

### Quadratic Formula:

If  $ax^2 + bx + c = 0$ ,  $a \neq 0$ , then

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

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

First note this is equivalent to  $(2x+1)(x-3) = 0$   
 $\Rightarrow (2x+1) = 0$  or  $x-3 = 0 \Rightarrow x = -\frac{1}{2}$  or  $3$ .

OR:

$a = 2$ ,  $b = -5$ ,  $c = -3$ .

$$x = \frac{5 \pm \sqrt{(-5)^2 - 4(2)(-3)}}{2 \cdot 2} = \frac{5 \pm \sqrt{25 + 24}}{4} = \frac{5 \pm \sqrt{49}}{4}$$
$$= \frac{5 \pm 7}{4} = \frac{12}{4} \text{ or } \frac{-2}{4} \Rightarrow x = 3 \text{ or } -\frac{1}{2}$$

Example:  $4x^2 - 8x + 1 = 0$

$a = 4$ ,  $b = -8$ ,  $c = 1$ .

$$x = \frac{8 \pm \sqrt{64 - 4 \cdot 4 \cdot 1}}{2 \cdot 4} = \frac{8 \pm \sqrt{48}}{8}$$
$$= \frac{8 \pm \sqrt{16 \cdot 3}}{8} = \frac{8 \pm 4\sqrt{3}}{8} = \frac{2 \pm \sqrt{3}}{2}, \quad x = \frac{2 + \sqrt{3}}{2} \text{ or } \frac{2 - \sqrt{3}}{2}$$

Example  $x(4x-3) = 11+x$

$$\Rightarrow 4x^2 - 3x = 11 + x$$

$$\Rightarrow 4x^2 - 4x - 11 = 0$$

$a = 4$ ,  $b = -4$ ,  $c = -11$ .

$$\text{So, } x = \frac{4 \pm \sqrt{16 - 4 \cdot (-44)}}{2 \cdot 4} = \frac{4 \pm \sqrt{16(1+11)}}{2 \cdot 4}$$
$$= \frac{4 \pm 4\sqrt{4 \cdot 3}}{2 \cdot 4} = \frac{1 \pm 2\sqrt{3}}{2}, \text{ so}$$

$$x = \frac{1 + 2\sqrt{3}}{2} \text{ or } \frac{1 - 2\sqrt{3}}{2}$$

Example  $x^2 + 2x + 5 = 0$

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

$$\begin{aligned} \text{So } x &= \frac{-2 \pm \sqrt{4 - 4 \cdot 5}}{2} \\ &= \frac{-2 \pm \sqrt{-16}}{2} \\ &= \frac{-2 \pm 4i}{2} \\ &= -1 \pm 2i. \end{aligned}$$