A) $\frac{5}{2}, -\frac{5}{2}$

B) $-\frac{5}{2}$

C) 5 and 2

D) -5

17) Which of the following equations matches the graph shown?

~~A) $y = (x-3)(x+2)$~~

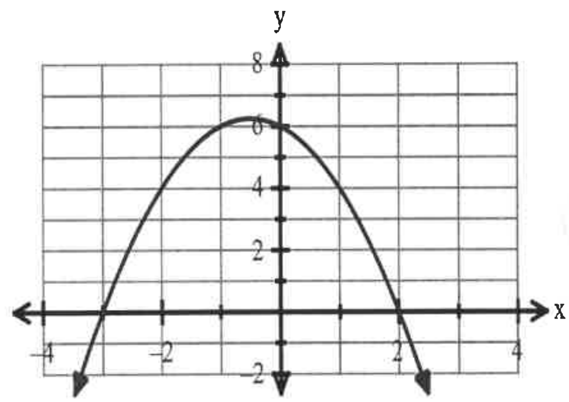
~~B) $y = (x+3)(x-2)$~~

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

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

$y = 6$

$x = -3, 2$



Challenge: 18) Which of the following equations matches the graph shown? Choose all that apply.

~~A) $y = (x+4)(x-2)$~~

B) $y = -(x-4)(x+2)$ ←

~~C) $y = (x-1)^2 + 9$~~

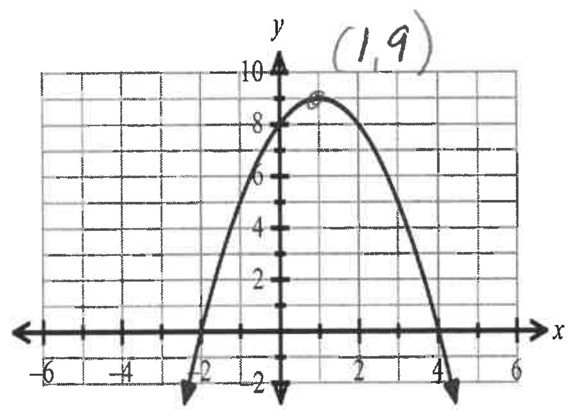
D) $y = -(x-1)^2 + 9$

E) $y = -x^2 + 2x + 8$

$-(x^2 - 2x - 8)$

$-(x-4)(x+2)$

same



$x = -2, 4$

9.4 Notes: The Quadratic Formula

1st always try to factor!

if not, use

The Quadratic Formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For Examples 1 – 4, solve each equation for *x* by using the quadratic formula. If needed, write your answers as simplified radicals.

1) $x^2 - 5x + 2 = 0$ (a, b, c) can't factor

$(x \quad)(x \quad) = 0$

$$\frac{5 \pm \sqrt{25 - 4(1)(2)}}{2(1)} = \boxed{\frac{5 \pm \sqrt{17}}{2}}$$

-8

2) $5x^2 - 9 = -3x$ ⇒ $5x^2 + 3x - 9 = 0$ (a, b, c)

$\cancel{(5x \quad)(x \quad) = 0}$

$$\frac{-3 \pm \sqrt{9 - 4(5)(-9)}}{2(5)} = \frac{-3 \pm \sqrt{189}}{10}$$

$+180$

$$= \boxed{\frac{3 \pm 3\sqrt{21}}{10}}$$

$\sqrt{189} = \sqrt{3 \cdot 3 \cdot 3 \cdot 7} = 3\sqrt{21}$

You try #3 – 4!

3) $x^2 + 5x = 3$

$x^2 + 5x - 3 = 0$

$\cancel{(x \quad)(x \quad) = 0}$

$$\frac{-5 \pm \sqrt{25 - 4(1)(-3)}}{2(1)} = \boxed{\frac{-5 \pm \sqrt{37}}{2}}$$

$+12$

4) $x^2 - 9x + 9 = 0$

$\cancel{(x \quad)(x \quad) = 0}$

$$\frac{9 \pm \sqrt{81 - 4(1)(9)}}{2(1)} = \frac{9 \pm \sqrt{45}}{2}$$

$$= \boxed{\frac{9 \pm 3\sqrt{5}}{2}}$$

$\sqrt{45} = \sqrt{3 \cdot 3 \cdot 5} = 3\sqrt{5}$

For Examples 5 – 8, solve each equation for x by using the quadratic formula. If needed, write your answers as simplified radicals.

5) $-4x^2 + 8x - 3 = 0$

$\cancel{\dfrac{-8 \pm \sqrt{64 - 4(-4)(-3)}}{2(-4)}} =$ -48

$-(4x^2 - 8x + 3) = 0$

$-(2x-1)(2x-3) = 0$

$\boxed{x = \frac{1}{2}, \frac{3}{2}}$

6) $5x^2 + 3x = -2$

$5x^2 + 3x + 2 = 0$

$\cancel{(5x \quad)(x \quad) = 0}$

$\dfrac{-3 \pm \sqrt{9 - 4(5)(2)}}{2(5)} = \dfrac{-3 \pm \sqrt{-31}}{10}$

$\boxed{\text{no solution}}$ can't have $\ominus$ in radical

You try #7 – 8!

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

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

$(x-3)(x-1) = 0$

$\boxed{x = 3, 1}$

8) $4x^2 - x + 20 = 0$

$\dfrac{1 \pm \sqrt{1 - 4(4)(20)}}{2(4)} = \dfrac{1 \pm \sqrt{-319}}{8}$

$\boxed{\text{no solution}}$

For Examples 9 – 10, solve each equation for x by using the quadratic formula. If needed, write your answers as simplified radicals.

9) $3x^2 - 2 = -10x$

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

$\cancel{(3x \quad)(x \quad) = 0}$

$\dfrac{-10 \pm \sqrt{100 - 4(3)(-2)}}{2(3)}$ $+24$

$\sqrt{124} = \sqrt{2 \cdot 2 \cdot 31} = 2\sqrt{31}$

$= \dfrac{-10 \pm \sqrt{124}}{6} = \dfrac{-10 \pm 2\sqrt{31}}{6} = \boxed{\dfrac{-5 \pm \sqrt{31}}{3}}$

Reduce

You try!

10) $2x^2 - 6x - 5 = 0$

$\cancel{(2x \quad 5)(x \quad 1) = 0}$

$\dfrac{6 \pm \sqrt{36 - 4(2)(-5)}}{2(2)} = \dfrac{6 \pm \sqrt{76}}{4}$ $+40$

$\sqrt{76} = \sqrt{2 \cdot 2 \cdot 19} = 2\sqrt{19}$

$= \dfrac{6 \pm 2\sqrt{19}}{4} = \boxed{\dfrac{3 \pm \sqrt{19}}{2}}$

Reduce

Example 11: Consider the function $y = x^2 + 7x - 3$.

- A) Solve $0 = x^2 + 7x - 3$ for x by using the quadratic equation. If needed, write your answers as simplified radicals.

~~$0 = (x \quad)(x \quad)$~~

+12

$$\frac{-7 \pm \sqrt{49-4(1)(-3)}}{2(1)} = \frac{-7 \pm \sqrt{61}}{2}$$

calc:

$(-7-\sqrt{61})/2$

$= -7.405$

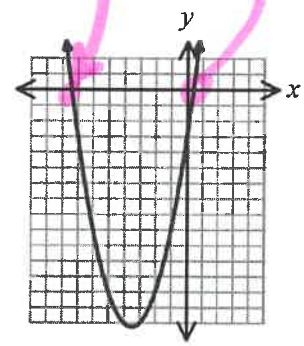
$(-7+\sqrt{61})/2$

$= .405$

- B) Write the solutions for x as decimals rounded to the nearest tenth.

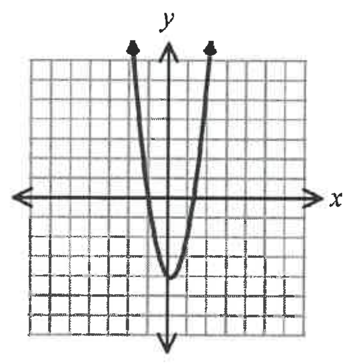
-7.405 , $.405$

- C) The graph of the function $y = x^2 + 7x - 3$ is shown to the right.
  What did you find when you solved this equation for x?



Example 12: Consider the function $3x^2 - x = f(x) + 4$.

- A) Solve $3x^2 - x = 4$ for x by using either factoring or the quadratic formula. Either way will work!



- B) The graph of the function $3x^2 - x = f(x) + 4$ is shown to the right.
  What did you find when you solved this equation for x?

Example 13: Consider the function $y = 2x^2 - 2x + 4$

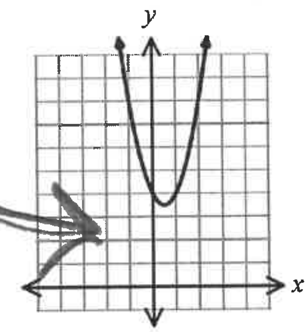
- A) Solve $0 = 2x^2 - 2x + 4$ for x by using the quadratic equation. If needed, write your answers as simplified answers.

$0 = 2(x^2 - x + 2)$

$\cancel{2(x\quad)(x\quad)}$

$\dfrac{2 \pm \sqrt{4 - 4(2)(4)}}{2(2)} = \dfrac{2 \pm \sqrt{-28}}{4}$

$\boxed{\text{no solutions}}$



- B) The graph of the function $y = 2x^2 - 2x + 4$ is shown to the right. What did you find when you solved this equation for x?

Example 14: Which of the following is the solution set of $2x^2 + 14x = 18$?

$2x^2 + 14x - 18 = 0$

$\cancel{2}(x^2 + 7x - 9) = 0$

$\dfrac{-7 \pm \sqrt{49 - 4(1)(-9)}}{2(1)}$

$\dfrac{-7 \pm \sqrt{85}}{2}$

A. $x = \dfrac{7 \pm \sqrt{85}}{2}$

B. $x = \dfrac{-14 \pm \sqrt{85}}{4}$

C. $x = \dfrac{-7 \pm \sqrt{85}}{2}$

D. $x = \dfrac{14 \pm \sqrt{52}}{4}$

Where did the Quadratic Formula come from?

It came from starting with the standard form of a quadratic, setting it equal to zero, and then solving the equation by completing the square. The solution is below. ☺

$$ax^2 + bx + c = 0$$

$$a\left(\left(x^2 + \frac{bx}{a} + ?\right) - ? + \frac{c}{a}\right) = 0$$

$$\left(x^2 + \frac{bx}{a} + ?\right) - ? + \frac{c}{a} = 0$$

$$\left(\frac{b}{2a}\right)^2 = \frac{b^2}{4a^2}$$

$$\left(x^2 + \frac{b}{2} + \frac{b^2}{4a^2}\right) - \frac{b^2}{4a^2} + \frac{c}{a} = 0$$

$$\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a^2} + \frac{4ac}{4a^2} = 0$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{4ac}{4a^2}$$

$$\sqrt{\left(x + \frac{b}{2a}\right)^2} = \sqrt{\frac{b^2 - 4ac}{4a^2}}$$

$$x + \frac{b}{2a} = \frac{\pm\sqrt{(b^2 - 4ac)}}{2a}$$

$$x = -\frac{b}{2a} \pm \frac{\sqrt{(b^2 - 4ac)}}{2a}$$

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Wow! ☺

9.5 Notes: Classifying Functions, and Systems with Quadratic Functions

Warm Up: Classify each function below as linear, exponential, or neither.

1)

x	0	1	2	3
y	7	-1	-9	-17

−8 −8 −8 $\boxed{L}$

2)

x	1	2	3	4
y	6	12	24	48

·2 ·2 ·2 $\boxed{E}$

3)

x	-2	-1	0	1	2
y	4	1	0	1	4

−3 −1 +1 +3

+2 +2 +2 ⟵ 2nd differences match! This is $\boxed{\text{Quadratic}}$

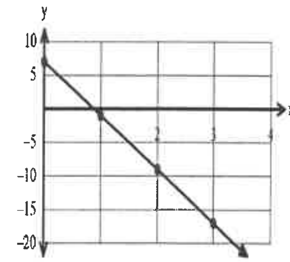
Linear	Exponential	Quadratic
		 parabola
constant slope ★(1st differences all match)	grows fast ★multiply to get next term	★ 2nd differences match
$y = x$ regular x	$y = b^x$ x in exponent	$y = x^2$ (x is squared — 2nd degree polynomial)

Classifying Functions as Linear, Exponential, or Quadratic

Linear Functions have a ________________ ____________________.

x	0	1	2	3
y	7	-1	-9	-17

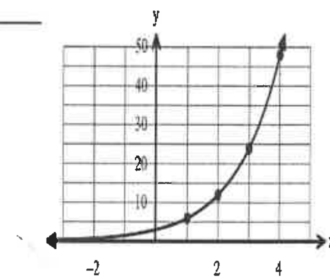
$y = -8x + 7$



Exponential functions have a ________________ ______________________

x	1	2	3	4
y	6	12	24	48

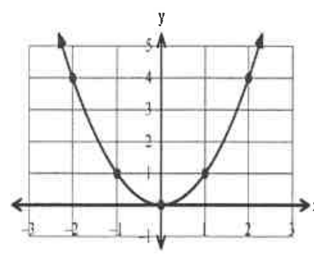
$y = 3(2)^x$



Quadratic functions have a ________________ _____ ________________.

x	-2	-1	0	1	2
y	4	1	0	1	4

$y = x^2$



For Examples #1 – 7, classify each function as linear, exponential, or quadratic.

1)

x	-1	0	1	2
y	1	3	1	-5

+2 -2 -6

-4 -4

Q

2.

x	0	1	2	3
y	8	4	2	1

$\cdot\frac{1}{2}$ $\cdot\frac{1}{2}$ $\cdot\frac{1}{2}$

E

3)

x	y
3	-1
4	2
5	5
6	8

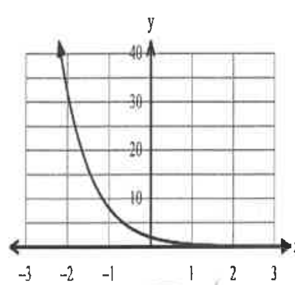
+3
+3
+3

L

5) $y = 6\left(\frac{1}{4}\right)^x$

E

6)



E

7) $f(x) = 2x - 4$

L

You try! For Examples #8 – 13, classify each function as linear, exponential, or quadratic.

8) $g(x) = -2(x+1)^2 + 4$

$\boxed{Q}$

9)

x	0	1	2	3
y	22	15	10	7

$-7 \quad -5 \quad -3$

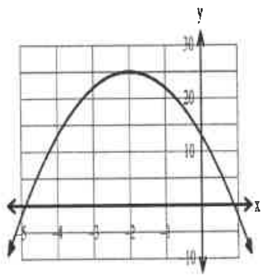
$+2 \quad +2$

$\boxed{Q}$

10) $y = x$

$\boxed{L}$

11)



$\boxed{Q}$

12)

x	y
-1	5
0	6.5
1	8
2	9.5

$+1.5 \quad +1.5 \quad +1.5$

$\boxed{L}$

13)

x	3	4	5	6
y	2	10	50	250

$\cdot 5 \quad \cdot 5 \quad \cdot 5$

$\boxed{E}$

Challenge: Write the equations that model #12 and 13 above.

(12) $y = mx + b \Rightarrow \boxed{y = 1.5x + 6.5}$

Slope is +1.5

when $x=0$, $y = 6.5$

(13) $y = a \cdot b^x$

when $x=0$

rate

0	1	2	3
2/125	2/25	2/5	2

$\div 5 \quad \div 5 \quad \div 5$

$\boxed{\frac{2}{125}(5)^x}$

Converting Quadratic Functions into Different Forms.

Standard Form

$y = ax^2 + bx + c$

Vertex Form

$y = a(x-h)^2 + k$

Intercept Form

$y = a(x-p)(x-q)$

complete the square

factor

Example 12: Given $y = -(x+3)(x-2)$, write this function in standard form, and identify the y-intercept.

Simplify

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

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

$-x^2 + 2x - 3x + 6$

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

You try #13: Given $y = 2(x-1)(x-5)$, write this function in standard form, and identify the y-intercept.

Simplify

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

$(2x-2)(x-5)$

$2x^2 - 10x - 2x + 10$

$\boxed{y = 2x^2 - 12x + 10}$ $\boxed{y = 10}$

Example 14: Given $y = x^2 + 8x - 20$.

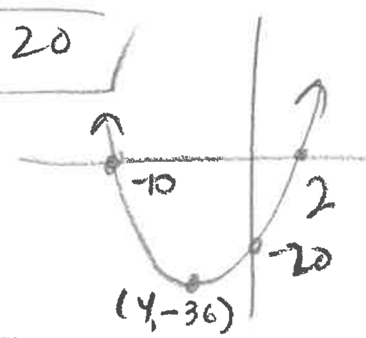
A) Write this function in vertex form, and then identify the vertex.

$y = x^2 + 8x \overset{+16}{} - 20 \overset{-16}{}$

$\boxed{y = (x-4)^2 - 36}$

$\boxed{\text{vertex } (4, -36)}$

$\boxed{y = -20}$



B) Write this function in intercept form, and then identify the x-intercepts.

$y = x^2 + 8x - 20$

$y = (x+10)(x-2)$

$\boxed{x = -10, 2}$

You try #15: Given $y = x^2 + 4x + 3$

A) Write this function in vertex form, and then identify the vertex.

$x^2 + 4x^{+4} + 3^{-4}$

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

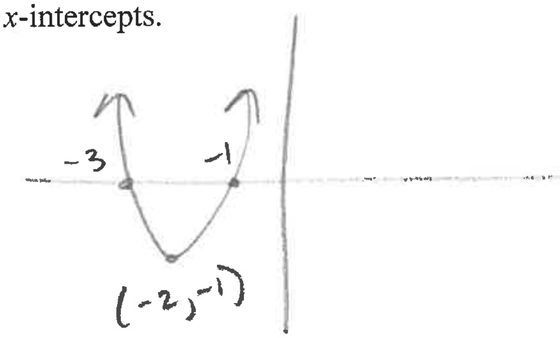
vertex $(-2, -1)$

B) Write this function in intercept form, and then identify the x-intercepts.

$x^2 + 4x + 3$

$(x+3)(x+1)$

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



Example 16: Given $f(x) = -2x^2 + 12x - 16$.

A) Write this function in vertex form, and then identify the vertex.

$y = -2x^2 + 12x - 16$

$-2(x^2 - 6x^{+9}) \quad -16^{+18}$

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

vertex: $(3, 2)$

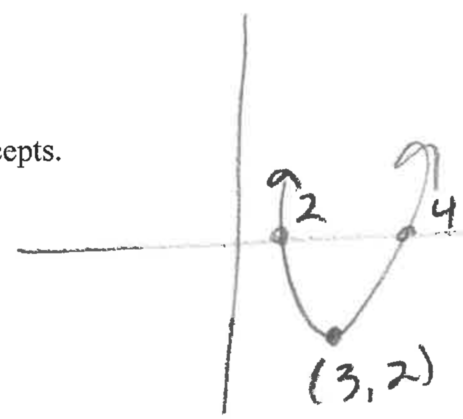
B) Write this function in intercept form, and then identify the x-intercepts.

$y = -2x^2 + 12x - 16$

$-2(x^2 - 6x + 8)$

$-2(x-4)(x-2)$

$\boxed{x = 4, 2}$



9.6: Modeling with Quadratics

Warm -Up: Consider $f(x)$ as graphed to the right.

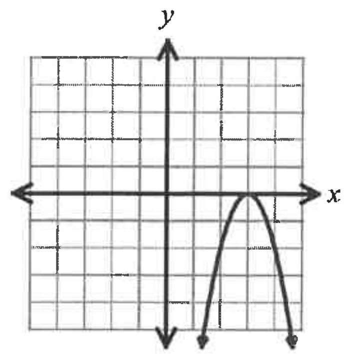
Which of the following statements is true? Choose all that apply.

A) The function has one solution.

B) The maximum value of the function is ~~3.~~ 0

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

D) The range of the function is $y \leq 0$.



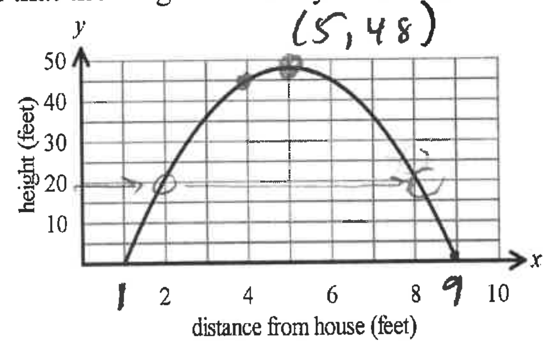
easy to tell vertex (height, max/min, range)

Vertex Form of a Quadratic Function: $y = a(x-h)^2 + k$

Intercept Form of a Quadratic Function: $y = a(x-p)(x-q)$ easy to tell roots

Standard Form of a Quadratic Function: $y = ax^2 + bx + c$ easy to tell y-intercepts

Exploration: A toy rocket is launched from the ground, and its height is shown at various distances from a house. Use the graph below to answer the following questions, given that the height of the toy rocket can be modeled by $y = -3(x-5)^2 + 48$.



A) What is the maximum height achieved by the rocket?

48 ft

B) What is the total horizontal distance traveled by the rocket?

9 - 1 = 8 ft

C) How far away is the rocket from the house when it lands?

9 ft

D) What is the approximate height of the rocket after 4 seconds?

45 ft

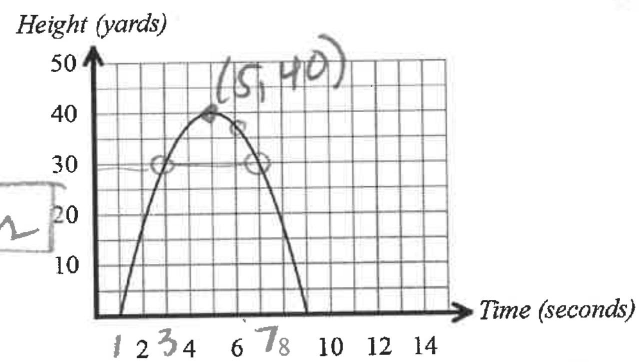
E) At what time(s) is the height of the rocket 20 feet?

≈ 2 and 8 ft

You try!

For #1 – 5: A rocket was shot up into the air. The graph shows the height of its flight t seconds after it was shot.

The equation $h(t) = -\frac{5}{2}(t-5)^2 + 40$ models the height of the rocket (in yards) at t seconds.



1) At about what height was the rocket after 6 seconds?

≈ 37 yards

2) What is the maximum height reached by the rocket?

40 yards

3) At what time(s) was the height of the rocket 30 yards?

3 sec, 7 sec

4) At what time(s) was the rocket on the ground?

at 1 sec, 9 sec

5) How long did it take the rocket to come back down to the ground, after it was shot into the air?

9 - 1 = 8 seconds

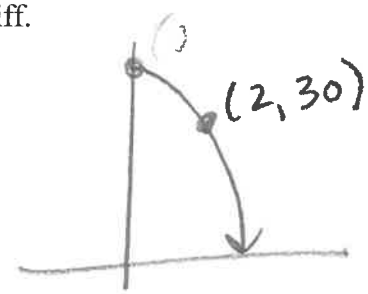
Example 6) Sarah is a cliff diver standing on the top of a cliff with a height of 50 feet. When she dives off, she reaches a height of 30 feet in 2 seconds. Determine the quadratic function, $f(t)$, that could model Sarah's height t seconds after she jumps off the cliff.

~~A. $f(t) = 5(t-0)^2 + 30$~~

~~B. $f(t) = -5(t-0)^2 + 30$~~

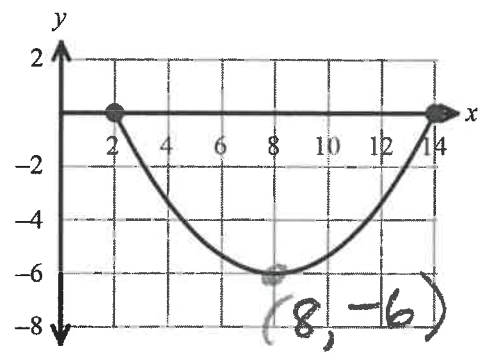
C. $f(t) = -5(t-0)^2 + 50$

~~D. $f(t) = (t-0)^2 + 50$~~



must be (−)
also vertex
not at 30

You try #7! The cross-section of a half-pipe at a skate park is shaped like a quadratic function that opens upward. The graph shows the ramp in terms of its height, y, measured in feet, and its horizontal distance, x, also measured in feet. Which of the following equations correctly model the relationship between x and y, given thatat $|a| = \frac{1}{6}$? **Choose all that apply!**



~~A. $y = -\frac{1}{6}(x-2)(x-14)$~~

~~B. $y = \frac{1}{6}(x+2)(x+14)$~~

C. $y = \frac{1}{6}(x-2)(x-14)$

D. $y = \frac{1}{6}(x-8)^2 - 6$

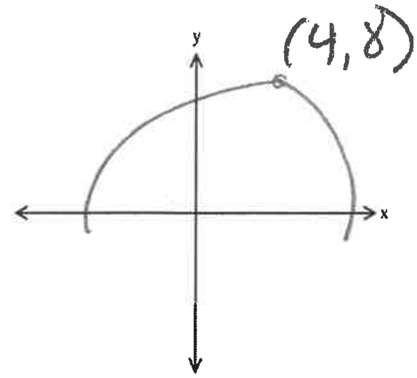
~~E. $y = \frac{1}{6}(x+8)^2 - 6$~~

$x = 2, 14$
$a = +1/6$

Exploration #2: A rainbow can be modeled by $y = -\frac{1}{3}(x-4)^2 + 8$, where x is the horizontal distance in miles, and y is the height of the rainbow in miles.

A) Sketch the graph of the rainbow. Include the vertex.

B) What is the maximum height of the rainbow? $\boxed{\text{8 miles}}$

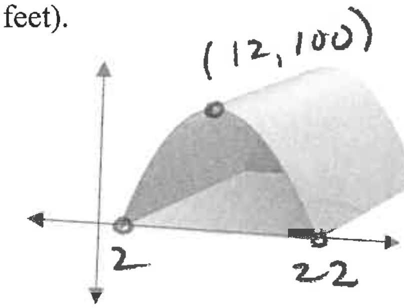


Maximum/Minimum Value of a Quadratic Function:

For #8 – 10: The storage building shown can be modeled by the graph of the function $y = -x^2 + 24x - 44$ where x is the horizontal width of the building (in feet) and y is the height (in feet).

8) What is the width of the building at the base?

x-intercepts



$0 = -x^2 + 24x - 44$

$-(x^2 - 24x + 44)$

$-(x - 22)(x - 2)$ $x = 22, 2$

$\boxed{20 = \text{width}}$

9) What is the height of the building at a horizontal distance of $x = 5$?

What is y when x is 5?

$f(5) = -5^2 + 24(5) - 44 = \boxed{51}$

Challenge: 10) What is the maximum height of the storage building?

→ what's vertex?

$-x^2 + 24x - 44$

$-(x^2 - 24x \overset{+144}{}) - 44 + 144$

$-(x - 12)^2 + 100$ $\boxed{100}$

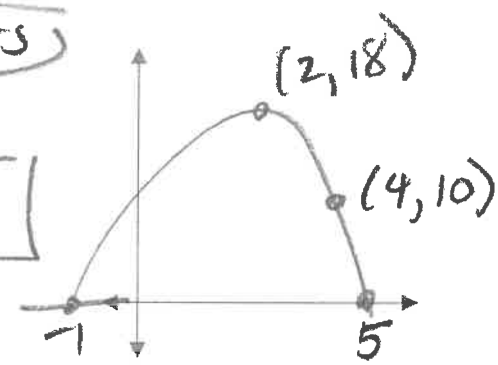
You try #11 – 13! A ball is thrown, and the height h (in meters) as a function of time t (in seconds) is given by $h(t) = -2t^2 + 8t + 10$.

11) At what time does the ball hit the ground? x-intercepts

$-2t^2 + 8t + 10$

$-2(t^2 - 4t - 5)$

$-2(t-5)(t+1) \Rightarrow t = 5, -1$ $\boxed{5}$



12) What is the height of the ball when $t = 4$ seconds? vertex $-2t^2 + 8t + 10$

$-2(t^2 - 4t + 4) + 10 + 8 \Rightarrow -2(t-2)^2 + 18$ $\boxed{18}$

oops

Challenge: 13) What is the maximum height of the ball?

$h(4) = -2(4)^2 + 8(4) + 10 = \boxed{10}$

Challenge: 14) At what time(s) is the height of the ball 16 meters?

$16 = -2t^2 + 8t + 10$

$-16 \qquad\qquad -16$

$0 = -2t^2 + 8t - 6$

$0 = -2(t^2 - 4t + 3) \Rightarrow -2(t-3)(t-1)$

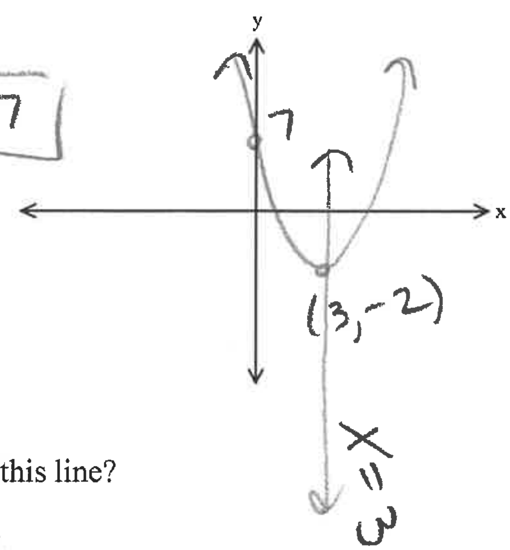
$\boxed{t = 3, 1}$

Example 15) Consider the function $y = (x-3)^2 - 2$.

a) Find the vertex. $\boxed{(3, -2)}$

b) Find the y-intercept. $(0-3)^2 - 2 = 9 - 2 = \boxed{7}$

b) Sketch the function. Include the vertex and y-intercept.



c) **Challenge:** Find the x-intercepts.

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

$2 = (x-3)^2$

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

d) Draw a vertical line through the vertex. What is the equation of this line?

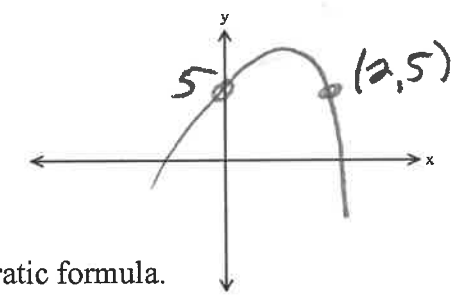
$\boxed{x = 3}$

Axis of Symmetry:

Example 16: A football is kicked in the air, and its path can be modeled by the equation $f(x) = -16x^2 + 32x + 5$, where x is the time (in seconds) and $f(x)$ is the height in feet.

A. What is the height of the football after 2 seconds?

$f(2) = -16(2)^2 + 32(2) + 5 = 5$



B. What is the starting height of the football when it was first kicked?

y-int = 5

C. At what horizontal distance will the football hit the ground? Use the quadratic formula. Write your answer as a decimal, rounded to the nearest tenth.

x-intercepts

$0 = -16x^2 + 32x + 5$

$\frac{-32 \pm \sqrt{32^2 - 4(-16)(5)}}{2(-16)} = \boxed{2.028},\ \cancel{-.028}$

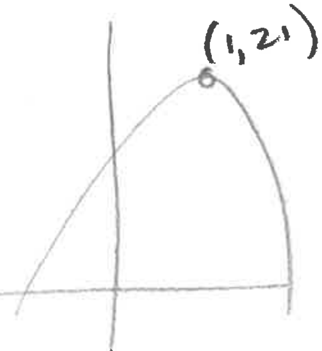
D. What is the maximum height reached by the football?

vertex

$-16(x^2 - 2x + 1) + 5 + 16$

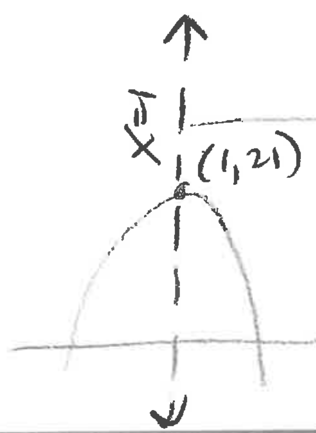
$-16(x-1) + 21$

$(1, 21)$



E. What is the equation for the axis of symmetry?

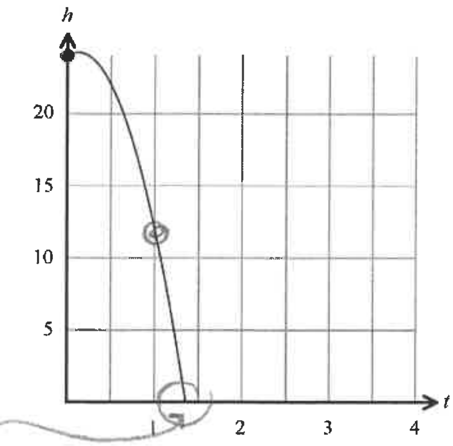
$\boxed{x = 1}$



You try #17! The height (h), in feet, of Jon jumping off a rock into a lake can be modeled by the equation $h(t) = -16t^2 + 4t + 24$, where t represents the time in seconds after Jon has jumped off the rock.

A) What is Jon's height after 1 second?

$h(1) = -16(1)^2 + 4(1) + 24 = \boxed{12}$



B) What is the height of the rock?

y-intercept $= \boxed{24}$

C) After how many seconds does Jon enter the water? Use the quadratic formula. Round to the nearest tenth.

We know ≈ 1.3 but to get exact use quad. form.

$$\frac{-4 \pm \sqrt{16-4(-16)(24)}}{2(-16)} = -1.106, \boxed{1.356}$$

Graphing Quadratics

Form	What it tells us	Read about it in your notes!
Intercept Form $y = a(x-p)(x-q)$	• x-intercepts at $(p, 0)$and $(q, 0)$ • The y-intercept can be found by substituting x with 0, and solving for y.	Section 9.3
Standard Form $y = ax^2 + bx + c$	• The y-intercept is at c. • Factor the function, set equal to 0, and solve to find the x-intercepts. • If the function does not factor, then the x-intercepts can be found by using the quadratic formula.	Section 9.3
Vertex Form $y = a(x-h)^2 + k$	• The vertex is at (h, k). • The y-intercept can be found by substituting x with 0, and solving for y.	Chapter 8; reviewed in 9.5

Solving Quadratics

Technique	Hints and Steps	Read about it in your notes!
Solving by Factoring $ax^2 + bx + c = 0$	• Get a 0 on one side of the equation. • Factor completely. • Set each factor = 0 and solve	Section 9.2
Solving by the Quadratic Formula $ax^2 + bx + c = 0$	• Get a 0 on one side of the equation • Use $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$	Section 9.4
Solving by Systems	• Set up a system, with one function for each side of the equation. • Graph each function. • Find the point(s) of intersection.	Section 9.5

Dividing Radicals

Hints and Steps	Read about it in your notes!
• Reduce the fraction, if possible. • Simplify the radicals, if possible, by taking out perfect square factors. • Rationalize if there is a radical on the denominator.	Section 9.1