TOPIC: SOLVING QUADRATIC EQUATIONS
Intro to Quadratic Equations

● If you take a **linear equation** and add an _____ term, you get a **quadratic equation!**

  ▪ Also called a polynomial of *degree 2.*

$$\underline{\hspace{2cm}} \; 2x - 6 = 0$$

● You will often need to write quadratic equations in *standard form.*

$$\boxed{ax^2 + bx + c = 0}$$

  ▪ All terms are on the **same** side in *descending* order of _____.

EXAMPLE: Write each given quadratic equation in standard form. Identify $a, b,$ and c.

(A)

$$5x^2 = x - 3$$

$a = \underline{\hspace{1.5cm}}$

$b = \underline{\hspace{1.5cm}}$

$c = \underline{\hspace{1.5cm}}$

(B)

$$-2x^2 + \frac{5}{3} = 0$$

$a = \underline{\hspace{1.5cm}}$

$b = \underline{\hspace{1.5cm}}$

$c = \underline{\hspace{1.5cm}}$

PRACTICE**:** Write the given quadratic equation in standard form. Identify $a, b,$ and c.

$$-4x^2 + x = 8$$

$a = \underline{\hspace{1.5cm}}$

$b = \underline{\hspace{1.5cm}}$

$c = \underline{\hspace{1.5cm}}$

TOPIC: SOLVING QUADRATIC EQUATIONS

Factoring

● To **solve** a quadratic equation, we want to find every value of _____ that makes the equation _____.

   ▪ There are often _____ correct values of x, which we call the **solutions, roots,** or **zeros**.

<table>
<tr><td><u style="color:red">Solving Linear Equations</u></td><td><u style="color:blue">Solving Quadratic Equations</u></td></tr>
<tr><td>

$$2x - 6 = 0$$

$$2x = 6$$

$$x = 3$$

</td><td>

$$x^2 - 5x + 4 = 0$$

</td></tr>
</table>

● We will need to use something else to solve quadratic equations:

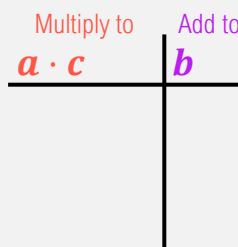● One way to solve a quadratic equation is to **factor** from standard form, then set each factor equal to ___.

$$x^2 + x - 6 = 0$$

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

$$0 \qquad\quad 0$$

   ▪ If the factors **multiplied** $= 0$, one of the **factors** must $= 0$ to make this true.

<u>EXAMPLE</u>**:** Solve the given quadratic equation by factoring.

$$x^2 - 9x = -20$$

Multiply to	Add to
$\boldsymbol{a \cdot c}$	$\boldsymbol{b}$

FACTORING QUAD. EQNS

1) Write eqn in _____ form

2) _____ completely

3) Set factors = ___, solve for x

4) Check solutions in original eqn

TOPIC: SOLVING QUADRATIC EQUATIONS

<u>PRACTICE</u>**:** Solve the given quadratic equation by factoring.

$$3x^2 + 12x = 0$$

<u>PRACTICE</u>**:** Solve the given quadratic equation by factoring.

$$2x^2 + 7x + 6 = 0$$

TOPIC: SOLVING QUADRATIC EQUATIONS
The Square Root Property

● You won't always be able to **factor** to solve quadratics.

  ▪ There are **3 other methods** that you can use:

$x^2 + x - 6 = 0$	$x^2 - 5 = 0$
$(x \quad)(x \quad) = 0$	$(x \quad)(x \quad) = 0$
Factorable? [YES | NO]	Factorable? [YES | NO]

SOLVING QUADRATIC EQUATIONS			
$ax^2 + bx + c = 0$ *(Standard form)*			
FACTORING	**SQUARE ROOT PROPERTY**	**METHOD #3**	**METHOD #4**
USE IF ● Has _____ factors **OR** ● No _____ term ($c = $ __)	● $(x + \#)^2 = [\textbf{constant}]$ **OR** ● No __ term ($b = $ __)		
STEPS **1)** Write eqn in standard form **2)** Factor completely **3)** Set factors = 0, solve for x **4)** Check solutions	**1)** _____ squared expression **2)** Take __ & __ square root **3)** Solve for x **4)** (Optional) Check solutions		

EXAMPLE: Solve the given quadratic equations using the square root property.

(A)
$$(x + 1)^2 = 4$$

(B)
$$4x^2 - 5 = 0$$

● Solutions aren't always whole numbers! They could have _____ and/or _____.

PRACTICE: Solve the given quadratic equation using the square root property.

$$\left(x - \frac{1}{2}\right)^2 - 5 = 0$$

TOPIC: SOLVING QUADRATIC EQUATIONS

PRACTICE**:** Solve the given quadratic equation using the square root property.

$$2x^2 - 16 = 0$$

Imaginary Roots

● You may get imaginary (or complex) roots when using the square root property.

▪ Simplify them as you would any complex number!

EXAMPLE**:** Solve the given quadratic equation using the square root property.

$$4x^2 + 25 = 0$$

SQ. ROOT PROPERTY
1) Isolate squared expression
2) Take $+$ & $-$ square root
3) Solve for x
4) (Optional) Check solutions

Note: When a and c have the same sign in standard form, you will *always* end up with a complex answer.

TOPIC: SOLVING QUADRATIC EQUATIONS
The Quadratic Formula

● The solutions to *ANY* quadratic equation in standard form can be found using the **quadratic formula.**

$$x = \underline{\hspace{5cm}}$$

(Quadratic Formula)

SOLVING QUADRATIC EQUATIONS			
$ax^2 + bx + c = 0$ *(Standard form)*			
FACTORING	**SQ. ROOT PROPERTY**	**COMPLETE THE SQUARE**	**QUADRATIC FORMULA**
USE IF ● Has obvious factors **OR** ● $c = 0$	● $(x + \#)^2 = [\textbf{constant}]$ **OR** ● $b = 0$	● Leading coeff. is 1 **AND** ● b is even	● Can't easily _____ ● Unsure what method to use
STEPS **1)** Write eqn in standard form **2)** Factor completely **3)** Set factors = 0, solve for x **4)** Check solutions	**1)** Isolate squared expression **2)** Take + & − square root **3)** Solve for x **4)** Check solutions	**1)** Simplify eqn to $x^2 + bx = c$ **2)** + $\left(\frac{b}{2}\right)^2$ to <u>both</u> sides **3)** Factor to $\left(x + \frac{b}{2}\right)^2$ **4)** Solve using sqrt prop.	**1)** Write eqn in standard form **2)** Plug a, b, c in quad. form. $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ **3)** Compute & _____ sol'ns

EXAMPLE: Solve each equation using the quadratic formula.

(A)

$$x^2 + 2x - 3 = 0$$

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

$$x = \underline{\hspace{1cm}} \ \& \ x = \underline{\hspace{1cm}}$$

(B)

$$x^2 - 5x = -1$$

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

$$x = \underline{\hspace{1cm}} \ \& \ x = \underline{\hspace{1cm}}$$

TOPIC: SOLVING QUADRATIC EQUATIONS

PRACTICE: Solve the given quadratic equation using the quadratic formula.

$$3x^2 + 4x + 1 = 0$$

PRACTICE: Solve the given quadratic equation using the quadratic formula.

$$2x^2 - 3x = -3$$