

To solve polynomial equations for their roots (solutions, zeros):

- 1) Write the equation with everything on one side and zero on the other side.
- 2) Factor the polynomial into its prime factorization.
- 3) Use the **Zero Product Property** listed below to set each factor equal to zero, and
- 4) solve each equation.

The Zero Product Property (ZPP)

For any real numbers a and b ,
if $a \cdot b = 0$, then $a = 0$ or $b = 0$, or $a = 0$ and $b = 0$.

Ex 1) Solve $(3x - 4)(2x + 3) = 0$

$$\begin{array}{l} 3x - 4 = 0 \\ 3x = 4 \end{array} \left. \vphantom{\begin{array}{l} 3x - 4 = 0 \\ 3x = 4 \end{array}} \right\} \begin{array}{l} 2x + 3 = 0 \\ 2x = -3 \end{array}$$

$x = \frac{4}{3}$ OR $x = -\frac{3}{2}$

Ex 2) Solve $6y^2 + 14y = -4$

$$6y^2 + 14y + 4 = 0 \quad \text{Factor GCF}$$

$$2(3y^2 + 7y + 2) = 0$$

$$\frac{2(3y^2 + 7y + 2)}{2} = \frac{0}{2}$$

$$3y^2 + 7y + 2 = 0$$

$$(3y + 1)(y + 2) = 0$$

$$\left. \begin{array}{l} 3y + 1 = 0 \\ 3y = -1 \end{array} \right\} \begin{array}{l} y + 2 = 0 \\ y = -2 \end{array}$$

$y = -\frac{1}{3}$ OR $y = -2$

Ex 3) Solve: $x^2 - 6x + 9 = 0$

Solution 1

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

$$x-3=0 \text{ OR } x-3=0$$

$$x=3 \text{ OR } x=3$$

$x=3$ Double Root
(multiplicity 2)

Solution 2

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

$$x-3=0$$

$x=3$ double
root

