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Date: _____

Day 2: Quadratic Formula

I can find the roots of a quadratic function by using the quadratic formula.

Do Now: Find the roots of the quadratic functions below algebraically.

1) $\sqrt{32}$
 $\sqrt{16} \sqrt{2}$
 $4\sqrt{2}$

2) $\sqrt{50}$
 $\sqrt{25} \sqrt{2}$
 $5\sqrt{2}$

3) $\sqrt{64}$
 8

Another method to solve for the roots of a quadratic is using the quadratic formula. In order to use this formula, the quadratic must be in $ax^2 + bx + c$.

This must be memorized!

Quadratic Formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Steps:

1. Write the quadratic equation in standard form
2. Determine the values of a, b, and c
3. Write the quadratic equation
4. Substitute in the values for a, b, and c
5. Do the math!
6. Determine **TWO** roots (+, -)

Solve:

a. $c^2 - 14 = 5c$
 ~~$5c - 5c$~~

$$c^2 - 5c - 14 = 0$$

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

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)} = \frac{5 \pm \sqrt{81}}{2} = \frac{5 \pm 9}{2}$$

$a=1$

$$x = \frac{5+9}{2} = \frac{14}{2} = 7$$

$b=-5$

$c=-14$

$$x = \frac{5-9}{2} = \frac{-4}{2} = -2$$

$$\boxed{x=7}$$

$$\boxed{x=-2}$$

$$\text{b. } 4x^2 + 5x + 3 = 2x^2 - 3x$$

$$\frac{-2x^2 + 3x}{2x^2 + 8x + 3} = 0$$

$$a=2$$

$$b=8$$

$$c=3$$

$$\frac{\sqrt{40}}{2\sqrt{10}}$$

$$\frac{\sqrt{4} \sqrt{10}}{2\sqrt{10}}$$

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

$$x = \frac{-8 \pm \sqrt{8^2 - 4(2)(3)}}{2(2)} = \frac{-8 \pm \sqrt{40}}{4}$$

$$x = \frac{-8 \pm 2\sqrt{10}}{4} = \frac{-4 \pm \sqrt{10}}{2}$$

$$\boxed{\begin{array}{l} x = \frac{-4 + \sqrt{10}}{2} \\ x = \frac{-4 - \sqrt{10}}{2} \end{array}}$$

Solve the following equations using the quadratic formula. If necessary, round your answer to the nearest tenth.

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

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

$$a=1$$

$$b=-2$$

$$c=1$$

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(1)}}{2(1)} = \frac{2 \pm 0}{2}$$

$$\boxed{x = 1}$$

$$2. 3b^2 + 2b + 8 = 0$$

$$a=3$$

$$b=2$$

$$c=8$$

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

$$x = \frac{-2 \pm \sqrt{2^2 - 4(3)(8)}}{2(3)} = \frac{-2 \pm \sqrt{308}}{6}$$

$$\boxed{\begin{array}{l} x = \frac{-2 + \sqrt{308}}{6} \\ x = \frac{-2 - \sqrt{308}}{6} \end{array}}$$

$\sqrt{308}$

$$3. 2t^2 + 7t - 4 = 0$$

$$a=2$$

$$b=7$$

$$c=-4$$

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

$$x = \frac{-7 \pm \sqrt{7^2 - 4(2)(-4)}}{2(2)} = \frac{-7 \pm \sqrt{81}}{4}$$

$$x = \frac{-7 + 9}{4} = \frac{2}{4} = \frac{1}{2}$$

$$x = \frac{-7 - 9}{4} = \frac{-16}{4} = -4$$

$$\boxed{\begin{array}{l} x = \frac{1}{2} \\ x = -4 \end{array}}$$

4. Write your answer in simplest radical form.

$$q^2 - 2q - 1 = 0$$

$a=1$
 $b=-2$
 $c=-1$

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

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-1)}}{2(1)} = \frac{2 \pm \sqrt{8}}{2} = \frac{2 \pm 2\sqrt{2}}{2} = \frac{1 \pm \sqrt{2}}{1}$$

$\sqrt{8}$
 $\sqrt{4} \sqrt{2}$
 $2\sqrt{2}$

$x = 1 + \sqrt{2}$
 $x = 1 - \sqrt{2}$

5. Write your answer in simplest radical form.

$$m^2 - 4 = 0$$

$a=1$
 $b=0$
 $c=-7$

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

$$x = \frac{0 \pm \sqrt{0^2 - 4(1)(-7)}}{2(1)} = \frac{\pm \sqrt{28}}{2}$$

$m^2 - 4 = 0$
 $-3 = -3$
 $m^2 - 7 = 0$

$x = \frac{\pm \sqrt{28}}{2}$

6. $x^2 - 3x = 10$

$-10 \quad -10$
 $x^2 - 3x - 10 = 0$

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

$$x = \frac{3 \pm \sqrt{49}}{2} = \frac{3 \pm 7}{2}$$

$x = \frac{3+7}{2} = \frac{10}{2} = 5$
 $x = \frac{3-7}{2} = \frac{-4}{2} = -2$

$x = \frac{3 \pm \sqrt{(3)^2 - 4(1)(-10)}}{2(1)}$

$a=1$
 $b=-3$
 $c=-10$

$x=5$
 $x=-2$

7. $x^2 + 2x - 1 = 0$

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

$$x = \frac{-2 \pm \sqrt{2^2 - 4(1)(-1)}}{2(1)}$$

$a=1$
 $b=2$
 $c=-1$

$$x = \frac{-2 \pm \sqrt{8}}{2(1)} = \frac{-2 \pm 2\sqrt{2}}{2} = -1 \pm \sqrt{2}$$

$\sqrt{8}$
 $\sqrt{2} \sqrt{4}$
 $2\sqrt{2}$

$x = -1 + \sqrt{2}$
 $x = -1 - \sqrt{2}$

8. $x^2 + 8x = -11$

$$x^2 + 8x + 11 = 0$$

$a=1$

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

$$x = \frac{-8 \pm \sqrt{(8)^2 - 4(1)(11)}}{2(1)}$$

$b=8$

$$x = \frac{-8 \pm \sqrt{20}}{2(1)} = \frac{-8 \pm 2\sqrt{5}}{2} = -4 \pm \sqrt{5}$$

$c=11$

$$\frac{\sqrt{20}}{\sqrt{5} \sqrt{4}} = \frac{2\sqrt{5}}{2\sqrt{5}}$$

$$x = -4 + \sqrt{5}$$

$$x = -4 - \sqrt{5}$$

9. $5x^2 + 12x - 2 = 0$

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

$$x = \frac{-12 \pm \sqrt{(12)^2 - 4(5)(-2)}}{2(5)}$$

$$\sqrt{184}$$

$a=5$

$b=12$

$$x = \frac{-12 \pm \sqrt{184}}{10}$$

$c=-2$

10. $4x^2 - 8x - 2 = 0$

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

$a=4$

$b=-8$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(4)(-2)}}{2(4)} = \frac{8 \pm \sqrt{64}}{8} = \frac{8 \pm 8}{8} =$$

$c=-2$

$$x = \frac{8+8}{8} = \frac{16}{8} = 2$$

$$x = 2$$

$$x = 0$$

$$x = \frac{8-8}{8} = \frac{0}{8} = 0$$