Algebra 1: 11.4 Notes & CW/HW **Name** ____ **Period** _____

Factored Form of a Quadratic Function

Let's Review

What is a quadratic function?

A polynomial of degree 2 (the highest exponent is 2). The graph is a "U" shaped curve called a parabola.

Examples: $5x^2 + 7$ $6x^2 + 3x - 1$ $9x^2$

What are 2 forms of writing a quadratic function?

Standard form	$y = ax^2 + bx + c$, where $a \neq 0$
Vertex form	$y = a(x - h)^2 + k$, where $a \neq 0$

3rd Form: Writing a Quadratic Function in Factored Form

$y = a(x - r_1)(x - r_2)$, where $a \neq 0$

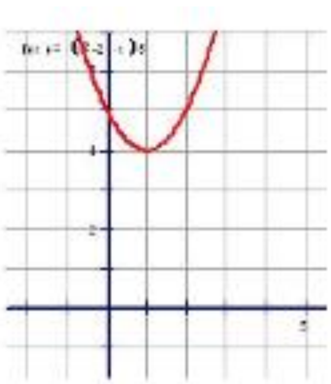
r_1 and r_2 = x-coordinates of the solution, written as $(r_1, 0)$ and $(r_2, 0)$.

Solutions for Quadratic Functions

When you graph a quadratic equation, the solutions are the x-intercepts or the point(s) where the parabola crosses the *x*-axis.

The *x*-intercepts also called the zeros or roots.

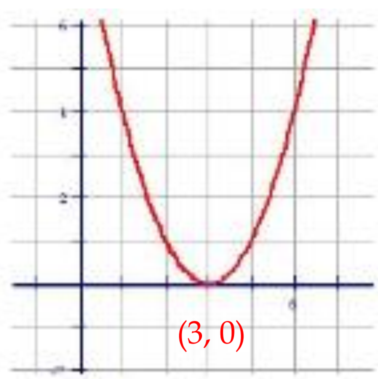
How many solutions does each parabola have?



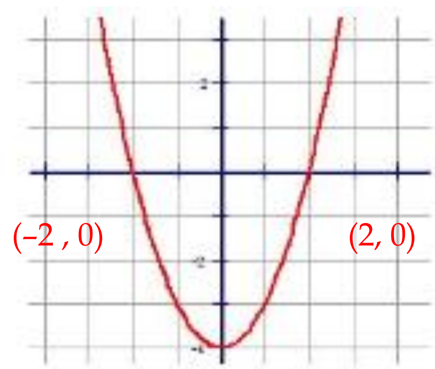
No solution

Why is there no solution?

There are no *x*-intercepts.



1 solution



2 solutions

Can a parabola have more than two real solutions?

A quadratic equation can have 0, 1, or 2 real solutions.

Solving Quadratic Functions in Factored Form

Use the ***Zero Product Property***: If $ab = 0$, then $a = 0$ or $b = 0$.

Think about It! If $4 \cdot b = 0$, what is the value of b? 0

Let's Look at an Example! How do we find a solution?

If $(x + 4)(x - 3) = 0$, then $(x + 4) = 0$ **or** $(x - 3) = 0$

$$\begin{array}{rr} x + 4 = 0 \\ -4 \quad -4 \\ x = -4 \end{array} \qquad \begin{array}{rr} x - 3 = 0 \\ +3 \quad +3 \\ x = 3 \end{array}$$

Point out that this just a sign change, $x + 4 = 0$ means $x = -4$

Solutions: $(-4, 0)$ and $(3, 0)$

Is the y-coordinate always 0? Why?

Find the solution(s) or x-intercept(s) for each quadratic function written in factored form.

1. $(x + 7)(3x - 1) = 0$

   $x + 7 = 0$ $\quad$ $3x - 1 = 0$

   $x = -7$ $\quad$ $x = \frac{1}{3}$

   Solutions: $(-7, 0)$ and $\left(\frac{1}{3}, 0\right)$

2. $(4s + 8)(s + 9) = 0$

   $4s + 8 = 0$ $\quad$ $s + 9 = 0$

   $s = -2$ $\quad$ $s = -9$

   Solutions: $(-2, 0)$ and $(-9, 0)$

3. $j(j - 8) = 0$

   $j = 0$ $\quad$ $j - 8 = 0$

   $j = 0$ $\quad$ $j = 8$

   Solutions: $(0, 0)$ and $(8, 0)$

4. $(x - 4)(3x - 12) = 0$

   $x - 4 = 0$ $\quad$ $3x - 12 = 0$

   $x = 4$ $\quad$ $x = 4$

   Solution: $(4, 0)$

5. $\frac{1}{2}(x-4)(x+1) = 0$

   $x - 4 = 0$ $\quad$ $x + 1 = 0$

   $x = 4$ $\quad$ $x = -1$

   Solutions: $(4, 0)$ and $(-1, 0)$

6. $-(x - 3)(x - 11) = 0$

   $x - 3 = 0$ $\quad$ $x - 11 = 0$

   $x = 3$ $\quad$ $x = 11$

   Solutions: $(3, 0)$ and $(11, 0)$

Writing a Quadratic Function in Factored Form

We need to know two things!

If the parabola opens DOWN, add a "–" in front of the factors.

1. Does the parabola open up or down?
2. What are the x-intercepts?

Let's Look at an Example! How do we write a quadratic function in factored form?

The parabola opens UP and x-intercepts are (2, 0) and (4, 0).

If (2, 0) is a solution, then $x = 2$.

$$\begin{aligned} x &= 2 \\ \underline{-2} &\quad \underline{-2} \\ x - 2 &= 0 \end{aligned}$$

If (4, 0) is a solution, then $x = 4$.

$$\begin{aligned} x &= 4 \\ \underline{-4} &\quad \underline{-4} \\ x - 4 &= 0 \end{aligned}$$

Work backwards! Point out that this just a sign change, $x = 2$ means $x - 2 = 0$.

$f(x) = \underline{(x - 2)(x - 4)}$

Write a quadratic equation in factored using the given information.

1. The parabola opens DOWN and the x-intercepts are (–3, 0) and (1, 0).

   $f(x) = -(x + 3)(x - 1)$

2. The parabola opens UP and the x-intercepts are (3.5, 0) and (–4.3, 0).

   $f(x) = (x - 3.5)(x + 4.3)$

3. The parabola opens DOWN and the x-intercepts are (0, 0) and (5, 0).

   $f(x) = -x(x - 5)$ or $f(x) = -(x - 0)(x - 5)$

4. The parabola opens UP and the x-intercepts are $\left(-\frac{1}{2}, 0\right)$ and $\left(-\frac{3}{4}, 0\right)$.

   $f(x) = \left(x + \frac{1}{2}\right)\left(x + \frac{3}{4}\right)$

5. The parabola opens DOWN and the x-intercepts are (4, 0) and (–2, 0).

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

6. The parabola opens UP and the x-intercepts are (1, 0) and $\left(\frac{2}{3}, 0\right)$.

   $f(x) = (x - 1)\left(x - \frac{2}{3}\right)$