

UNIT 21 *Formulae*

Introduction to SIM

Learning objectives

This unit is focused on the use of mathematical formulae to solve practical and interesting problems. After completing this unit of STUDENT INSTRUCTIONAL MATERIAL (SIM) you should

- understand the difference between a formula and an equation
- be able to substitute numbers into formulae in practical situations
- be able to change the subject of a formula
- appreciate how formulae are used to solve practical and relevant problems.

Key points and principles

- Be very careful to use the correct units when substituting into formulae
- Be careful when using algebraic notation. For example,

$$3 \times a = 3a$$

$$(3a)^2 = (3a) \times (3a) = (3 \times a) \times (3 \times a) = (3 \times 3) \times (a \times a) = 9 \times a^2 = 9a^2$$

- When changing the subject of an equation, always write down clearly the operations which have been used. For example, make a the subject of the equation $4a + b = c$.

$$4a + b = c \quad (\text{add } -b \text{ to each side})$$

$$4a + b - b = c - b$$

$$4a = c - b \quad (\text{divide both sides by } 4)$$

$$a = \frac{c - b}{4}$$

Facts to remember

$$(-a) \times b = -a \times b \quad (= -ab) \quad \text{for any number } a, b$$

$$(-a) \times (-b) = a \times b \quad (= ab) \quad \text{for any number } a, b$$

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Glossary of terms***Formula***

This describes how one quantity is related to one or more other quantities.

For example,

$$y = x^2, \quad y = 2x + 1, \quad A = ab, \quad V = xyz, \quad F = \frac{9}{5}C + 32, \quad T = 2\pi\sqrt{\frac{l}{g}}$$

Substituting numbers into a formula

This means that letters are replaced by numbers in a formula.

For example,

$$F = \frac{9}{5}C + 32 \quad \text{when } C = 25$$

gives

$$\begin{aligned} F &= \frac{9}{5} \times 25 + 32 \\ &= 45 + 32 \\ &= 77 \end{aligned}$$

Changing the subject

This means rearranging a formula so that, for example,

$$y = f(x) \quad (\text{formula in } x)$$

is rearranged to give

$$x = g(y) \quad (\text{formula in } y)$$

For example,

$$F = \frac{9}{5}C + 32$$

can be rearranged to give

$$\begin{aligned} \frac{9}{5}C &= F - 32 \\ C &= \frac{5}{9}(F - 32) \end{aligned}$$