

4.6 Notes: The Quadratic Formula

key

Objectives:

- 1) Solve quadratic equations using the Quadratic Formula.
- 2) Classify roots using the discriminant.

Warm-Up

1. Solve: $9x^2 + 25 = 0$
 $-25 \quad -25$

$\cancel{9}x^2 = \frac{-25}{9}$ $\sqrt{x^2} = \sqrt{\frac{-25}{9}}$ $x = \pm \frac{\sqrt{-25}}{\sqrt{9}}$ $x = \pm \frac{5i}{3}$

2. Find the roots of:

$\frac{2x^2}{2} + \frac{4x}{2} + \frac{9}{2} = 0$ $x^2 + 2x + \frac{9}{2} = 0$ $(\frac{2}{2})^2 = 1$
 $x^2 + 2x + \frac{1}{2} = \frac{9}{2} + \frac{1}{2}$
 $\sqrt{(x+1)^2} = \sqrt{\frac{11}{2}}$ $x+1 = \pm \frac{\sqrt{11}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$
 $x = -1 \pm \frac{\sqrt{22}}{2}$

The Quadratic Formula:

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

EX: $2x^2 + x = 3$

Step 1: Change to standard form. $2x^2 + x - 3 = 0$

Step 2: Identify a, b, c. $a = 2 \quad b = 1 \quad c = -3$

Step 3: Substitute the values to formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \Rightarrow x = \frac{-1 \pm \sqrt{1^2 - 4(2)(-3)}}{2(2)}$

Step 4: Simplify and find x.
 $x = \frac{-1 \pm \sqrt{1^2 - 4(2)(-3)}}{2(2)}$ $x = \frac{-1 \pm \sqrt{25}}{4}$

$x = \frac{-1 \pm 5}{4} \Rightarrow x = \frac{-1+5}{4} \quad x = \frac{-1-5}{4}$
 $x = 1 \quad x = -\frac{3}{2}$

Ex. Solve using the Quadratic Formula

$f(x) = 2x^2 + 25x + 33$

$a = 2$
 $b = 25$
 $c = 33$

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

$x = \frac{-25 \pm \sqrt{25^2 - 4(2)(33)}}{2(2)}$

$x = \frac{-25 \pm \sqrt{361}}{4}$

$x = \frac{-25 \pm 19}{4}$ $x = \frac{-16}{4} = -4$
 $x = \frac{-44}{4} = -11$

Ex. Solve using the Quadratic Formula & Graph.

$$-2x^2 + 8x = -12 \quad x^2 - 4x - 6 = 0$$

$$-2x^2 + 8x + 12 = 0$$

$$a=1 \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

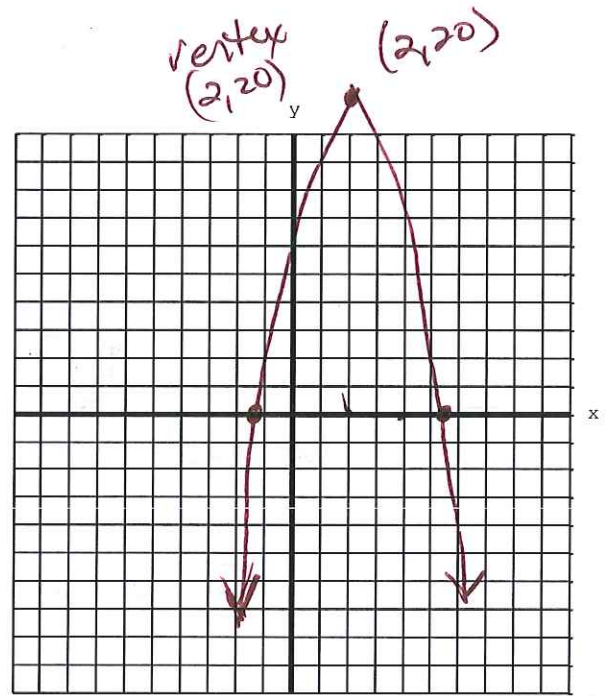
$$b=-4$$

$$c=-6$$

$$x = \frac{4 \pm \sqrt{16 - 4(1)(-6)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{40}}{2} \quad x = \frac{4 \pm 2\sqrt{10}}{2}$$

$$x = 2 \pm \sqrt{10}$$



$$x = 9.162 \quad x = -1.16$$

Solve using the quadratic formula:

$$a=1 \quad f(x) = x^2 - 8x + 9$$

$$b=-8$$

$$c=9$$

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

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(1)(9)}}{2(1)}$$

$$x = \frac{8 \pm \sqrt{28}}{2}$$

$$x = \frac{8 \pm 2\sqrt{7}}{2}$$

$$x = 4 + \sqrt{7}$$

$$x = 4 - \sqrt{7}$$

$$a=3 \quad f(x) = 3x^2 + 5x + 1$$

$$b=5$$

$$c=1$$

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

$$x = \frac{-5 \pm \sqrt{5^2 - 4(3)(1)}}{2(3)}$$

$$x = \frac{-5 \pm \sqrt{13}}{6}$$

$$f(x) = 2x^2 + 6x - 7$$

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

$$a=2$$

$$b=6$$

$$c=-7$$

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

$$x = \frac{-6 \pm \sqrt{92}}{4}$$

$$x = \frac{-6 \pm 2\sqrt{23}}{4}$$

$$x = \frac{-3 \pm \sqrt{23}}{2}$$

$$f(x) = x^2 + 34x + 289$$

$$a=1$$

$$b=34$$

$$c=289$$

$$x = \frac{-34 \pm \sqrt{34^2 - 4(1)(289)}}{2(1)}$$

$$x = \frac{-34 \pm \sqrt{0}}{2}$$

$$= \frac{-34}{2} = -17$$