Algebra I

Lesson 9.5 – Solving Quadratic Equations by Graphing

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When we work with a quadratic function we are looking at the relationship between the independent variable **x** and the dependent variable **y.** These variables seem random, but if we apply real life situations to the variables we will see a need using quadratics. When we lob a projectile over a castle wall how can we determine the maximum height? How long will it take before it lands? What about a dolphin leaping out of the water; how high will it go, and how long before it reenters the water? The height of a football may be modeled by a quadratic equation. The number of bacteria in refrigerated food is related to the temperature at which it is kept, and yes, this too is a quadratic equation. What is most frequently looked for is where the parabola crosses the x-axis. Hence we set the quadratic equal to zero, and solve for values of x when y =0. (yes, we also look for the minimum and maximum too).

Vocabulary

Quadratic equation – a single variable 2nd degree polynomial equation written in terms of **x** and equal to zero.

Standard form – $ax^2 + bx + c = 0$

Solution to a quadratic equation – with $y = 0$, solutions are x-intercepts.

X-intercepts – zeros, roots, solutions. You must be comfortable and recognize each of these terms as meaning the same thing. Answers will be written either as x-y ordered pairs, (x,0) or in set notation listing the x=solutions, $\{x_1, x_2\}$

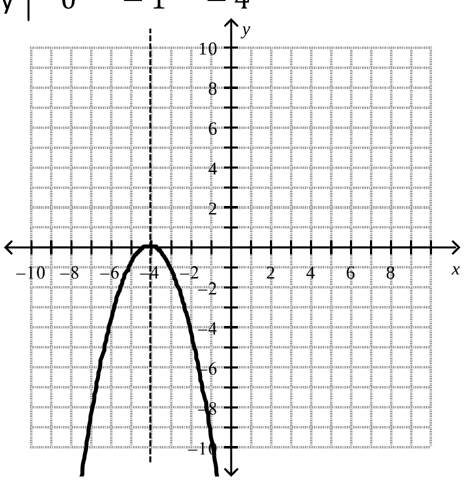
Solving a quadratic equation may be accomplished by graphing. To graph we need to go back to the function form: $ax^2 + bx + c = 0$. The solutions will be the x-intercepts. Remember! There may be 1, 2 or no x-intercepts/solutions.

Graph the following equations:

$$x^2 - 8x - 16 = 2x^2$$
$$-x^2 - 8x - 16 = 0$$
$$x = -\frac{b}{2a} = -\frac{(-8)}{2(-1)} = -\frac{8}{2} = -4$$
$$-(-4)^2 - 8(-4) - 16 = 0$$

$$= -4\ axis\ of\ symmetry\ \&\ (-4,0)\ vertex$$
$$c = -16, \quad the\ y\ incpt.$$
$$LC\ is\ negative: \quad opens\ down$$

x	-4	-3	-2
y	0	-1	-4



$zero: \ -4$

1. Get into standard form
2. Rewrite in the related function form ($y = 0$)
3. Calculate the axis of symmetry
4. the axis of symmetry will lead us the vertex

5. ***c*** is the y-intercept;

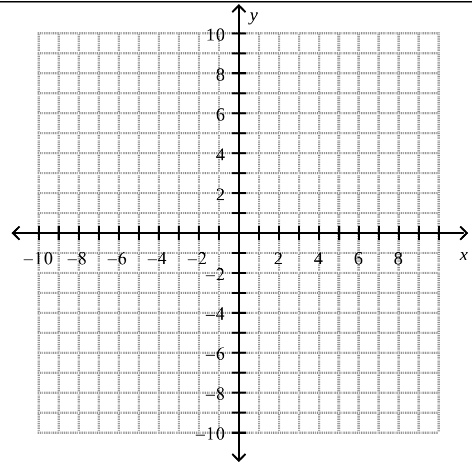
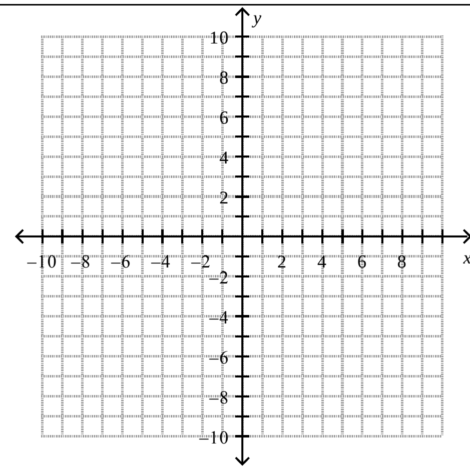
6. leading coefficient
$\pm$, *are we happy/open up or sad/open down?*

7. Calculate 2 other points

8. Graph the points and reflect them across the axis of symmetry.

9. Carefully graph your parabola. Where does the parabola cross the x-axis? These values will be your zeros/solutions/x-intercepts/roots.

You try:

$6x + 10 = -x^2$	
$3x^2 - 27 = 0$	
A dolphin jumps out of the water. The quadratic function $y = -16x^2 + 32x$ models the dolphin's height above the water after *x* seconds. About how long is the dolphin out of the water? Keep in mind height above the water at 0 seconds is 0. So we only need Quadrant 1. Use your graphing calculator to determine the answer.