

Formulae, Expressions and Equations

Formula	A formula tells you how to calculate the answer. It is a rule linking two or more variables. It contains an '=' sign but no answer	$P = 2l + 2w$ Is a formula for the perimeter of a rectangle e.g. Perimeter = 2 x length + 2 x width If length = 4 and width = 2 the formula would be $P = (2 \times 4) + (2 \times 2)$ If we perform this calculation we get the answer: $P = 8 + 4$ $P = 12$
Expression	Made up of algebraic terms. It has no equals sign	$2x + 3b$ $2(l+w)$
Equation	An expression with an answer (has an '=' sign) which will only be true for the specific variable included (in this case 4)	$x + 4 = 10$ From this we can see that $x = 6$ 10 is only the correct answer when x is + 4

Exercise 1

Write these under the correct table headings:

- a) $a + bc = d$
- b) $3a + 5 = -4$
- c) $4xy + 3x - y$
- d) $E = mc^2$
- e) $s = ut$
- f) $3x + 6 = 12$
- g) $3y + 3x - a$
- h) $2a + 3b$
- i) $7 = 19 + 3c$

Formula	Expression	Equation

Writing Formulae

Formula can be used to save time when working out similar calculations over and over again.

A formula can represent an everyday situation.

1. Write the formula in words and then using letters
2. Explain what the letters represent

Example 1

A plumber charges £25 for a callout and £30 per hour of work.

Write a formula for the plumbers charge.

Charge in pounds = 25 + 30 x number of hours of work

$$C = 25 + 30h$$

Where C = charge in pounds, h = number of hours of work

Example 2

A bus ticket to town costs £3 for an adult and 90p for a child.

- a) Write a formula to work out the cost in pounds of bus tickets for different numbers of adults and children.

Cost in pounds = 3 x number of adults + 0.90 x number of children

$$C = 3n + 0.90m$$

where C = cost in pounds, n = number of adults, m = number of children

- b) Use the formula to work out the cost of tickets for 3 adults and 5 children

$$C = 3n + 0.90m \quad n = 3, m = 5$$

$$C = 3 \times 3 + 0.90 \times 5$$

$$C = 9 + 4.50$$

$$C = \text{£}13.50$$

- c) Mr and Mrs Karim and their children paid £8.70 for bus tickets. How many children bought tickets?

$$C = 3n + 0.90m \quad n = 2 \text{ (Mr \& Mrs Karim)}, m = \text{unknown}$$

$$8.70 = 3 \times 2 + 0.90m$$

$$8.70 = 6 + 0.90m$$

$$8.70 - 6 = 6 + 6 + 0.90m$$

$$\frac{2.70}{0.90} = \frac{0.90m}{0.90}$$

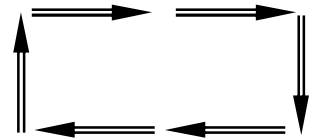
$$3 = m \quad 3 \text{ children bought tickets}$$

Exercise 2

Pencils are arranged in rectangles.

The number of pencils needed to make a rectangle is

$$2 \times \text{number of pencils along the bottom} + 2$$



a) Write this formula using letters

b) Check that your formula gives the correct answer for a rectangle of length 5.

c) Work out how many pencils are needed for a rectangle of length 8.

d) A rectangle uses 48 pencils. What is its length?

Exercise 3

The cost of hiring a steam cleaner is £32.50 for the first day and £24.75 for each extra day.

Tariq paid £131.50 to hire the steam cleaner.

How many days did he hire it for?

a) Answers

Exercise 1

Formula	Expression	Equation
a) $a + bc = d$	c) $4xy + 3x - y$	b) $3a + 5 = -4$
d) $E = mc^2$	g) $3y + 3x - a$	f) $3x + 6 = 12$
e) $s = ut$	h) $2a + 3b$	i) $7 = 19 + 3c$

Exercise 2

a) Write this formula using letters **$P = 2n + 2$**

b) Check that your formula gives the correct answer for a rectangle of length 5. **12**

$$P = 2n + 2 \quad P = 2 \times 5 + 2 \quad P = 10 + 2$$

c) Work out how many pencils are needed for a rectangle of length 8. **18**

$$P = 2n + 2 \quad P = 2 \times 8 + 2 \quad P = 16 + 2$$

d) A rectangle uses 48 pencils. What is its length? **23**

$$\begin{aligned}
 P &= 2n + 2 \\
 48 - 2 &= 2n + 2 - 2 \\
 \frac{46}{2} &= \frac{2n}{2} \\
 23 &= n
 \end{aligned}$$

Exercise 3

The cost of hiring a steam cleaner is £32.50 for the first day and £24.75 for each extra day.

Tariq paid £131.50 to hire the steam cleaner.

How many days did he hire it for? **5**

$$\begin{aligned}
 C &= 32.50 + 24.75d \\
 131.50 &= 32.50 + 24.75d \\
 131.50 - 32.50 &= 32.50 - 32.50 + 24.75d && \text{Remember } 32.50 = 1 \text{ day} \\
 \frac{99}{24.75} &= \frac{24.75d}{24.75} \\
 4 &= d \\
 4 + 1 \text{ (first day)} &= 5
 \end{aligned}$$