NOTES: SECONDARY 2 HONORS

SOLVE A QUADRATIC BY FACTORING AND TAKING SQUARE ROOTS (4.2, 4.3)

STARTER

1. Factor using either method $3x^2+5x+2$

$(x+1)(3x+2)$

2. Factor using either method $6x^2+7x-3$

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

3. Solve for x. $2x^2=18$

$x=\pm 3$

4. Simplify $3\sqrt{144x^3}$

$36|x|\sqrt{x}$

5. Simplify $-5\sqrt{72x^5}$

$-30x^2\sqrt{2x}$

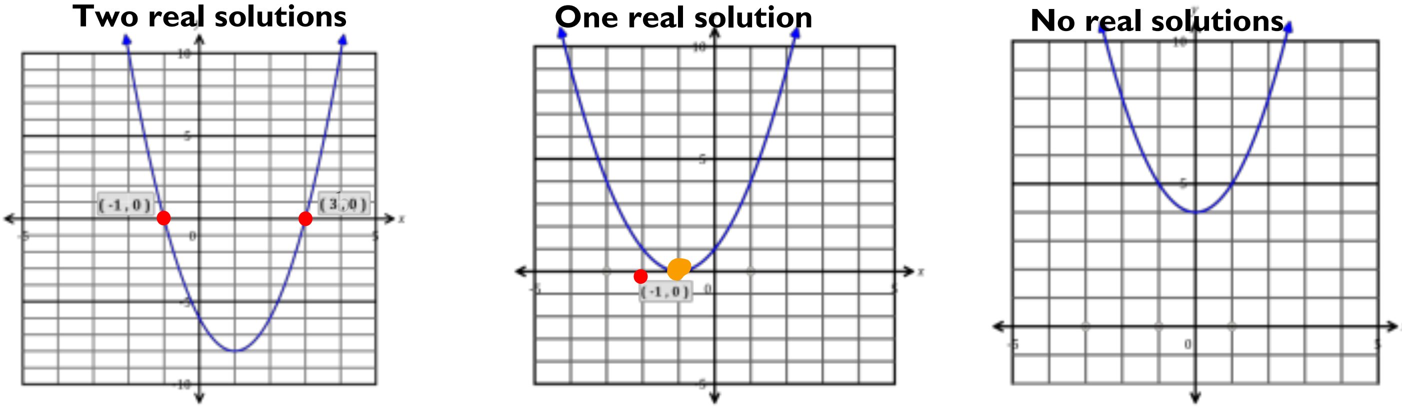
Vocabulary

Forms of **Quadratic Functions,** where $a \neq 0$	
• Standard Form: $f(x)=ax^2+bx+c$	$f(x)=2x^2+4x-6$
• Vertex Form: $f(x)=a(x-h)^2+k$	$f(x)=2(x-1)^2-8$
• Factored Form *or* Intercept Form: $f(x)=a(x-p)(x-q)$	$f(x)=2(x+3)(x-1)$

- x-intercept: The point (x,y) that represents the real number solution to the equation. Where the graph intersects the x-axis.
- zeros/roots: The x-values of a quadratic function that makes the function equal to zero. zeros/roots/x-intercepts are interchangeable.
- Zero Product Property: Any number multiplied by zero equals zero. ab=0, then a=0 or b=0.

The *x*-intercept(s) represent the real number solution(s) to the quadratic equation.

Two real solutions **One real solution** **No real solutions**



What is the meaning of "zero of a function"?

a. Algebraically: The values of x that make the function equal to zero.

b. Graphically: where the graph crosses the x-axis.

Example:

1. Identify the zeros of $f(x) = 3x(x+5)$

$\frac{3x}{3} = \frac{0}{3}$ $\quad x + 5 = 0$

$\quad\quad\quad\quad\quad -5\ -5$

$\boxed{x=0}$ $\boxed{x=-5}$

2. Identify the zeros of $g(x) = -3(x+2)(x-7)$

$\cancel{-3 \neq 0}$ $\quad x+2=0$ $\quad x-7=0$

$-2\ -2$ $\quad +7\ +7$

$\boxed{x=-2}$ $\boxed{x=7}$

3. Find the zeros of the quadratic equation $3x^2 - 12 = 0$

$3x^2 - 12 = 0$

$+12\ +12$

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

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

$\boxed{x = \pm 2}$

$x=2$ $\quad x=-2$

4. Find the zeros of the quadratic equation $x^2 - 36 = -5x$

$+5x \quad +5x$

$x^2 + 5x - 36 = 0$

$(x+9)(x-4) = 0$

$x+9=0$ $\quad x-4=0$

$\boxed{x=-9}$ $\boxed{x=4}$

5. Write a quadratic equation with solutions of 2 and -3.

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

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

6. Write a quadratic equation with solutions of 0 and 4.

$(x-0)(x-4)$

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

GRAPH THE QUADRATIC FUNCTION $f(x) = x^2 + 2x - 8$

1st: Identify the zeros of $f(x) = x^2 + 2x - 8$

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

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

$\boxed{x=-4}$ $\boxed{x=2}$

2nd: Write the x-intercepts as a coordinate. (NOTE: All x-intercepts are in the form (,0))

$(-4,0)$ and $(2,0)$

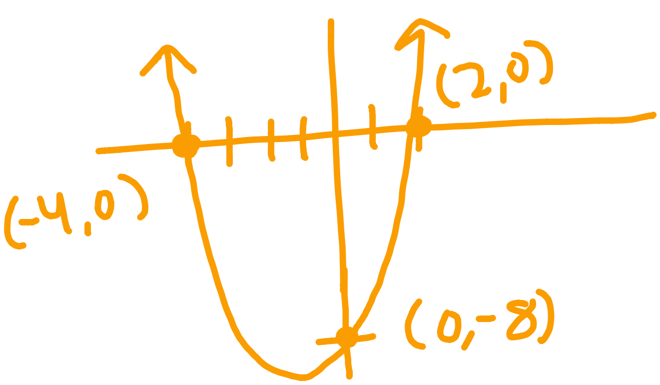
3rd: Determine the y-intercept. $(x=0)$

$f(0) = (0)^2 + 2(0) - 8$

$= -8$

$(0,-8)$

4th: Plot the intercepts and sketch the graph



Practice Exercises E

a) Algebraically find the zero(s) of the function.
b) Using the zeros, determine the *x*-intercept(s) of the graph.
c) Graph the function using a graphing calculator.
d) Compare the *x*-intercept(s) you found in *part b* with the *x*-intercept(s) on a graphing calculator. Are the *x*-intercepts the same? If not, why?

1. $f(x) = 2x(x - 6)$

zero(s): $x = 0, 6$

x-intercept(s):
(0,0) (6,0)

2. $f(x) = -x(x + 7)$

zeros: $x = 0, -7$

x-intercept(s):
(0,0) (-7,0)

3. $f(x) = (x + 13)(x - 4)$

zeros: ____________

x-intercept(s):

____

4. $f(x) = x^2 + 8x + 12$

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

zeros: $x = -6, -2$

x-intercept(s):
(-6,0) (-2,0)

5. $f(x) = x^2 - 7x + 6$

zeros: ____________

x-intercept(s):

____

6. $f(x) = x^2 + 4x + 4$

$0 = (x+2)^2$

zeros: $x = -2$

x-intercept(s):
(-2,0)

7. $f(x) = x^2 + 8x + 12$

zeros: ____________

x-intercept(s):

____

8. $f(x) = x^2 - 2x - 15$

zeros: ____________

x-intercept(s):

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9. $f(x) = x^2 - x - 2$

zeros: ____________

x-intercept(s):

____

SOLVING QUADRATIC EQUATIONS USING SQUARE ROOTS

Example:

1. Solve the equation $2x^2 + 5 = 41$

$-5 \quad -5$

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

$x^2 = 18$

$x = \pm\sqrt{18}$

$9 \cdot 2$

$3 \cdot 3$

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

2. Solve the equation $3(x-3)^2 = 12$

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

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

$x - 3 = \pm 2$

$x - 3 = 2 \qquad x - 3 = -2$

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

3. Solve the equation $4(x+7)^2 - 8 = 24$

$+8 \quad +8$

$\frac{4(x+7)^2}{4} = \frac{32}{4}$

$\sqrt{(x+7)^2} = \sqrt{8}$

$x + 7 = \pm 2\sqrt{2}$

$\boxed{x = -7 \pm 2\sqrt{2}}$

Example: Given the function $f(x) = (x+1)^2 - 4$

a. Determine the x-intercepts.
b. Determine the vertex.
c. Determine if the vertex is a maximum or minimum.
d. Determine the y-intercept.
e. Sketch a graph (label the intercepts and vertex).

a.) $0 = (x+1)^2 - 4$

$4 = (x+1)^2$

$\pm 2 = x + 1$

$x + 1 = 2 \qquad x + 1 = -2$

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

$\boxed{(1, 0)}$ and $\boxed{(-3, 0)}$

b.) vertex: $(-1, -4)$

c.) min value at -4 when $x = -1$

d.) $f(0) = (0+1)^2 - 4$

$= (1)^2 - 4$

$= 1 - 4$

$= -3$

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

e.)