Algebra RH

Essential Question: What is the quadratic formula?

Do Now: Solve each quadratic equation below.

a. $x^2 = 16$

$\sqrt{x^2} = \sqrt{16}$

$x = \pm 4$

OR

$x^2 - 16 = 0$

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

$x - 4 = 0 \quad x + 4 = 0$

$x = 4 \quad x = -4$

b. $x^2 = 12$

$\sqrt{x^2} = \sqrt{12}$

$x = \pm\sqrt{12}$

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

c. $x^2 + 9x = -14$

$x^2 + 9x + 14 = 0$

$(x+7)(x+2) = 0$

$x + 7 = 0 \quad x + 2 = 0$

$x = -7$ or $x = -2$

d. $x^2 + 2x = 1$

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

$(x \quad)(x \quad) = 0$

↑ Not factorable

Up until this point, you have solved quadratic equations by finding the square root or by factoring a "factorable" quadratic equation in the form of $ax^2 + bx + c = 0$.

How do we solve $x^2 + 2x - 1 = 0$?

Always set the equation to zero before using the formula!

The quadratic formula can be used to solve any quadratic equation. However, it is most useful when solving quadratic equations that cannot be factored.

Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ when $a \neq 0$ and $b^2 - 4ac \geq 0$

↑ discriminant

If $b^2 - 4ac < 0$ the answers are imaginary

Using the quadratic formula, solve for x.

$x^2 + 9x = -14$

$x^2 + 9x + 14 = 0$

$a = 1$, $b = 9$, $c = 14$

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

$$x = \frac{-9 \pm \sqrt{25}}{2}$$

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

$$x = \frac{-9+5}{2} \quad x = \frac{-9-5}{2}$$

$x = -2$ OR $x = -7$

Same solutions as the do now "c"

$x^2 + 2x = 1$

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

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

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

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

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

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

Could be written as $x = -1 + \sqrt{2}$ or $x = -1 - \sqrt{2}$

Solve each quadratic equation using the quadratic formula. Express final answers in simplest radical form.

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

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

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

$$x = \frac{2 \pm \sqrt{12}}{2}$$

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

$$\boxed{x = 1 \pm \sqrt{3}}$$

2. $x^2 - 2 = 4x$

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

$a = 1$, $b = -4$, $c = -2$

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

$$x = \frac{4 \pm \sqrt{24}}{2}$$

$$x = \frac{4 \pm 2\sqrt{6}}{2}$$

$$\boxed{x = 2 \pm \sqrt{6}}$$

3. $2x^2 - 3x = 8$

$$2x^2 - 3x - 8 = 0$$

$a = 2$, $b = -3$, $c = -8$

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

$$\boxed{x = \frac{3 \pm \sqrt{73}}{4}}$$

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

$a = -1$, $b = -2$, $c = 5$

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

$$x = \frac{2 \pm \sqrt{24}}{-2}$$

$$x = \frac{2 \pm 2\sqrt{6}}{-2}$$

$$\boxed{x = -1 \pm \sqrt{6}}$$

5. $-7x + x^2 = -6$

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

$(x-6)(x-1)$

Since the answers are rational, the quadratic was factorable

$a = 1$, $b = -7$, $c = 6$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(1)(6)}}{2(1)}$$

$$x = \frac{7 \pm \sqrt{25}}{2}$$

$$x = \frac{7 \pm 5}{2}$$

$$\boxed{x = 6 \text{ or } x = 1}$$

6. $9x^2 + 1 = 12x$

$$9x^2 - 12x + 1 = 0$$

$a = 9$, $b = -12$, $c = 1$

$$x = \frac{12 \pm \sqrt{(-12)^2 - 4(9)(1)}}{2(9)}$$

$$x = \frac{12 \pm \sqrt{108}}{18}$$

$$x = \frac{12 \pm 6\sqrt{3}}{18}$$

$$\boxed{x = \frac{2 \pm \sqrt{3}}{3}}$$