

## THE QUADRATIC FORMULA

The Quadratic Formula allows us to solve quadratic equations. It is most useful when trying to solve quadratics that can't be factored.

Given a quadratic equation in the form  
 $ax^2 + bx + c = 0$

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

Note: The values for a, b and c are the same values we use for the abc method.

EXAMPLE 1: solve for x if

$$2x^2 - 5x - 3 = 0$$

using the Quadratic Formula

$$2x^2 - 5x - 3 = 0$$

↳

$$a =$$

$$b =$$

$$c =$$

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

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

We must follow the order of operations

$$x = \frac{5 \pm \sqrt{25 - (-24)}}{4}$$

$$= \frac{5 \pm \sqrt{49}}{4}$$

$$= \frac{5 \pm 7}{4}$$

We have two solutions:

$$x = \frac{5+7}{4} \quad \text{and} \quad x = \frac{5-7}{4}$$

$$x = \frac{12}{4} \quad x = \frac{-2}{4}$$

$$x = 3 \quad x = -\frac{1}{2}$$

## PROOF of the QUADRATIC FORMULA

$$\text{Let } ax^2 + bx + c = 0, \quad a \neq 0$$

$$ax^2 + bx + c = 0$$

given

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

divide both sides  
by  $a$

$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 + \frac{c}{a} = \left(\frac{b}{2a}\right)^2$$

add  $\left(\frac{b}{2a}\right)^2$  to  
both sides

$$\left(x + \frac{b}{2a}\right)^2 + \frac{c}{a} = \left(\frac{b}{2a}\right)^2$$

complete the  
square  
(factor)

$$\left(x + \frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

subtract  $\frac{c}{a}$   
on both sides

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{c}{a}$$

simplify  
exponents

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{4ac}{4a^2}$$

make like  
terms

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

combine like  
terms

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

square root  
both sides

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

simplify  
denominator

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

subtract  $\frac{b}{2a}$   
on both sides  
to isolate  $x$

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

combine like  
terms

## The QUADRATIC FORMULA

Use the quadratic formula to solve each equation.

1.  $x^2 + 3x + 2 = 0$

2.  $2x^2 - 3x - 1 = 0$

3.  $x^2 + 2x = 2$