

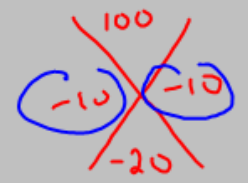
Warmup:

Factor each of the following expressions:

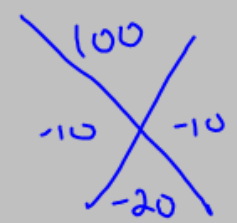
perfect square

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

$$(t - 10)^2$$



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



$$\begin{array}{l}
 t^2 - 10t \quad -10t + 100 \\
 t(t - 10) \quad -10(t - 10) \\
 \uparrow \qquad \qquad \qquad \uparrow \\
 (t - 10)(t - 10)
 \end{array}$$

difference of squares

$$49x^2 - 36$$

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

sum of squares

$$n^2 + 25$$

Not Factorable

~~$$(n + 5)(n + 5)$$~~

$$n^2 + 10n + 25$$

~~$$(n + 5)(n - 5)$$~~

$$n^2 - 25$$

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

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

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

$$8(n-7)(n+1)$$

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

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

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

$$(n-7)(8n+8) = 8(n-7)(n+1)$$

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

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

$$6r^2 - 15r \quad \left. \begin{array}{l} + 8r - 20 \end{array} \right\}$$

$$3r(2r-5) \quad \left. \begin{array}{l} + 4(2r-5) \end{array} \right\}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$13) \underline{12k^2} - \underline{50k} + \underline{50} = \underline{2} (6k^2 - 25k + 25) \quad 14) 6n^2 + 19n - 36$$

$$\begin{array}{ccc} 600 & & \\ -20 & \times & -30 \\ & & -50 \end{array}$$

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

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

$$* (4k-10)(3k-5)$$

$$2(2k-5)(3k-5)$$

$$\begin{array}{ccc} -216 & & \\ 27 & \times & -8 \\ & & 19 \end{array}$$

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

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

$$(3n-4)(2n+9)$$

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) $4k^2 + k - 3$

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

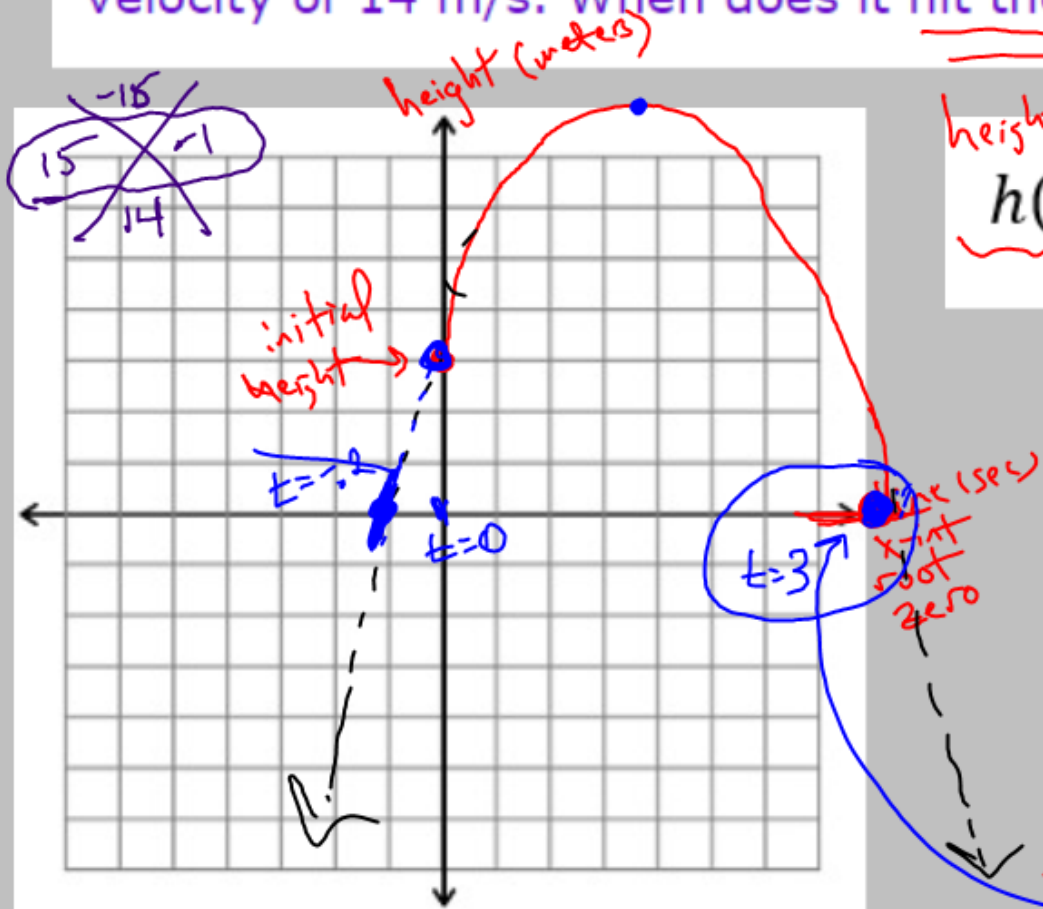
$$\begin{array}{l} 4k^2 + 4k - 3k - 3 \\ 4k(k+1) \quad \left\{ \begin{array}{l} -3(k+1) \end{array} \right. \\ (4k-3)(k+1) \end{array}$$

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?



height @ any given time.

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

$$0 = -5t^2 + 14t + 3$$

$$0 = -5t^2 + 15t - t + 3$$

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

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

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

$$\frac{-t}{-1} = \frac{-3}{-1}$$

$$\text{or} \quad \frac{5t}{5} = \frac{-1}{5}$$

$$t=3$$

$$t = -\frac{1}{5}$$



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:

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

$$\begin{array}{l} \downarrow \qquad \qquad \qquad \searrow \\ 2x = 0 \qquad \text{or} \qquad x + 4 = 0 \\ \frac{2}{2} \quad \frac{2}{2} \qquad \qquad \qquad -4 \quad -4 \end{array}$$

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

$$\begin{aligned} (2 \cdot 0)(0 + 4) &= \\ (0)(4) &= 0 \end{aligned}$$

$$\begin{aligned} (2 \cdot -4)(-4 + 4) &= \\ -8 \cdot 0 &= 0 \\ \text{NO} & \end{aligned}$$

$$2) (x - 6)(x + 9) = 0$$

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

$$\boxed{x = 6} \qquad \boxed{x = -9}$$

$$\begin{aligned} (6 - 6)(6 + 9) &= \\ 0 \cdot 15 &= 0 \checkmark \end{aligned}$$

$$\begin{aligned} (-9 - 6)(-9 + 9) &= \\ -15 \cdot 0 &= 0 \checkmark \end{aligned}$$

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

$$2x - 5 = 0 \quad \text{or} \quad x - 3 = 0$$

$$2x = 5$$

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

$$x = 3$$

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

$$x = 0$$

$$3x - 12 = 0$$

$$x = 4$$

$$2x + 1 = 0$$

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

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

$$x - 2 = 0$$

$$x = 2$$

$$x - 5 = 0$$

$$x = 5$$

$$x + 6 = 0$$

$$x = -6$$

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

$$6x + 2 = 0$$

$$6x = -2$$

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

$$2x + 3 = 0$$

$$2x = -3$$

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

$$4x - 10 = 0$$

$$4x = 10$$

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

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

$$\begin{array}{c} -120 \\ \swarrow \quad \searrow \\ -15 \quad +8 \\ \nwarrow \quad \nearrow \\ -7 \end{array}$$

EXAMPLES:

$$\begin{array}{c} -3 \\ \swarrow \quad \searrow \\ -3 \quad +1 \\ \nwarrow \quad \nearrow \\ -2 \end{array}$$

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

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

$$x - 15 = 0$$

$$x + 8 = 0$$

$$x = 15$$

or

$$x = -8$$

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

$$\begin{array}{r} -6a \quad -15 \\ \hline 3a^2 - 6a - 9 = 0 \end{array}$$

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

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

$$\cancel{3} = 0$$

$$a - 3 = 0$$

$$a = 3$$

$$a + 1 = 0$$

$$a = -1$$

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

$$\begin{array}{cc} \leftarrow 400 & \leftarrow 100 \end{array}$$

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

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

$$2x - 10 = 0$$

$$2x + 10 = 0$$

$$x = 5$$

$$x = -5$$

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

$$\begin{array}{cc} -30n & -30n \end{array}$$

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

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

$$5n = 0$$

$$n - 6 = 0$$

$$n = 0$$

$$n = 6$$

$$5) \quad -x^2 - 2x = 5x - 44$$

$$+x^2 \quad +2x \quad +x^2 \quad +2x$$

$$0 = x^2 + 7x - 44$$

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

$$\begin{aligned} x &= 4 \\ x &= -11 \end{aligned}$$

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

$$6) \quad 8r^2 + 6r = 6r + 98$$

$$-98 \quad -6r \quad -6r \quad -98$$

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

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

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

$$\cancel{2} \neq 0$$

$$2r - 7 = 0$$

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

$$2r + 7 = 0$$

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

YOU TRY!

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

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

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

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

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

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

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

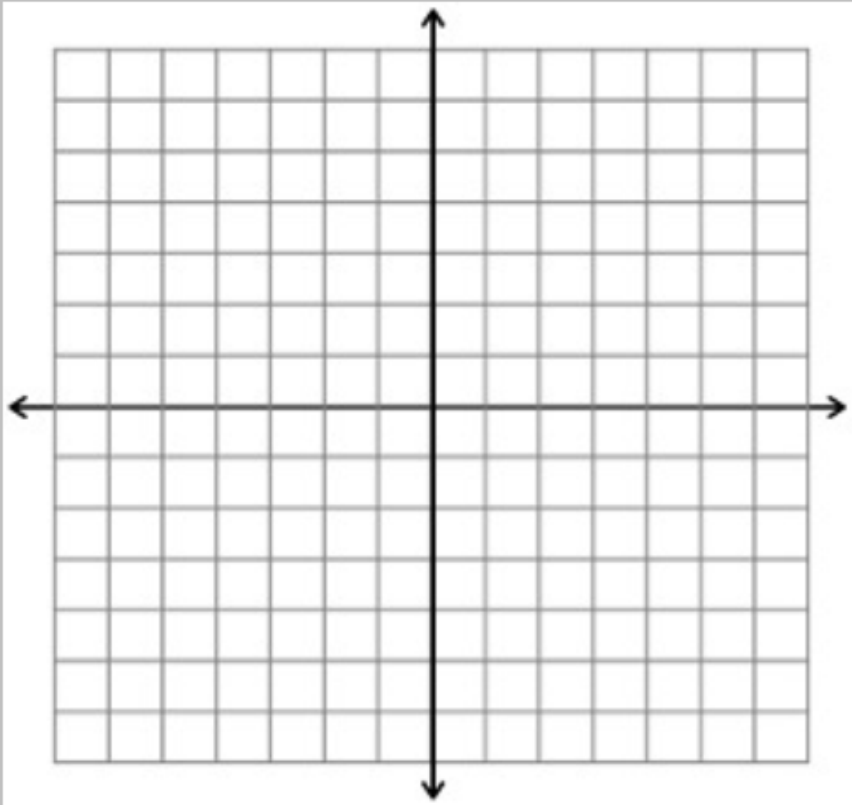
$$3(a - 12)(a - 4) = 0$$

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

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

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

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