Key 2/24/2020

# Unit 9: Solving Quadratic Equations

*After completion of this unit, you will be able to…*

**Learning Target #9.1: Solving Quadratic Equations**

- Solve a quadratic equation by factoring a GCF. /
- Solve a quadratic equation by factoring when a is not 1.
- Create a quadratic equation given a graph or the zeros of a function.
- Solve a quadratic equation by finding square roots.
- Solve a quadratic equation by completing the square.
- Solve a quadratic equation by using the Quadratic Formula.
- Solve a quadratic equation by analyzing the equation and determining the best method for solving.
- Solve application problems using quadratic equations.

**Timeline for Unit 9**

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| **24**<br>*Day 1*<br>Solving by Factoring | **25**<br>*Day 2*<br>Solving by Factoring | **26**<br>*Day 3*<br>Solving by Square Roots | **27**<br>*Day 4*<br>Solving by Square Roots | **28**<br>*Day 5*<br>Solving by Completing the Square |
| **2**<br>*Day 6*<br>Solving by Quadratic Formula | **3**<br>*Day 7*<br>Solving by Quadratic Formula | **4**<br>*Day 8*<br>Quadratic Formula Applications | **5**<br>Day 9<br>Determining Best Method and Review Day | **6**<br>**Day 10**<br>**9.1 Learning Assessment** |

## <u>Tutoring Times</u>

Tuesday and Thursday 7:40-8:15

## Review of Factoring Types

### Factoring A = 1

*Solve:* $x^2 + 3x - 18 = 0$

GCF

$a = 1$

$b = 3$

$c = -18$

$-18$

$-3$ $-6$

$3$

$\frac{-3}{1}$ $\frac{6}{1}$

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

$x - 3 = 0$ $x + 6 = 0$

$x = 3$ $x = -6$

### Difference of Two Squares

*Solve:* $x^2 - 16 = 0$

$a = 1$

$b = 0$

$c = -16$

$-16$

$4$ $-4$

$0$

$\frac{4}{1}$ $\frac{-4}{1}$

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

$x + 4 = 0$ $x - 4 = 0$

$x = -4$ $x = 4$

### Factoring A not 1

*Solve:* $2x^2 - 13x + 15 = 0$

$a = 2$

$b = -13$

$c = 15$

$30$

$-3$ $-10$

$-13$

$\frac{-3}{2}$ $\frac{-10}{2} = \frac{-5}{1}$

$(2x-3)(x-5)$

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

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

$2x = 3$ $x = 5$

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

### Factoring by GCF

*Solve:* $x^2 - 6x = 0$

GCF $= x$

$x\,\boxed{x^2 \mid -6x}$

$x - 6$

$x(x-6) = 0$

$x = 0$ $x - 6 = 0$

$x = 6$

### Factoring with GCF & A = 1

*Solve:* $3x^2 - 3x - 60 = 0$

GCF $= 3$

### Factoring with GCF and A not 1

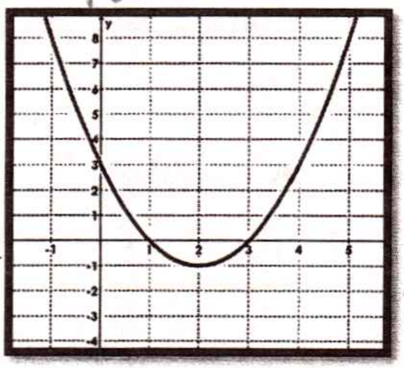
*Solve:* $10x^2 - 22x + 4 = 0$

GCF $= 2$

# Day 1 & 2: Solving by Factoring

Take a look at the following graph. Do you know what type of graph it is? List some of the things you see:

Feet



Time

Opens up so A value is positive
vertex 2, -1
$y=(x-2)^2-1$
Axis of symetry $x=2$
find zeros - they are at 1 + 3
y intercept (0,3)

**The Main Characteristics of a Quadratic Function**

- A quadratic function always has an exponent of 2. Therefore, a quadratic function always has the term of $x^2$.
- The standard form of a quadratic equation is $f(x) = Ax^2 + bx + c$
- The U-shaped graph is called a Parabola.
- The highest or lowest point on the graph is called the Vertex.
- The points where the graph crosses the x-axis are called the X intercept or Zeros or Solution or Roots.
- The points where the graph crosses are also called the Solutions to the quadratic equation. A quadratic equation can have None, One, or two solutions.

In this unit, we are going to explore how to solve quadratic equations. The solutions to the quadratic equations can look very different depending on what the graph of the quadratic equation looks like. We are going to explore what we learned in Unit 7 (factoring) and how we can apply that to solving quadratic equations.

## Exploration with Factoring and Quadratic Graphs

Find the zeros of the following graphs and then factor the expressions on the right:

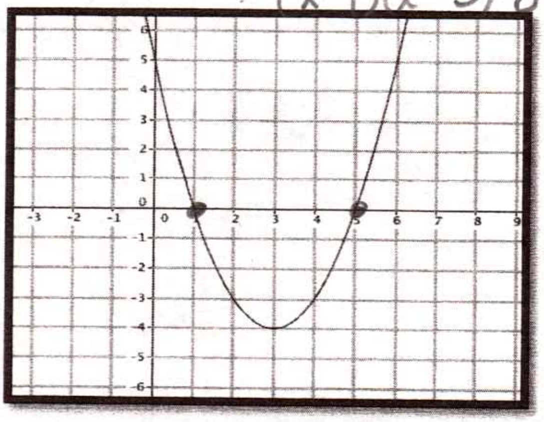
1. $y = x^2 - 6x + 5$

a=1
b=-6 -1
c=5

5, -1, -5, -6

⇒ $\frac{-1}{1}$ $\frac{-5}{1}$

(x-1)(x-5)=y

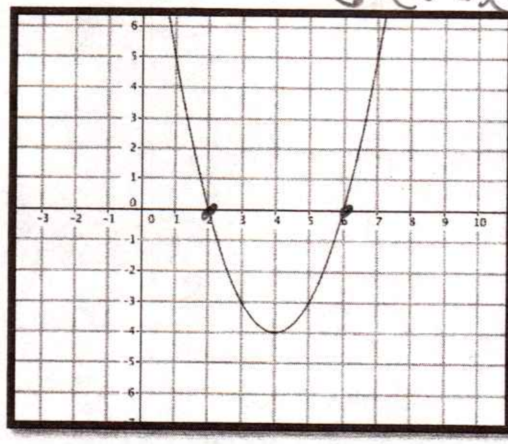


2. $y = x^2 - 8x + 12$

a=2
b=-8 -6
c=6

12, -6, -2, 8

y=(x-6)(x-2)



3. $y = x^2 + 3x$

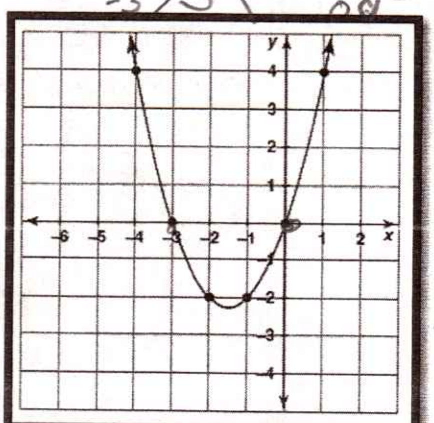
$\frac{0}{1}$ $\frac{3}{1}$

a=1
b=3
c=0

0, 0, 3, 3, -3

y=(x+0)(x+3)

y=x(x+3)



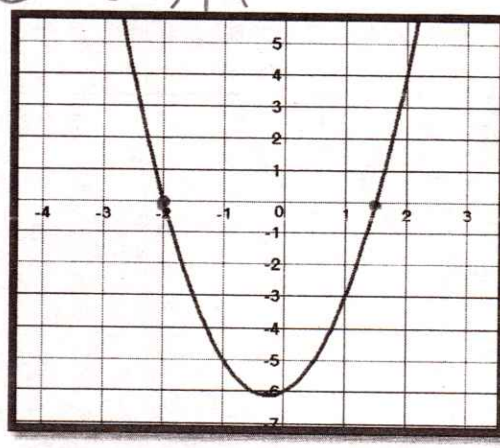
4. $y = 2x^2 + x - 6$

a=2
b=1
c=-6

-12, 4, -3, 1

$\frac{4}{2}$ $\frac{-3}{2}$

y=(x+12)(2x-3)



a. What do you notice about the zeros on the graph and the factored form of your equation?

b. What is the value of y when the parabola crosses the x-axis for each graph?

c. If you were to replace the y in your equation, with your answer in part b, how do you think you could solve your equations so your answers match the zeros on your graph?

## Zero Product Property and Factored Form

A polynomial or function is in ***factored form*** if it is written as the product of two or more linear binomial factors. The **zero product property** is used to solve an equation when one side is zero and the other side is a product of binomial factors.

**Examples:** a. $(x-2)(x+4)=0$ b. $x(x+4)=0$ c. $(x+3)^2=0$

a. $x-2=0$ or $x+4=0$
$x=2$ $x=-4$

b. $x=0$ or $x+4=0$
$x=-4$

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

**Practice**: Identify the zeros of the functions:

a. $y=(x+4)(x+3)$ b. $f(x)=(x-7)(x+5)$ c. $y=x(x-9)$ d. $f(x)=5(x-4)(x+8)$

a. $x+4=0$ $x+3=0$
$x=-4$ $x=-3$

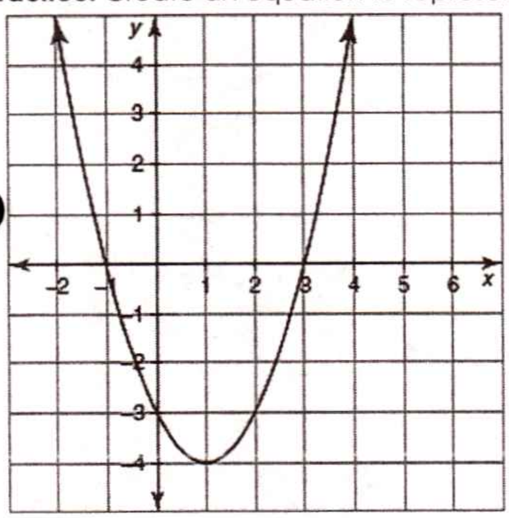
b. $x-7=0$ $x+5=0$
$x=7$ $x=-5$

c. $x=0$ $x-9=0$
$x=0$ $x=9$

d. $5=0$ $(x-4)(x+8)$
$5\neq0$ $x=4$ $x=-8$

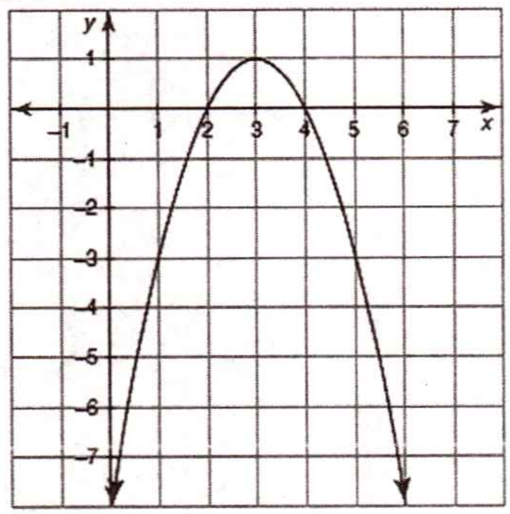
Using the zero product property, go back and solve your factored equations for their zeros on page 3.

**Practice:** Create an equation to represent the following graphs:




x = _____ & _____

y = ____________________




x = _____ & _____

y = ____________________

In this unit, you will be solving quadratic equations. In order to understand what we mean by "solving" quadratic equations, you must understand exactly what we will be solving for from an equation.

| **Solving a quadratic equation really means:** |
|---|
| |

The place(s) where the graph crosses the x-axis has several names. They can be referred as:

X intercept ______ Zero ______ Solution ______ Roots ______