

## How do I solve quadratic equations?

### Factoring

#### Procedure:

1. Set  $= 0$
2. factor GCF (if any)
3. factor into a (binomial)(binomial)
4. set each factor  $= 0$  + solve

$$2x^2 + 9x = -4$$

$$\{ 2x^2 + 9x + 4 = 0$$

$$(2x + 1)(x + 4) = 0$$

$$\begin{array}{cc} \downarrow & \downarrow \\ \boxed{x = -\frac{1}{2}} & \boxed{x = -4} \end{array}$$

$$4x^2 = 4x - 1$$

$$4x^2 - 4x + 1 = 0$$

$$(2x - 1)(2x - 1) = 0$$

$$\begin{array}{c} \downarrow \quad \downarrow \\ \boxed{x = \frac{1}{2}} \end{array}$$

$$3x^2 - 27 = 0$$

$$3(x^2 - 9) = 0$$

$$3(x - 3)(x + 3) = 0$$

$$\begin{array}{cc} \downarrow & \downarrow \\ \boxed{x = 3, -3} \end{array}$$

### Square Roots

#### Procedure:

Isolate the variable,  $x$

[note: don't forget to include  $\pm$  sign when taking the square root of a number]

$$4x^2 - 3 = 0$$

$$4x^2 = 3$$

$$x^2 = \frac{3}{4}$$

$$\sqrt{x^2} = \pm \sqrt{\frac{3}{4}}$$

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

$$3 - x^2 = -6$$

$$-x^2 = -9$$

$$x^2 = 9$$

$$\sqrt{x^2} = \pm \sqrt{9}$$

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

$$\sqrt{(2x - 3)^2} = \sqrt{12}$$

$$2x - 3 = \pm \sqrt{12}$$

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

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

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

# Completing the Square

- Procedure:
1. move constant to right side
  2. add  $(\frac{b}{2})^2$  to both sides
  3. factor left side, simplify right side
  4. rewrite left side as a square
  5. square root both sides, solve for x

$$x^2 - 4x - 6 = 0$$

$$x^2 - 4x + 4 = 6 + 4$$

$$(x - 2)(x - 2) = 10$$

$$\sqrt{(x - 2)^2} = \sqrt{10}$$

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

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

$$x^2 = 6x - 5$$

$$x^2 - 6x + 9 = -5 + 9$$

$$(x - 3)(x - 3) = 4$$

$$(x - 3)^2 = 4$$

$$x - 3 = \pm\sqrt{4}$$

$$x - 3 = \pm 2$$

$$x = \pm 2 + 3$$

$$x = 5, 1$$

$$x^2 - 2x - 11 = 0$$

$$x^2 - 2x + 1 = 11 + 1$$

$$(x - 1)(x - 1) = 12$$

$$(x - 1)^2 = 12$$

$$x - 1 = \pm\sqrt{12}$$

$$x = \pm\sqrt{12} + 1$$

$$x = \pm 2\sqrt{3} + 1$$

# Quadratic Formula

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

- Procedure:
1. Put in standard form = 0
  2. find discriminant,  $b^2 - 4ac$
  3. use quadratic formula and simplify to solve for x

$$6x^2 + 4x - 2 = 0$$

$$D = (4)^2 - 4(6)(-2) = 64$$

$$x = \frac{-4 \pm \sqrt{64}}{2(6)} = \frac{-4 \pm 8}{12}$$

$$x = \frac{-4 + 8}{12} = \frac{4}{12} = \frac{1}{3}$$

$$x = \frac{-4 - 8}{12} = \frac{-12}{12} = -1$$

$$3x^2 = 6x - 2$$

$$3x^2 - 6x + 2 = 0$$

$$D = (-6)^2 - 4(3)(2) = 12$$

$$x = \frac{6 \pm \sqrt{12}}{2(3)} = \frac{6 \pm 2\sqrt{3}}{6}$$

$$= \frac{2(3 \pm \sqrt{3})}{6} = \frac{3 \pm \sqrt{3}}{3}$$

$$16 = 3x + x^2$$

$$x^2 + 3x - 16 = 0$$

$$D = (3)^2 - 4(1)(-16) = 73$$

$$x = \frac{-3 \pm \sqrt{73}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{73}}{2}$$