# UNIT 8 - SOLVING QUADRATIC EQUATIONS

## Steps for Factoring & T-Baring:

I. **G.C.F Method**: Do the terms have anything in common?...Remember, the GCF is the largest number factor and a common variable with the *lowest* exponent.

$$x^2+10x=0$$
$$x\,(x+10)=0$$
$$x=0 \quad x=-10$$

II. **D.O.T.S Method**: Do I have two perfect squares with a subtraction sign in between?...Remember, even exponents for variables have a square root of their exponent divided by two.

$$x^2-100=0$$
$$(x-10)(x+10)=0$$
$$x=10 \quad x=-10$$

III. **EASY TRI Method**: Do I have a trinomial with the leading coefficient of one that can be factored?

$$x^2-x-6=0$$
$$(x-3)(x+2)=0$$
$$x=3 \quad x=-2$$

IV. **HARD TRI Method**: Do I have a trinomial with the leading coefficient of *more than* one that can be factored?

$$2x+5x+2=0$$
$$\frac{2x^2+4x}{2x} \quad \frac{+x+2}{1}=0$$
$$2x(x+2)+1(x+2)=0$$
$$(2x+1)\,(x+2)=0$$
$$2x+1=0 \quad x+2=0$$
$$-1-1 \quad -2 \quad -2$$
$$\frac{2x}{2}=\frac{-1}{2} \qquad x=-2$$
$$x=-\frac{1}{2} \qquad x=-2$$
$$\left\{-\frac{1}{2},-2\right\}$$

## Steps for Completing the Square:

1. If "a" value is not equal to 1, divide both sides of the equation by the leading coefficient.

2. Move the constant ("c" value) to the right side.

3. Make the left side a perfect square trinomial. Take half of the "b" value and square it and add it to BOTH sides.

4. Factor the perfect square trinomial and simplify the right side.

5. Take the square root of both sides and solve. Don't forget positive and negative results!

**EXAMPLE:**

$$2x^2+12x-6=0$$

$$2(x^2+6x-3)=0$$

$$x^2+6x-3=0$$

$$+3 \quad +3$$

$$x^2+6x=3$$

$$x^2+6x+9=3+9$$

$$(x+3)^2=12$$

$$\sqrt{(x+3)^2}=\sqrt{12}$$

$$x+3=\pm\sqrt{12} \qquad \sqrt{12}$$

$$-3 \quad -3 \qquad \sqrt{4}\bullet\sqrt{3}$$

$$x=-3\pm 2\sqrt{3}$$

## Steps for using the Quadratic Formula:

1. **Put the quadratic equation into standard form. ($ax^2 + bx + c = 0$)**

2. **Identify the a, b, & c values.**

3. **Write down the quadratic formula and substitute a, b, and c values into the formula.**

4. **Evaluate the formula and express answer according to directions.**
   **a) Simplest radical form-follow the rules for simplifying radicals.**
   **b) Simplest decimal form-use your "alpha y = " key in calculator.**

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

**EXAMPLE:**

$a \quad b \quad c$

$$2x^2 + 12x - 6 = 0$$

$$x = \frac{-(12) \pm \sqrt{(12)^2 - 4(2)(-6)}}{2(2)}$$

$$x = \frac{-12 \pm \sqrt{192}}{4}$$

$$x = \frac{-12 \pm \sqrt{64} \bullet \sqrt{3}}{4}$$

$$x = \frac{-12 \pm 8\sqrt{3}}{4}$$

$$x = -3 \pm 2\sqrt{3}$$

# NATURE OF THE ROOTS:

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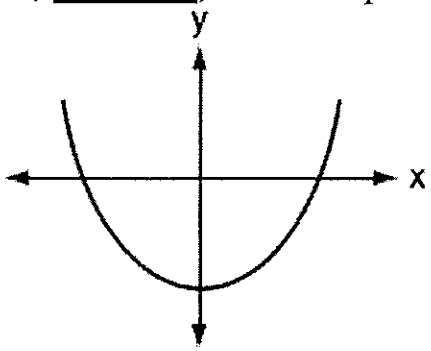
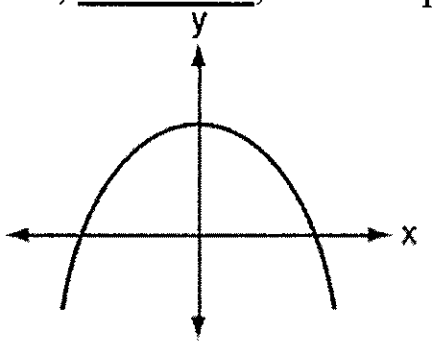
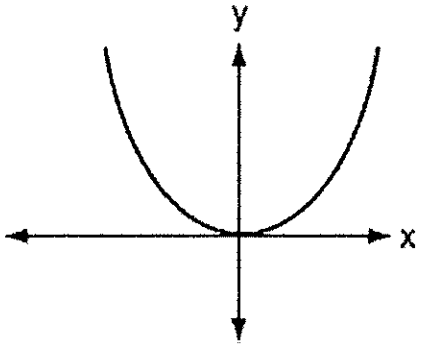
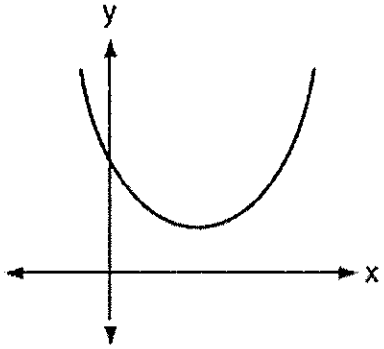
| Real, **rational**, and unequal or   **Touches the x-axis: twice on "tick marks"** | Real, **irrational**, and unequal   **Touches the x-axis: twice not on "tick marks"** |
| Real, rational, and **equal**   **Touches the x-axis: once** | **Imaginary**   **Does NOT touch the x-axis.** |

## Steps for simplifying radicals:

1) Find factors of the radicand that has the highest perfect square.
2) Write both factors- put the highest perfect square first!
3) Simplify the "perfect" radical (comes out of the radical!) and keep the non "perfect" radical.

$\sqrt{48x^2}$

$\sqrt{16} \cdot \sqrt{3} \cdot \sqrt{x^2}$

$4x\sqrt{3}$

# SOLVING QUADRATIC EQUATIONS INVOLVING WORD PROBLEMS

| **Consecutive Integers** (increase by **one**) | **Consecutive Even Integers** (increase by **two**) | **Consecutive Odd Integers** (increase by **two**) |
|---|---|---|
| $x = 1^{st}\, C.I$ | $x = 1^{st}\, C.E.I.$ | $x = 1^{st}\, C.O.I.$ |
| $x+1 = 2^{nd}\, C.I$ | $x+2 = 2^{nd}\, C.E.I.$ | $x+2 = 2^{nd}\, C.O.I.$ |
| $x+2 = 3^{rd}\, C.I$ | $x+4 = 3^{rd}\, C.E.I.$ | $x+4 = 3^{rd}\, C.O.I.$ |

**Example of an Area Word Problem:** The length of a rectangle is 5 more than the width. If the area of the rectangle is 150, what are the dimensions of the rectangle?

Step 1: Write a legend from the question.

Step 2: Write area formula.

Step 3: Substitute in terms of "x" from your legend into the area formula.

Step 4: Distribute.

Step 5: Quadratic Equation must be in standard form.

Set equation equal to zero.

Step 6. Factor (G.C.F., D.O.T.S, Easy Tri or Hard Tri)

Step 7: T-Bar

Step 8: Decide whether to reject a solution.

Step 9: Plug solution into legend

Step 10: Check

**If the quadratic equation DOES NOT FACTOR, use the **quadratic formula or completing the square.**

$$x = width$$

$$x+5 = length$$

$$A = lw$$

$$150 = x(x+5)$$

$$150 = x^2 + 5x$$

$$-150 \qquad -150$$

$$0 = x^2 + 5x - 150$$

$$(x+15)(x-10) = 0$$

$$\cancel{x = -15} \quad x = 10$$

x = 10

x + 5 = 15