By the end of the lesson, you will be able to:

- ~ Solve by using the Quadratic Formula
- ~ Find the Discriminant
- ~ Identify type of roots

Let's complete the square:

$$\int ax^2 + bx + c = 0$$

2.
$$x^{2} + \frac{b}{a}x + \frac{c}{a} = 0$$
Divide by "a".

3.
$$x^{2} + \frac{b}{a}x = -\frac{c}{a}$$
Subtract $\frac{c}{a}$.

4.
$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$
Add $\left(\frac{b}{2a}\right)^2$ to both sides to complete the square.

5.
$$x^{2} + \frac{b}{a}x + \frac{b^{2}}{4a^{2}} = -\frac{c}{a} + \frac{b^{2}}{4a^{2}}$$

$$Factor the left side. Also get a$$

$$common denominator on the right side. (x + \frac{b}{2a})^{2} = -\frac{4ac}{4a^{2}} + \frac{b^{2}}{4a^{2}}$$

6.
$$\sqrt{(x+\frac{b}{2a})^2} = \sqrt[4]{\frac{b^2 - 4ac}{4a^2}}$$
 $x + \frac{b}{2a} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

Square root both sides.

7.
$$x = \frac{-b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$$
Subract $\frac{b}{2a}$ from both sides.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
The QUADRATIC FORMULA.

This is a formula that allows you to solve <u>any</u> quadratic equation:

If
$$ax^2 + bx + c = 0$$
, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Memorize this!!!

Steps to solve using the Quadratic Formula:

- 1. Set the equation equal to zero. (MUST be set to zero, not another number.)
- 2. Identify the values of **a**, **b**, and **c** from the equation.
- 3. Substitute *a*, *b*, and *c* into the quadratic formula.
- Simplify the expression using the order of operations and rules for simplifying radicals.
- 5. If the simplified expression has a radical or i, then write it as one expression with ±.
 If there is no radical or i, then split into two expressions (+ and -) and evaluate each.

Let's do an example:

$$x^2 - 7x = 18$$

$$X^{2} - 7x - 18 = 0$$

$$\chi = \frac{+7 \pm \sqrt{(-7)^2 - 4(1)(-18)}}{2(1)}$$

$$X = \frac{7 \pm \sqrt{49 + 72}}{2}$$

$$a = 1$$

$$b = -7$$

$$C = -18$$

$$X = \frac{7 \pm \sqrt{121}}{2}$$

$$X = \frac{7 \pm 11}{2}$$

$$X = \frac{1}{2}$$

$$X = \frac{1}{2}$$

$$X=9$$
, $X=-2$

The **Discriminant**:

The Discriminant is the part under the radical: $b^2 - 4ac$

If the Discriminant is:

- 1. Zero (0), then there is one real, rational root.
- Perfect Square (pos), then there are two real, rational roots.
- Positive, then there are two real, irrational roots.
- Negative, then there are two complex roots.
 (There will be i's in the roots.)

Examples: a.) Find the Discriminant.

b.) What kind of root(s)?

C= 16 c.) Solve by the Quad. Formula.

1.
$$x^2 - 8x + 16 = 0$$

$$\chi = \frac{S(i)}{\xi \pm \sqrt{D}}$$

$$\chi = \frac{8}{2} - \frac{1}{2} \left(\chi = 4 \right)$$

Examples: a.) Find the Discriminant.

b.) What kind of root(s)?

c.) Solve by the Quad. Formula.

$$2. -3x^2 + 4x - 4 = 0$$

$$D = (4)^2 - 4(-3)(-4)$$

$$D = -32$$
; two Complex

$$\chi = -\frac{4\pm\sqrt{-32}}{2(-3)}$$

$$\chi = \frac{-4 \pm 4i12}{-6}$$

$$\chi = -2 \pm 2i\sqrt{2}$$

$$X = \frac{2 \pm 2i12}{3}$$

Examples: a.) Find the Discriminant.

b.) What kind of root(s)?
$$C = -50$$

c.) Solve by the Quad. Formula.

3.
$$x^{2} - 5x - 50 = 0$$

 $D = (-5)^{2} - 4(1)(-50)$
 $= 25 + 200$
 $D = 225$; two rational $x = \frac{5-15}{2}$
 $x = \frac{5-15}{2}$
 $x = \frac{5+15}{2}$
 $x = \frac{5+15}{2}$
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Examples: a.) Find the Discriminant.

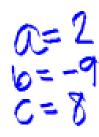
- b.) What kind of root(s)?
- c.) Solve by the Quad. Formula.

4.
$$2x^2 - 9x + 8 = 0$$

 $D = (-9)^2 - 4(2)(8)$
 $= 81 - 64$

$$X = \frac{9 \pm \sqrt{17}}{2(2)}$$

$$X = \frac{9 \pm \sqrt{17}}{4}$$



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Can you?

