احجز مكانك واستعد للامتحان بثقة كاملة

ملزمة الرياضيات الفصل الثاني

Reveal 6 عام لعام 2026

تنويه:

تم إنشاء هذه الملزمة لمساعدتك، ولكن المرجع الرئيسي هو الكتاب، وسيكون هناك ملف إضافي للأمثلة.

لحجز مقعدك قم بالتواصل معنا

اضغط هنا: 0566991363

يمكنكم حجز حصة لأي مادة دراسية معنا وبأسعار مريحة.

شرح الدروس

للتواصل والحجز

انضم للقناة

لحجز مقعدك قم بالتواصل معنا

اضغط هنا: 0566991363

Module (5): Numerical and Algebraic Expressions

Module (5): Numerical and Algebraic Expressions

01/02 First & Second Lessons:

Powers and Exponents & Numerical Expressions

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363

Math Masterclass

by mr.aghead

Part 1: Powers & Exponents | Part 2: Numerical Expressions

A Masterclass by mr.aghead

Your Path to Mastery

Today, we will master two essential building blocks of mathematics. First, we'll learn a powerful shortcut for multiplication. Then, we'll learn the universal rules that allow us to solve any complex expression.

Part 1: Mastering the Shortcut

- ✓ What are Powers and Exponents?
- ✓ How to Write and Evaluate Them
- ✓ Putting Powers to Work in the Real World

Part 2: Mastering the Rules

- Why We Need an Order of Operations
- The Four Steps to Solve Any Expression
- Translating Words into Math

A Shortcut for Repeated Multiplication

Multiplication is a shortcut for repeated addition. For example,
For example, $4 + 4 + 4$ is just 3×4.

But what about repeated *multiplication*? How would you write this?

$$7 \times 7 \times 7 \times 7 \times 7$$

It's long and messy. We need a better way. We need **powers**.

$$7^5$$

BASE
(The number used as a factor)

EXPONENT
(How many times the base is used as a factor)

POWER

How to Write Products as Powers

To write a product using an exponent, identify the base (the number being multiplied) and count how many times it's used as a factor. That count is your exponent.

Example 1: Whole Numbers

Product: $8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8$

Base: 8
Count: 10 times

Power: 8^{10}

Example 2: Fractions

Product: $(2/5) \times (2/5) \times (2/5)$

Base: 2/5
Count: 3 times

Power: $(2/5)^3$

Key Point

Use parentheses! $(2/5)^3$ is not the same as $2^3/5$. The parentheses show that the entire fraction is the base.

$(2/5)^3$ ✓

$2^3/5$ ✗

How to Evaluate Powers

Evaluating a power means finding its final value by doing the multiplication.

CRITICAL WARNING!

A common mistake is to multiply the base and the exponent.

4^5 **NOT** $4 \times 5 = 20$ ✗

4^5 **IS** $4 \times 4 \times 4 \times 4 \times 4 = 1{,}024$ ✓

Example 1: Whole Number

Power: 4^5

As a Product: $4 \times 4 \times 4 \times 4 \times 4$

Value: **1,024**

Example 2: Fraction

Power: $\left(\frac{1}{3}\right)^4$

As a Product: $\left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right)$

Value: **1/81**

Example 3: Decimal

Power: $(2.5)^3$

As a Product: $2.5 \times 2.5 \times 2.5$

Value: **15.625**

Check Your Understanding

Take a moment to solve these. The answers are on the bottom right.

Part A: Write as a Power

1. $3 \times 3 \times 3 \times 3 \times 3 \times 3$
2. $(1/4) \times (1/4) \times (1/4)$
3. 15×15

Part B: Evaluate Each Power

4. 5^3
5. 10^4
6. $(2/5)^3$
7. $(0.2)^4$

Answers

1. 3^6
2. $(1/4)^3$
3. 15^2
4. 125
5. 10,000
6. 8/125
7. 0.0016

Powers in the Real World: Bacteria Growth

A biologist is studying bacteria. He starts with 3 cells and records their growth. The table shows the pattern. How many bacteria will there be after 30 hours?

Number of Hours	Number of Bacteria as a Product	Number of Bacteria as a Power
5	3×3	3^2
10	$3 \times 3 \times 3$	3^3
15	$3 \times 3 \times 3 \times 3$	3^4
20	$3 \times 3 \times 3 \times 3 \times 3$	3^5

Let's Find the Pattern:

1. The exponent is always `(hours ÷ 5) + 1`.
2. For 30 hours, the exponent is `(30 ÷ 5) + 1 = 7`.
3. The expression is `3^7`.

Solution:

$$3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 2{,}187$$

There will be **2,187 bacteria cells** after 30 hours.

Part 2: Why We Need Rules for Math

You've mastered powers, but what happens when they're part of a bigger problem?
Consider this expression: **$12 + 3 \times 4$**

Path 1: Solving Left to Right

$$12 + 3 = 15$$
$$\downarrow$$
$$15 \times 4 = 60$$

60 ✗

Path 2: Multiplying First

$$3 \times 4 = 12$$
$$\downarrow$$
$$12 + 12 = 24$$

24 ✓

The Problem: Two different answers for the same expression. Math can't work this way! We need a single set of rules so that everyone, everywhere, gets the same correct answer. This is called the **Order of Operations.**

The Order of Operations: Your 4-Step Game Plan

Follow these steps in order, every single time, to guarantee the correct answer.

1 ( )

Step 1: Grouping Symbols

Solve everything inside parentheses `( )` or brackets `[ ]` first.

2 x^2

Step 2: Exponents

Evaluate all powers.

3 × ÷

Step 3: Multiply and Divide

Work from **left to right**, performing any multiplication or division as you see it.

4 + −

Step 4: Add and Subtract

Work from **left to right**, performing any addition or subtraction as you see it.

Let's Solve One Together: Step-by-Step

$$6^2 - 12 \div 3 + (14 - 9) \times 2$$

Step 1: Grouping Symbols

$6^2 - 12 \div 3 + \boxed{(14 - 9)} \times 2$

$= 6^2 - 12 \div 3 + \mathbf{5} \times 2$

Step 2: Exponents

$\boxed{6^2} - 12 \div 3 + 5 \times 2$

$= \mathbf{36} - 12 \div 3 + 5 \times 2$

Step 3: Multiply & Divide (Left to Right)

$36 - \boxed{12 \div 3} + 5 \times 2$

$= 36 - \mathbf{4} + \boxed{5 \times 2}$

Step 4: Add & Subtract (Left to Right)

$\boxed{36 - 4} + 10$

$= \mathbf{32} + 10$

$= \mathbf{42}$

Final Answer: 42

Now, You Try It

Use the Order of Operations to find the value of each expression. Show your steps!

1 $100 - 3^2 \times (6 + 4) + 2$	2 $9 + 7 \times (15 + 3) \div 3^2$	3 $8.2 \times (2^4 - 3) + 8$
Answer: 12	*Answer: 23*	*Answer: 114.6*

Check Your Work
Solution 1: $100 - 3^2 \times 10 + 2$ -> $100 - 9 \times 10 + 2$ -> $100 - 90 + 2$ -> $10 + 2 = 12$
Solution 2: $9 + 7 \times 18 \div 3^2$ –> $9 + 7 \times 18 \div 9$ –> $9 + 126 \div 9$ -> $9 + 14 = 23$
Solution 3: $8.2 \times (16 - 3) + 8$ -> $8.2 \times 13 + 8$ –> $106.6 + 8 = 114.6$

From Words to Expressions

Paula is shopping for gifts. Write an expression to find her total cost, then solve it.

- 5 lotions
- 2 candles
- 4 lip balms

Item	Cost ($)
Lotion	5.00
Candle	7.80
Lip Balm	2.49

Part A: Write the Expression

We can represent the total cost like this:

(Cost of Lotions) + (Cost of Candles) + (Cost of Lip Balms)

→ $(5 \times 5.00) + (2 \times 7.80) + (4 \times 2.49)$

We can even use powers!

→ $(5^2) + (2 \times 7.80) + (4 \times 2.49)$

Part B: Find the Total Cost

$25 + 15.60 + 9.96 = \$50.56$

The total cost is **$50.56**.

Your Final Challenge: Art Supply Logistics

Problem: An art store sells kits. A school buys 30 small, 35 medium, and 10 large kits. They return 11 medium kits. How many total boxes of crayons and sketch pads do they have?

Art Kit Size	Boxes of Crayons	Sketch Pads
Small	16	20
Medium	24	40
Large	68	100

Solution Breakdown

1 **Find the final number of medium kits.**

35 - 11 = 24 medium kits

2 **Write an expression for the total CRAYONS.**

(30 × 16) + (24 × 24) + (10 × 68)

480 + 576 + 680 = 1,736 crayons

3 **Write an expression for the total SKETCH PADS.**

(30 × 20) + (24 × 40) + (10 × 100)

600 + 960 + 1000 = 2,560 sketch pads

You've Mastered the Building Blocks

You now have two of the most powerful tools in mathematics. Remember these key ideas to avoid common mistakes.

Key Takeaway 1: Powers are Repeated Multiplication

Don't Do This	$2^3 = 2 \times 3 = 6$	✗
Do This	$2^3 = 2 \times 2 \times 2 = 8$	✓

Key Takeaway 2: The Order of Operations is Law

In $42 + 6 \div 2$, you **must** divide before you add.

Don't Do This	$48 \div 2 = 24$	✗
Do This	$42 + 3 = 45$	✓

Your Superpower: You can now take complex problems, translate them into the language of math, and solve them with confidence using a clear set of rules.

Module (5): Numerical and Algebraic Expressions

03
04

Third & Fourth Lessons:

Write Algebraic Expressions &
Evaluate Algebraic Expressions

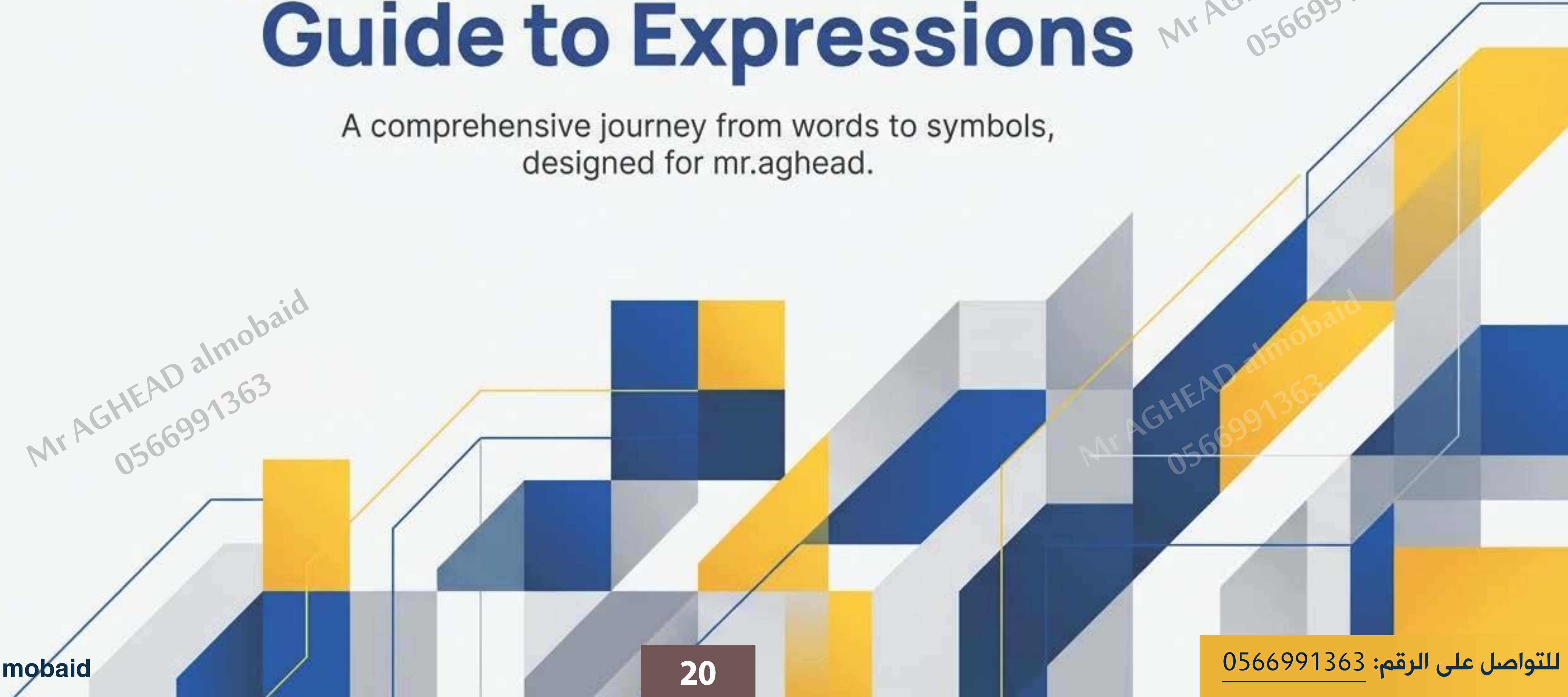
لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363

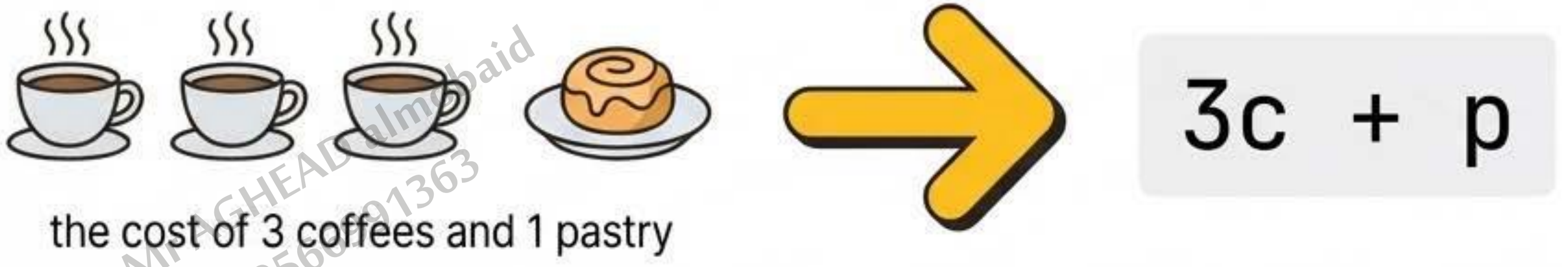
Algebra Ace: Your Ultimate Guide to Expressions

A comprehensive journey from words to symbols, designed for mr.aghead.



What is Algebra? It's the Language of Problem Solving.

Algebra is a mathematical language of symbols, including variables. It's a powerful tool that helps us represent unknown information and relationships in a clear, concise way. Mastering this language allows you to model real-world situations and find solutions efficiently.



the cost of 3 coffees and 1 pastry

$3c + p$

Key Vocabulary

Algebraic Expression: A combination of numbers, variables, and at least one operation. Unlike a numerical expression, it contains one or more variables.

Example: $5n + 2$

In this guide, you will learn how to read, write, and use this powerful language.

Your Path to Mastery: The 5 Levels

Level 1: Decode the Anatomy

Learn the fundamental parts of any algebraic expression.

Level 2: Basic Translation

Translate simple word phrases into one-step expressions.

Level 3: Advanced Translation

Combine operations to build two-step expressions from complex phrases.

Level 4: Calculate the Value

Substitute numbers for variables to evaluate any expression.

Level 5: The Final Challenge

Apply all your skills to solve real-world problems.

Level 1: Decode the Anatomy of an Expression

Term

When addition or subtraction signs separate an expression, each part is a term.

In our example: 4x, 12, and 2x are all terms.

Variable

A letter or symbol used to represent an unknown quantity.

In our example: x is the variable.

Coefficient

The numerical factor of a term that contains a variable.

In our example: 4 is the coefficient of 4x, and 2 is the coefficient of 2x.

Constant

A term without a variable. Its value does not change.

In our example: 12 is the constant.

Like Terms

Terms that contain the same variables raised to the same powers.

In our example: 4x and 2x are like terms.

Level 1 Challenge: Identify the Parts

I Do (Guided Example)

Expression: 6n + 7n + 4 + 2n

- **Terms:** 6n, 7n, 4, 2n
- **Like Terms:** 6n, 7n, 2n (All have the variable ‘n’)
- **Coefficients:** 6, 7, 2
- **Constant:** 4

We Do (Check Your Understanding)

Your Turn! Identify the parts of this expression: 3x + 2 + 10 + 4x

Solution:

- **Terms:** 3x, 2, 10, 4x
- **Like Terms:** 3x and 4x; 2 and 10
- **Coefficients:** 3, 4
- **Constants:** 2, 10

Level 2

Level 2: The Translator's Toolkit

To write an expression, you need to recognize the keywords that signal specific operations. Always start by defining your variable (e.g., ‘Let `n` represent a number’).

+

- increased by
- the sum of
- more than

−

- less than a number
- fewer than
- decreased by

×

- the product of
- times
- twice

÷

- the quotient of
- one-third of
- divided by

Pro Tip: The phrase ‘less than’ is tricky! ‘5 less than a number’ is written as `n - 5`, not `5 – n`. The order is reversed.

Level 2 Challenge: One-Step Translations

Words → Define Variable → Expression

I Do: Guided Examples

1. **Addition:**
   Words: “ten dollars more than Anthony earned”
   Variable: Let `d` = dollars Anthony earned
   Expression: `d + 10`
2. **Subtraction:**
   Words: “twelve dollars less than the original price”
   Variable: Let `p` = the original price
   Expression: `p − 12`
3. **Multiplication:**
   Words: “four and one-half times the number of gallons”
   Variable: Let `g` = number of gallons
   Expression: `4.5g`

We Do: Check Your Understanding

Your Turn!

Translate: “six times more money than Eliot saved”

Solution:

Let `m` = money Eliot saved; **Expression:** `6m`

Level 3: Advanced Translation with Two Steps

Level 3

Two-step expressions simply combine two of the operations you've already mastered. The key is to identify both keywords and build the expression piece by piece.

I Do: Guided Example

Words: "five less than three times the number of points"

Step 1: Identify the operations.

- ✓ "less than" → Subtraction
- ✓ "three times" → Multiplication

Step 2: Define the variable.
Let `p` = the number of points.

Step 3: Build the expression.
"three times the number of points" → `3p`
→ "five less than *that*" → `3p - 5`

Key Insight: Notice how "less than" reverses the order. We are subtracting 5 *from* the `3p`. The expression `5 - 3p` would mean "3 times the number of points less than 5," which is different!

Level 3 Application: From Geometry to Algebra

A rectangle has a length that is twice its width. Write an algebraic expression to represent its perimeter.

I Do: Step-by-Step Solution

1. **Visualize:** A clean, simple diagram of a rectangle is shown.

2. **Define Variable:** Let "w" represent the width.
3. **Express Other Quantities:** The length is "twice the width," so the length is "2w".
4. **Label the Diagram:** The diagram is now labeled, with the short sides marked "w" and the long sides marked "2w".

5. **Write the Expression:** The perimeter is the sum of all sides. Perimeter = "w + w + 2w + 2w".

We Do: Check Your Understanding

Your Turn! A rectangle's length is *three times* its width. Write the expression for its perimeter.

Solution: Let ‘w’ = width, length = ‘3w’.
Perimeter = ‘w + w + 3w + 3w’.

Level 4: Calculate the Value

Level
4

To "evaluate" an algebraic expression means to find its numerical value once you know the value of the variable(s).

The 3-Step Process

1. Write the expression.
2. Substitute the given value for the variable.
3. Simplify the resulting numerical expression using the Order of Operations.

Order of Operations Refresher (PEMDAS)

Parentheses

Exponents

Multiplication and **D**ivision (from left to right)

Addition and **S**ubtraction (from left to right)

Simple "I Do" Example

Evaluate `4x + 2` when `x = 5′. → `4(5) + 2` (Substitute) → `20 + 2` (Multiply) → `22` (Add)

Level 4 Challenge: Evaluating One-Step Expressions

I Do: Guided Example 1 (Fractions)

Evaluate `6b` when `b = 1/2`

→ 6 · (1/2)

→ 3

I Do: Guided Example 2 (Adding Fractions)

Evaluate `x + y` when `x = 3/4` and `y = 2/3`

→ 3/4 + 2/3

→ 9/12 + 8/12 (Find common denominator)

→ 17/12 or 1 5/12

**We Do: Check Your Understanding

Your Turn! Evaluate the expression a + b when a = 5/6 and b = 1/3.

**Solution: 5/6 + 1/3 → 5/6 + 2/6 → 7/6 or 1 1/6.

Level 4 Challenge: Evaluating Multi-Step Expressions

Follow the Order of Operations (PEMDAS) to evaluate complex expressions.

I Do: Guided Example

Evaluate $(5x - 4y) \div z^2$ when $x = 4$, $y = \frac{1}{2}$, and $z = 3$

Step 1: Substitute

$$\left(5 * 4 - 4 * \frac{1}{2}\right) \div 3^2 \longrightarrow$$

Step 2: Parentheses & Exponents

$$(20 - 2) \div 9 \longrightarrow$$

Step 3: Finish Parentheses

$$18 \div 9$$

Step 4: Divide

2

We Do: Check Your Understanding

Your Turn!

Evaluate $3a + (b - 1)^2$ when $a = 5$ and $b = 4$.

Solution:

$3(5) + (4 - 1)^2$

$\rightarrow 15 + 3^2 \rightarrow 15 + 9$

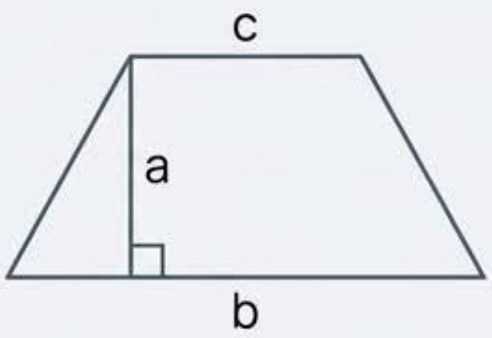
$\rightarrow \mathbf{24}$

Level 5 The Final Challenge - Real-World Applications

Follow the steps to solve real-world problems using expressions.

I Do: Guided Example - Trapezoid Area

The area of a trapezoid can be found using the expression $\frac{1}{2} * a(b+c)$. Find the area of the trapezoid shown when a = 9.8, b = 12, and c = 7.



1. **Write Expression:** $\frac{1}{2} * a(b+c)$
2. **Substitute:** $\frac{1}{2} * 9.8(12+7)$
3. **Parentheses:** $\frac{1}{2} * 9.8(19)$
4. **Multiply:** $4.9 * 19$
5. **Solution:** 93.1 square inches.

We Do: Check Your Understanding

Your Turn!

Find the area of a trapezoid when a = 4, b = 6, and c = 8.

Solution:

$\frac{1}{2} * 4(6+8) \rightarrow 2 * (14)$

$\rightarrow$ 28 square units.

Final Challenge: The Woodworking Project

Martina is making picture frames. The perimeter is found using $2\ell + 2w$.
How much total wood is needed to make two small frames and three large frames?

Your Mission: Calculate the total length of wood required.

Frame Size	Length (in.)	Width (in.)
Small	5	3
Large	10	8

Solution Breakdown

1. **Perimeter of 1 Small Frame**
   $2(5) + 2(3) = 10 + 6 = 16$ in.
2. **Wood for 2 Small Frames**
   $2 * 16 = 32$ in.
3. **Perimeter of 1 Large Frame**
   $2(10) + 2(8) = 20 + 16 = 36$ in.
4. **Wood for 3 Large Frames**
   $3 * 36 = 108$ in.
5. **Total Wood Needed**
   $32 + 108 = 140$ in.

You Are an Algebra Ace

ALGEBRA ACE

You have successfully completed the five levels of mastery. You can now confidently read, write, and evaluate the algebraic expressions that form the foundation of higher math. You've learned to decode the language, translate words into symbols, and use those symbols to find solutions to real-world problems.

- **DECODE**: Identify terms, coefficients, variables, and constants.
- **TRANSLATE**: Convert verbal phrases into one- and two-step expressions.
- **EVALUATE**: Substitute values and simplify expressions to find a final answer.
- **APPLY**: Use expressions to model and solve practical problems.

This is more than just math. It's a new way of thinking.

Module (5): Numerical and Algebraic Expressions

05
06
07

Fifth, Sixth & Seventh Lessons:

Factors and Multiples, Use the Distributive Property & Equivalent Algebraic Expressions

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363

Building Your Math Toolkit: Mastering Expressions

A comprehensive guide by mr.aghead

Your Journey: From Simple Numbers to Powerful Algebra

We're going to build your mathematical skills step-by-step, just like a master craftsperson builds their toolkit. Our journey has three parts:

Part 1: The Foundation | Mastering Your First Tools (GCF & LCM)

We'll learn the essential tools for working with numbers: the Greatest Common Factor and the Least Common Multiple.

Part 2: The Power Tool | The Distributive Property

We'll acquire a versatile "power tool" that connects multiplication and addition, unlocking new ways to solve problems.

Part 3: Master Craftsmanship | Building & Simplifying Expressions

With a full toolkit, we'll learn to construct, simplify, and prove that complex algebraic expressions are equivalent.

Tool #1: The Greatest Common Factor (GCF)

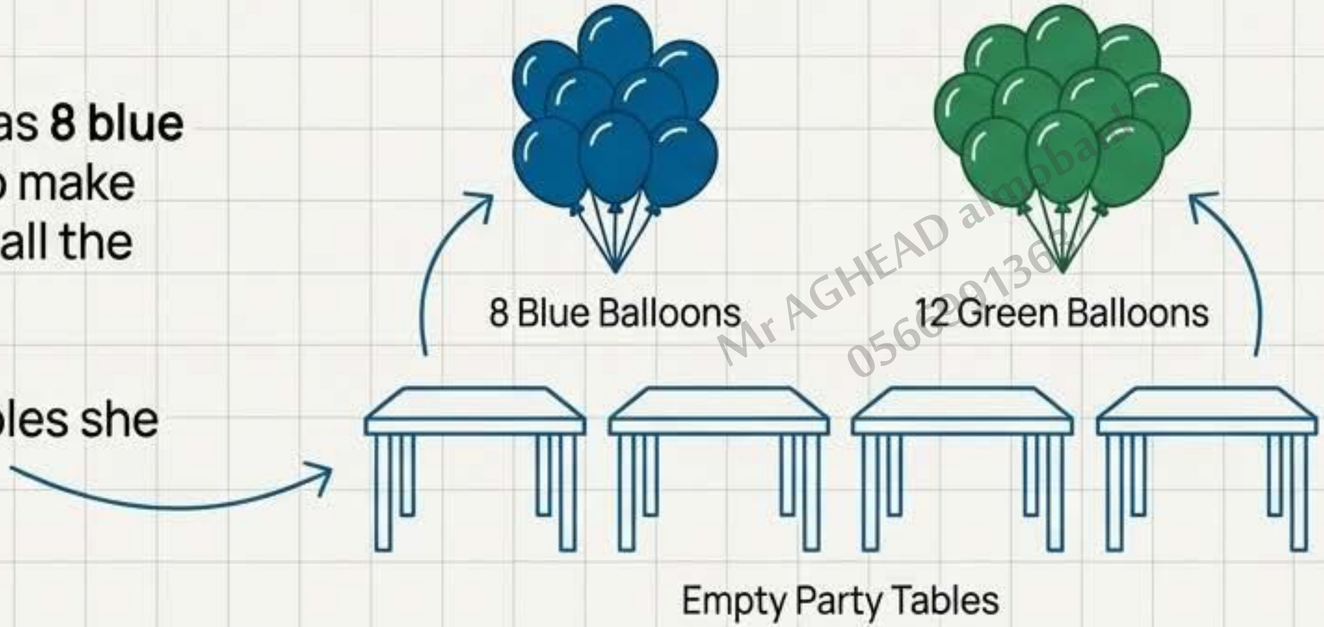
- **What is it?**
  The GCF is the largest number that is a factor of two or more numbers.
- **Why do we need it?**
  It's the perfect tool for problems where you need to create the maximum number of identical groups from different sets of items.

A Practical Problem:

Lucy is decorating for a birthday party. She has **8 blue balloons** and **12 green balloons**. She wants to make **identical** arrangements for each table, using all the balloons.

Question: What is the greatest number of tables she can decorate?

Finding the GCF will give us the answer.



How to Find the GCF: Two Proven Methods

Method 1: Listing Factors ('The Manual Search')

Example: Find the GCF of 12 and 28.

Step 1: List all factors of 12: {1, 2, 3, **4**, 6, 12}

Step 2: List all factors of 28: {1, 2, **4**, 7, 14, 28}

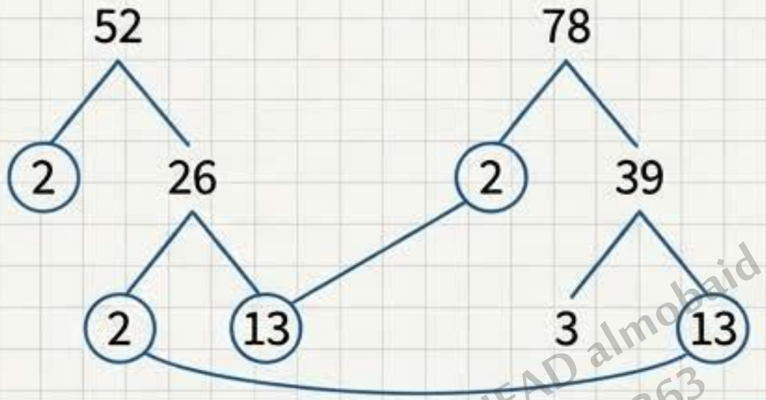
Step 3: Identify the common factors: {1, 2, 4}. The greatest one is **4**.

Answer: The GCF of 12 and 28 is **4**. Lucy can decorate 4 tables.

Method 2: Prime Factorization ('The Blueprint')

For bigger numbers, a factor tree is more efficient.

Example: Find the GCF of 52 and 78.



Step 2: Identify the common prime factors: **2** and **13**.

Step 3: Multiply the common prime factors: 2 × 13 = **26**.

Answer: The GCF of 52 and 78 is **26**.

GCF in Action: Solving Real-World Puzzles

Problem 1 (We Do): School Supply Kits

A store manager has 48 pencils and 36 notepads. He wants to create the greatest number of identical supply kits using all the items. How many kits can he make?

Solution: We need the GCF of 48 and 36.

- Factors of 48: {1, 2, 3, 4, 6, 8, **12**, 16, 24, 48}
- Factors of 36: {1, 2, 3, 4, 6, 9, **12**, 18, 36}

The GCF is **12**. He can make **12 identical kits**.
(Each kit will have 48/12 = 4 pencils and 36/12 = 3 notepads).

Problem 2 (Your Turn!): Flower Garden Design

A gardener has 27 pansies and 36 daisies. What's the greatest number of identical rows she can plant if she uses all the flowers?

(Pause and solve!)

Answer: The GCF of 27 and 36 is **9**. She can plant **9 identical rows.**

Tool #2: The Least Common Multiple (LCM)

- **What is it?** The **LCM** is the **smallest** non-zero number that is a multiple of two or more numbers.
- **Why do we need it?** It's the perfect tool to figure out when two events with different cycles will happen at the same time.

A Practical Problem:

Ernesto takes a painting class every 6 weeks.
Kamala takes a pottery class every 8 weeks.

They were both at the community center this week.

Question: In how many weeks will they be at the center together again?

Finding the LCM will give us the answer.

How to Find the LCM: Two Simple Methods

Method 1: Listing Multiples ("The Race")

Example: Find the LCM of 6 and 8.

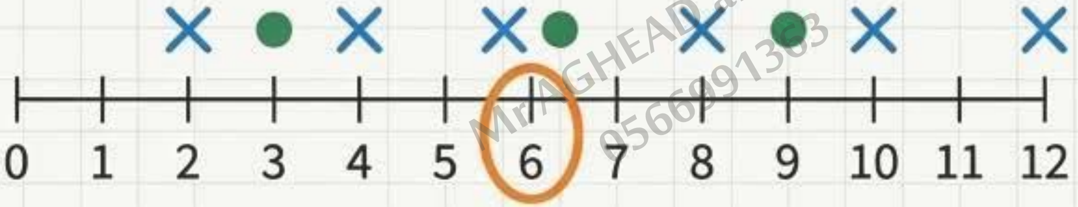
- Step 1: List multiples of 6:
  {6, 12, 18, **24**, 30, 36, 42, **48**...}
- Step 2: List multiples of 8:
  {8, 16, **24**, 32, 40, **48**...}
- Step 3: Identify the common multiples
  {24, 48, ...}. The least one is **24**.

Answer: The LCM is **24**. They will be at the center together in **24** weeks.

Method 2: Using a Number Line ("The Jumps")

Example: Find the LCM of 2 and 3.

- Draw a number line.
- Place an X above each multiple of 2.
- Place a ● above each multiple of 3.
- The first number with both an X and a ● is **6**.



Answer: The LCM of 2 and 3 is **6**.

LCM in Action: Timing is Everything

Problem 1 (We Do): Planning Visits

Tamika visits the zoo every 10 weeks and the pet rescue every 12 weeks. If she visited both this week, how many weeks will pass until she visits both in the same week again?

Solution: We need the LCM of 10 and 12.

Multiples of 10: {10, 20, 30, 40, 50, **60**...}
Multiples of 12: {12, 24, 36, 48, **60**...}

The LCM is **60**. She will visit both again in **60 weeks**.

Problem 2 (Your Turn!): School Shopping

A teacher is buying supplies. Notebooks come in packages of 6, and pencils come in packages of 10. What is the smallest number of notebooks and pencils she can buy to have the exact same quantity of each?

(Pause and solve!)

Answer: The LCM of 6 and 10 is **30**. She needs to buy **30 of each item**.

The Power Tool: Introducing the Distributive Property

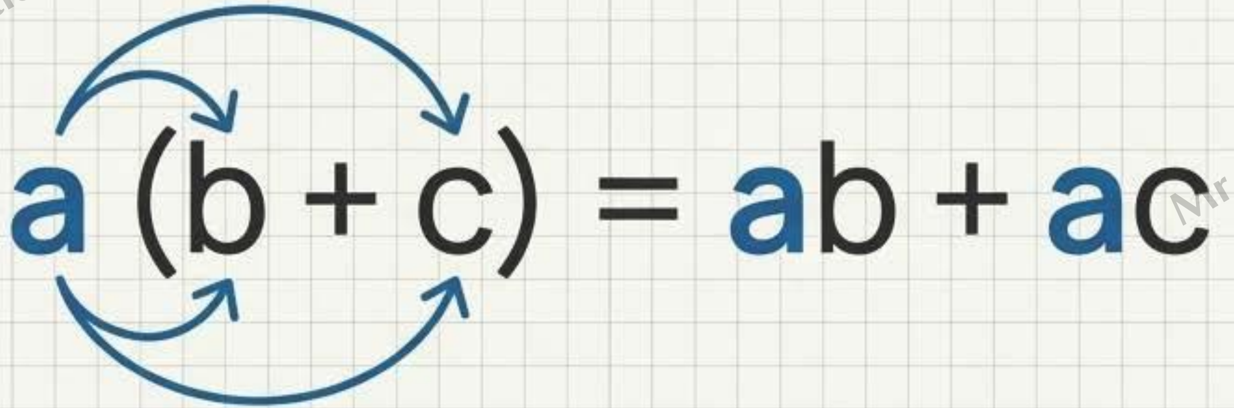
The Key That Connects Multiplication and Addition

The Distributive Property is one of the most important rules in math. It allows us to rewrite expressions in new and useful ways.

The Rule in Words: To multiply a sum by a number, multiply *each part* of the sum by that number.

The Rule in Numbers: $2(5 + 6) = 2(5) + 2(6)$

The Rule in Algebra: $a(b + c) = ab + ac$



$$a\,(b + c) = ab + ac$$

Using Your Power Tool: Expanding Expressions

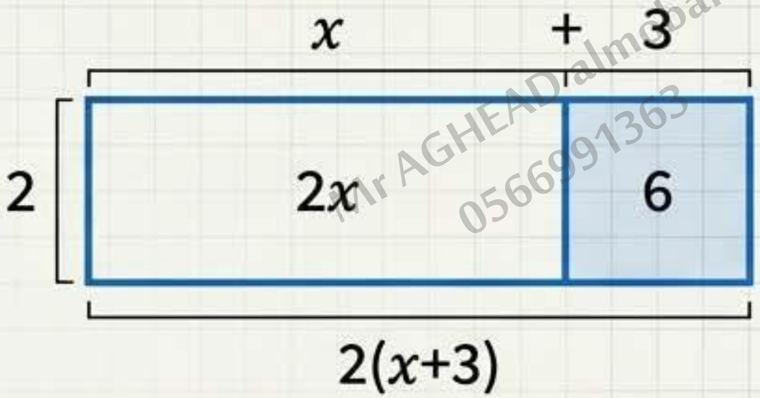
Use 1: To Simplify Algebraic Expressions (I Do)

This is like “unzipping” a compressed file.

Example: Expand $2(x+3)$

Solution: Distribute the 2 to both the x and the 3.

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



Use 2: To Perform Mental Math (We Do)

This makes tricky multiplication much easier.

Example: Calculate 8 × 3 ½ in your head.

Solution: Think of 3 ½ as (3 + ½).

$8 \times (3 + \frac{1}{2}) = 8(3) + 8(\frac{1}{2}) = 24 + 4 = 28$

Your Turn!

Problem: Five friends each buy a shirt (cost: x) and a pair of shoes (cost: \$24). Write and expand an expression for their total cost.

Answer: $5(x+24) = 5x + 120$

Distributing in Reverse: Factoring with the GCF

Factoring is the process of pulling out common factors. It's the opposite of expanding. Here, we use our GCF tool and our Distributive Property power tool together!

How to Factor an Expression:

1. Find the **GCF** (in Blueprint Blue) of all the terms.
2. Rewrite each term as a product of the GCF and its remaining factor.
3. Use the **Distributive Property** (in Blueprint Blue) to pull the GCF outside the parentheses.

Numerical Example (We Do): Factor 45 + 72

Step 1: GCF(45, 72) is **9**.

Step 2: Rewrite the expression: 9(5) + 9(8)

Step 3: Factor out the GCF: 9(5 + 8)

Algebraic Example (Your Turn!): Factor 6x + 15

*(Pause and solve!)

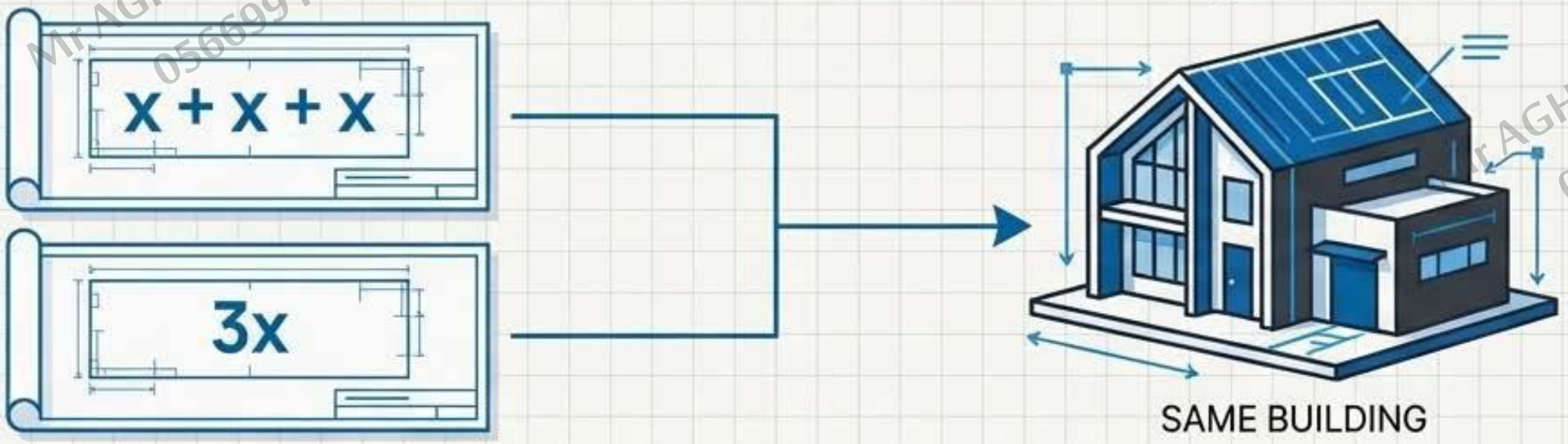
Step 1: GCF(6x, 15) is **3**.

Step 2: Rewrite: 3(2x) + 3(5)

Step 3: Factored form: 3(2x + 5)

Master Craftsmanship: What Makes Expressions Equivalent?

Different Blueprints, Same Building



Definition: Equivalent expressions are expressions that look different but have the exact same value for any number you substitute for the variable.

Example: x + x + x and 3x

Test 1: Let $x = 2$

$x + x + x \longrightarrow 2 + 2 + 2 = 6$

$3x \longrightarrow 3(2) = 6$

✓

Test 2: Let $x = 5$

$x + x + x \longrightarrow 5 + 5 + 5 = 15$

$3x \longrightarrow 3(5) = 15$

✓

Non-Example: 5(x + 4) and 5x + 4

Test: Let $x = 1$

$5(x + 4) \longrightarrow 5(1 + 4) = 5(5) = 25$

$5x + 4 \longrightarrow 5(1) + 4 = 5 + 4 = 9$

✗

They don't match! They are **not** equivalent.

The Properties of a Master Craftsman

These are the fundamental rules that allow us to rewrite and simplify expressions.

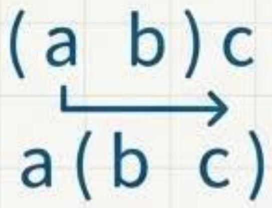
Commutative Property (Re-ordering)

The order doesn't matter for addition or multiplication.

$a + b = b + a$

$a \cdot b = b \cdot a$

Associative Property (Re-grouping)



How you group numbers doesn't matter for addition or multiplication.

$(a + b) + c = a + (b + c)$

$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Distributive Property (The Power Tool)

Links multiplication with addition.

$a(b + c) = ab + ac$

Identity Property (Keeping its Value)

Adding zero or multiplying by one doesn't change a number's value.

$a + 0 = a$

$a \cdot 1 = a$

The Art of Simplifying: Combining Like Terms

An expression is in its **simplest form** when it has no like terms and no parentheses.

What are "Like Terms"?
Terms that have the exact same variable part (same variable raised to the same power).

Like Terms:
$3x$ and $5x$ | x^2 and $6x^2$ | 4 and 10 (constants)

NOT Like Terms:
$3x$ and $3x^2$ | $5y$ and $2x$

How to Simplify: A Step-by-Step Example

$5x^2 + 2x + 2 + x^2 + 6$

Step 1: Identify Like Terms

$\underbrace{5x^2 + 2x} + 2 + \underbrace{x^2 + 6}$

($5x^2$ and x^2) ($2x$) (2 and 6)

$\rightarrow$

$5x^2 + x^2 + 2x + 2 + 6$

Step 2: Re-order to Group Like Terms (Commutative Property)

$\rightarrow$

$\overbrace{(5+1)}^{5+1=6}x^2 + 2x + \overbrace{(2+6)}^{2+6=8}$

Step 3: Combine the Like Terms (Add/Subtract Coefficients)

$\rightarrow$

Step 4: Write the Simplest Form

$\boxed{6x^2 + 2x + 8}$ ✓

The simplest form of the expression.

Master Challenge: Putting Your Whole Toolkit to Work

The Problem: Dawit is buying vintage comic books and shipping them to his cousin. The price of each comic depends on a base value, ***x***, and its condition. Shipping is a flat $5.00.

He buys:

- 2 “Excellent” comics
- 2 “Good” comics
- 2 “Fair” comics

Condition	Cost Formula
Excellent	$18x$
Good	$9.75x$
Fair	$4.5x$

Your Task: → Write one, single, simplified expression for the total cost of his purchase.

Building the Solution:

1. Write the initial expression for the cost of the books plus shipping:

$$[2(18x) + 2(9.75x) + 2(4.5x)] + 5$$

2. Perform the multiplication for each condition:

$$36x + 19.5x + 9x + 5$$

3. Identify and combine all the like terms (the ‘x’ terms):

$$(36 + 19.5 + 9)x + 5$$

4. The Final, Simplified Expression (Your Masterpiece):

$$\boxed{64.5x + 5}$$ ✓

Module (6): Equations and Inequalities

Module (6): Equations and Inequalities

01/02

First & Second Lessons:

Use Substitution to Solve One-Step Equations & One-Step Addition Equations

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

The Equation Quest

A Math Detective's Guide to Solving for the Unknown

Presented by mr.aghead

Your Mission: Uncover the Unknown

What is an Equation?

An equation is a mathematical sentence stating that two things are equal. Think of it as a perfectly balanced scale. The equals sign (=) is the center point, the fulcrum.

What is the "Unknown"?

Your target is the **variable** (usually a letter like x, p, or m). It's a placeholder for an unknown number. Finding its value is your mission.

What is a "Solution"?

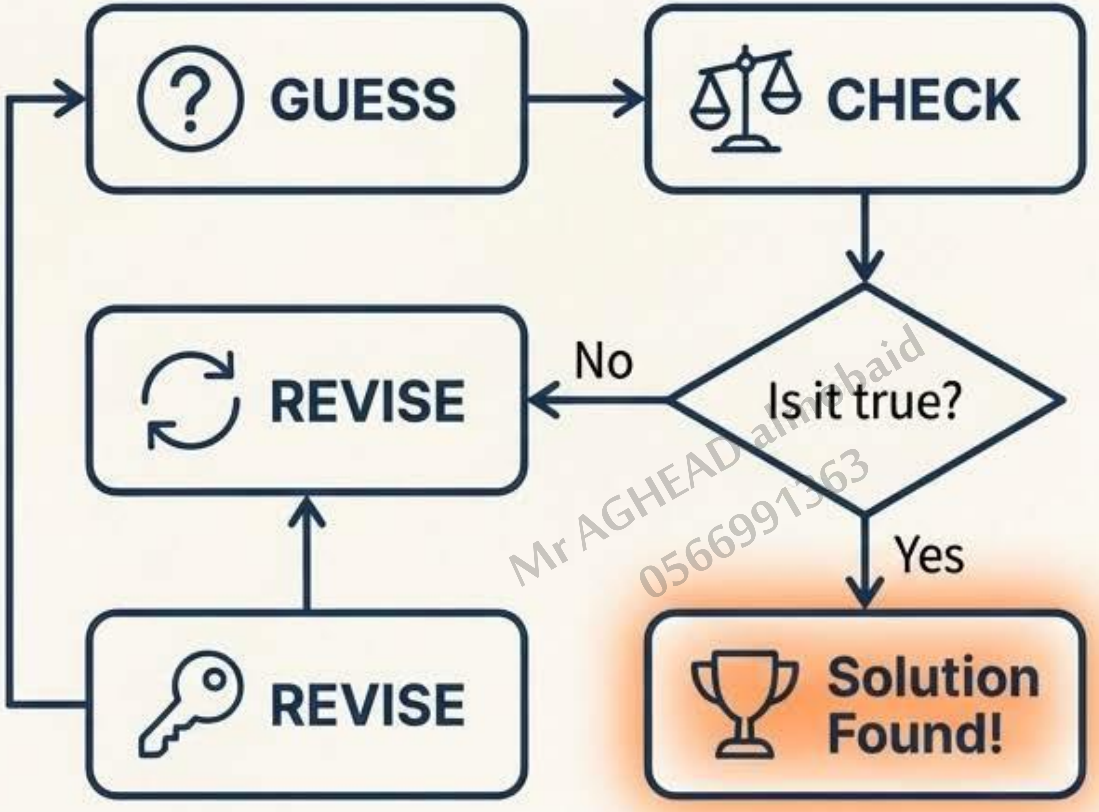
A **solution** is the specific value of the variable that makes the equation true—that keeps the scale balanced.

LEVEL 1: The Investigator’s Intuition

Skill Unlocked: Guess, Check, and Revise

Every great detective starts by gathering clues and testing theories. This method is your first tool for solving equations. It’s a powerful three-step process:

1. **GUESS**: Make a reasonable guess for the variable’s value.
2. **CHECK**: Substitute your guess into the equation. Do the two sides balance?
3. **REVISE**: If your check fails, use the result to make a smarter guess. Was your guess too high or too low? Adjust and try again.



Level 1 Challenge: The Decimal Dilemma

Is 3, 4, or 5 the solution to the equation $p + 9.7 = 13.7$?

Value of p (Guess)	$p + 9.7 = 13.7$ (Check)	Is the value a solution?
3	$3 + 9.7 = 12.7 \neq 13.7$	No ✗
4	$4 + 9.7 = 13.7 = 13.7$	Yes! ✅
5	$5 + 9.7 = 14.7 \neq 13.7$	No ✗

By substituting each value, we proved that $p = 4$ is the one and only solution that balances the equation.

Level 1 Challenge: The Door Frame Puzzle

Navaeh is building a door that is 36 **inches wide** using wooden planks that are each 4 ½ **inches** wide. The equation is $4 \frac{1}{2} * p = 36$. Find **p**, the number of planks needed.

Guess 1 ($p = 6$)

$4 \frac{1}{2} * 6 = 27$

Result: 27 < 36. My guess is too low. I need to revise upwards.

Guess 2 ($p = 7$)

$4 \frac{1}{2} * 7 = 31 \frac{1}{2}$

Result: 31 ½ < 36. Still too low, but closer! Revise upwards again.

Guess 3 ($p = 8$)

$4 \frac{1}{2} * 8 = 36$

Result: 36 = 36. Perfect balance!

Challenge Complete. Nevaeh needs 8 planks to build the door.

You've Mastered the Basics. Time to Level Up.

The 'Guess, Check, and Revise' strategy is great, but what if the numbers are huge, or the solution is a complex fraction? It can get slow.

Elite detectives need a faster, more precise tool that works every time, on the first try.

Get ready to unlock a new skill that will change the way you solve equations.

LEVEL 2: The Master Sleuth's Method

Skill Unlocked: Inverse Operations

Core Concept

Inverse operations are opposites that “undo” each other.

The Golden Rule of Equations

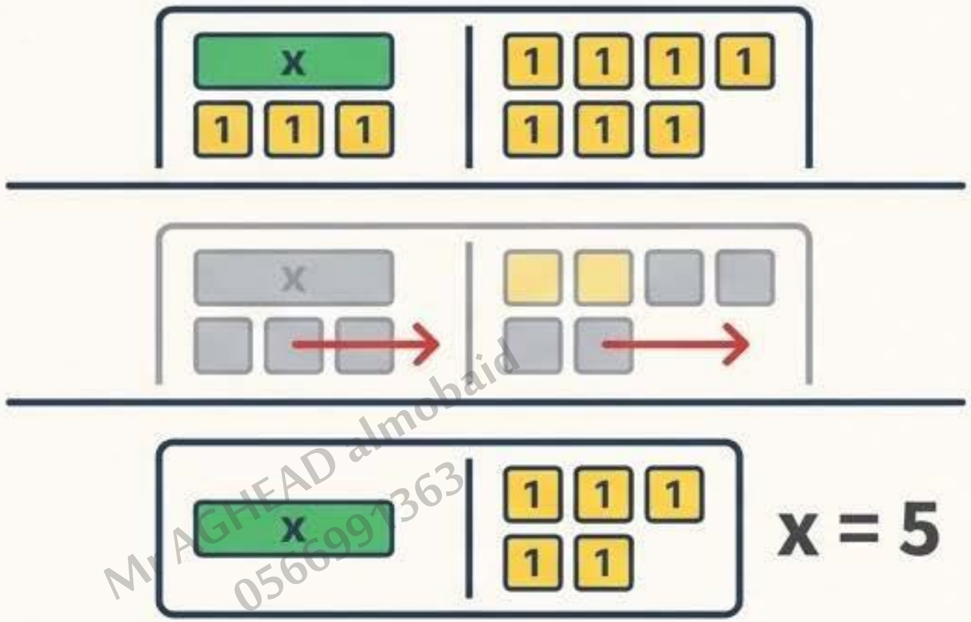
To keep the scale balanced, whatever you do to one side of an equation, **you MUST do to the other side.**

This is the **Subtraction Property of Equality**: If you subtract the same number from each side, the two sides remain equal.

Visualizing the Golden Rule

$x + 3 = 8$

Method 1: Algebra Tiles



$x = 5$

Method 2: Bar Diagram

$x = 8 - 3$

$x = 5$

Both models show the same thing: to isolate x, we must remove 3 from both sides.
This is the Subtraction Property of Equality in action.

Level 2 Challenge: Translating Clues into Code

Together, Ruben and Tariq downloaded 245.5 megabytes (MB) of music. Ruben downloaded 132 MB. Write an addition equation to find how many megabytes Tariq downloaded.

1. WORDS

Describe the problem simply.
"Ruben's MB plus Tariq's MB equals the total MB."

2. VARIABLE

Define your unknown.
"Let m represent the MB that Tariq downloaded." (Defining the variable is a critical step!)

3. EQUATION

Translate the words into algebra.

$132 + m = 245.5$

You've successfully translated the real-world situation into a mathematical equation, ready to be solved.

Level 2 Challenge: The Algebraic Solution

Solve $8 = x + 3$.

Step-by-Step Solution

$8 = x + 3$	Write the original equation.
$-3 \qquad\quad -3$	Goal: Isolate x. To undo '+ 3', use its inverse: '- 3'. Apply the Golden Rule: Subtract 3 from BOTH sides.
$5 = x$	Simplify. The solution is 5. →

The Final Check (Crucial!)

Always check your work by substituting your solution back into the original equation.

$$8 = x + 3$$

$$8 = (5) + 3$$

$$8 = 8$$

✓

Level 2 Challenge: Cracking the Fraction Code

Solve $3\tfrac{3}{4} + m = 7\tfrac{1}{2}$.

1. **Write the Equation**
   $3\tfrac{3}{4} + m = 7\tfrac{1}{2}$
2. **Find Common Denominators**
   To work with these fractions, we need a common denominator.
3. **Isolate the Variable**
   Use the Subtraction Property of Equality. Subtract 3 ¾ from both sides.
4. **Solve**
   We need to borrow from the whole number.

$$7\tfrac{1}{2} \longrightarrow 7\tfrac{2}{4}$$

$$3\tfrac{3}{4} + m = 7\tfrac{2}{4}$$

$$m = 7\tfrac{2}{4} - 3\tfrac{3}{4}$$

$$7\tfrac{2}{4} \longrightarrow 6\tfrac{6}{4}$$

$$m = 6\tfrac{6}{4} - 3\tfrac{3}{4}$$

$$\boxed{m = 3\tfrac{3}{4}}$$

The solution is m = 3 ¾. The method works perfectly, no matter how complex the numbers are.

Practice Drills: Sharpen Your Skills

Use the Subtraction Property of Equality to solve for the variable in each equation. Check your work!

1) $x + 5.6 = 11.6$

2) $9 = 3 + a$

3) $18.35 = c + 5.1$

4) $5 + x = 10$

Final Challenge: The Bookstore Budget

Abigail has \$70 to spend. She buys two paperbacks, one hardcover, and one e-book. How much money does she have left to spend?

Book Type	Cost
Hardcover:	\$19.49
Paperback:	\$8.25
E-book:	\$10.99

Step 1: Calculate Total Spent

1 (Hardcover) + 2 (Paperbacks) + 1 (E-book)

$\$19.49 + 2(\$8.25) + \$10.99 = \$19.49 + \$16.50 + \$10.99 = \$46.98$

Step 2: Write the Equation

Let x be the money she has left.

Total Spent + Money Left = Starting Budget

$46.98 + x = 70$

Step 3: Solve the Equation

$$\begin{array}{r} 46.98 + x = 70 \\ -46.98 \qquad -46.98 \\ \hline x = \$23.02 \end{array}$$

Abigail has \$23.02 left to spend.

Your Detective Toolkit: A Recap

LEVEL 1: Guess, Check, Revise

- **How it Works:**
  Test values until one fits.
- **Best For:**
  Simple problems, or when you're given a set of choices.

Limitation: Can be slow and inefficient.

LEVEL 2: Inverse Operations

- **How it Works:**
  Isolate the variable by "undoing" operations.
- **Best For:**
  Any equation, especially complex ones.

Advantage:
Precise, fast, and always finds the solution.

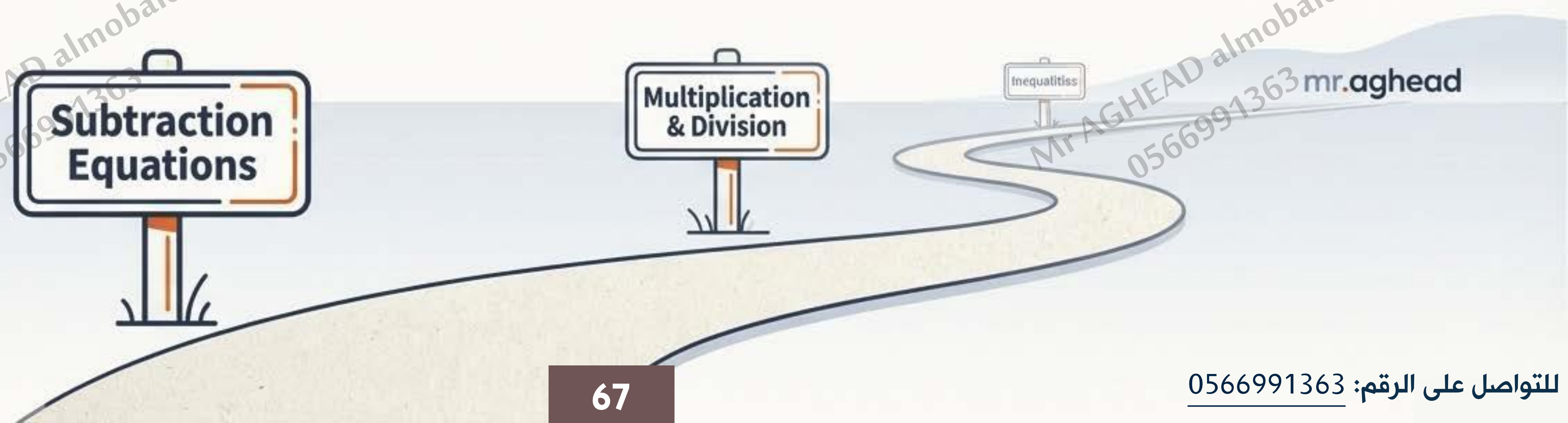
Key Takeaway: You now have two powerful tools. A true master knows which tool to use for the job.

Quest Complete!

You have successfully mastered the art of solving one-step addition equations. You can now confidently find the unknown in any balanced puzzle presented to you.

What's Next?

- Your journey as a Math Detective is just beginning. The world of equations is vast.
- Next, you will learn the secrets of **subtraction equations** and unlock their inverse tool: the **Addition Property of Equality**.
- Then, new challenges involving multiplication and division await!



Module (6): Equations and Inequalities

03/04 Third & Fourth Lessons:

One-Step Subtraction Equations &
One-Step Multiplication Equations

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

mr.aghead's Mastery Guide: Solving One-Step Equations

From Understanding the 'Why' to Mastering the 'How'

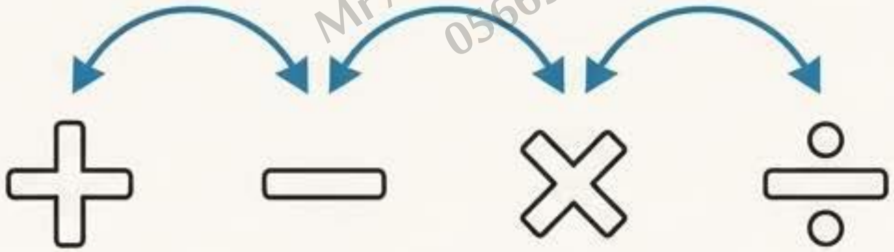
By mr.aghead

The Golden Rule of Algebra: Keep the Scale Balanced

An equation is just like a balanced scale.
Both sides are equal.

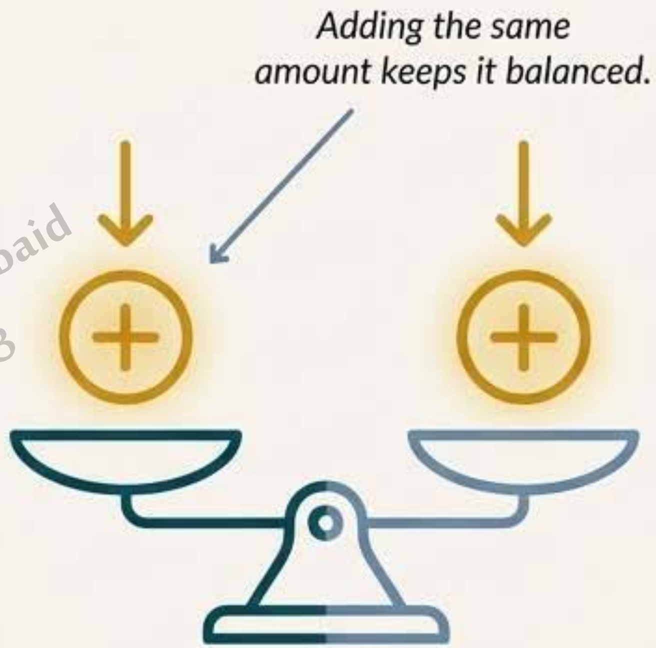
To keep the scale balanced, whatever action you take on one side, you *must* perform the exact same action on the other side.

This is the only rule you need to remember.



The Puzzle: Something is taken away, and we need to find the original amount.

How do we "undo" subtraction to find our unknown value?



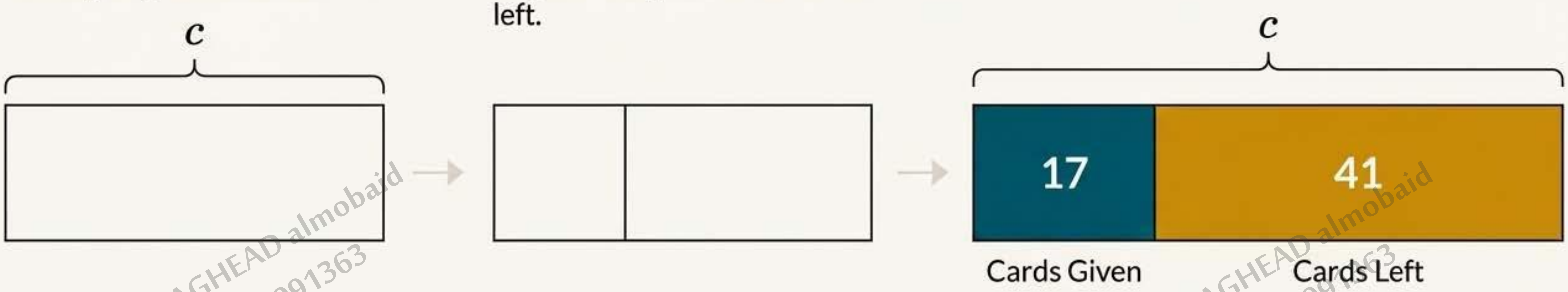
Adding the same amount keeps it balanced.

Our Secret Weapon: The Addition Property of Equality

This property lets us add the same value to both sides of the equation to isolate our variable, all while keeping the scale perfectly balanced.

First, Let’s See the Problem: Using Bar Diagrams

Miles had a collection of trading cards. He gave 17 cards to his sister and had 41 cards left. How many cards (c) did he have originally?



1. The whole bar represents the original, unknown total: `$c$`

2. It's made of two parts: what he gave away and what he has left.

The visual makes it clear: the total c is the sum of the parts. From this model, we can easily write our equation.

From a Story to a Solvable Equation

WORDS
Describe the math.

VARIABLE
Define the unknown.

EQUATION
Write the sentence.

Example 1: The Astronauts

The oldest person in space, John Glenn, was 52 years older than the youngest, who was 25. Write an equation to find John Glenn's age (*a*).

WORDS

John Glenn's age minus 52 years equals the youngest person's age.

VARIABLE

Let a = the age of John Glenn.

EQUATION

$$a - 52 = 25$$

Example 2: The Beads

Caroline gave Everly 8 beads and was left with 37. Write an equation to find the total beads (*t*) she started with.

WORDS

Total beads minus beads given away equals beads remaining.

VARIABLE

Let t = total number of beads.

EQUATION

$$t - 8 = 37$$

The Key Move: Using Addition to Isolate the Variable

To solve a subtraction equation, we use the inverse operation: addition. The **Addition Property of Equality** allows us to do this.

The Rule

If you add the same number to each side of an equation, the two sides remain equal.

In Action

If $10 = 10$, then $10 + 3 = 10 + 3$.

If $\mathbf{n - 6} = 7$, then $\mathbf{n - 6} + 6 = 7 + 6$.

Inverse Operations Cancel Each Other Out!

Guided Example: Solving with Whole Numbers

Solve $32 = x - 7$.

Step 1: SETUP $32 = x - 7$

Goal: Isolate 'x' by undoing the subtraction of 7.

Step 2: SOLVE $\underline{32 + 7 = x \cancel{-7} + 7}$

Use the Addition Property of Equality. Add 7 to both sides.

Step 3: ANSWER $\boxed{39 = x}$

Step 4: CHECK $32 = (39) - 7$

Substitute 39 back into the original equation.

$32 = 32$ ✓

Level Up: Solving with Fractions

Solve $m - 13\frac{2}{3} = 2\frac{1}{6}$.

Step 1: SETUP

$$m - 13\frac{2}{3} = 2\frac{1}{6}$$

First step: We need to add, so we need a common denominator (6).

Step 2: REWRITE

$$m - 13\frac{4}{6} = 2\frac{1}{6}$$

Step 3: SOLVE

$$m - \cancel{13\frac{4}{6}} + \cancel{13\frac{4}{6}} = 2\frac{1}{6} + 13\frac{4}{6}$$

Add 13 4/6 to both sides to isolate 'm'.

Step 4: ANSWER

$$m = 15\frac{5}{6}$$

Talk About It!

How can you check your solution? Substitute 15 5/6 back into the original equation. If the sentence is true, the solution is correct!

Apply Your Skills: The Shopping Trip

Tyson had $302.87 in his savings account *after* he withdrew money to go shopping. The table shows what he spent. He also had $18.25 in cash left over.

Use an equation to find how much Tyson originally had in his savings account (*s*).

Item	Total Spent ($)
Clothes	95.21
Gifts	42.79
Soccer ball	23.75

1. Find Total Withdrawn

$95.21 (spent) + $42.79 (spent) + $23.75 (spent) + $18.25 (leftover) = **$180.00**

2. Write the Equation

Original Savings (s) - Amount Withdrawn = Amount Left in Account

s - 180.00 = 302.87

3. Solve the Equation

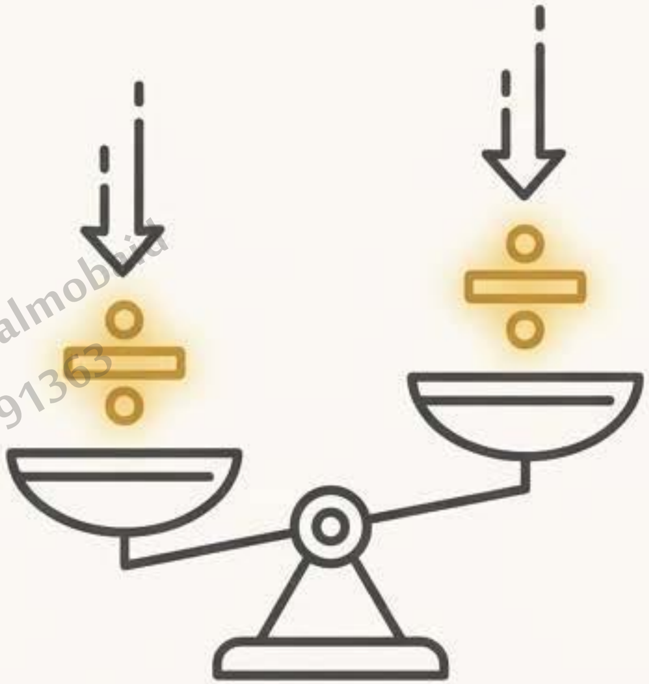
$$\begin{array}{rcl} s - 180.00 & = & 302.87 \\ +\,180.00 & & +\,180.00 \\ \hline & s = \$482.87 & \end{array}$$

Tyson originally had **$482.87** in his savings account.

Chapter 2: Conquering Mellding Multiplication Equations

The Puzzle: A quantity is scaled up, and we need to find the original unit value.

How do we 'undo' multiplication to find our unknown?



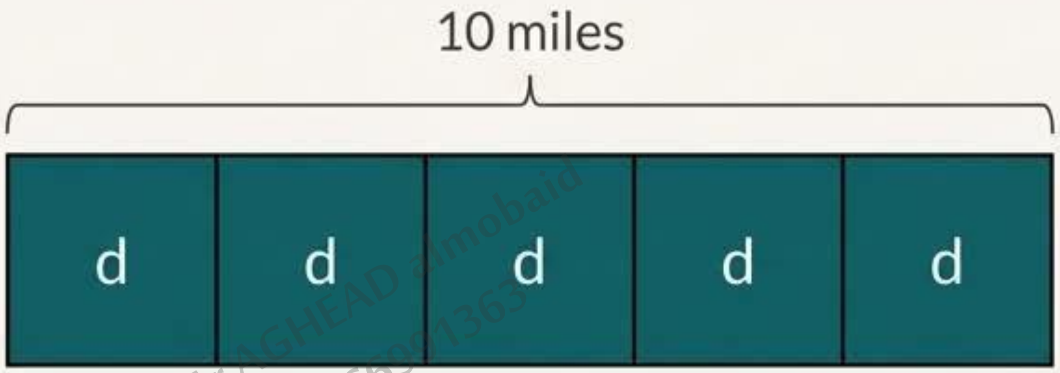
Our Secret Weapon: The Division Property of Equality

This property lets us **divide both sides of the equation by the same non-zero value**, keeping the scale **balanced** while isolating the variable.

Two Ways to See the Problem: Models for Multiplication

Model 1: Bar Diagram (Equal Groups)

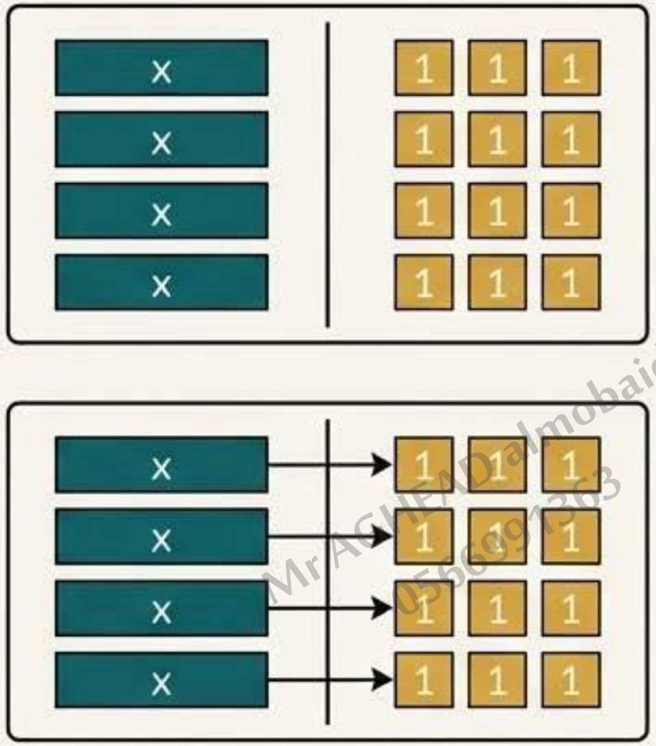
In 5 days, Hamza ran a total of 10 miles. He ran the same number of miles each day (d).



$5d = 10$

Model 2: Algebra Tiles

Model the equation $4x = 12$.



Each x-tile balances with three 1-tiles, so $x = 3$.

Turning Scenarios into Multiplication Equations

1. WORDS
Describe the math.

2. VARIABLE
Define the unknown.

3. EQUATION
Write the sentence.

Example 1: The Football Tickets

Vincent and some friends shared the cost of a $745 season ticket package. Each person contributed $186.25. Write an equation to find how many friends (*f*) contributed.

WORDS

The number of friends times the amount each paid equals the total cost.

VARIABLE

Let f = the number of friends.

EQUATION

$$\boxed{186.25f = 745}$$

Example 2: Saving for a Game

Kosumi is saving an equal amount each week for 4 weeks to buy a video game for $55. Write an equation for the amount (*a*) she is saving each week.

WORDS

4 weeks times the amount saved each week equals the total cost.

VARIABLE

Let a = amount saved each week.

EQUATION

$$\boxed{4a = 55}$$

The Key Move: Using Division to Isolate the Variable

To solve a multiplication equation, we use the inverse operation: division. The **Division Property of Equality** is the rule that allows this.

Montserrat Semibold
The Rule

If you divide each side of an equation by the same *nonzero* number, the two sides remain equal.

Montserrat Semibold
In Action

Arithmetic: If $9 = 9$, then
$9 \div 3 = 9 \div 3$.

Algebra: If $4x = 8$, then
$4x \div 4 = 8 \div 4$.

Inverse Operations!

Guided Examples: From Whole Numbers to Fractions

Part 1: Whole Number Equation

Problem: Solve 84 = 7x.

SOLVE: $\frac{84}{7} = \frac{\cancel{7}x}{\cancel{7}}$

ANSWER: 12 = x

CHECK: 84 = 7(12) → 84 = 84 ✓

CHECK: 12 = x

Part 2: Fraction Equation

Problem: Solve (2/3)m = 5/8.

SOLVE: (2/3)m ÷ (2/3) = 5/8 ÷ (2/3)

m = 5/8 × 3/2

ANSWER: m = 15/16

Remember! Dividing by a fraction is the same as multiplying by its reciprocal.

$m = \frac{5}{8} \times \frac{3}{2}$

CHECK: (2/3)(15/16) = 30/48 = 5/8 ✓

Apply Your Skills: The Iced Tea Challenge

Which brand of **iced tea has more sugar per serving, and by how much?** Use equations to defend your answer.

Aunt Maggie's Iced Tea: 63g sugar in 3 servings.

Southern Goodness Sweet Tea: 74g sugar in 4 servings.

Brand 1: Aunt Maggie's

Let a = sugar per serving.

$$3a = 63$$

$$a = 63 / 3 = \mathbf{21g}$$

Brand 2: Southern Goodness

Let s = sugar per serving.

$$4s = 74$$

$$s = 74 / 4 = \mathbf{18.5g}$$

$$21g > 18.5g$$

Difference: $21 - 18.5 = 2.5g$

Aunt Maggie's Iced Tea has 2.5 grams more sugar per serving.

Your One-Step Equation Mastery Toolkit

The Balanced Scale

The foundation of all algebra. Always do the same thing to both sides.

The Key Properties

+ **Addition Property of Equality**

To undo subtraction, **ADD the same value to both sides.**

÷ **Division Property of Equality**

To undo multiplication, **DIVIDE** both sides by the **same non-zero value.**

The Universal Framework

SETUP Understand the story. Use models (like bar diagrams), define your variable, and write the equation.

→

SOLVE Use the correct inverse operation on both sides to isolate the variable.

→

CHECK Substitute your answer back into the original equation to prove your solution is correct.

You now have the tools and the strategy to solve any one-step subtraction or multiplication equation. Practice them, and you will master them.

Module (6): Equations and Inequalities

05/06 Fifth & Sixth Lessons:

One-Step Division Equations & Inequalities

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363

MATH MASTERCLASS

A Complete Guide to Equations & Inequalities

Your Mission: Master the Tools of Algebra

In this masterclass, we will conquer two powerful concepts that are fundamental to algebra and problem-solving.

Module 1: One-Step Division Equations

- Learn to find a missing total when you know the equal parts.

Module 2: Inequalities

- Learn to describe and solve problems where the answer isn't just one number, but a whole range of possibilities.

Let's begin.

See the Equation: Bar Diagrams

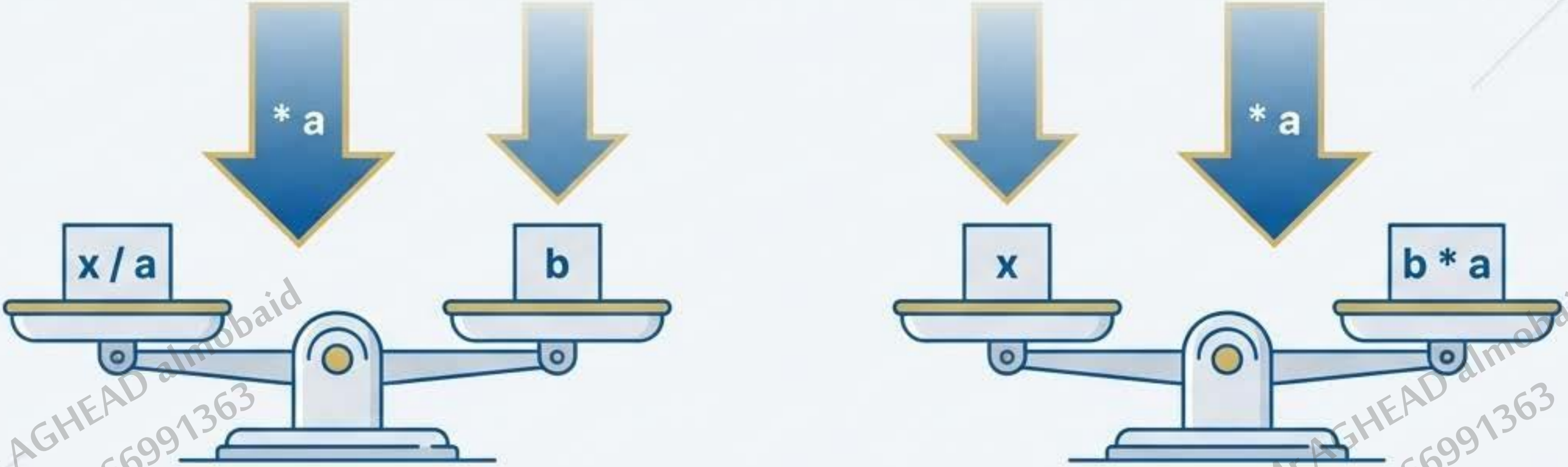
Before using algebra, let's visualize the problem. A bar diagram helps us see the relationship between the total amount (the variable) and the equal parts it's divided into.

Scenario: The students in Muraltia's club are contributing to buy a gift for their teacher. There are 12 students and they are each contributing $8. The variable ***c*** will be used to determine the total cost of the gift.

The Equation this represents: $c / 12 = 8$ *(The total cost divided by 12 people equals $8 per person.)*

The Golden Rule for Solving Equations

Think of an equation as a perfectly balanced scale. To keep it balanced, whatever operation you perform on one side, you **must** perform the exact same operation on the other side. To solve a division equation, we use the inverse operation: **multiplication**. This is the **Multiplication Property of Equality**.



The Rule: If x / a = b, you multiply both sides by a to isolate x.

$$(x / a) * a = b * a$$

$$x = b * a$$

Example 1: Solving with Whole Numbers

Problem: Solve x / 9 = 13

1. **Write the equation:**

   x / 9 = 13

2. **Identify the operation:** x is being divided by 9.

Pro-Tip: To undo division, we multiply.

3. **Apply the Golden Rule:** Multiply both sides by 9.

   $(x / 9) \mathbf{* 9} = 13 \mathbf{* 9}$

4. **Simplify:** The $\cancel{/\,9}$ and $\cancel{*\,9}$ on the left cancel each other out.

   x = 117

Check your answer:

Substitute 117 back into the original equation.

117 / 9 = 13

13 = 13

✓ The sentence is true.

Example 2: The Rule Still Applies to Fractions

Problem: Solve c / 3 = 2/5

1. **Write the equation:**

   $$c / 3 = \frac{2}{5}$$

2. **Identify the operation:** c is being divided by 3.
3. **Apply the Golden Rule:** Multiply both sides by 3.

   $$(c / 3) * \mathbf{3} = \frac{2}{5} * \mathbf{3}$$

4. **Simplify:**

   $$c = \frac{6}{5}$$

4. **Simplify:**

   $$c = \frac{6}{5}$$

5. **Convert to a mixed number (optional but good practice):**

   $$c = 1\frac{1}{5}$$

Example 3: Translating Words into Equations

Problem* Benji rode his bike from Pittsburgh to Cleveland over 3 days. His average distance was 48.5 miles per day. Write and solve a division equation to find *b*, the total distance he rode.

Step 1: Translate the words.

The total distance (*b*) divided by 3 days equals 48.5 miles per day.

Step 2: Write the equation.

$$b / 3 = 48.5$$

Step 3: Solve the equation.

Multiply both sides by 3.

$$(b / \mathbf{3}) \cdot \mathbf{3} = 48.5 \cdot \mathbf{3}$$

$$b = 145.5$$

Answer: Benji rode a total of 145.5 miles.

Module 2: When “Equal” Isn’t Enough

In the real world, we often deal with limits, not just exact numbers. An **inequality** is a mathematical sentence that compares quantities. The solution is often a whole range of numbers.

“You must be **at least** 18 years old to vote.” (**age ≥ 18**)

“A certain hotel only permits dogs that weigh **less than** 50 pounds.” (**weight < 50**)

The Four Inequality Symbols

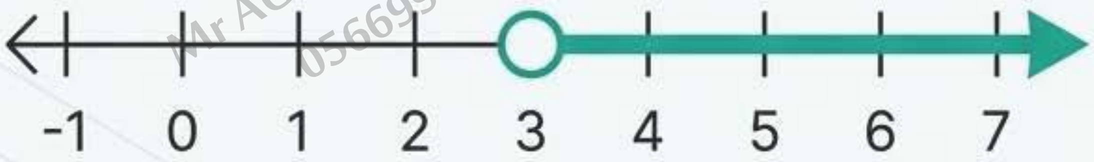
Symbol	Name	Key Phrase 1	Key Phrase 2
>	is greater than	is more than	
<	is less than	is fewer than	
≥	is greater than or equal to	is at least	
≤	is less than or equal to	is at most	

How to Visualize Infinite Solutions

Since an inequality can have countless solutions, we graph them on a number line. The type of dot you use is crucial.

Open Dot (○): The number is NOT included.

- Used for `<` (less than) and `>` (greater than).
- Example: `x > 3` (All numbers bigger than 3, but not 3 itself)



Closed Dot (●): The number IS included.

- Used for `≤` (less than or equal to) and `≥` (greater than or equal to).
- Example: `x ≤ 2` (All numbers smaller than 2, and including 2 itself)

Graphing Practice

1. Graph `x < -5.75`

- **Dot**: Place an **open dot** at -5.75 (because the symbol is <`).
- **Arrow**: Draw an arrow to the **left** (representing “less than”).

2. Graph `x ≥ 2/5`

- **Dot**: Place a **closed dot** at 2/5 (because the symbol is ≥`).
- **Arrow**: Draw an arrow to the **right** (representing “greater than”).

The Solution Test: Does it Work?

To determine if a specific number is a solution to an inequality, substitute the number for the variable. If the resulting statement is true, it's a solution.

Which of these numbers are solutions for $a + 4 \le 11$?
Test Values: 6, 7, 8

Value of a	Substitute into $a + 4 \le 11$	Is the Statement True?
6	$6 + 4 \le 11 \rightarrow 10 \le 11$	✓ Yes
7	$7 + 4 \le 11 \rightarrow 11 \le 11$	✓ Yes
8	$8 + 4 \le 11 \rightarrow 12 \le 11$	✗ No

Conclusion: 6 and 7 are solutions to the inequality, but 8 is not.

Application: Sticking to a Budget

Problem: Raven has \$60 to spend on T-shirts for her running team. Each shirt costs \$8.40. The inequality $60 \geq 8.40t$ represents the number of T-shirts (t) she can buy. Can she buy a shirt for all 9 teammates?

Let's test the values:

Test t = 9 (all teammates):

$60 \geq 8.40 * 9$

$60 \geq 75.60$ → **False.** The cost is too high. ✗

Test t = 7:

$60 \geq 8.40 * 7$

$60 \geq 58.80$ → **True.** This is within the budget. ✓

Answer: Raven can buy a maximum of 7 T-shirts, so 2 teammates will not receive one.

Sharpen Your Skills: A Quickfire Round

Solve an Equation

$$\frac{p}{9.2} = 5.31$$

Action: Multiply both sides by 9.2.

Solution: **$p = 48.852$**

Identify Inequality Solutions

Which are solutions for **$16b > 5.6$**? {1/4, 1/3, 1/2}

Test 1/4: 16 * (1/4) = 4.
4 > 5.6 is False.

Test 1/2: 16 * (1/2) = 8.
8 > 5.6 is **True.** ✅

Find the Error

A student solves *x* / 3 = 6 and gets *x* = 2. What's the mistake?

Mistake: They divided each side by 3 instead of multiplying.
Correction:
(x / 3) * 3 = 6 * 3 → x = 18

Mastery Unlocked: Your New Toolkit

You have now mastered the essential techniques for solving a wide range of algebraic problems.

- **Visualize problems** using bar diagrams to write equations.
- **Solve any one-step division equation** using the Multiplication Property of Equality.
- **Translate real-world scenarios** into precise mathematical inequalities.
- **Represent infinite solutions** by graphing inequalities on a number line.
- **Test and verify** solutions to confirm your answers are correct.

You’ve Got This.

A Math Masterclass by mr.aghead

Module (7): Relationships Between Two Variables

Module (7): Relationships Between Two Variables

01/02 First & Second Lessons:

Relationships Between Two Variables
& Write Equations to Represent
Relationships Represented in Tables

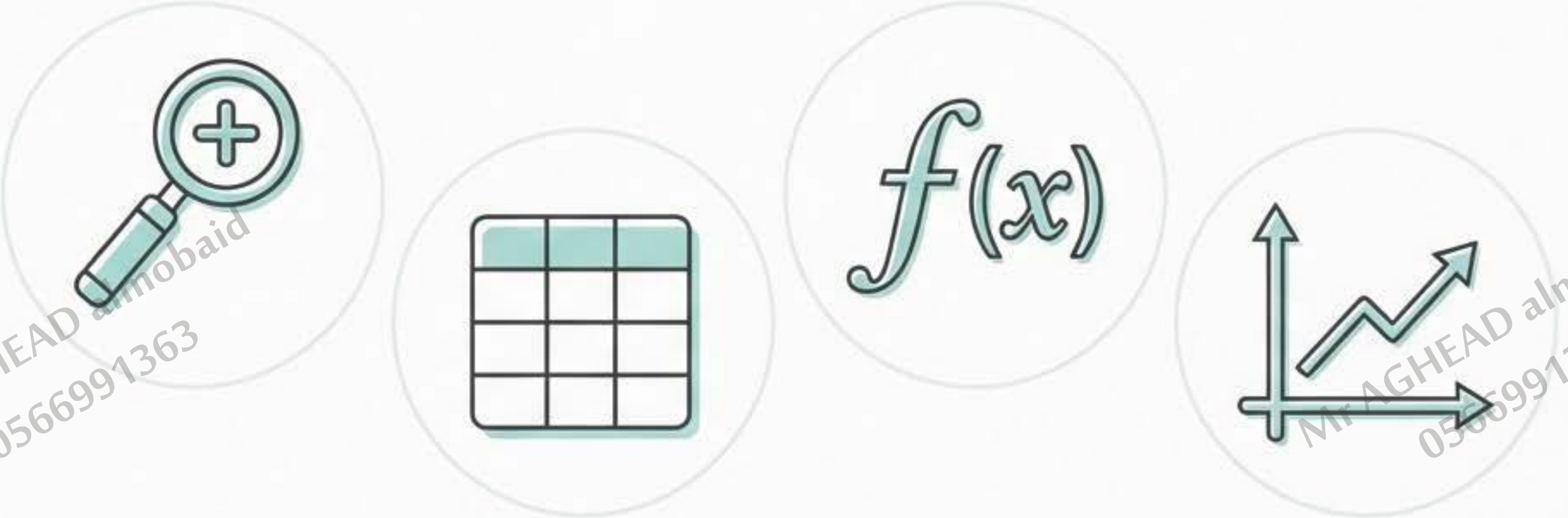
لا تتردد في التواصل معنا
قم بمسح رمز الـQR

Mr Aghead Almobaid
0566991363

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363

The Creator's Toolkit

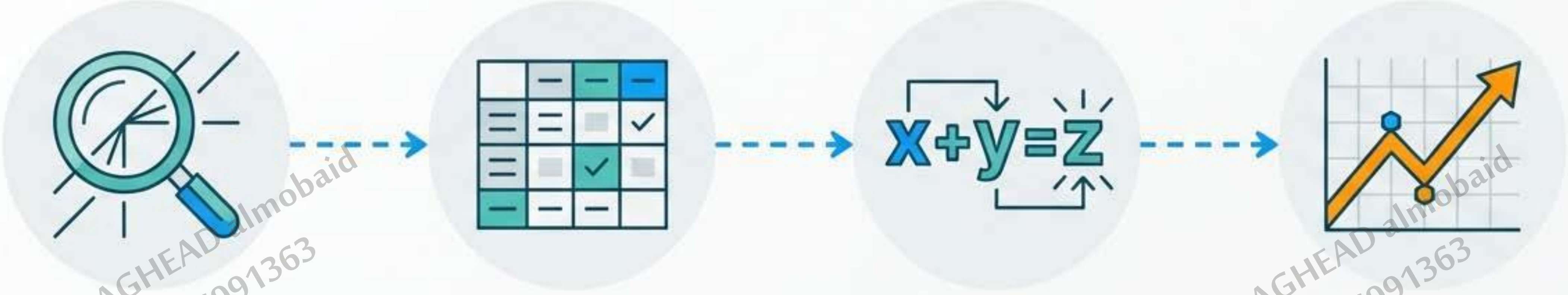
A Guide to Understanding and Building Relationships in Math



Presented by mr.aghead

Your Mission: Master the Tools of Creation

The world is full of patterns and connections. Math gives you the power to see them, understand them, and use them to build amazing things and solve real problems. In this guide, you will collect four essential tools that will help you become a master creator.



Identify Cause & Effect

Organize Your Data

Create a Universal Formula

Visualize Your Success

TOOL #1: IDENTIFY CAUSE & EFFECT

Finding the Connection: Independent vs. Dependent Variables

Independent Variable (The Input)

This is the variable you **control** or change. Its value doesn't depend on another variable.

Think of the prefix `**in-**` which means `**not**`. It is `**not**` dependent.

Dependent Variable (The Output)

This is the variable that you **observe** or **measure**. Its value **depends** on the independent variable.

The number of hours you study.

affects →

The grade you get on a a test.

Let's See It in Action: The Arcade

Suppose it costs $0.25 to play one game at an arcade. We want to understand the relationship between the number of games you play and the total amount of money you spend.

Which is the cause, and which is the effect?

Independent Variable (Input)	**The number of games played (g)** This is what you decide. You can choose to play 5 games, or 10, or 20.
Dependent Variable (Output)	**The total cost (c)** This changes *because* of the number of games you play. The cost *depends* on how many games you choose.

The Total Cost **depends on** the **Number of Games.**

TOOL #2: ORGANIZE YOUR DATA

The Input-Output Table: A Machine for Patterns

A table is the perfect way to organize the relationship between the independent and dependent variables. Think of it like a machine: you put an **input** in, a rule is applied, and you get an **output**.

Input: Number of Games (g)	Rule	Output: Total Cost (c)
5	0.25 × 5	1.25
10	0.25 × 10	2.50
15	0.25 × 15	3.75

Practice: Finding the Output

Joe bought an iced coffee for $2.95. The total cost of his breakfast (c) is equal to the cost of his food (f) plus $2.95. The rule is f + 2.95.

Complete the table to find the total cost of Joe's breakfast for different food costs.

Input: Cost of Food (f)	Rule: f + 2.95	Output: Total Cost (c)
$5.50	5.50 + 2.95	$8.45
$7.75	7.75 + 2.95	$10.70
$10.00	10.00 + 2.95	$12.95

When you know the input and the rule, you can find the output.

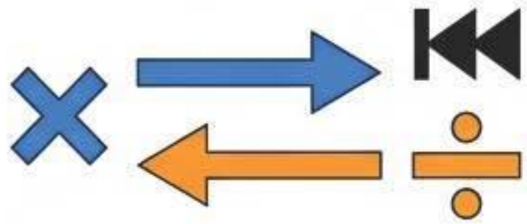
Practice: Working Backward to Find the Input

Each small pizza at a shop costs \$6.75. The total cost (*c*) is found by the rule `6.75*p*`, where *p* is the number of pizzas.

You know the total cost. How many pizzas were purchased?

	Input: Number of Pizzas (*p*)	**Rule: 6.75*p***	**Output: Total Cost (*c*)**
$\frac{13.50}{6.75} = 2$	**2**	6.75 × 2	\$13.50
$\frac{27.00}{6.75} = 4$	**4**	6.75 × 4	\$27.00
$\frac{33.75}{6.75} = 5$	**5**	6.75 × 5	\$33.75

Inverse Operations



The rule uses **multiplication** (`6.75 × *p*`).

To work backward from the output to the input, we use the inverse operation: **division**.

We can write this as `6.75*p* = *c*`.

To find *p*, we calculate ***p* = c / 6.75**.

You Try It! Build Your Skills

Use the rules to complete the tables for these real-world scenarios.

Phone Battery

Your phone battery starts at 100% and loses 15% each hour (h) you watch videos. The rule for the remaining percentage (p) is 100 - 15h.

Input: Hours (h)	Output: Percentage (p)
1	
2	
3	

Monthly Savings

You have $50 saved already. You add $25 each month (m). The rule for your total savings (s) is 50 + 25m.

Input: Months (m)	Output: Total Savings (s)
1	
4	
6	

Streaming Service

A streaming service costs $12 per month (m). The rule for the total cost (c) is 12m. Find the input m if the total cost c was $36, $60, or $96.

Input: Months (m)	Output: Total Cost (c)
	$36
	$60
	$96

Solutions

Scenario 1: p = 85, 70, 55.
Scenario 2: s = $75, $150, $200.
Scenario 3: m = 3, 5, 8.

TOOL #3: CREATE A UNIVERSAL FORMULA

From Tables to Equations

Tables are great for organizing data, but what if you want a rule that works for *any* number of games, or pizzas, or hours? That's where equations come in. An equation is the master blueprint for the relationship.

T-shirt Data Table

Input: Number of T-shirts (t)	Output: Total Cost (c)
1	$9
2	$18
3	$27

Shows specific examples.

$$c = 9t$$

Works for ALL examples.

Writing One-Step Equations

The table shows the total cost ***c*** for buying ***t*** souvenir T-shirts. Let's write an equation to represent this relationship.

Step 1: Look for a pattern.

As the input (***t***) increases by 1, the output (***c***) increases by 9.

Input (t): Number of T-shirts	Output (c): Total Cost ($)
1	9
2	18
3	27

Step 2: Determine the rule.

Because the output increases by the same amount each time, this is a multiplicative relationship. Let's check: Is the output always 9 times the input?

9 × 1 = 9 (✓)
9 × 2 = 18 (✓)
9 × 3 = 27 (✓)

Yes! The rule is **9t**.

Step 3: Write the equation.

The output (***c***) is equal to the rule (**9*t*'**).

$$c = 9t$$

Creator's Toolkit Aesthetic

What About More Complex Rules?

An online store sells baseball bats. The table shows the total cost **c** for **b** bats, including a one-time shipping fee.

Baseball Bats Data Table

Input: Number of Bats (*b*)	Output: Total Cost (*c*)
1	6
2	8
3	10

+1

+2

Step 1: Look for a pattern.

As the input (*b*) increases by 1, the output (*c*) increases by 2.
So, the rule must include `**2b**`.

Step 2: Test the simple rule.

Let's test the rule `**2b**`.
For input 1, `2 × 1 = 2`.
But the table says the output is 6!
The rule is incomplete. ❌

Step 3: Find the missing piece (the constant).

What's the difference between our rule's result and the actual output?

Input		
1	6 - 2 = 4	
2	8 - 4 = 4	2×2=4
3	10 - 6 = 4	2×3=6

The difference is always 4! This is our constant. The full rule is `**2b + 4**`.

Step 4: Write the equation.

Final Equation: $c = 2b + 4$ (The \$4 is the shipping fee).

You Try It! Decode the Two-Step Rule

Ari makes necklaces. The table shows the total number of necklaces *n* she has made after *h* hours. She started the day with some already finished. Write an equation to represent her progress.

Necklace Progress

Input: Hours (*h*)	Output: Total Necklaces (*n*)
1	5
2	7
3	9
4	11

Task

1. Find the rate of change (the coefficient).
2. Test the rule with an input/output pair.
3. Find the constant (the starting amount).
4. Write the final equation.

Solution Walkthrough

1. **Rate of change**

   As *h* increases by 1, *n* increases by 2. The rule includes 2*h*.

2. **Test** ✗

   For *h* =1, our rule 2*h* gives us 2. But the actual output is 5.

3. **Find constant**

   The difference is 5 - 2 = 3. The constant (starting amount) is 3. The full rule must be 2*h* + 3.

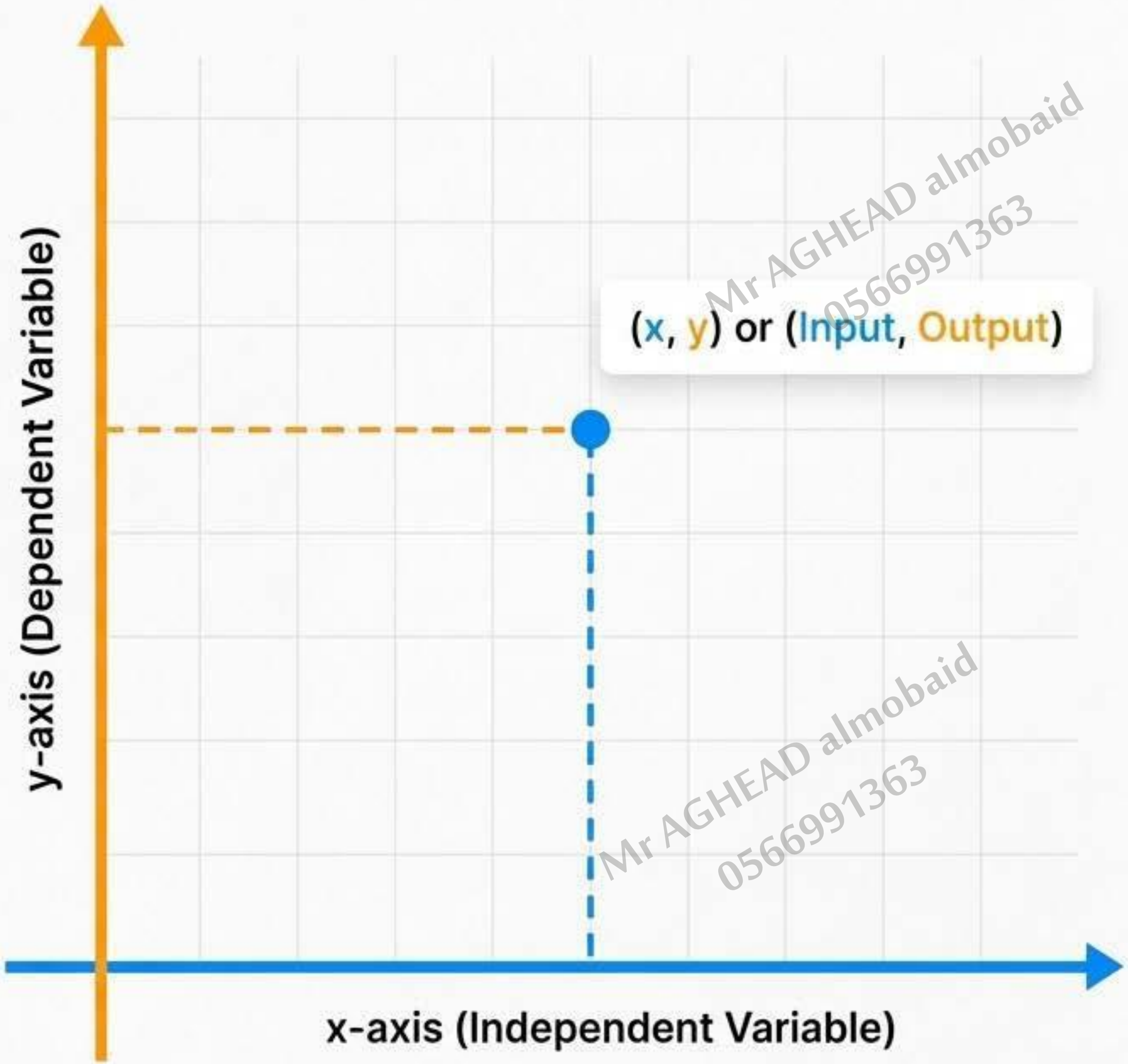
4. **Equation** ✓

$$n = 2h + 3$$

TOOL #4: VISUALIZE YOUR SUCCESS

Bringing Equations to Life with Graphs

An equation is a powerful rule, but a graph makes that rule visual. It’s a picture of every possible input and output, all at once. By plotting the relationship on a coordinate plane, we can see the pattern instantly.



How to Graph Any Equation in 3 Steps

$y = 2x + 1$

Step 1: Create an Input-Output Table.

Choose a few simple values for your input (x).

x	2x + 1	y
0		
1		
2		
3		

Step 2: Find the Ordered Pairs.

Use the equation to find the matching output (y) for each input.

x	2x + 1	y
0	2(0)+1	1
1	2(1)+1	3
2	2(2)+1	5
3	2(3)+1	7

(0, 1)

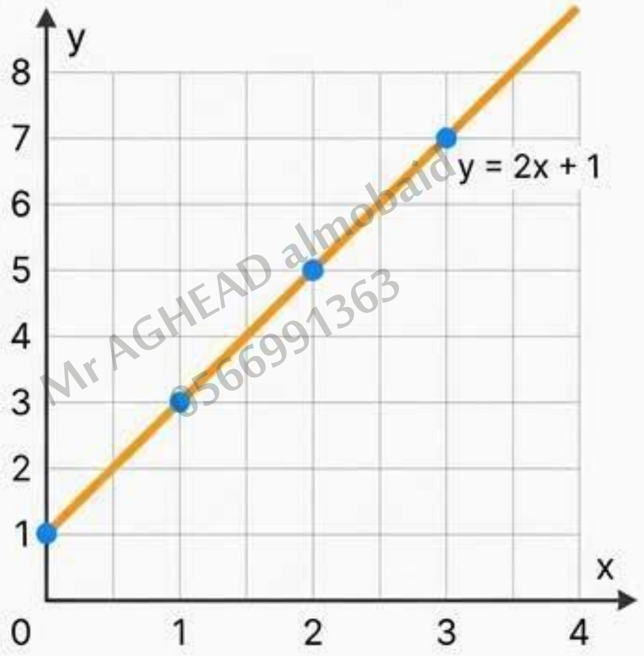
(1, 3)

(2, 5)

(3, 7)

Step 3: Plot the Points and Draw the Line.

Plot each ordered pair on the coordinate plane and connect them with a straight line.



Your Creator's Toolkit is Complete!

You've mastered the four essential tools for understanding the world through math. Use them to analyze problems, make predictions, and build your own solutions.

IDENTIFY
Independent & Dependent variables to see cause and effect.

ORGANIZE
data in tables to find patterns.

CREATE
equations to write a universal rule for any situation.

VISUALIZE
equations on a graph to see the big picture.

The world is full of patterns. Now you have the tools to find them.

Module (7): Relationships Between Two Variables

03/04 Third & Fourth Lessons:

Graphs of Relationships & Multiple Representations

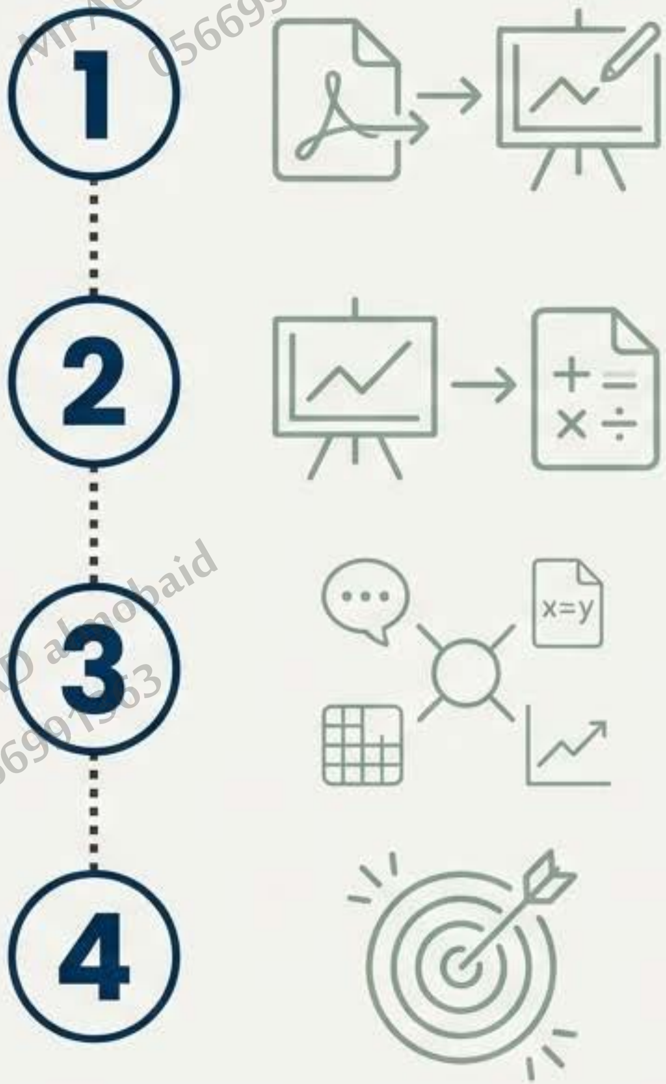
Mr Aghead Almobaid
0566991363

Mastering Mathematical Relationships: A Complete Guide

Translate, Analyze, and Apply the Four Languages of Mathematics.

A presentation by mr.aghead.

Your Path to Mastery



Part 1: From Code to Canvas

Learn to translate the instructions of an Equation into a visual Graph.

Part 2: From Canvas to Code

Become a mathematical detective and deduce the Equation from the clues on a Graph.

Part 3: The Four Languages

Unlock the power of representing any relationship in Words, Equations, Tables, and Graphs.

Part 4: The Challenge Arena

Apply your complete toolkit to solve complex, real-world problems.

Part 1: From Equation to Graph

An **equation** is a recipe. By following it step-by-step, we can create a perfect visual representation: **a graph.**

The Process:

1. **Identify Variables**
   Pinpoint the cause and effect.
2. **Make a Table**
   Generate coordinates by substituting values into the equation.
3. **List Ordered Pairs**
   Organize the coordinates from your table.
4. **Graph the Points**
   Plot the pairs and draw the line.

Key Concept

- **Independent Variable** (The Cause)**:** The quantity that is changed or controlled. Plotted on the horizontal x-axis.
- **Dependent Variable** (The Effect)**:** The quantity that is measured. Its value *depends* on the independent variable. Plotted on the vertical y-axis.

Example 1: Graphing a Direct Relationship

The equation $p = 144b$ represents the total number of pencils p in b boxes. Let's graph this relationship.

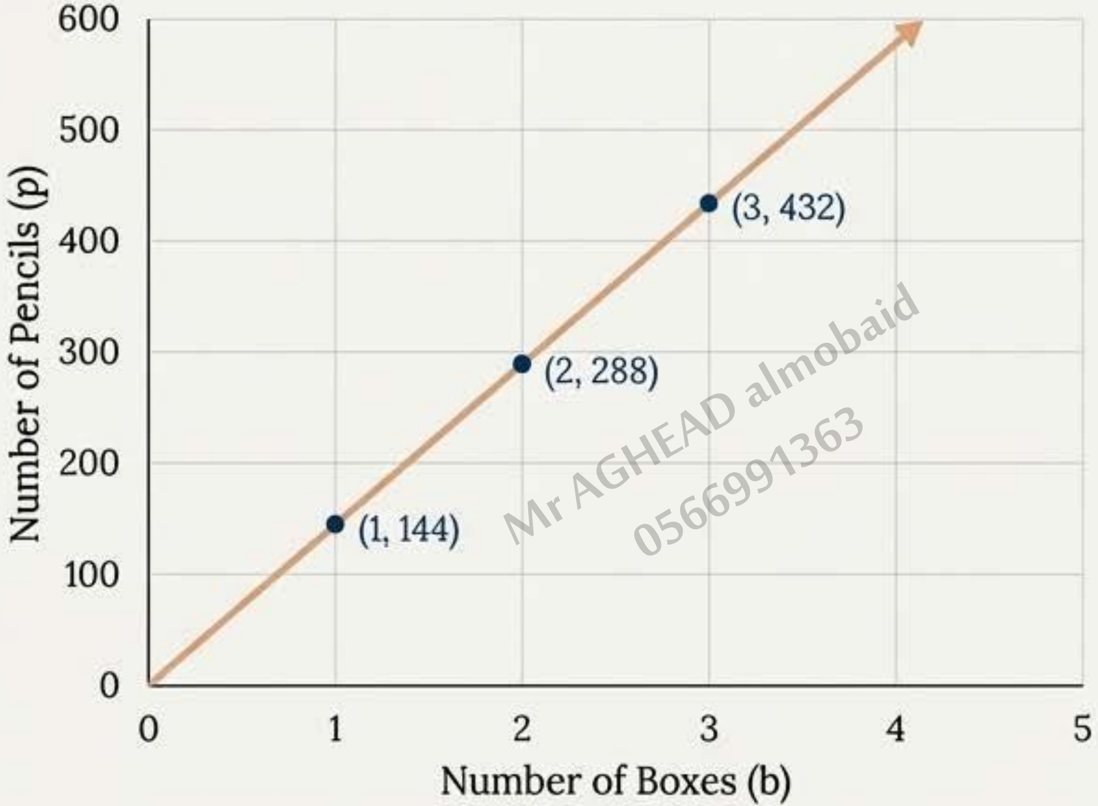
Step 1: Identify Variables

- Independent (Cause): Number of Boxes, b
- Dependent (Effect): Total Pencils, p

Step 2 & 3: Create Table and Ordered Pairs

b (Boxes)	$p = 144b$	p (Pencils)	Ordered Pair
1	144(1)	144	(1, 144)
2	144(2)	288	(2, 288)
3	144(3)	432	(3, 432)

Step 4: Graph the Relationship



Example 2: Graphing a Relationship with a Starting Point

The equation $c = 2b + 6$ represents the total cost c of b sets of beads plus one $6 necklace string.

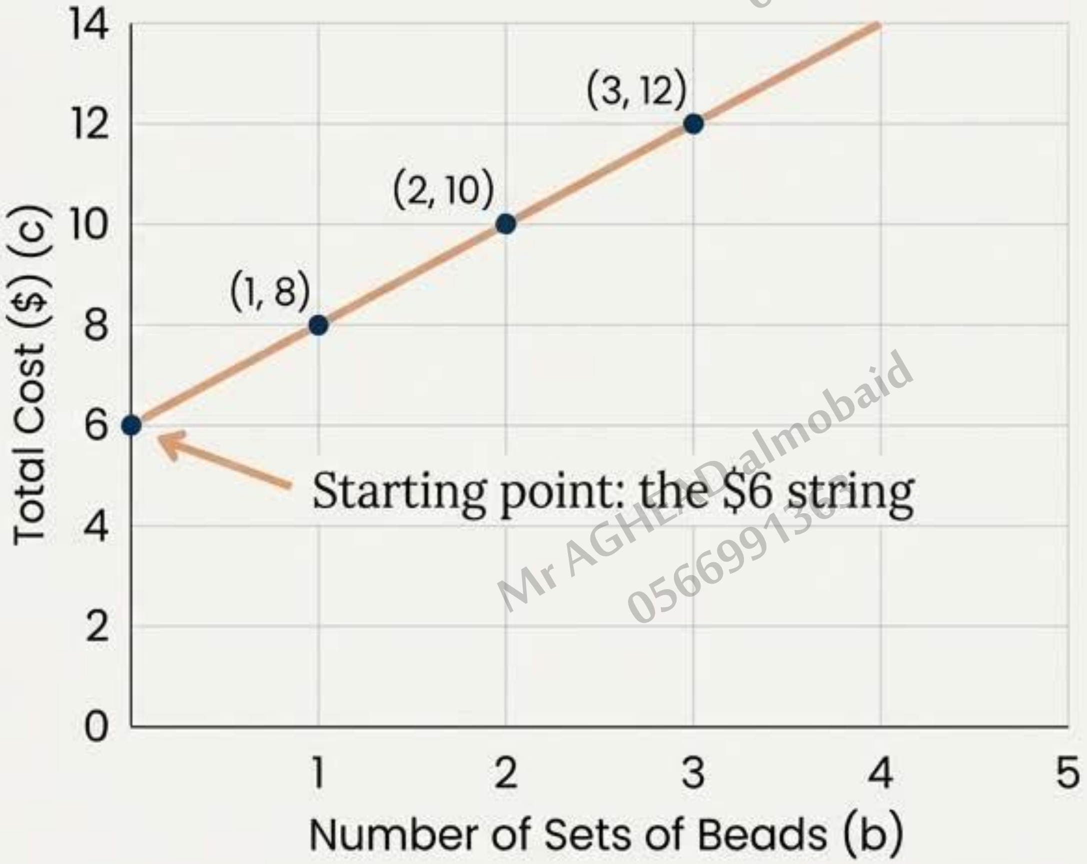
Step 1: Identify Variables

- Independent (Cause): Number of Sets of Beads, b
- Dependent (Effect): Total Cost ($), c

Step 2 & 3: Create Table and Ordered Pairs

b (Beads)	$c = 2b + 6$	c (Cost)	Ordered Pair
1	2(1) + 6	8	(1, 8)
2	2(2) + 6	10	(2, 10)
3	2(3) + 6	12	(3, 12)

Step 4: Graph the Relationship



Starting point: the $6 string

Part 2: From Graph to Equation

A graph is a collection of clues. By analyzing its patterns, we can uncover the secret formula—the equation—that created it.

The Detective's Process:

1. Gather the Clues: Identify at least three clear ordered pairs (points) from the graph's line.

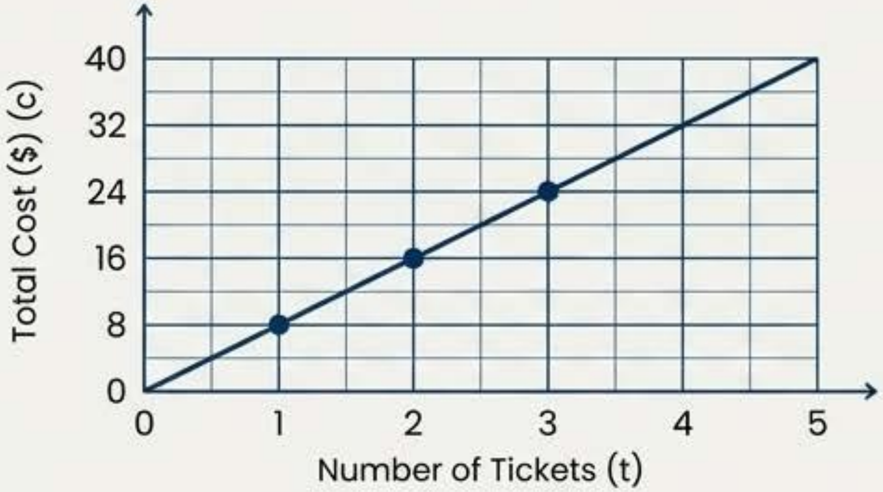
2. Organize the Evidence: Place the ordered pairs into a table to make the pattern easier to see.

3. Crack the Code: Analyze the table to find the rule.

- How does the dependent variable change for each step of the independent variable? (This is the rate of change, or coefficient).
- What is the starting value when the independent variable is zero? (This is the constant).

Detective Case 1: The Football Game

This graph shows the total cost *c* for buying *t* tickets to a football game. What is the equation?



Investigation:

Step 1: Gather Clues (Ordered Pairs)

- From the graph, we can see the points: (1, 8), (2, 16), (3, 24).

Step 2: Organize Evidence (Table)

t	c
1	8
2	16
3	24

+8

+8

+8

Step 3: Crack the Code

- **Pattern Analysis:** As t increases by 1, c consistently increases by 8.
- **Equation:** The cost is always 8 times the number of tickets.

- **The Formula is: $c = 8t$**

Detective Case 2: The Growing Cactus

The Evidence: This graph shows the height *h* (in inches) of Martino's cactus after *g* years of growth. Find the equation.

Investigation:

Step 1: Gather Clues (Ordered Pairs)

From the graph, we can see the points: (1, 42), (2, 44), (3, 46).

Step 2: Organize Evidence (Table)

g	h	
1	42	+2
2	44	+2
3	46	+2

Step 3: Crack the Code

- **Rate of Change:** As g increases by 1, h increases by 2. The rule involves 2g.
- Find the Constant: Let's test h = 2g. For g=1, 2(1) = 2, but the height is 42. We are off by 40. Let's try for g=2. 2(2) = 4, but height is 44. Again, we are off by 40.
- The Adjustment: We must add 40 after multiplying by 2.

- **The Formula is: $h = 2g + 40$**

Part 3: The Four Languages of Relationships

A single mathematical relationship can be expressed in four interconnected ways. True mastery means you can translate fluently between them. Think of it as a mathematical Rosetta Stone.

Relationship

Words

A real-world scenario or description. (e.g., “A cyclist travels at a constant speed of 14 miles per hour.”)

Equation

$d = 14t$

A symbolic formula that describes the rule.

Table

An organized list of input-output value pairs.

Graph

A visual representation of the relationship on a coordinate plane.

The All-in-One Dashboard: Student Council Car Wash

The student council has already earned $150. For their fundraiser, they are charging $7 for each car `c they wash to find their total earnings *t*.

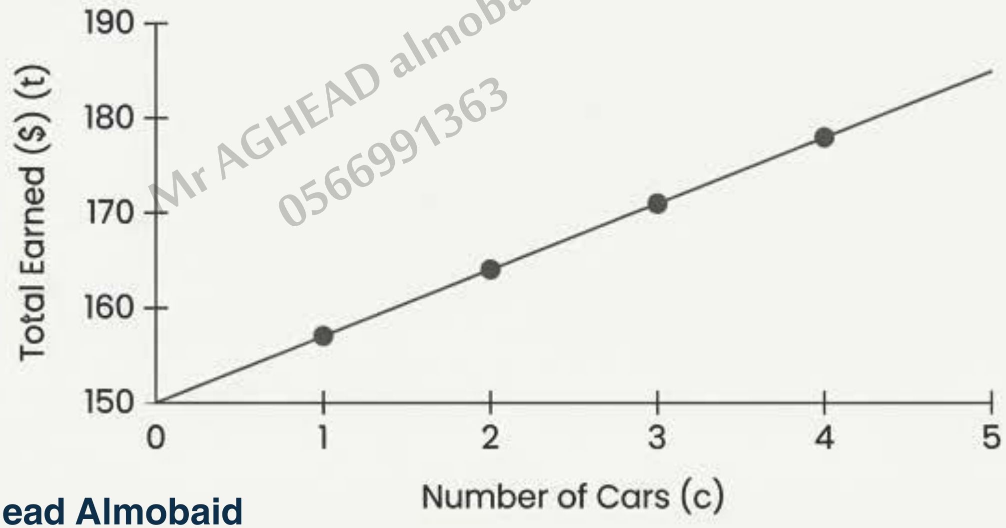
The Rule

$$t = 7c + 150$$

The Data

Number of Cars (c)	Total Earnings ($) (t)
1	157
2	164
3	171
4	178

The Visual



Universal Application: Trail Mix Costs

An online store sells trail mix for \$2.75 per pound p and charges a flat shipping fee of \$4. What is the total cost `?

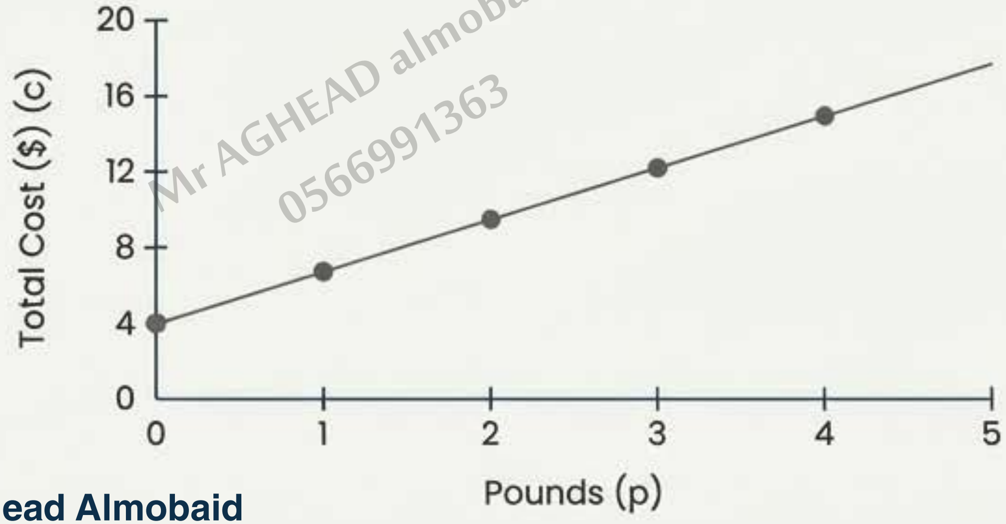
The Rule

$c = 2.75p + 4$

The Data

Pounds (p)	Total Cost (\$) (c)
1	6.75
2	9.50
3	12.25
4	15.00

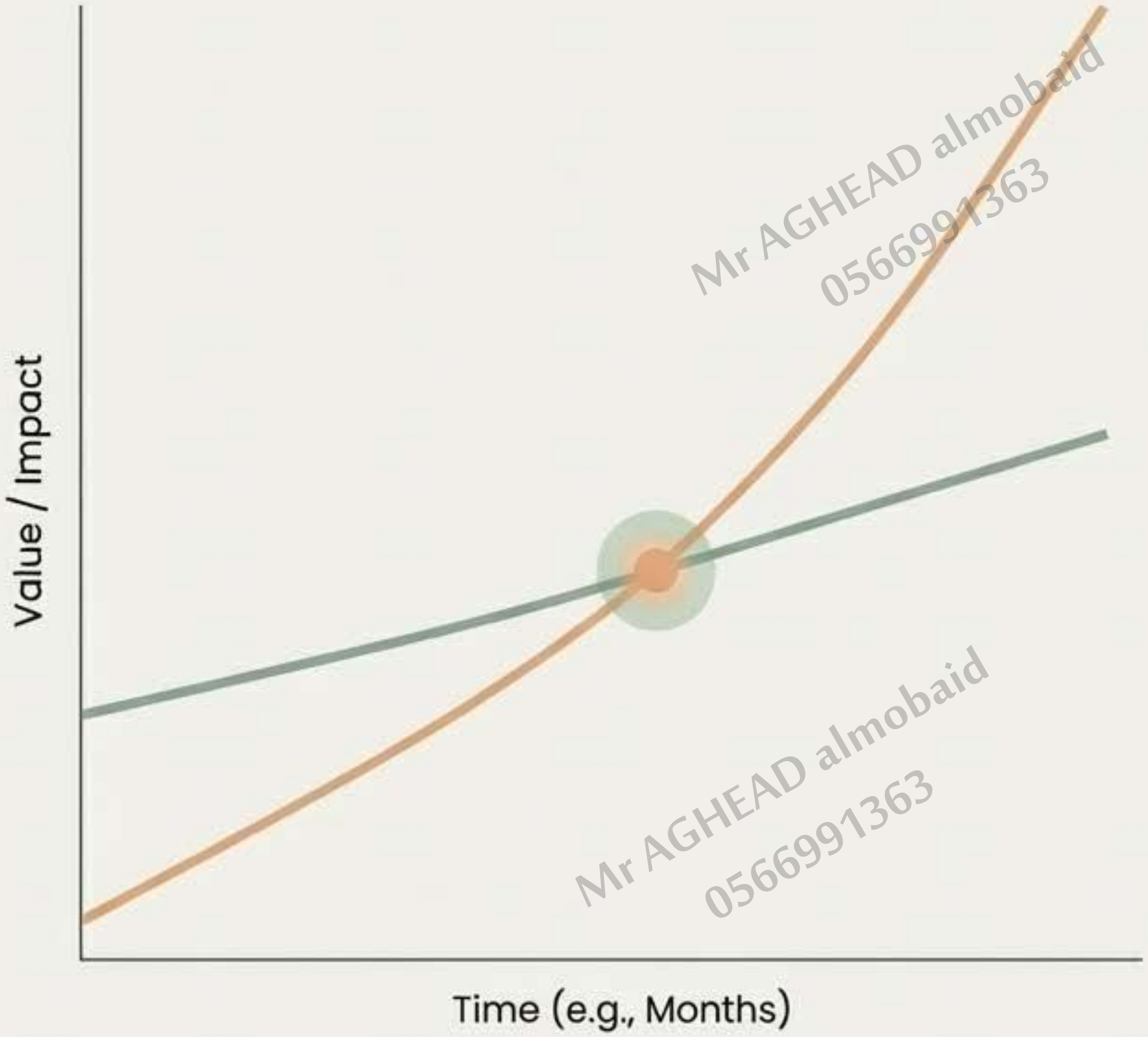
The Visual



Part 4:
The Challenge Arena

You now have a complete toolkit. It's time to apply your fluency in all four languages to solve practical problems. problems. These challenges will require you to analyze scenarios, compare options, and make informed decisions.

Projected Outcomes: Competing Scenarios



Challenge 1: The Bike Race

Nancy and Elsa like to ride bikes.

Nancy's Speed

Represented by the equation:

$$m = 12h$$

(where *m* is miles and *h* is hours)

Elsa's Speed

Represented by the equation:

$$m = 9h$$

The Question

How much longer will it take Elsa to bike 72 miles than Nancy?

Your Task: Use the equations to find the time it takes for each person to travel 72 miles and then find the difference.

Solution: The Bike Race

Step 1: Calculate Nancy's Time

We know Nancy's equation is m = 12h.

We need to find the hours h when miles m is 72.

72 = 12h

Divide both sides by 12: **h = 6 hours.**

Step 2: Calculate Elsa's Time

We know Elsa's equation is m = 9h.

We need to find the hours h when miles m is 72.

72 = 9h

Divide both sides by 9: **h = 8 hours.**

Step 3: Find the Difference

Elsa's Time – Nancy's Time

8 hours - 6 hours = 2 hours

Conclusion: It will take Elsa **2 more hours** to bike 72 miles.

Challenge 2: The Cupcake Decision

Zari has $110 to spend on cupcakes. She is comparing two bakeries. Which one offers the best deal?

Betty's Bakery

Lora Regular

Sells by the dozen with free delivery.
Cost is shown in the table.

Dozens (d)	Total Cost (c)
1	$24
2	$48
3	$72

The Sweet Shoppe

Lora Regular

Charges $18 per dozen plus a $20 delivery fee.

$$c = 18d + 20$$

Your Task

Determine the maximum number of dozens Zari can buy from each bakery with her $110 budget.

Solution: The Cupcake Decision

Step 1: Analyze Betty's Bakery

From the table, the cost is always 24 times the number of dozens. The equation is $c = 24d$.

How many dozens can Zari buy for $110?
$110 \div 24 = 4.58...$

Zari can only afford **4 full dozens** from Betty's Bakery.

Step 2: Analyze The Sweet Shoppe

The equation is $c = 18d + 20$.

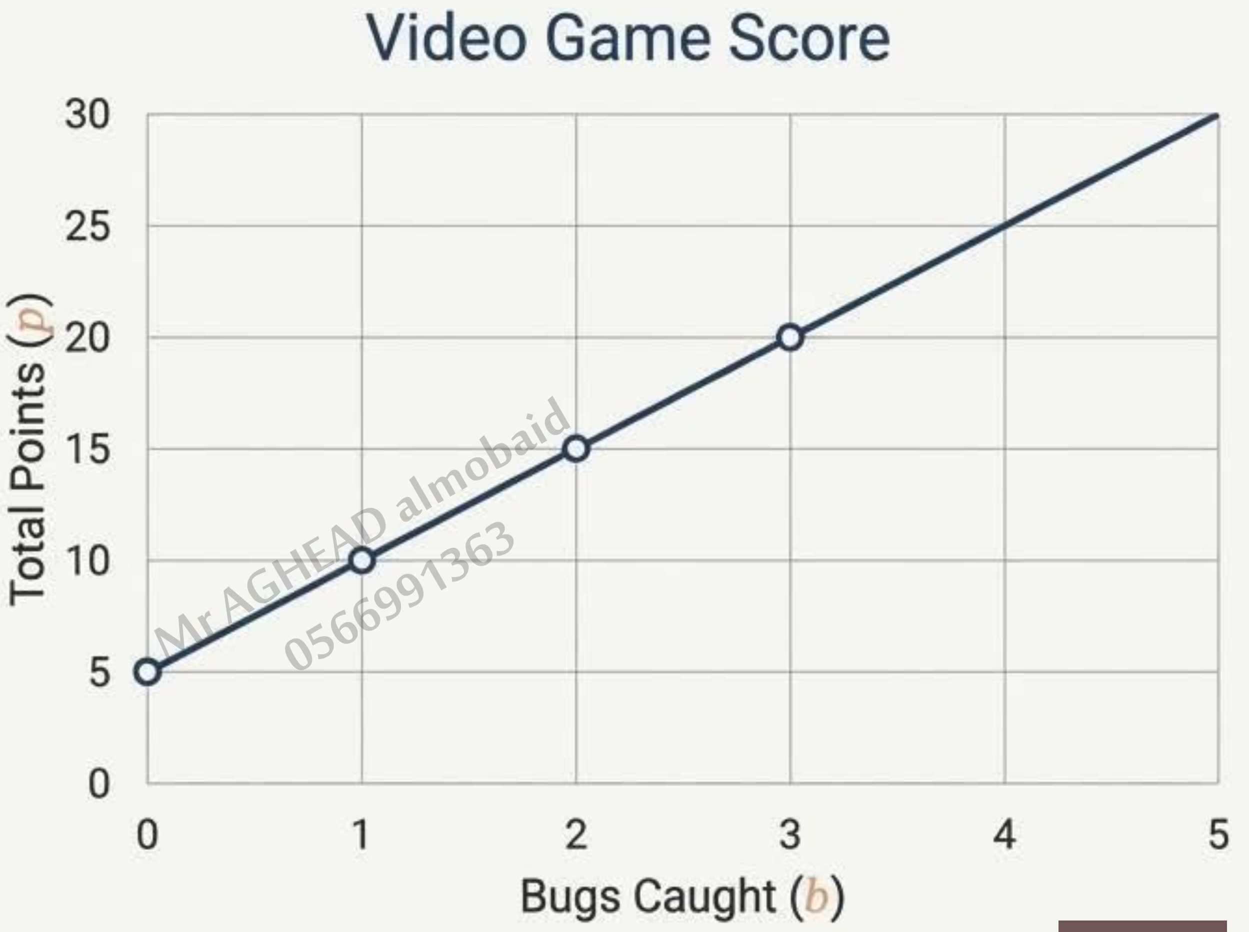
How many dozens can Zari buy for $110?
$110 = 18d + 20$
$90 = 18d$
$d = 5$

Zari can afford exactly **5 full dozens** from The Sweet Shoppe.

Conclusion: **The Sweet Shoppe** offers the greatest number of cupcakes for her budget.

Final Mastery Check: Video Game Score

The graph shows the total points *p* a player earns for catching *b* bugs in a video game.



Your Mission:

1. Write the Equation

Analyze the graph to determine the equation that represents the relationship between bugs caught (*b*) and points earned (*p*).

2. Calculate the Score

Use your equation to find the total points Ryder will have after catching 10 bugs.

Mission Complete: The Power of Fluency

Solution to the Video Game Challenge:

- Finding the Equation: The graph starts at 5 points (the constant). For each bug caught, the score increases by 5 (the rate of change).
  The equation is $p = 5b + 5$.
- Calculating the Score: Substitute $b = 10$ into the equation.
  $p = 5(10) + 5$
  $p = 50 + 5 = 55$ points.

Your Mastery Takeaway

You have learned that relationships are not just abstract formulas. They are stories that can be told with words, calculated with equations, organized in tables, and visualized on graphs. By mastering these four languages, you have gained the power to model, understand, and solve complex problems in the world around you.

Mr Aghead Almobaid
0566991363

لا تتردد في التواصل معنا
قم بمسح رمز الـQR

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

لحجز مقعدك قم بالتواصل معنا
اضغط هنا: 0566991363