

# Section 5.6 - Quadratic Formula

Focus: Solve...

$$\begin{aligned} 1) -bx &= x^2 \\ 0 &= x^2 + bx \\ 0 &= x(x+b) \\ x &= 0, x = -b \end{aligned}$$

$$\begin{aligned} 2) -3a^2 - 10 &= -30 \\ -3a^2 &= -20 \\ a^2 &= \frac{20}{3} \end{aligned}$$

$$a = \pm \frac{\sqrt{20}}{\sqrt{3}} = \pm \frac{\sqrt{20}}{\sqrt{3}} = \pm \frac{2\sqrt{5}}{\sqrt{3}}$$

$$a = \pm \frac{2\sqrt{5} \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} = \frac{2\sqrt{15}}{3}$$

$$a = \pm \frac{2\sqrt{15}}{3}$$

Solving Quadratics:

Method 1:  
Factoring EQ=0

Use  $b^2 - 4ac$  to det. if it can factor.

$$\begin{aligned} x^2 + 7 &= 8x \\ x^2 - 8x + 7 &= 0 \\ (x-7)(x-1) &= 0 \\ x &= 7, x = 1 \end{aligned}$$

Method 2:  
SQ Root (missing "b" term.)

$$\begin{aligned} (x-5)^2 &= 8 \\ x-5 &= \pm 2\sqrt{2} \\ x &= 5 \pm 2\sqrt{2} \end{aligned}$$

Method 3:  
Quadratic Formula - ALWAYS WORKS!

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

$$ax^2 + bx + c = 0 \quad \underline{\underline{EQ=0}}$$

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

ex:  $3x^2 + 5x = 1$   
 $3x^2 + 5x - 1 = 0$   
 $\downarrow \quad \downarrow \quad \downarrow$   
 $a \quad b \quad c$

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

$$x = \frac{-5 \pm \sqrt{25 - 4(3)(-1)}}{b}$$

$$x = \frac{-5 \pm \sqrt{25 + 12}}{b}$$

$$x = \frac{-5 \pm \sqrt{37}}{b}$$

$$x = \frac{-5 + \sqrt{37}}{b}, \quad x = \frac{-5 - \sqrt{37}}{b}$$

$$\begin{array}{c} \swarrow \quad \searrow \\ x = 0.180 \quad x = -1.847 \end{array}$$

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

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

$$x = \frac{6 \pm \sqrt{36 - 28}}{2}$$

$$x = \frac{6 \pm \sqrt{8}}{2} = \frac{6 \pm 2\sqrt{2}}{2} = 3 \pm \sqrt{2}$$

$$x = 3 + \sqrt{2}, \quad x = 3 - \sqrt{2}$$

ex:  $x^2 + 6x + 8 = 0$

$$x = \frac{-6 \pm \sqrt{(6)^2 - 4(1)(8)}}{2(1)}$$

$$x = \frac{-6 \pm \sqrt{36 - 32}}{2}$$

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

$$x = \frac{-6 \pm 2}{2} \Rightarrow x = -2, x = -4$$

RECAP: Solving Quads.

1) set EQ = 0.

2) Try to factor... if not... Quad. Formula

\* EXCEPTION... SQ Root (missing "b" term.)

When solving Quads  $\rightarrow b^2 - 4ac \Rightarrow$  DISCRIMINANT

WILL FACTOR! {

- 1) If  $b^2 - 4ac =$  Perfect SQ, then 2 rational roots
- 2) if  $b^2 - 4ac = 0$ , then 1 rational root

3) If  $b^2 - 4ac =$  nonperfect SQ, 2 irrational roots

4) if  $b^2 - 4ac =$  negative #, then no real roots  
2 imag. roots

ex:  $4x^2 + 1 = 4x$   
 $4x^2 - 4x + 1 = 0$   
 $(-4)^2 - 4(4)(1)$   
 $16 - 16 = 0$   
1 rational root

ex:  $x^2 + 40 = 12x$   
 $x^2 - 12x + 40 = 0$   
 $(-12)^2 - 4(1)(40)$   
 $144 - 160 = -16$   
no real roots  
2 imag. roots

ex:  $x^2 + 30 = 12x$   
 $x^2 - 12x + 30 = 0$   
 $(-12)^2 - 4(1)(30)$   
 $144 - 120 = 24$   
2 rational roots