

# Warmup:

Factor each of the following expressions:

$$t^2 - 20t + 100$$

$$2 \cdot 10t = -20t$$

$$(t - 10)^2$$

$$\begin{array}{ccc} & 100 & \\ -10 & \times & -10 \\ & -20 & \end{array}$$

$$(t - 10)(t - 10)$$

$$\begin{array}{ccc} & 100 & \\ -10 & \times & -10 \\ & -20 & \end{array}$$

$$t^2 - 10t \quad \{ \quad -10t + 100$$

$$\underline{t}(t - 10) - \underline{10}(t - 10)$$

$$(t - 10)(t - 10)$$

$$49x^2 - 36$$

$$\begin{array}{ccc} & -1764 & \\ -42 & \times & 42 \\ & 0 & \end{array}$$

$$49x^2 - 42x \quad \{ \quad 42x - 36$$

$$7x(7x - 6) \quad \{ \quad +6(7x - 6)$$

$$(7x - 6)(7x + 6)$$

$$\rightarrow (7x - 6)(7x + 6)$$

$$n^2 + 25$$

sum of squares

Not Factorable

Factor completely:

$$\boxed{8n^2 - 48n - 56}$$

$$\begin{array}{r} -7 \\ \times \\ -6 \\ \hline +1 \end{array}$$

$$8(n^2 - 6n - 7)$$

$$\boxed{8(n-7)(n+1)}$$

$$\underline{6r^2} - \underline{7r} - \underline{20}$$

$$\begin{array}{r} -120 \\ \times \\ -15 \quad +8 \\ \hline -7 \end{array}$$

$$= \underline{6r^2 - 15r} + 8r - 20$$

$$3r(2r-5) + 4(2r-5)$$

$$\boxed{(2r-5)(3r+4)}$$

$$\begin{array}{r} -448 \\ \times \\ -56 \quad +8 \\ \hline -48 \end{array}$$

$$\begin{array}{l} 8n^2 - 56n \\ 8n(n-7) \end{array} \left\{ \begin{array}{l} +8n - 56 \\ +8(n-7) \end{array} \right.$$

$$(n-7)(8n+8)$$

$$\boxed{8(n-7)(n+1)}$$

1)  $p^2 - 2p + 1$

$$(p-1)^2$$

2)  $n^2 + 2n + 1$

$$(n+1)^2$$

3)  $9b^2 - 12b + 4$

$$(3b-2)^2$$

4)  $4n^2 - 12n + 9$

$$(2n-3)^2$$

5)  $x^2 - 9$

$$(x+3)(x-3)$$

6)  $a^2 - 1$

$$(a+1)(a-1)$$

7)  $9v^2 - 25$

$$(3v+5)(3v-5)$$

8)  $a^2 - 16$

$$(a+4)(a-4)$$

9)  $8n^2 - 6n - 5$

$$\begin{array}{r} -40 \\ -10 \quad 4 \\ -6 \end{array}$$

$$8n^2 - 16n + 4n - 5$$

$$2n(4n-5) \quad \left\{ \begin{array}{l} +1(4n-5) \\ \end{array} \right.$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\}$$

$$(2n+1)(4n-5)$$

10)  $10n^2 + 89n - 9$

$$\begin{array}{r} -90 \\ 90 \quad -1 \\ 89 \end{array}$$

$$10n^2 + 90n - n - 9$$

$$10n(n+9) \quad \left\{ \begin{array}{l} -1(n+9) \\ \end{array} \right.$$

$$\left. \begin{array}{l} \\ \\ \end{array} \right\}$$

$$(10n-1)(n+9)$$

11)  $6p^2 + 7p - 3$

$$\begin{array}{r} -18 \\ 9 \quad \times \quad -2 \\ 7 \end{array}$$

$$\begin{array}{l} 6p^2 + 9p - 2p - 3 \\ 3p(2p+3) \quad \left. \begin{array}{l} -1(2p+3) \end{array} \right\} \\ (3p-1)(2p+3) \end{array}$$

12)  $9n^2 - 9n - 4$

$$\begin{array}{r} -36 \\ -12 \quad \times \quad 3 \\ -9 \end{array}$$

$$\begin{array}{l} 9n^2 - 12n + 3n - 4 \\ 3n(3n-4) \quad \left. \begin{array}{l} +1(3n-4) \end{array} \right\} \\ (3n+1)(3n-4) \end{array}$$

$$13) \underline{12k^2 - 50k + 50} = \underline{2} (6k^2 - 25k + 25)$$

$$\begin{array}{r} 600 \\ -20 \quad -30 \\ \hline -50 \end{array}$$

$$12k^2 - 20k - 30k + 50$$

$$4k(3k-5) \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} -10(3k-5)$$

$$\star (4k-10)(3k-5) \star$$

$$\star \underline{2(2k-5)(3k-5)} \star$$

$$14) 6n^2 + 19n - 36$$

$$\begin{array}{r} -216 \\ 27 \quad -8 \\ \hline 19 \end{array}$$

$$6n^2 + 27n - 8n - 36$$

$$3n(2n+9) \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} -4(2n+9)$$

$$\underline{(3n-4)(2n+9)}$$

15)  $6x^2 - 11x - 30$

$$\begin{array}{r} -180 \\ \diagdown \quad \diagup \\ -20 \quad 9 \\ \diagup \quad \diagdown \\ -11 \end{array}$$

$$6x^2 - 20x + 9x - 30$$

$$2x(3x - 10) \quad \left. \vphantom{2x(3x - 10)} \right\} +3(3x - 10)$$

$$(2x+3)(3x-10)$$

16)  $10x^2 + 7x - 6$

$$\begin{array}{r} -60 \\ \diagdown \quad \diagup \\ 12 \quad -5 \\ \diagup \quad \diagdown \\ 7 \end{array}$$

$$10x^2 + 12x - 5x - 6$$

$$2x(5x + 6) \quad \left. \vphantom{2x(5x + 6)} \right\} -1(5x + 6)$$

$$(2x-1)(5x+6)$$

17)  $4n^2 - 25n + 6$

$$\begin{array}{r} 24 \\ -24 \quad -1 \\ -25 \end{array}$$

$$\begin{array}{l} 4n^2 - 24n - n + 6 \\ 4n(n-6) \quad \left\{ \begin{array}{l} -1(n-6) \end{array} \right. \\ (4n-1)(n-6) \end{array}$$

18)  $4k^2 + k - 3$

$$\begin{array}{r} -12 \\ 4 \quad -3 \\ 1 \end{array}$$

$$\begin{array}{l} 4k^2 + 4k - 3k - 3 \\ 4k(k+1) \quad \left\{ \begin{array}{l} -3(k+1) \end{array} \right. \\ (4k-3)(k+1) \end{array}$$



## E.Q.:

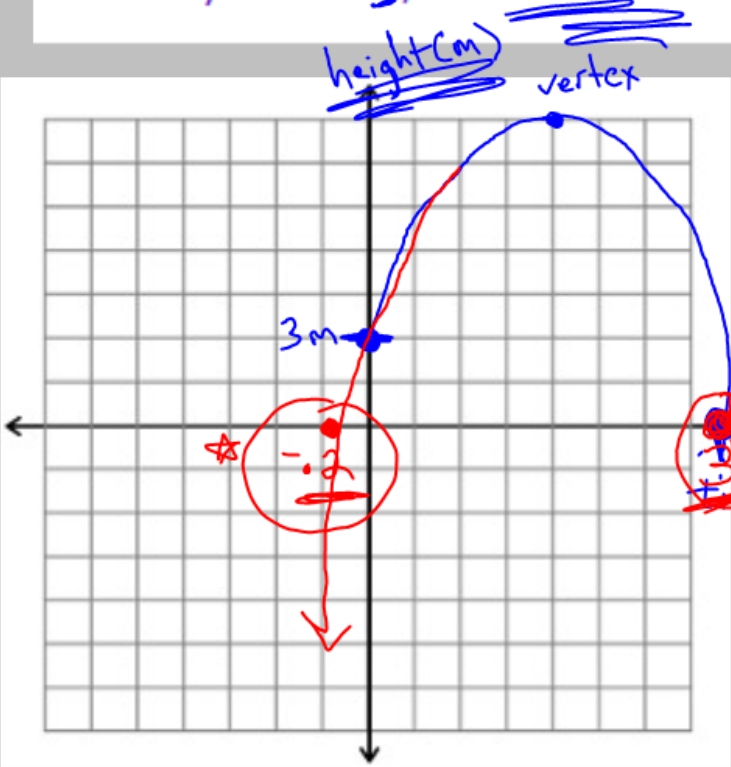
How do we solve a quadratic equation?

What are the roots, or x-intercepts, or zeroes, or **solutions** to a quadratic equation?

A ball is thrown straight up, from 3 m above the ground, with a velocity of 14 m/s. When does it hit the ground?

3 seconds

$$\begin{array}{r} -15 \\ 15 \times -1 \\ 14 \end{array}$$



$$h(t) = -5t^2 + 14t + 3$$

$$h(t) = -5t^2 + 15t - 1t + 3$$

$$h(t) = 5t(-t+3) + 1(-t+3)$$

$$h(t) = (-t+3)(5t+1)$$

$$0 = (-t+3)(5t+1)$$

$$0 = -t+3 \quad \text{or} \quad 0 = 5t+1$$

$$\frac{-t}{-1} = \frac{-3}{-1} \quad \left\{ t=3 \right\}$$

$$\frac{-1}{5} = \frac{5t}{5} \quad \left\{ t = -.2 \right\}$$

# ZERO★ PRODUCT★ PROPERTY

-The zero product property is used when solving equations that involve multiple factors.

-The zero product property states:

$$\textit{If } a \cdot b = 0, \textit{ then } a = 0 \textit{ or } b = 0$$

-When an equation is in factored form, applying the zero product property says:

- 1) Set every factor equal to zero.
- 2) Solve each equation.

## Examples:

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

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

$$(2x)(0) = 0$$

$$(6-6)(6+9) \\ (0)(15) = 0 \checkmark$$

$$2) (\underline{x-6})(\underline{x+9}) = 0$$

$$(0)(x+9) = 0$$

$$\text{or} \\ (x-6)(0) = 0$$

$$\frac{2x}{2} = 0 \quad \text{or} \quad \frac{x+4}{-4 \quad -4} = 0$$

$$x = 0 \quad \text{or} \quad x = -4$$

$$x = 0 \text{ or } -4$$

$$x-6=0 \quad \text{or} \quad x+9=0$$

$$x = 6 \quad \text{or} \quad x = -9$$

$$(9-6)(-9+9)$$

$$(-15)(0) = 0$$

$$3) (2x - 5)(x - 3) = 0$$

$$(2x - 5) = 0$$

$$(x - 3) = 0$$

$$\frac{2x}{2} = \frac{5}{2}$$

$$x = 3$$

$$x = 2.5 \text{ or } \frac{5}{2}$$

$$4) x(3x - 12)(2x + 1) = 0$$

$$x = 0$$

$$3x - 12 = 0$$

$$2x + 1 = 0$$

$$3x = 12$$

$$2x = -1$$

$$x = 4$$

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

$$5) (x - 2)(x - 5)(x + 6) = 0$$

$$x - 2 = 0$$

$$x - 5 = 0$$

$$x + 6 = 0$$

$$x = 2$$

$$x = 5$$

$$x = -6$$

$$6) (6x + 2)(2x + 3)(4x - 10) = 0$$

$$6x + 2 = 0$$

$$6x = -2$$

$$x = -\frac{2}{6} = -\frac{1}{3}$$

$$2x + 3 = 0$$

$$2x = -3$$

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

$$4x - 10 = 0$$

$$4x = 10$$

$$x = \frac{10}{4} = \frac{5}{2}$$

## **SOLVING EQUATIONS BY FACTORING**

**-We can use our methods of factoring and the zero product property to solve equations.**

**-In order to solve by factoring:**

**1) ALWAYS set the equation equal to zero**

**\*Make sure the term with  $x^2$  is positive\***

**2) Factor the equation using the appropriate method.**

**\*Remember to always check for a GCF first\***

**3) Use factored form to apply the zero product property**



# EXAMPLES:

$$1) (x^2 - 7x - 120) = 0$$

$$\begin{array}{r} -120 \\ -15 \quad 8 \\ -7 \end{array}$$

$$(x-15)(x+8) = 0$$

$$x-15=0 \quad x+8=0$$

$$x = 15 \text{ or } -8$$

$$2) 3a^2 + 6 = 6a + 15$$

$$-6a - 15 \quad -6a - 15$$

$$\begin{array}{r} -3 \\ -3 \quad +1 \\ -2 \end{array}$$

$$3a^2 - 6a - 9 = 0$$

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

$$3(a-3)(a+1) = 0$$

$$3 \neq 0$$

$$a-3=0$$

$$a=3$$

$$a+1=0$$

$$a=-1$$

$$3) 4x^2 = 100$$

$$\underbrace{4x^2}_{-100} = \underbrace{100}_{-100} = 0$$

$$(2x - 10)(2x + 10) = 0$$

$$2x - 10 = 0$$

$$2x + 10 = 0$$

$$x = 5$$

$$x = -5$$

$$4) 5n^2 = 30n$$

$$\underbrace{5n^2}_{-30n} = \underbrace{30n}_{-30n}$$

$$\star \star \quad \underline{5n^2} - \underline{30n} = 0 \quad \star \star$$

$$5n(n - 6) = 0$$

$$\frac{5n}{5} = \frac{0}{5}$$

$$n = 0$$

$$n - 6 = 0$$

$$n = 6$$

$$5) \quad \begin{array}{r} -x^2 - 2x = 5x - 44 \\ +x^2 + 2x \quad +2x + x^2 \end{array}$$

$$\circ = x^2 + 7x - 44$$

$$\begin{array}{r} -44 \\ -4 \quad +11 \\ \hline 7 \end{array}$$

$$0 = (x-4)(x+11)$$

$$0 = x-4 \quad 0 = x+11$$

$$x=4$$

$$x=-11$$

$$6) \quad \begin{array}{r} 8r^2 + 6r = 6r + 98 \\ -98 \quad -6r \quad -6r \quad -98 \end{array}$$

$$8r^2 - 98 = 0$$

$$2(4r^2 - 49) = 0$$

$$2(2r-7)(2r+7) = 0$$

$$2=0$$

$$2r-7=0$$

$$2r+7=0$$

$$r = \frac{7}{2}$$

$$r = -\frac{7}{2}$$

# YOU TRY!

$$7) x^2 = -6x + 27$$

$$x^2 + 6x - 27 = 0$$

$$(x + 9)(x - 3) = 0$$

$$x + 9 = 0 \quad x - 3 = 0$$

$$x = -9 \quad x = 3$$

$$8) 3a^2 + 144 = 48a$$

$$3a^2 - 48a + 144 = 0$$

$$3(a^2 - 16a + 48) = 0$$

$$3(a - 12)(a - 4) = 0$$

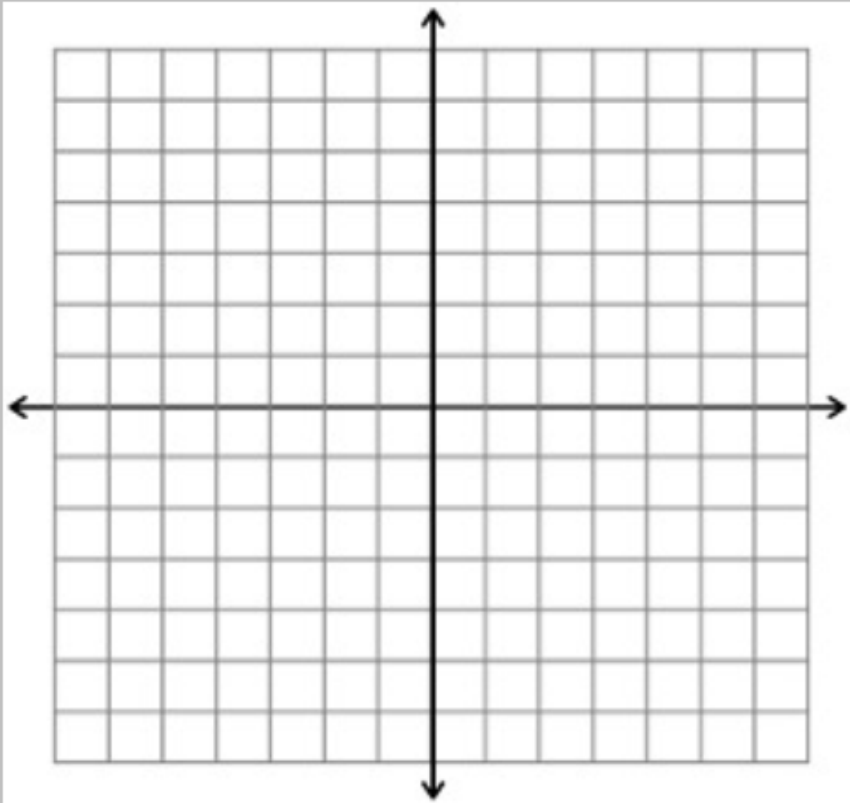
$$\cancel{3} = 0 \quad a - 12 = 0 \quad a - 4 = 0$$

$$a = 12 \quad a = 4$$

$$9) -2x^2 + 16x = -96$$

$$10) -2x^2 = -450$$

A ball is thrown straight up, from 3 m above the ground, with a velocity of 14 m/s. When does it hit the ground?



$$h(t) = -5t^2 + 14t + 3$$

# Homework #4

## Solving quadratics by factoring