

What's Going On?

Checking In

Weekend Assignment

Minds on

How can we solve quadratics?

Action!

Solving Quadratics Examples

Consolidation

Tough Questions

Learning Goal - I will be able to solve quadratics using multiple methods.

Checking In

LGL

Simplify fully. ***Hint: Ultra FOIL!**

$$(1 - \sqrt{3})(2 + \sqrt{6})(5 + \sqrt{2})$$

$$= (\sqrt{6} + 2 - 2\sqrt{3} - \sqrt{18})(5 + \sqrt{2})$$

$$= (5 + \sqrt{2})(\sqrt{6} + 2 - 2\sqrt{3} - \sqrt{18})$$

$$= 5(\sqrt{6} + 2 - 2\sqrt{3} - \sqrt{18}) + \sqrt{2}(\sqrt{6} + 2 - 2\sqrt{3} - \sqrt{18})$$

$$= 5\sqrt{6} + 10 - 10\sqrt{3} - 5\sqrt{18} + \sqrt{12} + 2\sqrt{2} - 2\sqrt{6} - \sqrt{36}$$

$$= 5\sqrt{6} + 10 - 10\sqrt{3} - 5\sqrt{9 \times 2} + \sqrt{4 \times 3} + 2\sqrt{2} - 2\sqrt{6} - 6$$

$$= \cancel{5\sqrt{6}} + \cancel{10} - \cancel{10\sqrt{3}} - 5\sqrt{2} + \sqrt{3} + 2\sqrt{2} - \cancel{2\sqrt{6}} - \cancel{6}$$

$$= 4 - 13\sqrt{2} - 8\sqrt{3} + 3\sqrt{6}$$

Checking In

Weekend Assignment
Due tomorrow

Unit Test
Thursday, March 26

Checking In

Will you be here on Friday?

Minds on

Solving Quadratics

We can solve quadratics by:

1. Graphing
2. Factoring
3. Using the Quadratic Formula
4. Completing the Square?

Do the Quad Solve!

Action!

Solving Quadratics

Anthony owns a business that sells parts for electronic game systems. The profit function for his business can be modelled by the equation $P(x) = -0.5x^2 + 8x - 24$, where x is the quantity sold, in thousands, and $P(x)$ is the profit in thousands of dollars.

How many parts must he sell to break even?

Complete the Square

$$y = -0.5(x^2 - 16x) - 24$$

$$y = -0.5(x^2 - 16x + 64 - 64) - 24$$

$$y = -0.5(\underbrace{(x-8)^2}_{\text{purple}} - 64) - 24$$

$$y = -0.5(x-8)^2 + 32 - 24$$

$$y = -0.5(x-8)^2 + 8$$

* set y to 0

$$-0.5(x-8)^2 + 8 = 0$$

+8 -8

$$\frac{-0.5(x-8)^2}{-0.5} = \frac{-8}{-0.5}$$

$$\sqrt{(x-8)^2} = \sqrt{16}$$

$$(x-8) = \pm 4$$

+8 +8

$$x = 4+8 \quad \text{or} \quad -4+8$$

$$= 12 \quad \text{or} \quad 4$$

Action!

Solving Quadratics

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How many parts must he sell to break even?

Factor

$$\begin{aligned} P(x) &= -0.5(x^2 - 16x + 48) \\ &= -0.5(x - 4)(x - 12) \end{aligned}$$

Action!

Solving Quadratics

Anthony owns a business that sells parts for electronic game systems. The profit function for his business can be modelled by the equation $P(x) = -0.5x^2 + 8x - 24$, where x is the quantity sold, in thousands, and $P(x)$ is the profit in thousands of dollars.

How many parts must he sell to break even?

$$\begin{aligned}
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 &= \frac{-8 \pm \sqrt{8^2 - 4(-0.5)(-24)}}{2(-0.5)} \\
 &= \frac{-8 \pm \sqrt{64 - 48}}{-1} \\
 &= \frac{-8 \pm \sqrt{16}}{-1} \\
 &= \frac{-8 \pm 4}{-1}
 \end{aligned}$$

$8 + 4 = 12$
 or
 $8 - 4 = 4$

Action!

Solving Quadratics

A water balloon is catapulted into the air from the top of a building. The height, $h(t)$, in metres, of the balloon after t seconds is $h(t) = -5t^2 + 30t + 10$.

What are the domain and range of the function?

To find the domain, we need to figure out when it hits the ground (max time). Obviously the lowest value for time is 0!

factor $h(t) = -5(t^2 - 6t - 2)$ \wedge
can't...

Let's find the vertex first!

To find the range, we need to find the vertex! The y-value of the vertex will be the high end of the range, and the ground (zero!) will be the low end.

complete the square

$$\begin{aligned} h(t) &= -5t^2 + 30t + 10 \\ &= -5(t^2 - 6t + 9 - 9) + 10 \\ &= -5(t-3)^2 + 45 + 10 \\ &= -5(t-3)^2 + 55 \end{aligned}$$

max!

Now solve the vertex form!

$$\begin{aligned} -5(t-3)^2 + 55 &= 0 \\ -5(t-3)^2 &= -55 \\ \frac{-5(t-3)^2}{-5} &= \frac{-55}{-5} \end{aligned}$$

$$\sqrt{(t-3)^2} = \sqrt{11}$$

$$t-3 = \pm\sqrt{11}$$

$$t = \pm\sqrt{11} + 3$$

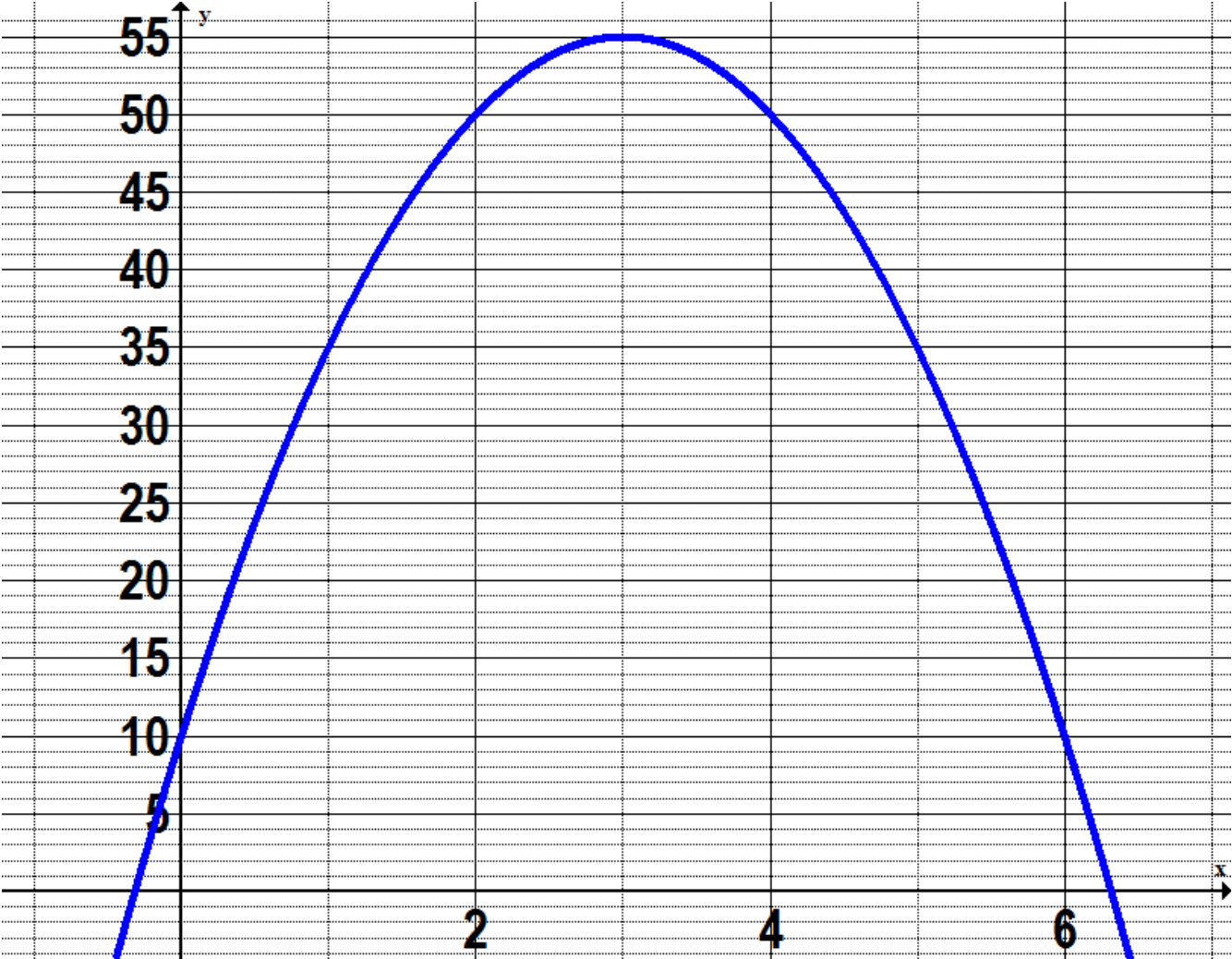
$$\begin{aligned} \sqrt{11} + 3 &\text{ or } -\sqrt{11} - 3 \\ \approx 6.32 &\quad \approx -0.32 \text{ impossible!} \end{aligned}$$

Domain

$$\{t \in \mathbb{R} \mid 0 \leq t \leq 6.32\}$$

Range

$$\{h(t) \in \mathbb{R} \mid 0 \leq h(t) \leq 55\}$$



Action!

Solving Quadratics

A water balloon is catapulted into the air from the top of a building. The height, $h(t)$, in metres, of the balloon after t seconds is $h(t) = -5t^2 + 30t + 10$.

When will the balloon reach a height of 30 m?

$$\begin{aligned}
 -5t^2 + 30t + 10 &= 30 \\
 -5t^2 + 30t - 20 &= 0 \\
 -5(t^2 - 6t + 4) &= 0
 \end{aligned}$$

use original equation in quadratic formula!

$$t = \frac{-30 \pm \sqrt{30^2 - 4(-5)(-20)}}{2(-5)}$$

$$= \frac{-30 \pm \sqrt{900 - 400}}{-10}$$

$$= \frac{-30 \pm \sqrt{500}}{-10}$$

100 x 5

$$= \frac{-30 \pm \sqrt{100 \times 5}}{-10}$$

simplify radical

$$= \frac{-30 \pm 10\sqrt{5}}{-10}$$

reduce!!

$$\boxed{= 3 \pm \sqrt{5}}$$

$$\begin{aligned}
 3 + \sqrt{5} &\doteq 5.24 \\
 3 - \sqrt{5} &\doteq 0.76
 \end{aligned}$$

\therefore balloon reaches 30m after 0.76s and 5.24s.

~~We~~ we could have used
the equation with 'a' factored
out

$$\frac{b \pm \sqrt{36 - 16}}{2}$$

$$\frac{b \pm \sqrt{20}}{2}$$

4 × 5

$$\frac{b \pm 2\sqrt{5}}{2}$$

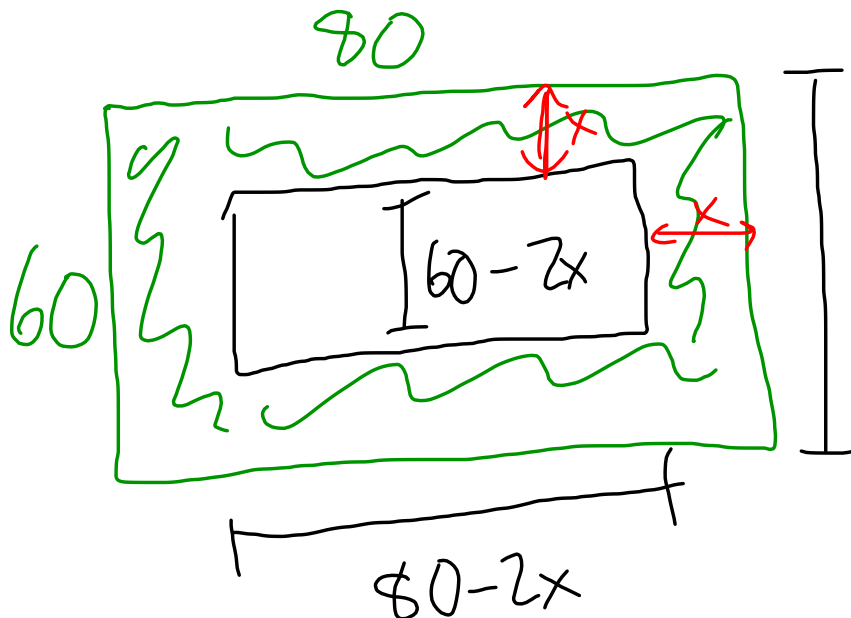
$$3 \pm \sqrt{5}$$

Action!

Solving Quadratics

A factory is to be built on a lot that measures 80 m by 60 m. A lawn of uniform width, equal to the area of the factory, must surround it.

How wide is the strip of lawn, and what are the dimensions of the factory?



area of factory

$$\begin{aligned} & (60 - 2x)(80 - 2x) \\ &= 4800 - 280x + 4x^2 \\ &= 4x^2 - 280x + 4800 \end{aligned}$$

area of lawn

$$\begin{aligned} & (80)(60) - \text{area of factory} \\ &= 4800 - (4x^2 - 280x + 4800) \\ &= -4x^2 + 280x \end{aligned}$$

This means $4x^2 - 280x + 4800 = -4x^2 + 280x$
solve for x

This means $4x^2 - 280x + 4800 = -4x^2 + 280x$
 solve for x

$$4x^2 - 280x + 4800 = -4x^2 + 280x$$

$$+4x^2 - 280x \quad +4x^2 - 280x$$

$$8x^2 - 560x + 4800 = 0$$

$$8(x^2 - 70x + 600) = 0$$

$$8(x-60)(x-10)$$

so the width is 10 or 60

~~X~~ If $x=60$, we end up with negative values for length and width... impossible!

$$x=10$$

Strip is 10m wide.


$$\text{Factory is } (80 - 2(10)) \times (60 - 2(10))$$


$$= 60\text{m} \times 40\text{m}$$

Consolidation

Tough Questions

 Find the zeros of the function $f(x) = 3x - 1 + \frac{1}{x + 1}$.

 The sum of the squares of two consecutive integers is 685. What could the integers be? List all possibilities.

 The perimeter of a right triangle is 60 cm. The length of the hypotenuse is 6 cm more than twice the length of one of the other sides. Find the lengths of all three sides.

Attachments



3U 3.6 (The Zeros of a Quadratic) - Quadratic Formula Song.mp4



3U 3.6 (The Zeros of a Quadratic) - Quad Solve.mp4