

ALGEBRA 1

UNIT 1 • LESSON 4

Equations, Functions & Quadratics

Equations • Inequalities • Systems • Functions • Quadratics



Goal: solve and represent equations, inequalities, system of equations, functions, and quadratics with clear reasoning.

Access IDEAS presents a customized session for Algebra 1, Unit 1, Lesson 4.



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Agenda

- Sample Math Problem
- Go over questions from Lesson#3 HW (show PDF)
- Announcements: Unit 2 Enrollment
- Solving Equations with One Variable
- Solving Inequalities with One Variable
- Systems of Equations with Two Variables
- Introducing Functions
- Quadratic Equations and the Quadratic Formula
- Questions and Homework Help

Sample Math Problem

Simplify: $(2x^2 + 3x - 4) - 3(x^2 - 5x + 6)$

Please post your answer in chat.

Sample Problem - Solution

Simplify: $(2x^2 + 3x - 4) - 3(x^2 - 5x + 6)$

SOLUTION

$$(2x^2 + 3x - 4) - 3(x^2 - 5x + 6)$$

$$2x^2 + 3x - 4 - 3x^2 + 15x - 18$$

$$(2x^2 - 3x^2) + (3x + 15x) + (-4 - 18)$$

$$-x^2 + 18x - 22$$

Distribute -3

Group x^2 , x terms and constants

Combine each group

Answer: $-x^2 + 18x - 22$

Attendance

Please post your name in Zoom Chat.
Also, let me know how many videos you watch for this week's lesson.

Example: Jack Chung, 1 video

Lesson#3 HW

Go over questions from Lesson#3 HW ([show PDF](#))

Announcements

Please remind your parents to enroll you for Unit 2

<https://forms.gle/ATAbLMnTRzuHG7Yh7>

Session Dates: 10/28, 11/4, 11/18

Time Change: 7:30pm to 8:30pm

Lesson #4

This is the last session for this Unit.
Whatever time we have left, we will preview other Algebra topics.
We will go pretty quickly, so it is fine if you don't fully understand.

Solving Equations with One Variable

Use inverse operations to isolate the variable while keeping both sides balanced.

1 ISOLATE

Get the variable alone on one side.

2 INVERSE OPS

Undo addition, subtraction, multiplication, and division.

3 BALANCE

Perform the same operation on both sides.

4 SIMPLIFY

Combine like terms and clear parentheses first.

5 CHECK

Substitute the solution into the original equation.

Show Example: $2x - 3 = 9$

Solving Equations — Problem 1

Solve: $3x + 5 = 20$

Please post your answer in chat.

Solving Equations — Problem 1 Solution

Solve: $3x + 5 = 20$

SOLUTION

$$3x + 5 = 20$$

$$3x = 15$$

$$x = 5$$

Subtract 5 from both sides

Divide both sides by 3

Check: $3(5) + 5 = 20$

Answer: $x = 5$

Solving Equations — Problem 2

Solve: $4(2x - 3) + 5 = 25$

Please post your answer in chat.

Solving Equations — Problem 2 Solution

Solve: $4(2x - 3) + 5 = 25$

SOLUTION

$$4(2x - 3) + 5 = 25$$

$$8x - 12 + 5 = 25$$

$$8x - 7 = 25$$

$$8x = 32$$

$$x = 4$$

Distribute 4

Combine constants

Add 7 to both sides

Divide both sides by 8

Answer: $x = 4$

Solving Inequalities with One Variable

Solve like an equation, then represent every solution on a number line.

1 ISOLATE

Use inverse operations to isolate the variable.

2 DIRECTION

The inequality symbol tells which values are included.

3 FLIP RULE

Reverse the symbol after multiplying or dividing by a negative.

4 ENDPOINT

Use an open circle for $<$ or $>$ and a closed circle for $\leq$ or $\geq$.

5 SHADE

Shade toward all values that make the inequality true.

Open circle: $<$ or $>$
Closed circle: $\leq$ or $\geq$

Solving Inequalities — Problem 1

Solve and graph: $x + 4 < 9$

Solving Inequalities — Problem 1 Solution

Solve and graph: $x + 4 < 9$

SOLUTION

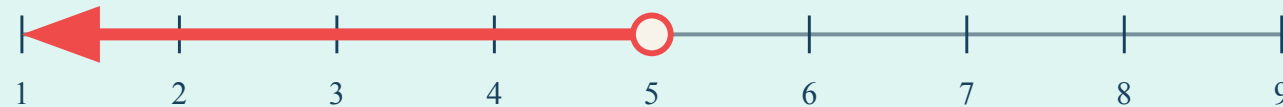
$$x + 4 < 9$$

$$x < 5$$

Subtract 4 from both sides

Open circle at 5

Shade to the left



Answer: $x < 5$

Solving Inequalities — Problem 2

Solve and graph: $-3x + 2 \geq 14$

Please post your answer in chat.

Solving Inequalities — Problem 2 Solution

Solve and graph: $-3x + 2 \geq 14$

SOLUTION

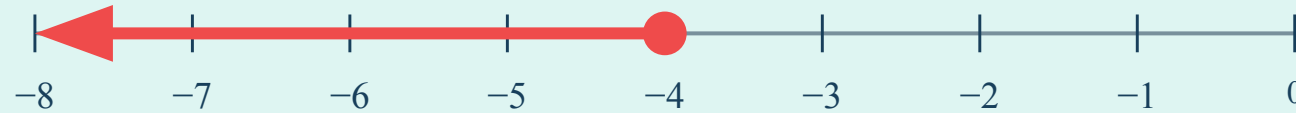
$$-3x + 2 \geq 14$$

$$-3x \geq 12$$

$$x \leq -4$$

Subtract 2; divide by -3 .

Flip $\geq$ to $\leq$; shade left from -4 .



Answer: $x \leq -4$

Systems of Equations with Two Variables

A solution is an ordered pair that makes both equations true.

1

SOLUTION PAIR

Write the answer as (x, y) .

2

GRAPHING

Find the intersection of the two lines.

3

SUBSTITUTION

Replace one variable using an equivalent expression.

4

ELIMINATION

Add or subtract equations to cancel a variable.

5

CHECK

Verify the ordered pair in both original equations.

Both equations $\rightarrow$ Same ordered pair $\rightarrow$ One intersection

Systems of Equations — Problem 1 Solution

Solve the system:

$$y = x + 1$$

$$y = -x + 5$$

Systems — Problem 1: Substitution Solution

$$y = x + 1 \quad \text{and} \quad y = -x + 5$$

SUBSTITUTION

$$x + 1 = -x + 5$$

$$2x = 4$$

$$x = 2$$

$$y = 2 + 1$$

$$y = 3$$

*Set the two expressions
for y equal*

Solve for x

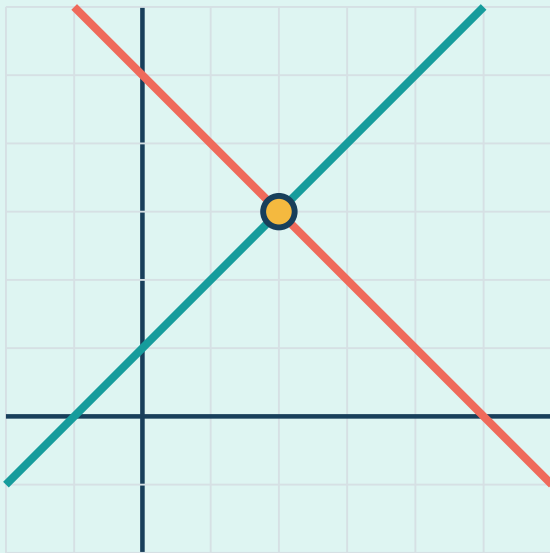
Substitute $x = 2$

Check in both equations

Answer: (2, 3)

Systems — Problem 1: Graphing Solution

$$y = x + 1 \quad \text{and} \quad y = -x + 5$$



GRAPHING

*Graph both equations.
The lines intersect at (2,
3).*

Answer: (2, 3)

Systems — Problem 1: Elimination Solution

$$y = x + 1 \quad \text{and} \quad y = -x + 5$$

(rewrite as)

$$x - y = -1 \quad \text{and} \quad x + y = 5$$

ELIMINATION

$$\begin{array}{r} (x - y = -1) \\ + (x + y = 5) \\ \hline 2x = 4 \\ x = 2 \\ y = 3 \end{array}$$

Rewrite in standard form
Add the equations to
eliminate y
Solve for x , then find y

Answer: (2, 3)

Systems of Equations — Problem 2

Solve the system:

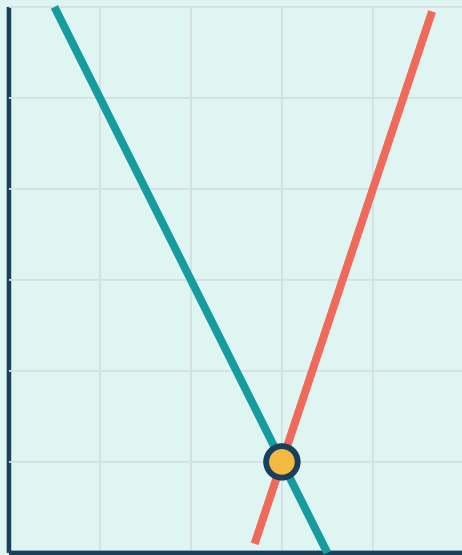
$$2x + y = 7$$

$$3x - y = 8$$

Please post your answer in chat.

Systems — Problem 2: Graphing Solution

$$2x + y = 7 \quad \text{and} \quad 3x - y = 8$$



GRAPHING

Rewrite as $y = 7 - 2x$ and $y = 3x - 8$.

The lines intersect at (3, 1).

Answer: (3, 1)

Systems — Problem 2: Substitution Solution

$$2x + y = 7 \quad \text{and} \quad 3x - y = 8$$

SUBSTITUTION

$$y = 7 - 2x$$

$$3x - (7 - 2x) = 8$$

$$5x - 7 = 8$$

$$5x = 15$$

$$x = 3, \quad y = 1$$

Solve the first equation for y
Substitute into the second
Solve for x, then find y

Answer: (3, 1)

Systems — Problem 2: Elimination Solution

$$2x + y = 7 \quad \text{and} \quad 3x - y = 8$$

ELIMINATION

$$\begin{array}{r} 2x + y = 7 \\ + 3x - y = 8 \\ \hline 5x = 15 \\ x = 3 \\ y = 1 \end{array}$$

*Add the equations to
eliminate y*

Solve for x

Substitute $x = 3$ to find y

Answer: (3, 1)

Introducing Functions

A function assigns exactly one output to each allowed input.



INPUT

Choose a value from the domain.



RULE

Apply the operation described by the function.



OUTPUT

The result belongs to the range.



NOTATION

$f(x)$ names the output produced by input x .



EVALUATE

Substitute the input and simplify carefully.

Input $\rightarrow$ Function Rule $\rightarrow$ Output

Introducing Functions — Problem 1

Given $f(x) = 2x + 3$, find $f(4)$.

Introducing Functions — Problem 1 Solution

Given $f(x) = 2x + 3$, find $f(4)$.

SOLUTION

$$f(x) = 2x + 3$$

$$f(4) = 2(4) + 3$$

$$f(4) = 8 + 3$$

$$f(4) = 11$$

Use input $x = 4$

Substitute 4 for x

Multiply, then add

Answer: $f(4) = 11$

Introducing Functions — Problem 2

Given $g(x) = x^2 - 3x + 2$, find $g(-2)$.

Please post your answer in chat.

Introducing Functions — Problem 2 Solution

Given $g(x) = x^2 - 3x + 2$, find $g(-2)$.

SOLUTION

$$g(x) = x^2 - 3x + 2$$

Use parentheses for a negative input

$$g(-2) = (-2)^2 - 3(-2) + 2$$

Evaluate the exponent and product

$$g(-2) = 4 + 6 + 2$$

Add the results

$$g(-2) = 12$$

Answer: $g(-2) = 12$

Quadratic Equations and the Quadratic Formula

Quadratic equations have degree 2 and may have two, one, or no real solutions.

1 STANDARD FORM

Write the equation as
 $ax^2 + bx + c = 0$.

2 ROOTS

Solutions are the x-values
that make the equation zero.

3 FACTORING

Use factors when the
trinomial factors cleanly.

4 FORMULA

Use $x = (-b \pm \sqrt{b^2 - 4ac}) / 2a$.

5 DISCRIMINANT

$b^2 - 4ac$ predicts the number
of real solutions.

Standard form → Choose a method → Verify the roots

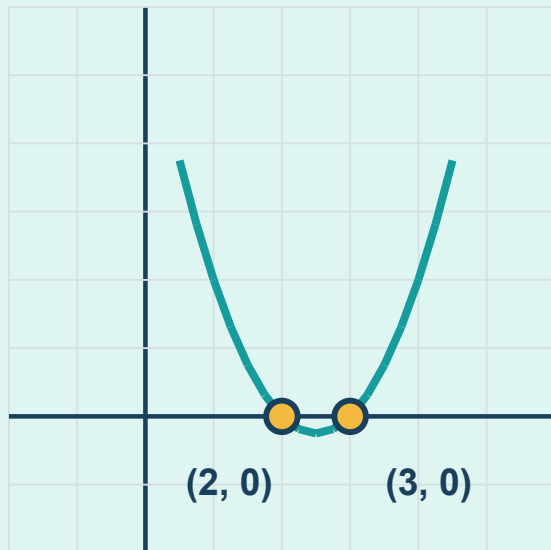
Quadratic Equations — Problem 1

Solve: $x^2 - 5x + 6 = 0$

Quadratic Equations — Problem 1

Graphing Solution

Graph: $y = x^2 - 5x + 6$



GRAPHING

*Graph $y = x^2 - 5x + 6$.
The x -intercepts are $(2, 0)$
and $(3, 0)$.
Therefore, $x = 2$ or $x = 3$.*

Answer: $x = 2$ or $x = 3$

Quadratic Equations — Problem 1

“Factoring” Solution

Solve: $x^2 - 5x + 6 = 0$

SOLUTION

$$x^2 - 5x + 6 = 0$$

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

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

$$x = 2 \text{ or } x = 3$$

Find factors of 6 that add to -5

Use the zero-product property

Solve each linear equation

Answer: $x = 2$ or $x = 3$

Quadratic Formula

Solve: $x^2 - 5x + 6 = 0$

To use the formula, the quadratic equation must first be written in **standard form**:

$$ax^2 + bx + c = 0$$

Where a , b , and c are numerical coefficients, and $a \neq 0$. Once the equation is in this form, the solutions for x are given by:

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

Quadratic Equations — Problem 1

Quadratic Formula Solution

Solve: $x^2 - 5x + 6 = 0$

QUADRATIC FORMULA

$$a = 1, b = -5, c = 6$$

$$x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$$

$$x = [5 \pm \sqrt{(25 - 24)}] / 2$$

$$x = (5 \pm 1) / 2$$

$$x = 2 \text{ or } x = 3$$

Identify a, b, and c

Substitute into the quadratic formula

Evaluate the discriminant

Compute both roots

Answer: $x = 2$ or $x = 3$

Quadratic Equations — Problem 2

Use the quadratic formula to solve: $x^2 + 4x - 1 = 0$

Quadratic Equations — Problem 2

Quadric Formula Solution

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

SOLUTION

$$x = [-4 \pm \sqrt{(16 + 4)}] / 2$$

$$x = (-4 \pm \sqrt{20}) / 2$$

$$x = (-4 \pm 2\sqrt{5}) / 2$$

$$x = -2 \pm \sqrt{5}$$

$$a = 1, b = 4, c = -1$$

Evaluate the discriminant

Simplify $\sqrt{20} = 2\sqrt{5}$

Reduce the fraction

$$\text{Answer: } x = -2 \pm \sqrt{5}$$

Questions and Homework Help

- Please let me know if you have any questions on the lesson today.
- Please let me know if you have any questions on your Algebra-related homework.



THANK YOU

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