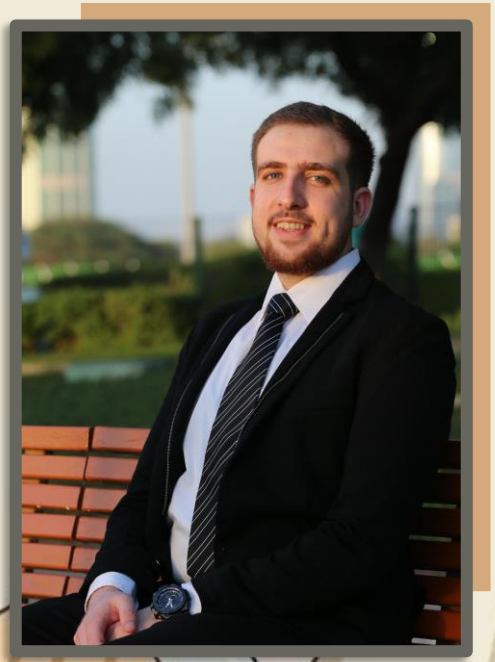
احجز مكانك واستعد للامتحان بثقة كاملة

ملزمة الرياضيات الفصل الثاني

Reveal 7 عام لعام 2026



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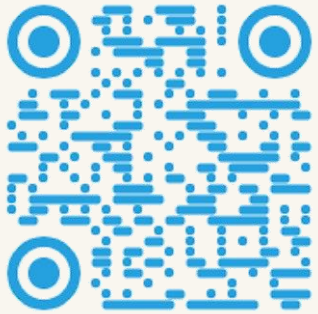

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Module (5): Simplify Algebraic Expressions

Module (5): Simplify Algebraic Expressions

01
02
03

First, Second & Third Lessons:
Simplify Algebraic Expressions, Add Linear Expressions & Subtract Linear Expressions

Mr Aghead Almobaid
0566991363

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Mastering Algebraic Expressions

A Complete Guide to Simplifying, Adding, and Subtracting

A special learning resource by mr.aghead

Our Journey to Mastery

Block 1: The Foundation: Deconstructing Expressions

We'll start by learning the language of algebra: terms, coefficients, and constants.

Block 2: The Core Skills: Simplifying Expressions

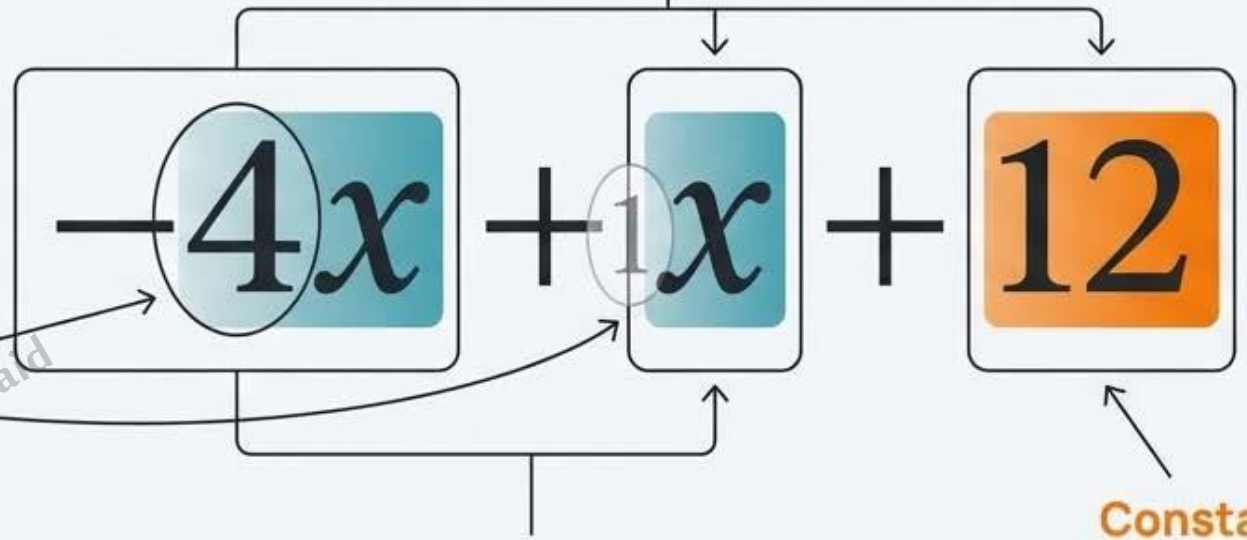
Next, we'll build the essential skills of combining like terms and using the distributive property.

Block 3: The Advanced Skills: Operating with Expressions

Finally, we'll apply our knowledge to add and subtract entire expressions with confidence.

Block 1: The Anatomy of an Expression

Term: The parts of an expression separated by addition or subtraction.



Coefficient: The numerical factor of a term that contains a variable.

Like Terms: Terms that have the same variable raised to the same power. Constants are also like terms.

Constant: A term without a variable.

Putting the Pieces Together: Combining Like Terms

You can only combine things that are alike. Think of it as sorting apples and oranges before you count them.

Example 1 (Integers)

Simplify $-5x + y + 6 - 5y - 3$

IBM Plex Mono

Step 1: Identify & Group Like Terms

$$(-5x) + (y - 5y) + (6 - 3)$$

Step 2: Combine Coefficients

Add or subtract the numbers in front of the variables.

$$-5x - 4y + 3$$

IBM Plex Mono

Example 2 (Fractions)

Simplify $(3/4)a - (2/3) - (1/2)a + (5/6)$

IBM Plex Mono

Step 1: Group Like Terms

$$((3/4)a - (1/2)a) + (-(2/3) + 5/6)$$

Step 2: Find Common Denominators

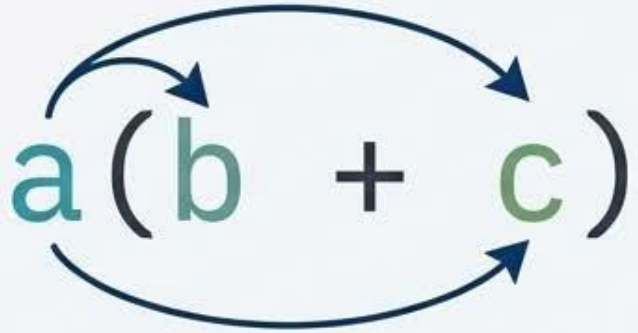
$$((3/4)a - (2/4)a) + (-(4/6) + 5/6)$$

$$(1/4)a + 1/6$$

IBM Plex Mono

The Multiplier: Mastering the Distributive Property

To multiply a sum or difference by a number, multiply each term inside the parentheses by the number outside the parentheses.



Example 1 (Over Addition)

$$4(-3x + 6)$$
$$= 4(-3x) + 4(6)$$
$$= -12x + 24$$

Example 2 (Over Subtraction)

$$(2x - 5y)3$$
$$= 3(2x) - 3(5y)$$
$$= 6x - 15y$$

Example 3 (With a Negative)

$$-5(2x - 9)$$
$$= -5(2x) - (-5)(9)$$
$$= -10x - (-45) = -10x + 45$$

Pro-Tip: Watch your signs! A negative number outside the parentheses flips the sign of **every** term inside.

Workshop: Simplifying in Action

Application 1: Retail Markup

The cost of a jacket (j) after a 5% markup is represented by $j + 0.05j$. Simplify the expression. Then, find the final cost if the original price was $35.

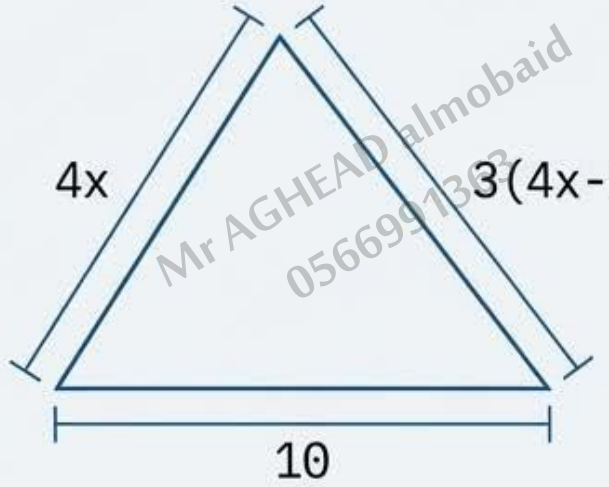
Step 1 (Simplify): $j + 0.05j$ is the same as $1j + 0.05j$. Combine like terms: $(1 + 0.05)j = 1.05j$.

Step 2 (Evaluate): $1.05 * 35 = \$36.75$.

Application 2: Geometry

Represent the perimeter of the triangle shown in simplest form.

1. **Write Expression:** $\text{Perimeter} = 10 + 4x + 3(4x-5)$
2. **Distribute:** $10 + 4x + 12x - 15$
3. **Combine Like Terms:** $(4x + 12x) + (10 - 15)$
4. **Simplified Perimeter:** $16x - 5$



Block 3: Combining Forces - Adding Linear Expressions

Adding expressions is just an extension of combining like terms. Simply remove the parentheses and combine all the like terms from both expressions.

Method 1: The Horizontal Method

Find the sum of $(4x - 2)$ and $(-7x - 3)$.

1. Write as a single expression: $(4x - 2) + (-7x - 3)$
2. Remove parentheses & rewrite subtraction: $4x - 2 - 7x - 3$
3. Group like terms: $(4x - 7x) + (-2 - 3)$
4. Combine: $\mathbf{-3x - 5}$

An Alternate Strategy: The Vertical Method

For a more organized approach, you can stack the expressions vertically, aligning the like terms in columns, just like you would with regular numbers.

Method 2: The Vertical Method

Example: Find **(1/3x + 9) + (5/12x – 4).**

Step 1: Line Up Like Terms

$$\begin{array}{r} (1/3)x + 9 \\ +\ (5/12)x - 4 \\ \hline \end{array}$$

Step 2: Find Common Denominators

1/3x becomes 4/12x

$$\begin{array}{r} (4/12)x + 9 \\ +\ (5/12)x - 4 \\ \hline \end{array}$$

Step 3: Add Each Column

$$\begin{array}{r} (4/12)x + 9 \\ +\ (5/12)x - 4 \\ \hline (9/12)x + 5 \end{array}$$

Step 4: Simplify Final Answer

$$(3/4)x + 5$$

Workshop: Adding in the Real World

A drama club is tracking ticket sales and donations. The amount from Friday night is represented by 92t + 109 and Saturday night by 34t + 13, where *t* is the cost of one ticket. Write and simplify an expression for the total amount collected.

Solution (Using the Vertical Method for clarity):

$$\begin{array}{r} 92t + 109 \\ +\ 34t + 13 \\ \hline 126t + 122 \end{array}$$

Answer: The simplified expression for the total sales and donations is 126t + 122.

The Key to Subtraction: The Additive Inverse

The Golden Rule

To subtract an algebraic expression, you must **add its opposite**. This opposite is called the **additive inverse**.

How to Find the Additive Inverse:

Simply multiply the entire expression you are subtracting by **-1**. This flips the sign of *every term* inside.

Example 1: Find the additive inverse of (4x + 2).

$-1 * (4x + 2) \rightarrow -4x - 2$

Example 2: Find the additive inverse of (5x – 7).

$-1 * (5x - 7) \rightarrow -5x + 7$

The Process:

So, a problem like (6x + 5) – (3x – 2) is transformed into an addition problem:

$(6x + 5) - (3x - 2) \rightarrow (6x + 5) + (-3x + 2)$

Subtraction in Action

Example 1 (Vertical Method)
Find $(8y - 5) - (3y + 4)$.

Step 1: Find the Inverse:
The inverse of $(3y + 4)$ is $-3y - 4$.

Step 2: Rewrite as Addition & Line Up:

$$\begin{array}{r} 8y - 5 \\ +\ (-3y - 4) \\ \hline \end{array}$$

Step 3: Add the Columns:

$5y - 9$

Example 2 (Horizontal Method with Fractions)
Find $(2/3x + 1/2) - (1/6x - 3/8)$.

Step 1: Rewrite as Adding the Inverse:
$(2/3x + 1/2) + (-1/6x + 3/8)$

Step 2: Group Like Terms:
$(2/3x - 1/6x) + (1/2 + 3/8)$

Step 3: Find Common Denominators:
$(4/6x - 1/6x) + (4/8 + 3/8)$

Step 4: Combine & Simplify:
$3/6x + 7/8 = 1/2x + 7/8$

Workshop: Finding the Difference

A bakery's sales are recorded in a table. Chocolate Chip cookie sales are represented by 10h + 6 and Sugar cookie sales by 6h – 5. Write a simplified expression to show how much more the bakery earned from chocolate chip cookies than sugar cookies. (h = hours)

Flavor	Expression for Sales
Chocolate Chip	10h + 6
Sugar	6h – 5

Solution:

1. Set up the Subtraction: $(10h + 6) - (6h - 5)$
2. Rewrite by Adding the Inverse: $(10h + 6) + (-6h + 5)$
3. Group and Combine Like Terms: $(10h - 6h) + (6 + 5)$
4. Final Answer: **4h + 11**

   The bakery earned 4h + 11 more from chocolate chip cookies.

Your Algebraic Expressions Toolkit

To Simplify an Expression

1. Use the **Distributive Property** to remove any parentheses.
2. Identify and group all like terms.
3. **Combine the like terms** by adding or subtracting their coefficients.

To Add Expressions

1. **Remove the parentheses**.
2. **Combine all like terms** using either the horizontal or vertical method.

To Subtract Expressions (The Golden Rule)

1. **Change** the operation to **addition**.
2. Find the **additive inverse** of the second expression (**flip the sign of every term**).
3. Follow the rules for adding expressions.

Put Your Skills to the Test

Use your toolkit to solve the following problems

1. Simplify

$-y + 9z - 16y - 25z + 4$

Answer: $-17y - 16z + 4$

2. Add with Fractions

$(-9x - 4/5) + (2x + 2/3)$

Answer: $-7x - 2/15$

3. Subtract with Negatives

$(-5x - 9) - (-6x - 1)$

Answer: $x - 8$

4. Find the Error MP

A student simplified $5x - 3(x + 4)$ and got $2x + 12$. Find and correct the student's error.

Error: The student did not distribute the -3 to the +4.
They multiplied -3 by x but forgot the second term.
Correction: 5x - 3x - 12 = 2x - 12

Mastery Achieved.

You now have the fundamental tools to deconstruct, simplify, and operate with algebraic expressions. These building blocks are the foundation for all of algebra. Keep practicing to make these skills second nature.

From mr.aghead

Module (5): Simplify Algebraic Expressions

04/05

Fourth & Fifth Lessons:

Factor Linear Expressions & Combine Operations with Linear Expressions

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Master Linear Expressions: The Complete Guide to Factoring & Simplifying

A step-by-step playbook for success.

By Mr. Aghead

Part 1: The Art of Factoring

Before we can factor expressions, we must understand their basic building blocks. The first step is learning to identify a **monomial**.

What is a Monomial?

A monomial is a number, a variable, or a product of a number and one or more variables. It is a single term.

Monomials vs. Non-Monomials

MONOMIALS (These are single terms)	NOT MONOMIALS (These are sums or differences of terms)
-12	x + 4
60x	2x + 5
25	3/4x - 7
2x	-6x + 1/2

The Key to Factoring: Finding the Greatest Common Factor (GCF)

To factor any expression, you must first find the GCF of its terms. We use prime factorization to break down each term and find what they share.

Example: Find the GCF of 18a and 20ab.

Step 1: Write the prime factorization for each term.

$$18a = 2 \cdot 3 \cdot 3 \cdot a$$
$$20ab = 2 \cdot 2 \cdot 5 \cdot a \cdot b$$

Step 2: Identify all common prime factors and variables.

$$18a = \textcircled{2} \cdot 3 \cdot 3 \cdot \textcircled{a}$$
$$20ab = \textcircled{2} \cdot 2 \cdot 5 \cdot \textcircled{a} \cdot b$$

The common factors are 2 and a.

Step 3: Multiply the common factors to find the GCF.

$$\text{GCF} = 2 \cdot a = 2a$$

Mr. Aghead's Pro-Tip

Prime factorization is your most powerful tool. It works every time, for any number or variable. Break it down to basics!

How to Factor a Linear Expression

Factoring is like working the Distributive Property backward. You pull out the GCF and see what's left inside.

Example: Factor the expression $12a + 6b$.

Step 1: Find the GCF of the terms.

$$12a = 2 \cdot 2 \cdot 3 \cdot a$$
$$6b = 2 \cdot 3 \cdot b$$

The common factors are 2 and 3. GCF = $2 \cdot 3 = 6$.

Step 2: Rewrite each term as a product of the GCF and its remaining factor.

$$12a + 6b$$
$$\rightarrow 6(2a) + 6(b)$$

Step 3: Apply the Distributive Property to factor out the GCF.

$$\rightarrow 6(2a + b)$$

So, the factored form of $12a + 6b$ is $6(2a + b)$.

Mr. Aghead's Pro-Tip

Prime factorization is your most powerful tool. It works every time, for any number or variable. Break it down to basics!

What If There Are No Common Factors?

Some expressions cannot be simplified by factoring. If the only common factor between the terms is 1, the expression is already in its simplest form.

Example: Factor the expression 12x + 7y.

Step 1: Write the prime factorization of each term.

$$12x = 2 \cdot 2 \cdot 3 \cdot x$$
$$7y = 7 \cdot y$$

? What, if any, are the common factors?

Because there are no common factors other than 1, the expression $12x + 7y$ cannot be factored.

Check Your Understanding

Which expression represents the factored form of $12x + 11$?

A) $12(x + 11)$ B) $12(x - 11)$ C) $6(2x + 11)$ ✓ D) The expression cannot be factored.

Level Up: Factoring Expressions with Fractions

The same rules apply even when working with fractions. Find the GCF of the fractional coefficients and factor it out.

Example: Factor the expression $\frac{3}{4}4x + \frac{1}{4}$.

Step 1: Identify the GCF of the terms.

The terms are $\frac{3}{4}4x$ and $\frac{1}{4}$.

The GCF of the coefficients is $\frac{1}{4}\mathbf{4}$.

Step 2: Rewrite the expression as a product of the GCF and its remaining factors.

$$\frac{3}{4}4x + \frac{1}{4} = \frac{1}{4}(3x) + \frac{1}{4}(\mathbf{1})$$

Step 3: Factor out the GCF.

$$= \frac{1}{4}(3x + 1)$$

Mr. Aghead's Pro-Tip

When you factor a term out of itself (like 1/4 from 1/4), don't forget the **1** that's left behind! It's a common mistake to leave it blank.

Challenge Mission: The Ice Skating Trip

The Scenario: The total cost for Baydan and three of her friends to go ice skating can be represented by the expression $4x + 36$. The four friends pay an amount x to rent the ice skates and an admission fee. How much is the admission fee for one person?

Your Task:

1. Recognize that the total cost is shared by 4 people.
2. Factor the expression $4x + 36$ to find the cost per person.

Solution Walkthrough

Expression: $4x + 36$

Find the GCF: The GCF of $4x$ and 36 is 4.

Factor: $4(x + 9)$

Mr. Aghead's Pro-Tip

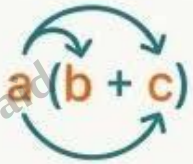
The 4 represents the four friends. The expression inside the parentheses, $(x + 9)$, represents the cost per person. Since x is the skate rental, the admission fee is $9 per person.

Part 2: The Power of Simplification

Now that you have mastered factoring, it's time to combine it with other operations. Simplifying complex expressions is a three-step process: distribute to remove parentheses, combine like terms, and then write the final answer in factored form.

1 DISTRIBUTE

Multiply to eliminate any parentheses.



2 COMBINE

Add or subtract like terms to condense the expression.

3 FACTOR

Pull out the GCF from the final, simplified expression for a clean result.

Simplifying in Action: A Step-by-Step Example

Simplify the expression $-2(x+3)+8x$. Write your answer in factored form.

Step 1: DISTRIBUTE	$-2(x+3)+8x$	*Apply the Distributive Property.
	$=-2x-6+8x$	
Step 2: COMBINE Like Terms	$=-2x+8x-6$	*Combine the x-terms.
	$=6x-6$	
Step 3: FACTOR the Result	$=6(x-1)$	*Write in factored form. The GCF is 6.

So, $-2(x+3)+8x=6(x-1)$.

Mastering Subtraction and Distribution

Simplify $\frac{2}{3}(18x - 12) - (6x + 7)$. Write your answer in factored form.

Step 1: DISTRIBUTE

$$\frac{2}{3}(18x - 12) - (6x + 7)$$
$$= (12x - 8) - (6x + 7)$$

Step 2: COMBINE Like Terms

$$= 12x - 8 - 6x - 7$$
$$= 12x - 6x - 8 - 7 \quad \textit{Arrange like terms}$$
$$= 6x - 15$$

Step 3: FACTOR the Result

The GCF of $6x$ and 15 is 3.

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

$$\boxed{3(2x - 5)}$$

Mr. Aghead's Pro-Tip: Danger Zone!

A minus sign in front of parentheses means you distribute a -1. It changes the sign of *every* term inside:

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

Learn from Mistakes: Find the Error

A student is simplifying $-3(x+2)+6x$. Find their mistake and correct it.

Student's Work:

$$-3(x+2)+6x = -3x+2+6x$$
$$= 3x+2$$

Where is the mistake?

The student only distributed the -3 to the x, not to the +2.

The Correction

The -3 must be multiplied by both terms inside the parentheses.

$$-3(x) = -3x$$
$$-3(+2) = -6$$

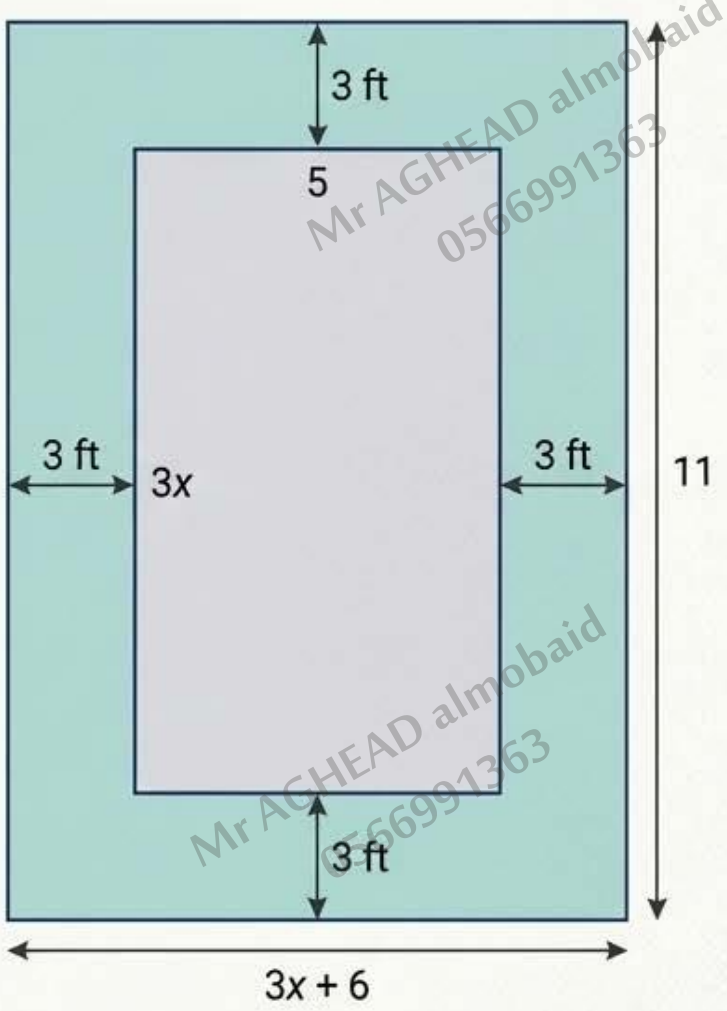
The Correct Solution

$$-3(x+2)+6x = -3x-6+6x$$
$$= 3x-6$$
$$= 3(x-2) \quad \text{Factored Form}$$

Challenge Mission: The Flower Border

The Scenario

A garden consists of a rectangular sitting region surrounded by a flower border. The sitting region has a length of **3*x* feet** and a width of **5 feet**. The flower border is **3 feet** wide on all sides. Write an expression, in factored form, that represents the area of the **flower border only**.



Strategy

1. Find the area of the **Total Rectangle** (sitting area + border).
2. Find the area of the **Inner Rectangle** (sitting area).
3. Subtract: **(Total Area) − (Inner Area) = Border Area.**
4. Simplify and factor the resulting expression.

Solution

- **Total Dimensions**: Length $= 3x + 3 + 3 = 3x + 6$.
  Width $= 5 + 3 + 3 = 11$.
- **Total Area**: $11(3x + 6) = 33x + 66$.
- **Inner Area**: $5(3x) = 15x$.
- **Border Area**: $(33x + 66) - 15x = 18x + 66$.
- **Factored Form**: "GCF is 6. $\boxed{6(3x + 11)}$"

Your Turn: The Practice Arena

Use your new skills to solve the following problems. The goal is to build speed and confidence.

Find the GCF (Use prime factorization)

1. $8xy, 12x$
2. $14ab, 28ab$
3. $27cd, 72cde$

Factor Each Expression (If it cannot be factored, write "cannot be factored")

4. $5x + 35$
5. $3x + 11y$
6. $45xy - 81y$

Simplify and Write in Factored Form

7. $3(x + 4) + 5x$
8. $\frac{2}{3}\left(6x - \frac{1}{2}\right) + 3x$
9. $\frac{3}{4}(24x + 28) - (4x - 1)$

*(Solutions will be on the next slide)

Practice Arena: Answer Key

GCF Solutions

1. $4x$

2. $14ab$

3. $9cd$

Factoring Solutions

4. $5(x+7)$

5. cannot be factored

6. $9y(5x-9)$

Simplification Solutions

7. $8x+12=4(2x+3)$

8. $4x-\frac{1}{3}+3x=7x-\frac{1}{3}$

   Cannot be factored further with integers

9. $18x+21-4x+1$

   $=14x+22$

   $=2(7x+11)$

Mr. Aghead's Pro-Tip

Check your work. Did you distribute the negative correctly in #9? Did you find the largest possible GCF in #6? Reviewing your mistakes is how you truly master the material.

Your Mastery Checklist

You have completed the guide to mastering linear expressions. Use this checklist to confirm your skills and remember the core strategies for any problem you face.

You Can Now...

- ✓ Identify a monomial.
- ✓ Find the GCF of any set of terms using prime factorization.
- ✓ Factor linear expressions by pulling out the GCF.
- ✓ Recognize an expression that cannot be factored.
- ✓ Simplify complex expressions using the correct order of operations (Distribute, Combine, Factor).
- ✓ Apply these skills to solve real-world problems.

Core Principles to Remember

Always look for the GCF first. It's the key that unlocks the problem.

Watch the signs. A single negative can change everything.

Factoring is the final polish. Always present your simplified answer in its cleanest, factored form.

Module (6): Write and Solve Equations

Module (6): Write and Solve Equations

01
02
03

First, Second & Third Lessons:

Write and Solve One-Step Equations,
Solve Two-Step Equations: $px + q = r$
& Write and Solve Two-Step
Equations: $px + q = r$

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Mastering the Art of Equations

A Comprehensive Guide to Solving One- and Two-Step Equations

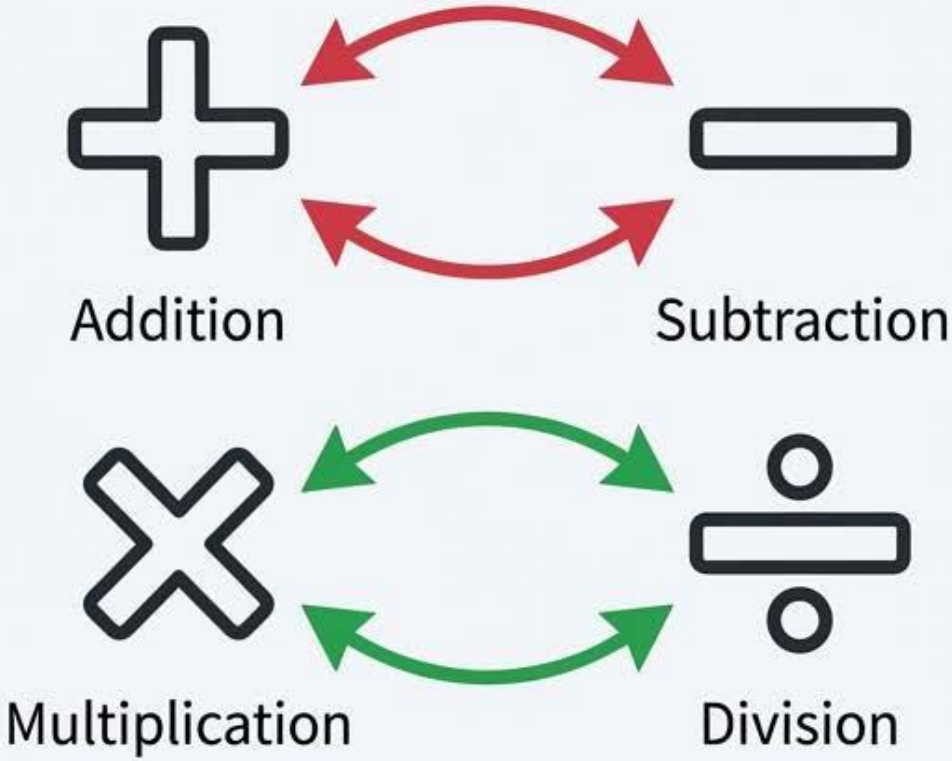
By Mr. Aghead

The #1 Rule: Keep the Equation Balanced

An equation is a sentence stating that two quantities are equal. Think of it like a balanced scale. Whatever you do to one side, you *must* do the exact same thing to the other side to maintain the balance.

Your Four Core Moves

The goal is to get the variable by itself (isolate it). To do this, we use the inverse, or opposite, move to cancel out the numbers on the same side as the variable.



Practice Drill: One-Step Equations (+ / −)

Use the inverse move to cancel the number next to the variable. If a number is being subtracted, add it to both sides. If it's being added, subtract it from both sides.

Worked Example

Solve: $x - 4 = -2$

$$x - 4 + 4 = -2 + 4$$

$$\mathbf{x = 2}$$

Check: $2 - 4 = -2$. Correct! ✓

Practice Problems

1. Solve: $6 + y = -8$
2. Solve: $-5 = b + 8$
3. Solve: $p - 11 = -5$

Practice Drill: One-Step Equations (× / ÷)

Use the inverse move to isolate the variable. If a variable is multiplied by a number, divide both sides by that number. If it's divided, multiply both sides.

Worked Example

Solve: $-8y = 24$

$$\frac{-8y}{-8} = \frac{24}{-8}$$

$$y = -3$$

Check: $-8(-3) = 24$. Correct! ✓

Practice Problems

1. Solve: $-7x = 56$
2. Solve: $\frac{d}{-9} = -6$
3. Solve: $12 = z - 8$

Watch out! This is a subtraction problem to keep you sharp!

Advanced Move: The Reciprocal

To undo multiplication by a fraction, you use a special move: multiply both sides by its reciprocal (the flipped version of the fraction). This instantly turns the coefficient into 1.

Pro-Tip: Before you use this move, always convert any mixed numbers into improper fractions!

Worked Example

Solve: $\left(-\frac{7}{8}\right)x = 4\frac{1}{2}$

Step 1 (Convert): $\left(-\frac{7}{8}\right)x = \frac{9}{2}$

Step 2 (Use Reciprocal): $\left(-\frac{8}{7}\right) * \left(-\frac{7}{8}\right)x = \frac{9}{2} * \left(-\frac{8}{7}\right)$

$x = -\frac{72}{14}$ which simplifies to $\boldsymbol{x = -\frac{36}{7}}$ or $\boldsymbol{-5\frac{1}{7}}$

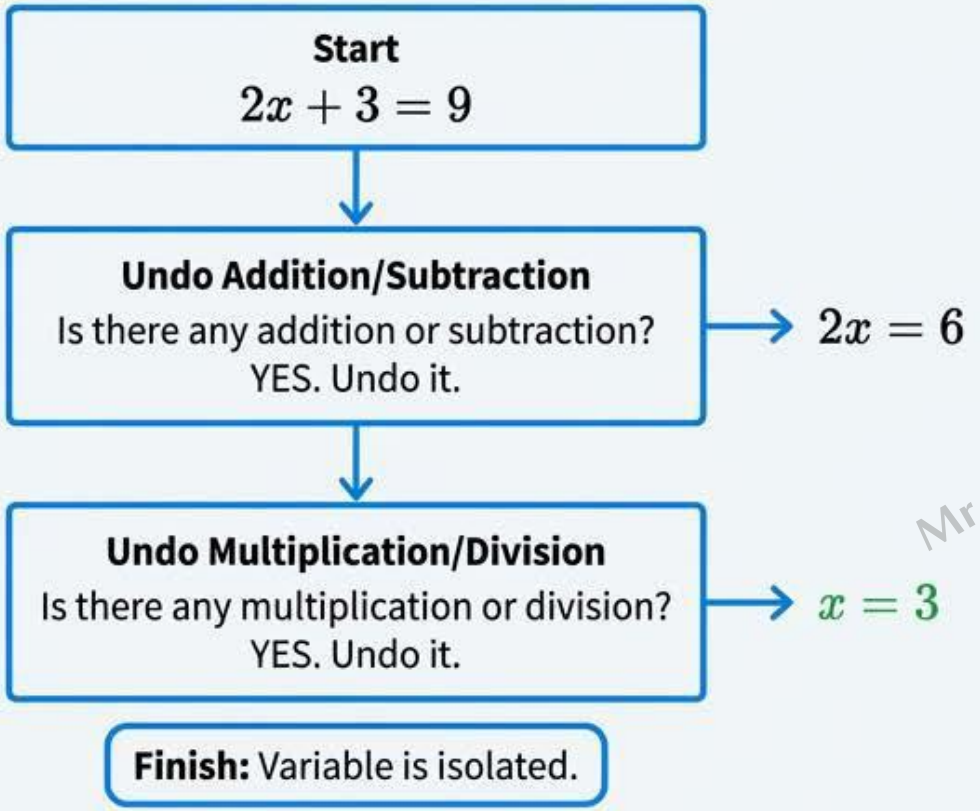
Practice

Solve: $\frac{2}{3}x = -1\frac{1}{4}$

The Two-Move Combo (px + q = r)

To solve two-step equations, we undo the operations in the *reverse* order of the usual order of operations (PEMDAS). This gives us a new order of attack: **SADMEP.**

1. **First Move:** Undo any **S**ubtraction or **A**ddition.
2. **Second Move:** Undo any **D**ivision or **M**ultiplication.



Combo Walkthrough

🧠 Worked Example: Solve $2x + 3 = 9$

Step 1: Undo Addition

$$2x + 3 - 3 = 9 - 3$$

First Move

$$2x = 6$$

Step 2: Undo Multiplication

$$\frac{2x}{2} = \frac{6}{2}$$

Second Move

$$x = 3$$

Always Check Your Work!

Substitute your answer back into the original equation:

$2(3) + 3 = 9$

$6 + 3 = 9$

$9 = 9$ ✓

Level Up: Combos with Decimals & Negatives

Don't panic! The moves and the strategy are exactly the same.

Negatives

Solve: $-2y - 7 = 3$

↓

Step 1: $-2y - 7 + 7 = 3 + 7$

→ $-2y = 10$

↓

Step 2: $\frac{-2y}{-2} = \frac{10}{-2}$

→ $y = -5$

✓ **$y = -5$**

Decimals

Solve: $5x - 3.8 = -6.4$

↓

Step 1: $5x - 3.8 + 3.8 = -6.4 + 3.8$

→ $5x = -2.6$

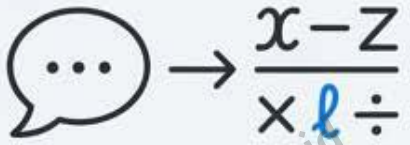
↓

Step 2: $\frac{5x}{5} = \frac{-2.6}{5}$

→ $x = -0.52$

✓ **$x = -0.52$**

Final Level: Translating Word Problems



Real-world problems use words. Your math skills use equations. The first step is always to translate the language.

Translation Key

English Phrase	Math Symbol
is equals results in	=
more than sum plus	+
less than difference minus	−
product of per times	×
quotient divided by	÷

Boss Battle: The Movie Party 

Toya had her birthday party at the movies. It cost $27 for pizza and $8.50 per friend for the movie tickets. How many friends could she have at her party if she spent a total of $78?

1. **Identify the Unknown:**
   🧠 What are we trying to find? The number of friends. Let's call it *n*.
2. **Translate to an Equation:**
   🧠 The cost is the flat fee for pizza PLUS the cost per friend. So: $27 + 8.50n = 78$.
3. **Solve the Equation:** 🧠
   $27 + 8.50n - 27 = 78 - 27 \rightarrow 8.50n = 51$
   $8.50n / 8.50 = 51 / 8.50 \rightarrow n = 6$
4. **Answer the Question in a Sentence:**
   Toya could have 6 friends at her party.

Boss Battle: Saving for a Skateboard

Rashan is saving for a skateboard that costs **$85**. He has already saved **$40** and plans to save the same amount each week for three weeks. **How much should Rashan save each week?**

1. Identify the Unknown:
   The amount saved each week. Let's call it **x**.

2. Translate to an Equation:
   ↳ His total savings will be what he already has PLUS 3 weeks of saving. So: **40 + 3x = 85**.

3. Solve the Equation:
   40 + 3x - 40 = 85 - 40 → 3x = 45
   3x / 3 = 45 / 3 → x = 15

4. Answer the Question in a Sentence:
   Rashan should save $15 each week.

Your Turn: The Sparring Session

Challenge yourself. Solve each equation, and check your answer.

Problem 1: $p - 11 = -5$	Problem 2: $-20 = -5b$
Problem 3: $(2/3)x = -1\ 1/4$	Problem 4: $n + 7.1 = 8.6$
Problem 5: $5x + 2 = 17$	Problem 6: $-3x - 9 = -15$
Problem 7: $1.3x + 1.5 = 5.4$	Problem 8: A taxi service charges \$1.50 plus \$0.60 per mile. The total charge for a trip to the airport was \$13.50. How many miles was the trip?

You've Mastered the Moves!

Your Strategies for Success

- The Golden Rule: Always keep the equation balanced.
- The Basic Moves: Use inverse operations (+/-, ×/÷) to isolate the variable.
- The Winning Combo (SADMEP): For two-step equations, undo Addition/Subtraction FIRST, then Multiplication/Division.
- The Final Level: Translate words into algebra to conquer any real-world problem.

A Presentation By Mr. Aghead

Content based on McGraw Hill's "Reveal Math" curriculum, Grade 7.

Module (6): Write and Solve Equations

04
05

Fourth & Fifth Lessons:

Solve Two-Step Equations: $p(x + q) = r$
& Write and Solve Two-Step Equations: $p(x + q) = r$

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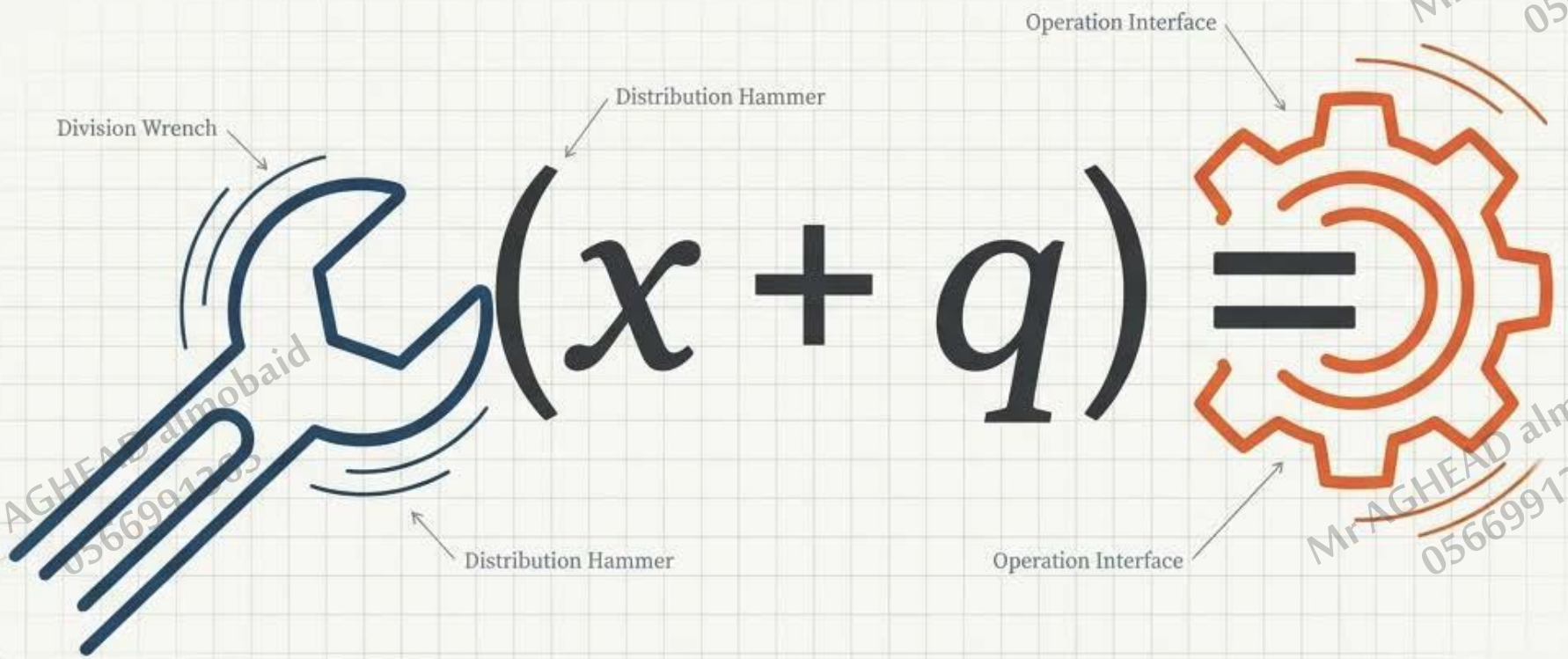
THE EQUATION SOLVER'S TOOLKIT

Mastering Two-Step Equations of the form $p(x + q) = r$



Anatomy of the Challenge: `p(x + q) = r`

$$p(x + q) = r$$

The Multiplier.
This is the number outside the parentheses that affects the entire group.

The Group.
A variable (x) and a constant (q) bundled together. Our primary goal is to find the value of x.

The Result.
The final value on the other side of the equation.

To solve for x, we need a strategy to handle the Multiplier and isolate the variable. We have two powerful tools in our toolkit to do just that.

Tool #1: The Division Wrench

Core Concept:

Use this tool to isolate the group $(x + q)$ first. It's most effective when the Result (r) is easily divisible by the Multiplier (p).

The Method:

1. **Identify:** Pinpoint p, $(x+q)$, and r.
2. **Divide:** Divide both sides of the equation by p. This removes the multiplier from one side.
3. **Isolate:** Solve the remaining one-step equation to find x.

Let's see it in action.

The Division Wrench in Action

Solve $3(x + 5) = 45$

$$3(x+5) = 45$$

$$\frac{3(x+5)}{3} = \frac{45}{3}$$

Step 1: Divide both sides by the multiplier.

$$x + 5 = 15$$

$$x + 5 - 5 = 15 - 5$$

Step 2: Isolate x by subtracting.

$$x = 10$$

Tool #2: The Distribution Hammer

Core Concept:

Use this tool to break open the parentheses first. This creates a standard two-step equation you already know how to solve.

The Method:

1. **Distribute:** Multiply the term outside the parentheses (p) with each term inside (x and q).
2. **Isolate the Term:** Add or subtract the constant to get the variable term by itself.
3. **Isolate the Variable:** Divide by the coefficient to find x.

Let's apply it to the same problem.

The Distribution Hammer in Action

Solve $3(x + 5) = 45$

$$3(x+5) = 45$$

Step 1: Distribute the 3.

$$(3 * x) + (3 * 5) = 45$$

$$3x + 15 = 45$$

Step 2: Isolate the term 3x.

$$3x + 15 - 15 = 45 - 15$$

$$3x = 30$$

Step 3: Isolate x.

$$3x / 3 = 30 / 3$$

$$x = 10$$

Two Paths, One Solution

Solve `5(n - 2) = -30`

Method 1 (The Division Wrench)

$$
\begin{aligned}
1 \quad & 5(n - 2) = -30 \\
2 \quad & 5(n - 2) / 5 = -30 / 5 \\
3 \quad & n - 2 = -6 \\
4 \quad & n - 2 + 2 = -6 + 2 \\
& \mathbf{n = -4}
\end{aligned}
$$

Method 2 (The Distribution Hammer)

$$
\begin{aligned}
1 \quad & 5(n - 2) = -30 \\
2 \quad & (5 * n) - (5 * 2) = -30 \\
3 \quad & 5n - 10 = -30 \\
4 \quad & 5n - 10 + 10 = -30 + 10 \\
5 \quad & 5n = -20 \\
6 \quad & 5n / 5 = -20 / 5 \\
& \mathbf{n = -4}
\end{aligned}
$$

Both tools get you to the correct answer. The best choice often depends on the numbers in the problem.

Strategic Choice: Which Tool is Best for the Job?

Use the **Division Wrench** when...

Pro-tip: The Result (r) is a clean multiple of the Multiplier (p).

4(x + 8) = 44

(Here, 44 ÷ 4 = 11, a whole number. Division is fast.)

Why? It avoids larger numbers and extra steps. It's direct and efficient.

Use the **Distribution Hammer** when...

Pro-tip: The Result (r) is NOT a clean multiple of the Multiplier (p).

3(x + 5) = 16

(Here, 16 ÷ 3 would create a fraction, making the next step more complex.)

Why? It keeps the calculations with whole numbers for as long as possible.

There's no 'wrong' first step, only more or less efficient paths. Practice helps you spot the fastest route!

Advanced Materials: Tackling Decimals & Fractions

Decimals

$0.2(c - 3) = -10$

Strategic Choice

Dividing by 0.2 is the same as multiplying by 5.
The Division Wrench is still a great choice.

Solution Snapshot

1. $0.2(c - 3) / 0.2 = -10 / 0.2$
2. $c - 3 = -50$
3. $c = -47$ ✅

Fractions

$(2/3)(n + 6) = 10$

Strategic Choice

Multiply by the reciprocal to clear the fraction.
This is a specialized use of the Division Property.

Solution Snapshot

1. $(3/2) * (2/3)(n + 6) = 10 * (3/2)$
2. $n + 6 = 15$
3. $n = 9$ ✅

The Final Step: The Quality Check

Your work isn't done until you've proven your answer is correct.
Substitute your solution back into the original equation.

Checking $x = 10$ for $3(x + 5) = 45$

1. Write the original equation: $3(x + 5) = 45$
2. Replace x with your solution: $3(\mathbf{10} + 5) = 45$
3. Solve using order of operations: $3(15) = 45$
4. Verify: $45 = 45$

The statement is true.
Your solution is correct.

From Words to Equations: Creating the Blueprint

Scenario

Mr. Vargas takes his class of **24 students** ice skating. Each student pays an **entrance fee (f)** and a **$4.75 fee** to rent skates. The **total cost** for the class is **$234.** What is the equation for this situation?

Deconstruction

Multiplier (p):

The number of groups -> **24** students

Group (x + q):

The cost per student -> **f** (unknown fee) + **$4.75** (skate rental)

Result (r):

The total cost -> **$234**

The Blueprint (The final equation):

$$24(f + 4.75) = 234$$

Key Idea: Look for a repeated action or group cost. That's your $p(x + q)$.

Field Mission #1: The Hay Ride

Three friends went to a local fair. Each friend spent the same amount of money for a total of $21. Each bought a hot dog for $5 and a ticket for a hay ride. How much did each hay ride ticket cost?

Step 1: Write the Equation (The Blueprint)

- Let x = the cost of a hay ride ticket.
- Cost per person: x + 5
- Number of people: 3
- Total cost: 21

$$3(x+5)=21$$

Step 2: Solve the Equation (Choose a Tool)

$$\frac{3(x+5)}{3}=\frac{21}{3}$$

(The Division Wrench is perfect here)

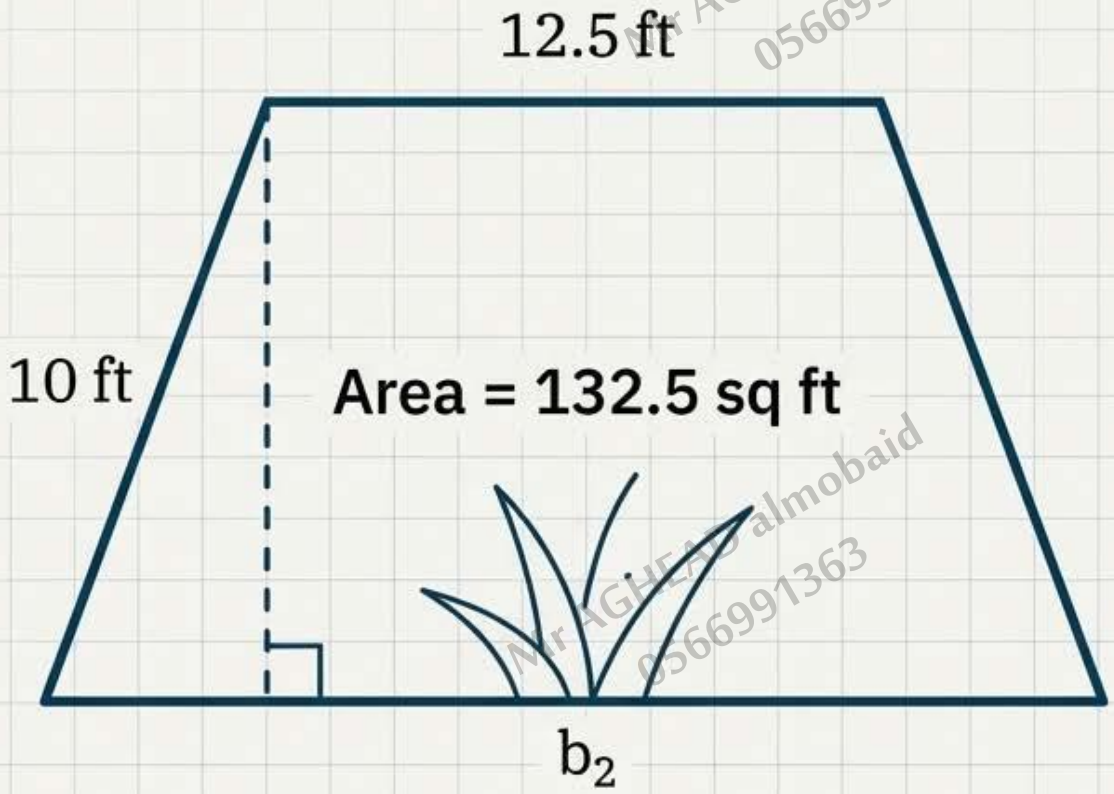
$$x+5=7$$

$$x=2$$

Each hay ride ticket cost $2. ✓

Field Mission #2: The Trapezoid Garden

Problem: A trapezoid-shaped garden has an area of 132.5 square feet. The height is 10 feet and one of the parallel bases is 12.5 feet long. What is the length of the other base?



Step 1: The Formula & Blueprint

Area of a Trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$

Substitute known values: $132.5 = \frac{1}{2}(10)(12.5 + b_2)$

Simplify to our form: $132.5 = 5(12.5 + b_2)$

Step 2: Solve the Equation

This is a $p(q + x) = r$ equation!

$$\frac{132.5}{5} = \frac{5(12.5 + b_2)}{5}$$

$$26.5 = 12.5 + b_2$$

$$14 = b_2$$

Answer: The other base of the garden is 14 feet long.

Workshop: Test Your Skills

Solve each equation. Check your solution. The answers are at the bottom of the slide.

1. $4(x + 8) = 44$

2. $-2(x + 4) = 18$

3. $-5(x - 10) = -35$

4. $0.4(x - 7) = 18$

5. $(\frac{4}{5})(x + 7) = 20$

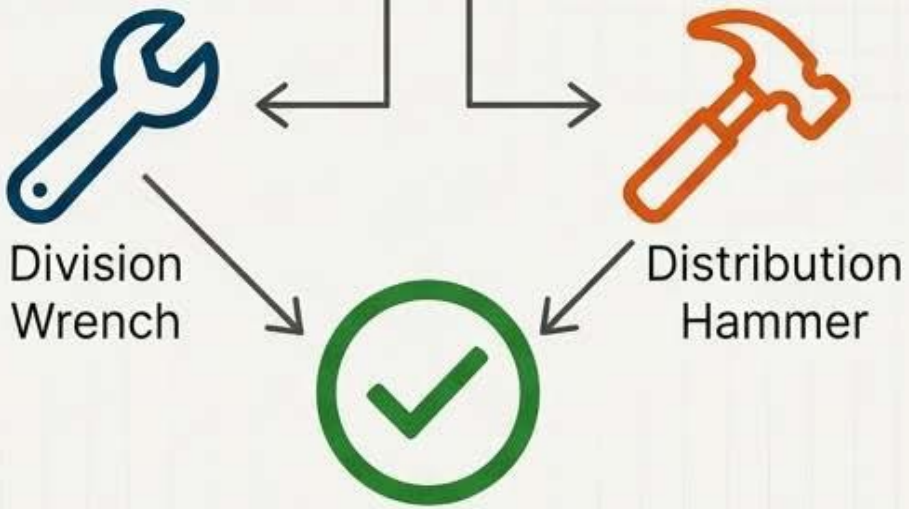
6. $-(\frac{7}{9})(x + 3) = 14$

1. $x = 3$ | 2. $x = 13$ | 4. $x = 52$ | 4. $x = 17$ | 3. $x = -18$ | 6. $x = -21$

You've Mastered the Toolkit

- **Deconstruct:** Always identify **p**, **(x+q)**, and **r** first.
- **Strategize:** Choose the best tool. Use the **Division Wrench** for clean divisions. Use the **Distribution Hammer** when division is messy.

$$p(x + q) = r$$



- **Execute:** Apply the properties of equality carefully and step-by-step.
- **Verify:** Always check your solution. It's the mark of a pro.

You are now equipped to deconstruct, solve, and verify any challenge in this form. Put your tools to work.

Module (7): Write and Solve Inequalities

Module (7): Write and Solve Inequalities

01
02
03

First, Second & Third Lessons:
Solve One-Step Addition and Subtraction Inequalities, Write and Solve One-Step Addition and Subtraction Inequalities & Solve One-Step Multiplication and Division Inequalities with Positive Coefficients.

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Mastering One-Step Inequalities

A Comprehensive Guide to Solving and Applying

Presented by mr.aghead

Beyond ‘Equals’: The Power of Inequalities

In mathematics, we don’t always want to say things are equal. Sometimes, we need to compare quantities to show that one is larger, smaller, or has a limit.

An **inequality** is a mathematical sentence that compares quantities.

Think about it:

The speed limit on a highway is a maximum, not an exact speed.

You need to be a certain height *or taller* to ride a rollercoaster.

Your phone has a limited amount of storage you cannot exceed.

These are all real-world inequalities. This guide will give you the tools to understand and solve them.

The Four Symbols of Comparison

$<$	is less than	$4 < 8$
$>$	is greater than	$3 > -2$
$\leq$	is less than or equal to	$-6 \leq -6$ or $5 \leq 5$
$\geq$	is greater than or equal to	$9 \geq 6$ or $-7 \geq -7$

Translating English into Math

When you see these phrases in a problem, you know which symbol to use. This is the key to setting up real-world problems correctly.

<

- is less than
- is fewer than

>

- is greater than
- is more than
- exceeds

≤

- is less than or equal to
- is no more than
- is at most

≥

- is greater than or equal to
- is no less than
- is at least

Visualizing the Solution: Graphing on a Number Line

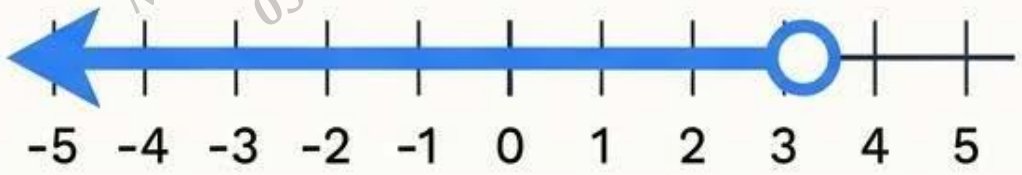
An inequality often has an infinite number of solutions. A graph is the best way to show them all.

The Open Dot

Use for: $<$ (less than) and $>$ (greater than).

Meaning: The number is NOT part of the solution. It's the starting point, but not included.

Example: Graphing $x < 3.5$. Place an open dot on 3.5. Draw an arrow to the left, showing all numbers less than 3.5 are solutions.

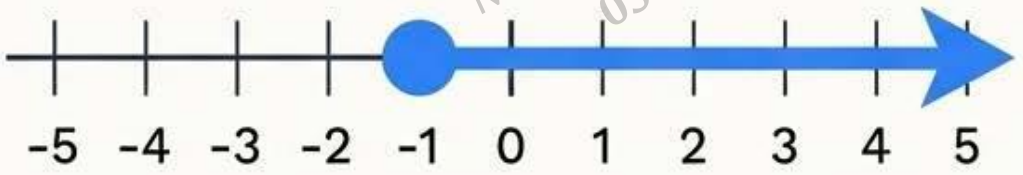


The Closed Dot

Use for: $\leq$ (less than or equal to) and $\geq$ (greater than or equal to).

Meaning: The number IS part of the solution.

Example: Graphing $x \geq -1$. Place a closed dot on -1. Draw an arrow to the right, showing -1 and all numbers greater than it are solutions.



The First Tools: Addition and Subtraction Properties

Your goal is to isolate the variable (get "x" by itself), just like with equations. These properties are the tools you'll use.

Subtraction Property of Inequality

In Words

If you subtract the same number from each side of an inequality, the inequality remains true.

In Symbols

If $a > b$, then $a - c > b - c$.

Example

$4 > -1$. Subtract 3 from both sides: ↘ ✓

$4 - 3 > -1 - 3$, which simplifies to $1 > -4$. True.

Addition Property of Inequality

In Words

If you add the same number to each side of an inequality, the inequality remains true.

In Symbols

If $a < b$, then $a + c < b + c$.

Example

$2 < 5$. Add 3 to both sides: ⟶

$2 + 3 < 5 + 3$, which simplifies to $5 < 8$. True.

Worked Example: Solving with Subtraction

Solve **x + 3 > 10**. Then graph the solution.

1 **Write the Inequality.**

$$x + 3 > 10$$

2 **Isolate 'x' using the Subtraction Property.**
Subtract 3 from both sides to undo the addition.

$$x + 3 - 3 > 10 - 3$$

3 **Simplify.**

$$x > 7$$

4 **Check Your Solution.**
Pick a number greater than 7, like 8. Substitute it back into the original inequality.

$$8 + 3 > 10 \longrightarrow 11 > 10$$

This is true, so our solution is correct.

5 **Graph the Solution.**
Draw a number line. Place an open dot on 7 (since it's >) and draw an arrow pointing to the right.

The Next Tools: Multiplication and Division Properties

Just like before, we use the inverse operation to isolate the variable. These properties let you do that with multiplication and division.

Important Note: These rules apply when you multiply or divide by a **positive** number.

Division Property of Inequality

In Words: If you divide each side of an inequality by the same positive number, the inequality remains true.

In Symbols: For $c > 0$, if $a > b$, then $\frac{a}{c} > \frac{b}{c}$.

Example: 9 < 15. Divide both sides by 3:
$\frac{9}{3} < \frac{15}{3}$, which simplifies to $3 < 5$. True.

Multiplication Property of Inequality

In Words: If you multiply each side of an inequality by the same positive number, the inequality remains true.

In Symbols: For $c > 0$, if $a > b$, then $ac > bc$.

Example: 10 > 7. Multiply both sides by 2:
$10(2) > 7(2)$, which simplifies to $20 > 14$. True.

Worked Examples: Solving with Multiplication & Division

Solving with Division

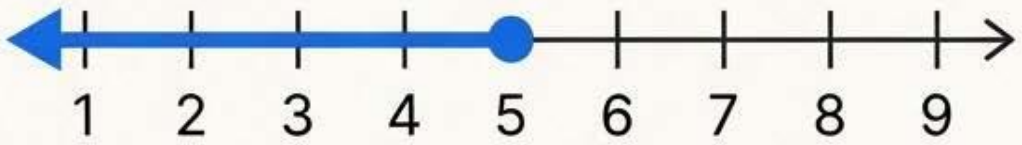
Solve $8x \leq 40$

Step 1: $8x \leq 40$

Step 2: $\frac{8x}{8} \leq \frac{40}{8}$

Step 3: $\boxed{x \leq 5}$

Step 4:



Solving with Multiplication

Solve $\frac{d}{2} > 7$

Step 1: $\frac{d}{2} > 7$

Step 2: $\frac{d}{2} * 2 > 7 * 2$

Step 3: $\boxed{d > 14}$

Step 4:

Masterclass: Deconstructing a Real-World Problem

Real-World Scenario

Dylan can spend **at most** $18 to ride go-karts and play games. The go-kart ride costs $5.50. Write and solve an inequality to determine the most he can spend on games.

Step 1: Translate the Words.

Identify the key phrase: '**at most** $18'.

≤ 18

Step 2: Define the Variable.

What are we trying to find?
The amount he can spend on games.

Let x = the cost of games.

Step 3: Write the Inequality.

Cost of go-karts + Cost of games ≤ Total money

$$5.50 + x \leq 18$$

Step 4: Solve.

$$5.50 + x - 5.50 \leq 18 - 5.50$$

$$x \leq 12.50$$

Step 5: Interpret the Solution in a Full Sentence.

The solution $x \leq 12.50$ means that the most Dylan can spend on games is $12.50.

More Real-World Scenarios

Exercise Goal

Problem: Hannah's exercise goal is to walk **at least** 6.75 miles this week. She has already walked 2.5 miles. How many more miles, m, does she need to walk?

Setup:

$$2.5 + m \geq 6.75$$

Solution:

$$m \geq 4.25$$

Hannah needs to walk at least 4.25 more miles.

Shopping Budget

Problem: Scarlett has \$60 to buy T-shirts and tie-dye kits. T-shirts are \$9 each and kits are \$2 each. If she buys an equal number of each, the inequality $9x + 2x \leq 60$ can be used. Find the number of each item she can buy.

Setup:

$$11x \leq 60$$

Solution:

$$x \leq 5.45\ldots$$

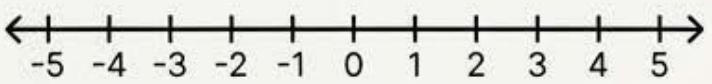
Since she can't buy part of a T-shirt, the greatest number of each item she can buy is 5.

Practice Zone, Part 1: Sharpen Your Skills

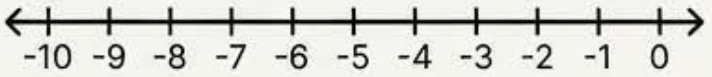
Solve each inequality and graph the solution set on a number line.

Addition & Subtraction

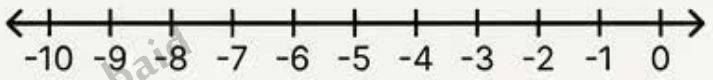
1. $x + 5 < 7$



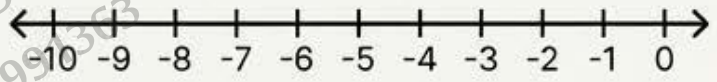
2. $5 \leq x + 12$



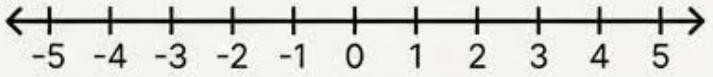
3. $x + 5.4 < -1.6$



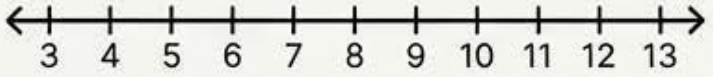
4. $x - 3 \leq -8$



5. $4 \geq x + \frac{3}{4}$

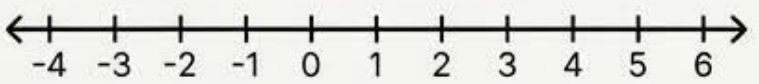


6. $6.9 < x - 2.3$

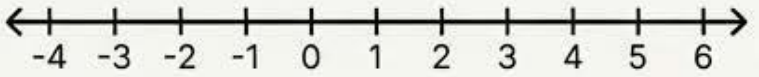


Multiplication & Division

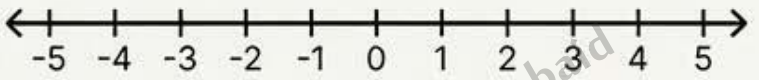
7. $3x > 12$



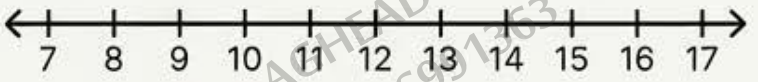
8. $60 \geq 12x$



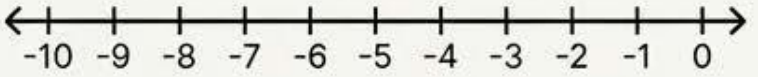
9. $-14 \geq 7x$



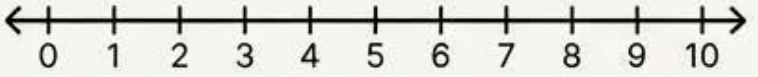
10. $\frac{x}{6} \geq 2$



11. $\frac{x}{2} > -4$



12. $\frac{x}{4} \leq 1.6$



Practice Zone, Part 2: Real-World Challenges

For each problem, first write an inequality. Then solve it and interpret the solution.

1.

Gabe went to an amusement park with $40 to spend. His ticket cost $26.50. Determine how much Gabe can spend on souvenirs and snacks.

Setup: $\$26.50 + x \leq 40$
Solution: $x \leq 13.50$
Interpretation: Gabe can spend at most $13.50 on souvenirs and snacks.

2.

Elena's account balance with her parents is −$5.50. She adds a certain amount of money by mowing the lawn. Elena now has an account balance less than $20. Determine a possible amount she earned.

Setup: $\$-5.50 + x < 20$
Solution: $x < 25.50$
Interpretation: Elena earned less than $25.50.

3.

A roller coaster requires riders to be at least 42 inches tall. William is 3 feet 1 inch tall. Determine how much taller William must be to ride the coaster. (Hint: Convert feet to inches first!)

Setup: $\$37 + x \geq 42$ (William's height is 3 * 12 + 1 = 37 inches)
Solution: $x \geq 5$
Interpretation: William needs to be at least 5 inches taller.

4.

To prepare for a dance competition, a team needs to practice at least 12.75 hours a week. The team has already practiced 10.5 hours. Find the minimum number of minutes the team needs to practice. (Hint: Notice the units!)

Setup: $\$10.5 + x \geq 12.75$ (x is in hours)
Solution: $x \geq 2.25$ hours
Interpretation: The team needs to practice for at least 135 minutes more. (2.25 hours × 60 minutes/hour = 135 minutes)

Precision Matters: $x < 2$ vs. $x \leq 2$

Compare and contrast the solutions to $x < 2$ and $x \leq 2$.

$x < 2$

Solutions are all numbers *strictly less than* 2. The number 2 itself is NOT a solution.

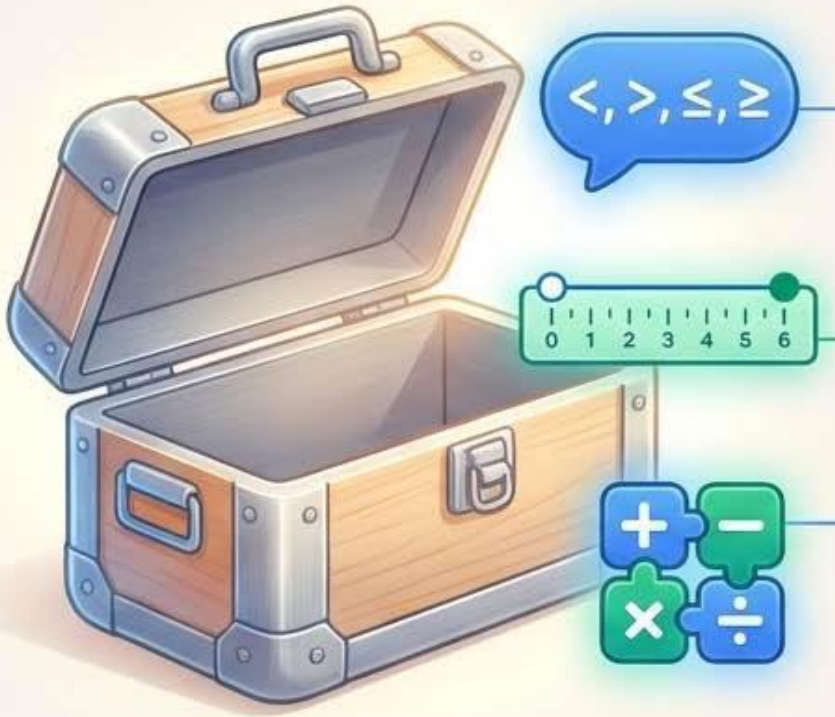
$x \leq 2$

Solutions are all numbers less than 2, *and also includes* the number 2. The number 2 IS a solution.

A single line under the symbol ($\leqq$ vs $<$) changes whether the boundary point is included in the answer. Always pay close attention!

You've Mastered the Toolkit

You now have the essential tools for solving one-step one-step inequalities. By mastering these skills, you can analyze and solve a huge range of problems that go beyond simple equality.



Your Master Toolkit – A Quick Recap:

- **The Language**: You can translate phrases like "at least" and "no more than" into the four inequality symbols: <, >, ≤, ≥.
- **The Graph**: You know that an open dot (○) means "not included" and a closed dot (●) means "included".
- **The Properties**: You can use the Addition, Subtraction, Multiplication, and Division Properties to isolate the variable and find the solution.

Keep practicing, and you'll find inequalities everywhere.
You now have the power to solve them.

Module (7): Write and Solve Inequalities

04
05
06

Fourth, Fifth & Sixth Lessons:

Solve One-Step Multiplication and Division Inequalities with Negative Coefficients, Write and Solve One-Step Multiplication and Division Inequalities & Write and Solve Two-Step Inequalities

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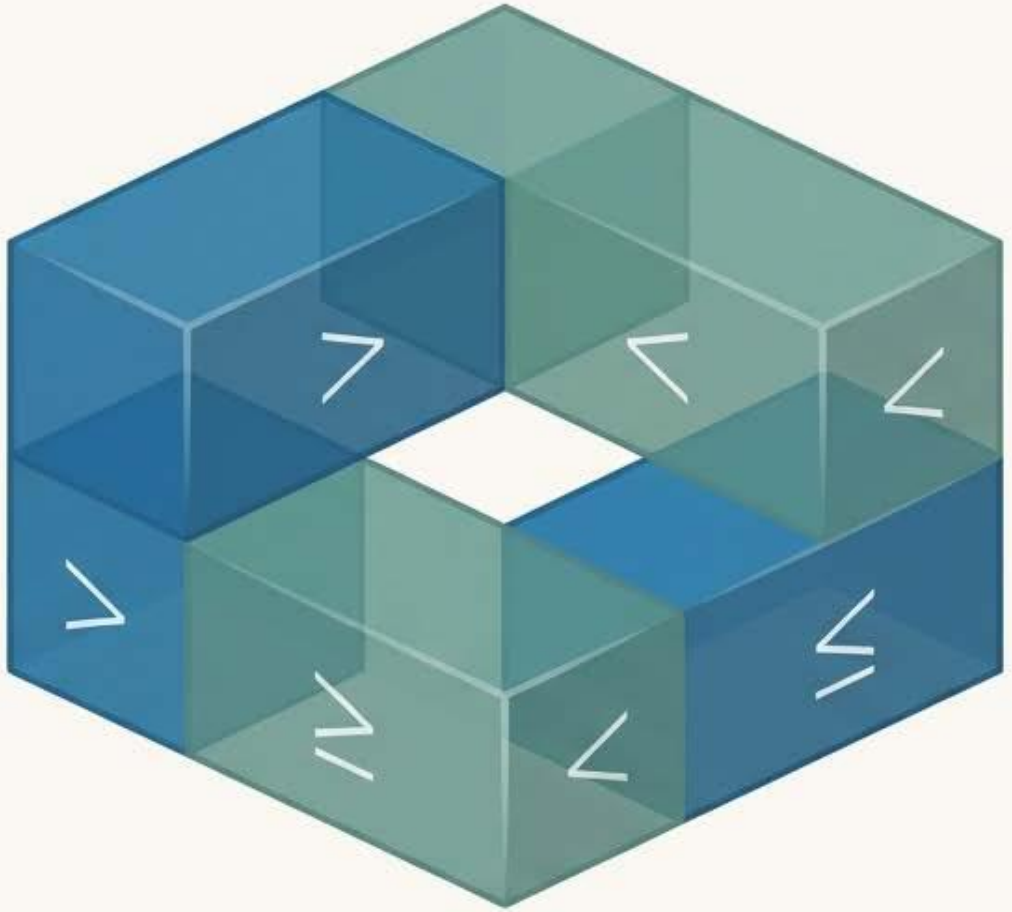
Mastering Inequalities

A Comprehensive Guide to Solving One-Step & Two-Step Problems



Presented by Mr. Aghead

Why Inequalities Matter: Telling Stories with Math

An equation gives you one precise answer (like $x = 5$). An inequality tells a story about a whole range of possibilities. You use them every day without realizing it.

Budgeting

You can spend *no more than* $50 on a new game.

$$cost \leq 50$$

Travel

The highway speed limit is 65 mph.

$$speed \leq 65$$

Goals

Our class needs to raise *at least* $1,000 for the trip.

$$money \geq 1000$$

Our mission is to learn how to build and solve these real-world stories.

Level 1: One-Step Problems (The Basics)

The main rule is simple: to isolate the variable, you perform the inverse operation on both sides—just like with equations.

- To undo multiplication, you **divide**.
- To undo division, you **multiply**.

Worked Example: Ling earns $15 per hour working at the **zoo.** She must work a week to earn *at least* $225. How many hours must she work?

1. Write the Inequality

Variable ▸ Let x be the number of hours.

$$15x \geq 225$$

2. Solve with Inverse Operations

$$\frac{15x}{/\,15} \geq \frac{225}{/\,15}$$

$$x \geq 15$$

3. Interpret the Solution

Ling must work **15 hours or more** to meet her goal.

The Golden Rule: The One Twist You MUST Remember

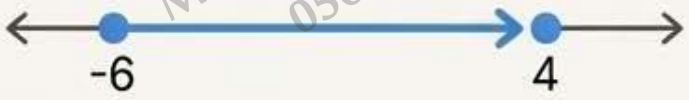
WHEN YOU MULTIPLY OR DIVIDE BOTH SIDES OF AN INEQUALITY BY A NEGATIVE NUMBER, YOU MUST FLIP THE INEQUALITY SYMBOL.

$<$ becomes $>$ $>$ becomes $<$ $\leq$ becomes $\geq$ $\geq$ becomes $\leq$

The 'Why' - A Visual Proof

Start with a true statement:

$-6 < 4$



Divide both sides by -2: $\frac{-6}{-2}$ $\frac{4}{-2}$

The result is: 3 and -2

The problem: If we don't flip the sign, we get $3 < -2$, which is FALSE. ✗

The solution: To keep the statement true, we must flip the symbol: $3 > -2$

The solution: To keep the statement true, we must flip the symbol: $3 > -2$

The inequality is now TRUE.

Golden Rule in Action: Division by a Negative

Step-by-Step Walkthrough

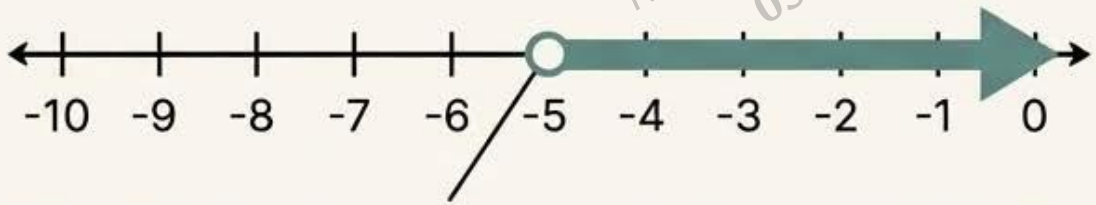
Solve **$-2x < 10$**

1. $-2x < 10$ (The goal is to get *x* alone)

2. $\frac{(-2x)}{-2} > \frac{10}{-2}$ ⟵ **FLIP!**

3. $\boxed{x > -5}$ (The final solution).

Graphing the Solution



The Circle: Use an **open circle** at -5. Why? Because the solution is *greater than* -5, but does not include -5 itself.

The Arrow: Draw the arrow pointing to the right, covering all numbers greater than -5.

Mr. Aghead's Pro-Tip

Always check your work! Pick a number in your solution set (like 0) and plug it into the original inequality: $-2(0) < 10 \rightarrow 0 < 10$. It's true!

Golden Rule in Action: Multiplication by a Negative

Step-by-Step Walkthrough

Solve $x / -4 \geq 3$

1. $x / -4 \geq 3$

FLIP!

2. $(x / -4) * -4 \leq 3 * -4$

3. $x \leq -12$

Graphing the Solution

The Circle: Use a closed (filled-in) circle at -12. Why? Because the solution is less than or equal to -12, so -12 itself is included.

The Arrow: Draw the arrow pointing to the left, covering all numbers less than -12.

Level 2: Combining Your Skills with Two-Step Inequalities

Don't be intimidated. Two-step problems just combine two steps you already know. The strategy is to "undo" the order of operations.

The Strategy (SADMEP)

1st **S**ubtraction or **A**ddition.

2nd **D**ivision or **M**ultiplication.

(And watch for the Golden Rule!)

Worked Example

Solve $-5x - 12 \leq 8$

Step 1 (Undo Subtraction): Add 12 to both sides.

$$-5x - 12 + 12 \leq 8 + 12$$

$$-5x \leq 20$$

Step 2 (Undo Multiplication): Divide both sides by -5.

$$\frac{-5x}{-5} \geq \frac{20}{-5}$$ ← Golden Rule alert!

$$x \geq -4$$

The Process is Always the Same, Even with Decimals & Fractions

Mr. Aghead's Pro-Tip

Don't let decimals or fractions intimidate you! The rules of algebra don't change. Just follow the SADMEP strategy.

Example 1: Decimals

Solve: $4.7x - 3.25 \leq 10.85$

Step 1 (Add 3.25):

$$\begin{array}{r} 4.7x - 3.25 \leq 10.85 \\ +\ 3.25 \quad +\ 3.25 \\ \hline 4.7x \leq 14.1 \end{array}$$

Step 2 (Divide by 4.7):

$$\frac{4.7x}{4.7} \leq \frac{14.1}{4.7}$$

$$x \leq 3$$

(Note: No flip needed, we divided by a positive number!)

Example 2: Fractions

Solve: $(3/4)x - 1/2 > 3/8$

Step 1 (Add 1/2 or 4/8):

$$\begin{array}{r} (3/4)x - 1/2 > 3/8 \\ +\ 1/2 \quad +\ 4/8 \\ \hline (3/4)x > 7/8 \end{array}$$

Step 2 (Multiply by reciprocal 4/3):

$$\left(\frac{4}{3}\right) \cdot \left(\frac{3}{4}\right)x > \left(\frac{4}{3}\right) \cdot \left(\frac{7}{8}\right)$$

$$x > 28/24$$

$$x > 7/6$$

From Words to Algebra: Writing Two-Step Inequalities

The Key

To translate a real-world problem, look for three main parts of the story.

The Starting Point / Flat Fee: A constant number that doesn't change.

The Rate of Change / Per-Item Cost: The number multiplied by the variable (x).

The Limit / Goal / Budget: The number on the other side of the inequality symbol.

Example: Meredith is given a $50 monthly allowance. She buys lunch for school, and each lunch costs $2.50. She wants to have *at least* $12 left at the end of the month.

Translate the Parts:

Starting Point: **50**

Rate of Change: **- 2.50x**

(It's negative because she's spending money)

The Goal: **≥ 12**

Build the Inequality:

Starting Amount - Spending ≥ Amount Left

Final Inequality:

$$50 - 2.50x \geq 12$$

Application Showcase 1: The Bowling Record

Scenario: Stewart has **34 strikes** so far this season. He averages **2 strikes per game**. He needs *at least* **61 strikes** to beat the league record. Write and solve **an inequality to find the number of additional games (g)** he must bowl.

Step 1:
Write the Inequality

Current Strikes + (Strikes per Game × Games) ≥ Record Goal

$$34 + 2g \geq 61$$

Step 2:
Solve the Inequality

$$34 + 2g - 34 \geq 61 - 34$$

$$2g \geq 27$$

$$g \geq 13.5$$

Step 3:
Interpret the Solution

The math says $g \geq 13.5$. But you can't bowl half a game. To have *at least* 61 strikes, he must round up.

Conclusion: Stewart must bowl **at least 14 games** to beat the record.

Application Showcase 2: The Bicycle Rental

Scenario

A rental company charges a $15 flat fee plus $4 per hour to rent a bicycle. Margie wants to spend ***no more than*** $27 for her rental. Write and solve an inequality to find how many hours (*h*) she can rent the bicycle.

Step 1: Write the Inequality →

Flat Fee + (Hourly Rate × Hours) ≤ Budget

$$15 + 4h \leq 27$$

Step 2: Solve the Inequality →

$$15 + 4h - 15 \leq 27 - 15$$

$$4h \leq 12$$

$$h \leq 3$$

Step 3: Interpret the Solution →

The math says $h \leq 3$. This means the number of hours must be 3 or less.

****Conclusion****

Margie can rent the bicycle for a **maximum of 3 hours**.

Check Your Understanding

Solve each inequality and graph the solution on a number line.

1. $-6x \geq 66$

2. $\frac{x}{8} > -2$

3. $-3x - 3 > 12$

4. $\frac{10 + x}{4} \geq 5$

Click to Reveal Solutions

1. Solution: $x \leq -11$

2. Solution: $x > -16$

No flip! We multiplied by a positive 8.

3. Solution: $x < -5$

4. Solution: $x \geq -20$

Watch Out! Avoid These 3 Common Traps

The Trap:

Forgetting to flip the symbol when multiplying/dividing by a negative OR flipping it when you don't need to (e.g., when the number on the other side is negative).

The Fix:

× (-) ÷ (-) ≥

The rule is ONLY about the number you are multiplying or dividing by. When you see **÷ (-)** or **× (-)** on both sides, immediately circle the inequality symbol to remind yourself to flip it.

The Word Mix-Up

Confusing the meaning of key phrases.

The Fix:

- 'At least' / 'minimum' / 'no less than' always means **≥** (that number or more).
- 'At most' / 'maximum' / 'no more than' always means **≤** (that number or less).

The Graphing Glitch

Using an open circle when you need a closed one, or vice-versa.

The Fix:

If the symbol has an 'equals' line under it (≥, ≥, ≤ ≤), it means the number is included, so you **'close the door'** with a filled-in circle (●).
If not (<, >), leave it open (O).

<, > →

Your Mastery Toolkit: The Complete Summary

The Core Process (SADMEP)

To solve any inequality, undo the operations in reverse order:

- **1st:** Undo Addition/Subtraction.
- **2nd:** Undo Multiplication/Division.

THE GOLDEN RULE

If you multiply or divide both sides by a **NEGATIVE** number, you **MUST FLIP THE SYMBOL!**

< FLIP >

Graphing Guide

> (greater than) or **<** (less than) → **Open Circle (○)**

≥ (greater than or equal to) or **≤** (less than or equal to) → **Closed Circle (●)**

Word Problem Keywords

- **≥:** at least, minimum, no less than
- **≤:** at most, maximum, no more than
- **>:** more than, is greater than
- **<:** less than, is fewer than

You've Mastered the Language of Inequalities!

You now have the complete toolkit to translate, solve, and interpret a wide range of real-world problems. The story of 'at least' and 'no more than' is yours to write and solve.

Keep practicing to make your skills even sharper.

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ختاماً، نسأل اللّه أن يوفقكم، وأن تكون هذه الملزمة قد حققت الفائدة المرجوة ♥

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363