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Rearranging Formulas

IGCSE Mathematics

The Panda Math Tutor

Prepared by

Nikolas Agisilaou

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1 Introduction to Rearranging Formulas

Note

Rearranging formulas (also called "changing the subject") is the process of rewriting a formula so that a different variable is isolated on one side. For example, if you know $v = u + at$ and want to find t, you need to rearrange the formula to make t the subject. This is one of the most widely tested algebraic skills at IGCSE level.
In this chapter, we will explore:

- What it means to change the subject of a formula
- The core principle: using inverse operations
- Rearranging formulas involving addition and subtraction
- Rearranging formulas involving multiplication and division
- Multi-step rearrangements
- Formulas involving powers and roots
- Formulas involving fractions
- Formulas where the new subject appears more than once
- Real-world applications of rearranging formulas

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2 What is the Subject of a Formula?

Definition

The **subject** of a formula is the variable that appears **by itself** on one side of the equals sign (usually the left).
For example, in the formula $A = \ell \times w$:

- A is the subject
- ℓ and w are not the subject, because they do not stand alone on one side

Rearranging a formula (or **changing the subject**) means rewriting it so that a different variable becomes the subject.

Note

Familiar formulas and their subjects:

Formula	Subject	Context
$A = \ell w$	A	Area of a rectangle
$P = 2\ell + 2w$	P	Perimeter of a rectangle
$v = u + at$	v	Equations of motion
$C = 2\pi r$	C	Circumference of a circle
$A = \pi r^2$	A	Area of a circle
$V = \frac{1}{3}\pi r^2 h$	V	Volume of a cone

3 The Core Principle: Inverse Operations

The Balance Principle

A formula is like a balanced set of scales. Whatever you do to one side, you must do to the other side to keep the equation balanced.
To isolate a variable, we "undo" the operations acting on it by applying the **inverse (opposite) operation** to both sides.

Definition

Inverse operations are pairs of operations that undo each other:

Operation	Inverse Operation
Addition $(+)$	Subtraction $(-)$
Subtraction $(-)$	Addition $(+)$
Multiplication $(\times)$	Division $(\div)$
Division $(\div)$	Multiplication $(\times)$
Squaring (x^2)	Square root $(\sqrt{\ })$
Square root $(\sqrt{\ })$	Squaring (x^2)
Cubing (x^3)	Cube root $(\sqrt[3]{\ })$
Cube root $(\sqrt[3]{\ })$	Cubing (x^3)

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