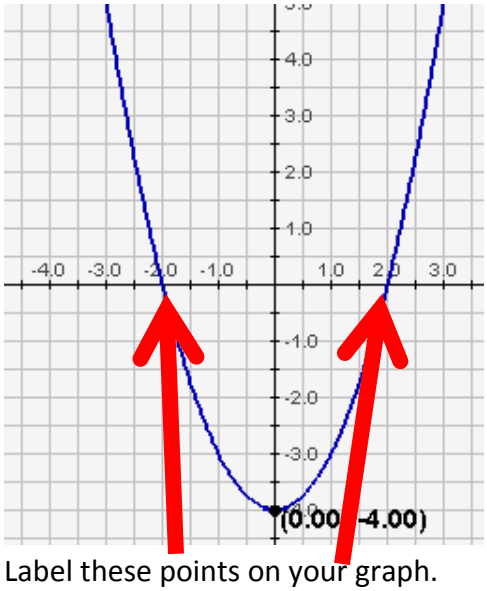
The Quadratic Family **Name: _____**

A 2nd degree polynomial function is called a ___Quadratic Function_____.

General form for a quadratic function is *y* = _____ax^2+bx+c_____.

A quadratic function's shape is a _____parabola_____.



Label these points on your graph.

Label the vertex on the parabola.
The coordinates of the vertex
___(0, -4)_____

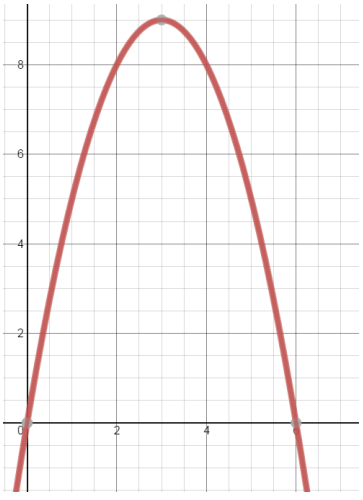
Intercepts:

The *y* value for any *x*-intercept is always this number:
___zero_____

Therefore, we call the points where the parabola crosses the *x-axis* this term:
___zeros_____

Check your understanding:

1) Sketch a parabola that is concave down (the parabolas vertex is the maximum value of the parabola, the arrows of a sketch would be pointing down) with zeros at 6 and 0.



Zero Product Property.

If *a* and *b* are real numbers, and *ab* = 0, then what do we know about *a* and *b*?

a, b, or a and b are equal to zero

Check for understanding:

Use the zero product property to solve these equations.

2) $2x = 0$ x = 0
3) $3x + 9 = 9$ x = 0
4) $2(x + 1)(x - 4) = 0$ x = -1 and x = 4
5) $-7(x - 1/2)(2x + 1) = 0$ x = ½ and x = -1/2
6) $x(x-1)(x-3)=0$ x = 1 and x = 3

Roots of an equation are also its solutions.

Write a statement that connects the idea of solutions, roots, zeros, and *x*-intercepts. This step is key to your success in this unit. YOU MUST understand the connection between all four. How did your neighbor connect them? The x-intercepts of a function are also called zeros, roots, and will help you find the solution to the equation.

When giving answers to questions, here is what I expect your answers to look like:

Let's say I ask for the solutions to a quadratic…answers should look like *x* = #, #

What if I ask for the roots…answers should look like *roots are* # and #

How about the zeros…answers should look like *zeros are* # and #

Finally, the *x-intercepts* should be given as a point…like this (#, 0) and (#, 0)

Check for understanding:

7) Find the solutions, roots, zeros, and *x-intercepts* of $0 = -\frac{1}{4}(x + 2.1)(x - 7)$

Solutions x = -2.1, x = 7 Roots are -2.1 and 7
Zeros are -2.1 and 7 x-int (-2.1, 0) and (7, 0)

When dealing with quadratics, there are 3 different forms we need to be familiar with. I have typed them below. This whole unit is based around these three forms. You need to know them to be successful.

***a* is the scale factor in all three forms. It does not change from form to form.**

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

Vertex Form: $y = a(x-h)^2 + k$ where (*h, k*) is the vertex.

Factored Form: $y = a(x-r_1)(x-r_2)$ where r_1 and r_2 are the roots.

Example: A parabola has *x-intercepts* at (-1, 0) and (3, 0) and has a vertex at (1, -4). Give the equation in all three forms.

My first hint: never start with general form.
My Second Hint: if they give you the vertex in the problem, start with vertex form. If they give they roots in the problem, use factored form. If they give you both, choose your favorite (like the example above gives us both the vertex and the roots)

Vertex Form

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

Plug in the vertex here:

$$\boldsymbol{y = a(x-1) - 4}$$

Factored Form

$y = a(x-r_1)(x-r_2)$

We know the *x-int* are also the roots; -1, 3. Plug them in here:

$$\boldsymbol{y = a(x+1)(x-3)}$$

To find the value of *a*, use a point that goes through the parabola (given in the problem) and plug it in for *x* and *y*. Solve for *a*. Remember that once you find *a*, it is the same in all three forms.

$0 = a(-1-1)^2 - 4$
$0 = a(4) - 4$
$4 = a(4)$
$a = 1$

Or

$-4 = a(1+1)(1-3)$
$-4 = a(2)(-2)$
$-4 = a(-4)$
$a = 1$

Final: $y = (x-1)^2 - 4$

Final: $y = (x+1)(x-3)$

Chose one of these to simplify into general form. You will have to box or foil to do so!

Final: $y = x^2 - 2x - 3$

If you were to graph all three of these parabolas, what would happen? (Same Graph)

Check for understanding.

7. Given roots at 7 and 2, find the factored form equation and general form equation if the curve passes through (4, -16)

Answers: $y = -\frac{8}{3}(x-7)(x-2)$
$y = -\frac{8}{3}x^2 + 24x - \frac{112}{3}$

8. Given $y = -3(x-3)^2 + 4$

   Find the vertex: (3, 4)

   The exact *x-intercepts*, simplified. (this is difficult) $(3+\sqrt{\frac{4}{3}}, 0)$ and $(3-\sqrt{\frac{4}{3}}, 0)$

   General Form: $y = -3x^2 + 18x - 23$

9. If you are given a parabola with a vertex at (1, 7), find the equation in vertex form and general form if the curve passes through (-5, 2).

Vertex: $y = \frac{-5}{36}(x-1)^2 + 7$
General: $y = -\frac{5}{36}x^2 + \frac{5}{18}x + \frac{247}{36}$

10. If a parabola has a zero at -6 and the vertex is (-2, -16), find the equation in all three forms.

Vertex: $y = (x+2)^2 - 16$
General: $y = x^2 + 4x - 12$

Because of the line of symmetry, we know that -6 is 4 units away from the vertex, therefore, 2 would be four units away, meaning 2 is a root as well. So…
Factored: $y = (x+6)(x-2)$. When will we run into problems??