

Mastering the Language of Algebra

A Guide to Translating Reality into Equations

I have
three apples
and add five more,
giving me fourteen.

$$3x + 5 = 14$$

A number times
seven is twenty-one.

$$7y = 21$$

The sum of a number
and eight is fifteen.

$$n + 8 = 15$$

Five less than twice
a number is three.

$$2z - 5 = 3$$

The Translator's Job

The Language Barrier

English sentences often feel cluttered and confusing. They describe situations with ambiguity.

Example: "Sarah has three times as many books as Tom, and the total is 24."



YOU ARE HERE
(The Translator)

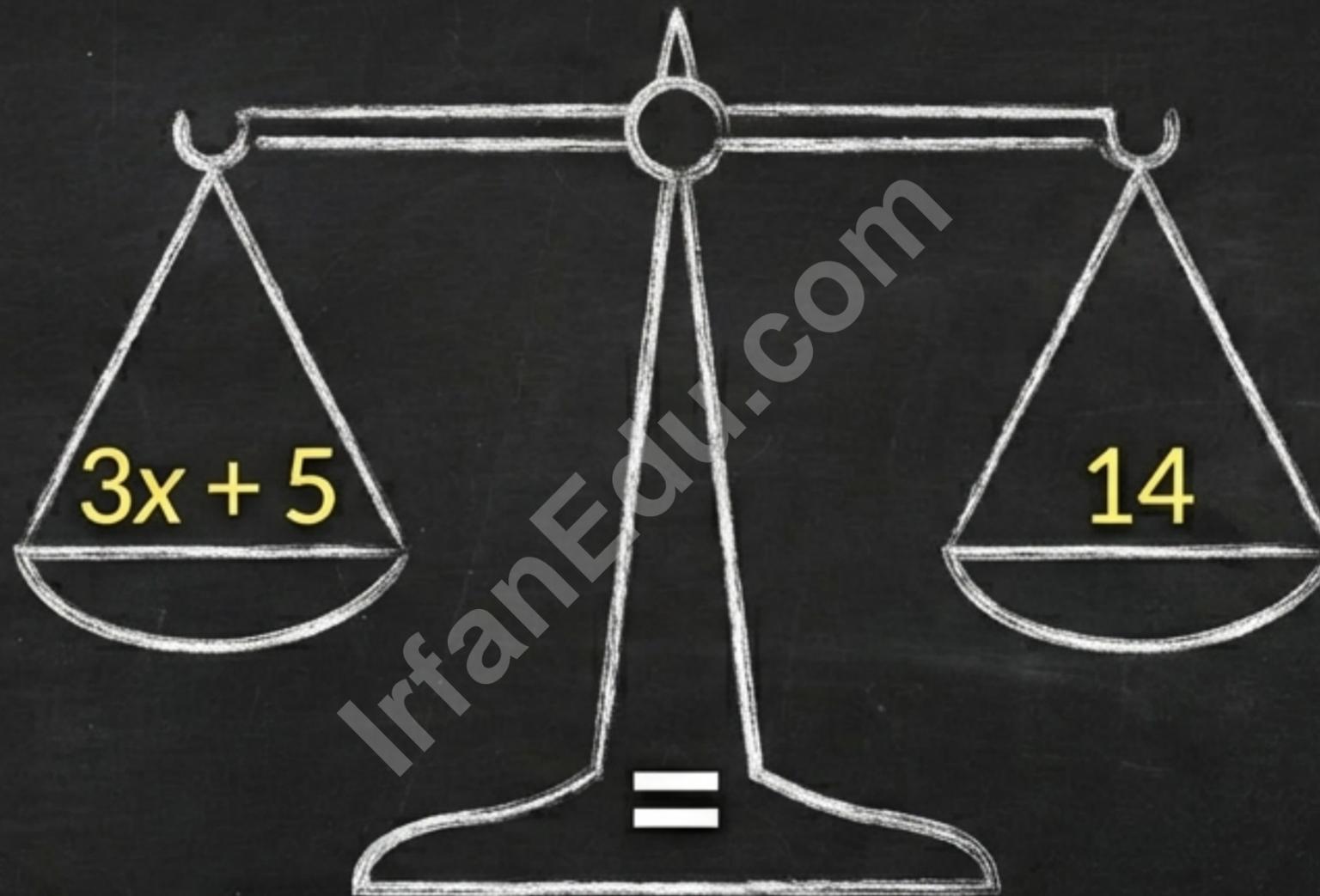
The Solution

Algebraic equations are clean, balanced, and solvable. They describe the same situation with precision.

Example: $3x = 24$

*Mastery is not calculation; it is recognizing patterns.
The better you know the vocabulary, the faster you translate.*

The Equation is a Balance Scale



An algebraic equation represents a state of perfect equilibrium. When you write $3x + 5 = 14$, you are asserting that the left side is identical in value to the right side.

The Translation Dictionary: Addition & Subtraction

Learning these keywords accelerates the translation process.

ADDITION (+)

Sum, more than, increased by, total, plus, combined, added to

“The sum of 8 and y ” $\rightarrow 8 + y$

SUBTRACTION (-)

Difference, less than, decreased by, minus, reduced by, fewer than

“The difference of 5 and y ” $\rightarrow 5 - y$

Note: While $y + 8$ is the same as $8 + y$, always try to maintain the order given in the problem to build good habits.

The Translation Dictionary: Operations & Equality

MULTIPLICATION (x)		
<u>Keywords</u> Product, times, multiplied by, of, twice, double, triple	<u>Rule</u> Place the constant before the variable.	<u>Example</u> “x multiplied by 13” → $13x$
DIVISION (÷)		
<u>Keywords</u> Quotient, divided by, per, ratio, out of, split	<u>Rule</u> Order matters critically. First item goes in the numerator.	<u>Example</u> “The quotient of x and 3” → $x/3$
EQUALITY (=)		
<u>Keywords</u> Is, are, will be, gives, equals, results in, yields		<u>Example</u> “The result is 10” → $= 10$

Syntax Alert: The 'Less Than' Trap

English Phrase: "4 less than x"

 **Incorrect: $4 - x$**

 **Correct: $x - 4$**

Logic Test: If someone earns \$4 less per hour than you (p), they earn $p - 4$, not $4 - p$. Always subtract the "less than" amount FROM the main variable.

Advanced Grammar: Complex Phrasing

Multi-Part Expressions (Ratios)

English: "The ratio of 9 more than x to x"

Ratio $\rightarrow \frac{(x + 9)}{x}$

$$\frac{(x + 9)}{x}$$

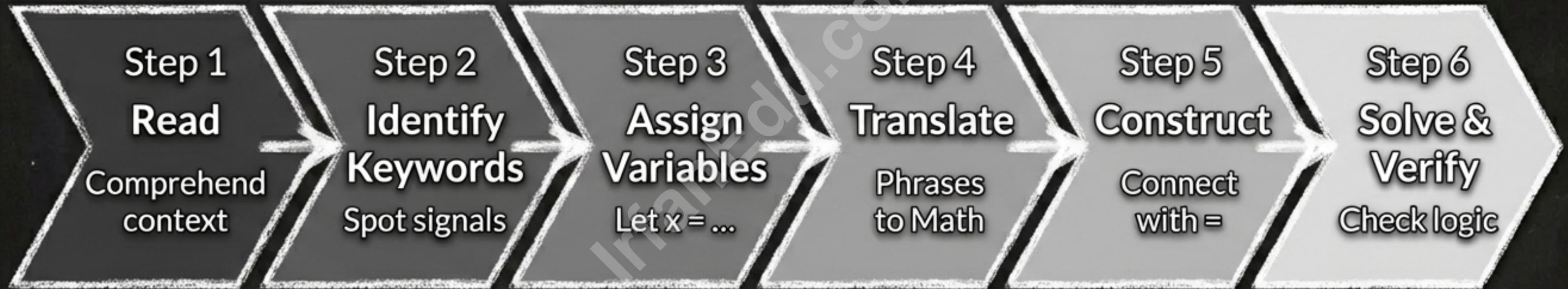
The "How Much Is Left" Construction

English: 20 gallons total. g gallons used. How much is left?

Logic (Cyan): Remaining = Total - Named Amount

$$20 - g$$

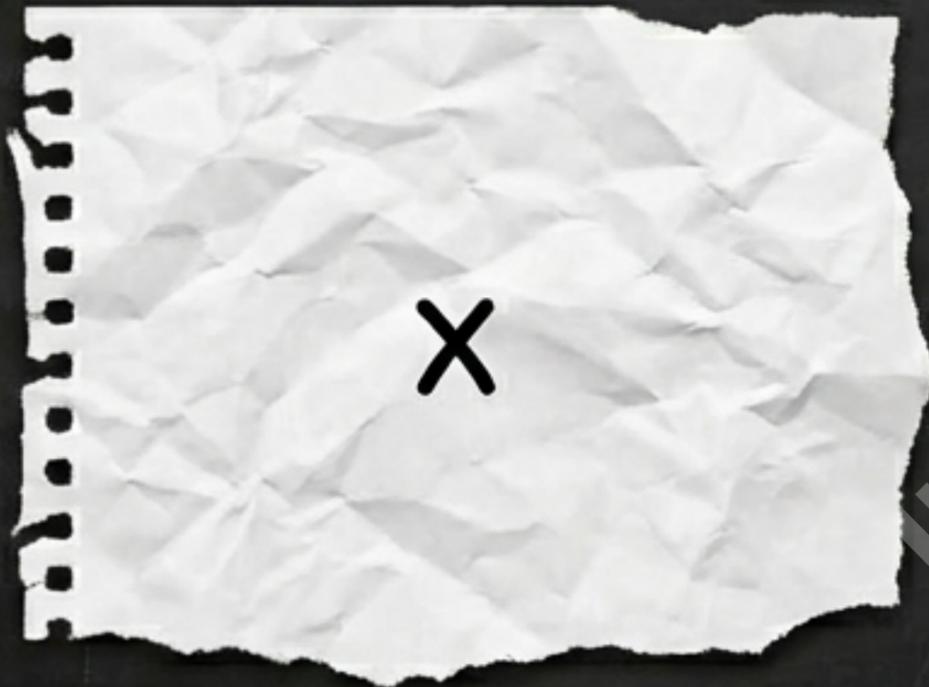
The 6-Step Translation Roadmap



Setup: Defining the Unknown

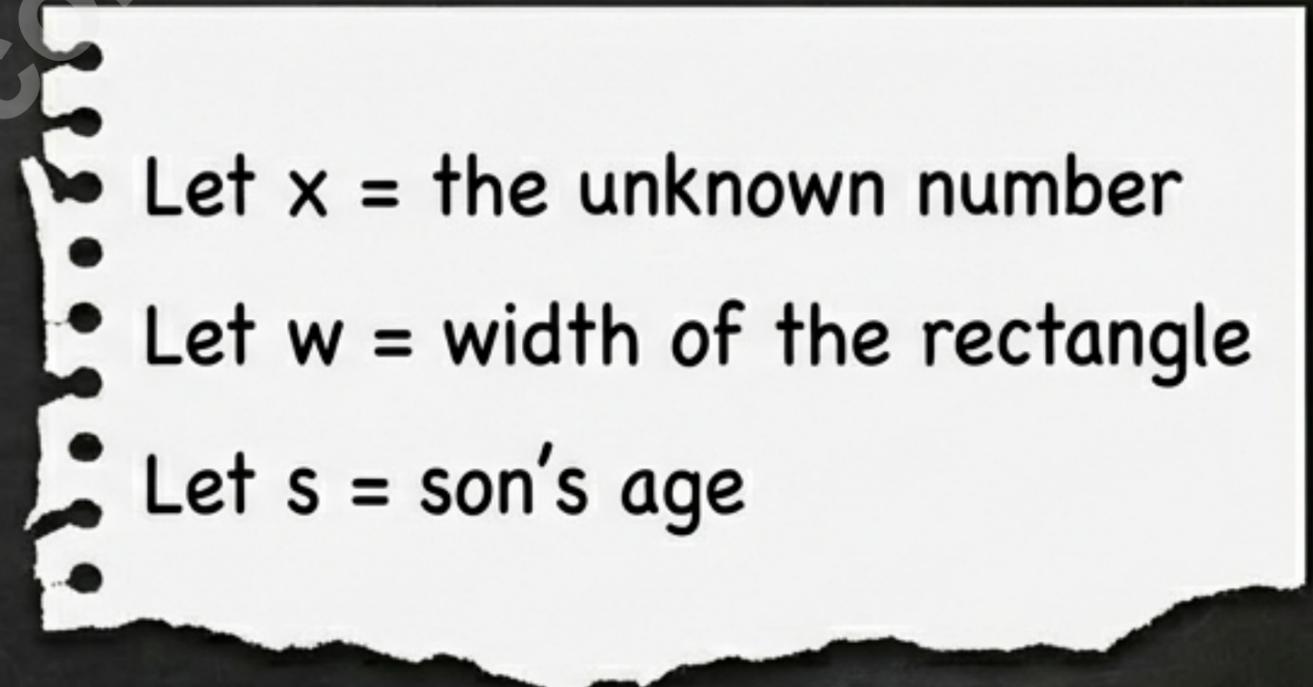
Step 3 is the most critical step to prevent confusion.

The Generic Mistake



Writing just “x” leaves you lost later.

The Professional Habit



Identifying the specific target guides the entire equation.

Identifying the specific target guides the entire equation

Execution: Building the Equation

Problem: Three times a number decreased by 4 equals 11.

Identify

Let x = the number

Translate

Three times a number $\rightarrow 3x$
Decreased by 4 $\rightarrow -4$
Equals 11 $\rightarrow = 11$

Construct

$$3x - 4 = 11$$

Solve

$$3x = 15$$
$$x = 5$$

Verify: Does $3(5) - 4$ equal 11? Yes.

Case Study: The Age Problem

Jessica is 4 years older than Mike. Their ages sum to 28.



$$x + (x + 4) = 28$$

$$2x + 4 = 28$$

$$2x = 24$$

$$x = 12 \text{ (Mike's Age)}$$

$$\text{Jessica} = 12 + 4 = 16$$

Case Study: The Value Problem

Tickets cost \$12. Popcorn costs \$6. Alex bought 3 popcorns.
Total spent was \$54. How many tickets?

$$(\text{Unit Price} \times \text{Quantity}) + (\text{Unit Price} \times \text{Quantity}) = \text{Total}$$

→ Let x = number of tickets

$$\rightarrow 12(x) + 6(3) = 54$$

$$12x + 18 = 54$$

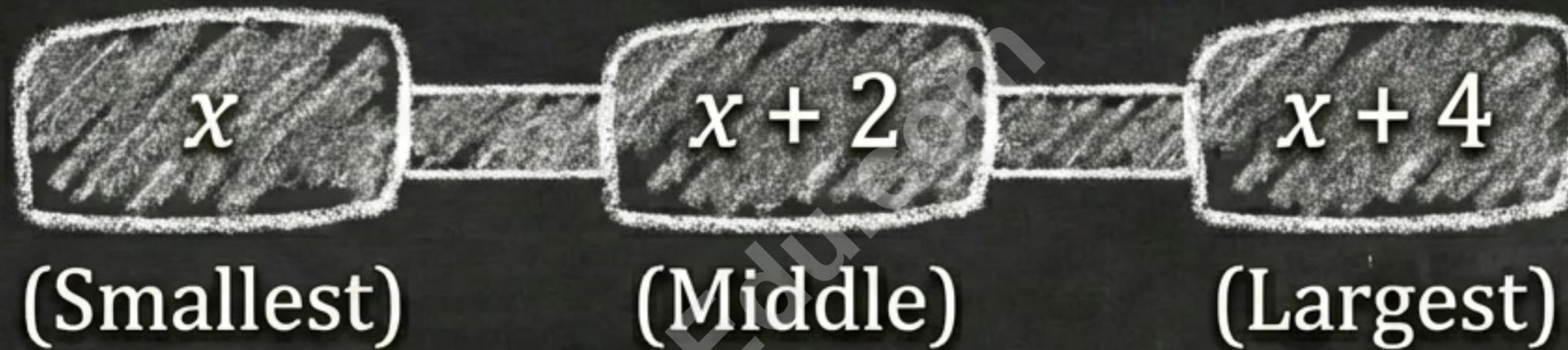
$$12x = 36$$

$$x = 3$$

Alex bought 3 tickets.

Case Study: Consecutive Integers

The sum of three consecutive even integers is 78.



$$x + (x + 2) + (x + 4) = 78$$

$$3x + 6 = 78$$

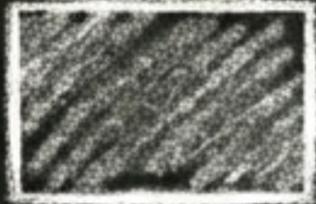
$$3x = 72$$

$$x = 24$$

The integers are 24, 26, and 28.

The Problem Landscape

Common archetypes you will encounter.



Geometry

Perimeter

$$P = 2l + 2w$$



Mixture

Combining
concentrations.



Distance

$$d = rt$$

(Distance = Rate \times Time)



Work

People working
together.



Investment

$$I = Prt$$

(Interest)

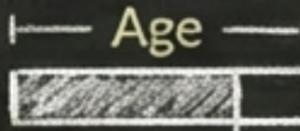
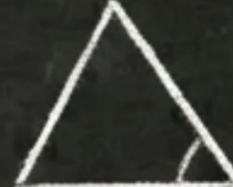


Percent

Discounts and
Increases.

Essential Tips for Translation Success

Cheat Sheet

- **1. Test with Real Numbers:** If the algebra is confusing, **plug** in a number like '**10**' to see the logic, then swap back to x .
- **2. Order Matters:** Watch out for '**less than**' (subtract from) and '**quotient**' (numerator first).
- **3. Draw Diagrams:** Visualize age bars, geometry shapes, or containers.   
- **4. Check Your Answer:** Always substitute your solution back into the original English sentence.

Algebra models the real world. If you can translate the problem, you can solve it.