

fs4u

Calculating using Simple Formulae

‘How To’ Booklet 13

Calculations Using Simple Formulae

What is a formula?

We all associate formulae with CHEMISTRY and EXPERIMENTS. For example, a very famous formula is Einstein's Theory of Relativity.

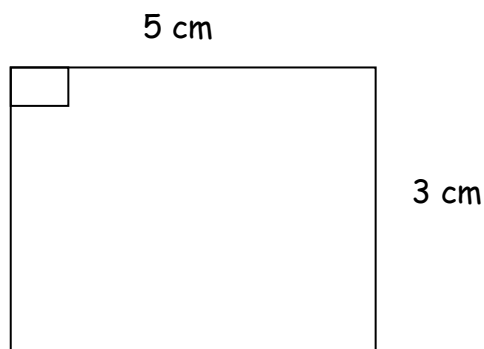
$$E = Mc^2$$

Formulae can be very simple

a	Profit = Revenue - Cost	$P = R - C$
b	Balance = Income - Expenditure	$B = I - E$
c	Speed = Distance Time	$S = D/T$
d	Distance = Speed x Time	$D = S \times T$
e	Area = Length x Width	$A = L \times W$

In each case, a single letter replaces the words. If you know what the symbol represents then the formula makes perfect sense.

Example



Length = 5 cm

Width = 3 cm

$$\text{Area} = L \times W$$

$$\text{Area} = 5 \times 3$$

$$\text{Area} = 15 \text{ cm}^2$$

$$\begin{aligned}\text{The perimeter} &= L + W + L + W \\ &\text{or } 2L + 2W\end{aligned}$$

$$\begin{aligned}\text{perimeter} &= (2 \times 5) + (2 \times 3) \text{ cm} \\ &= 10 + 6 \text{ cm} \\ &= \mathbf{16 \text{ cm}}\end{aligned}$$

The use of formulae is simply algebraic substitution. For each letter in the formula, simply put in a numerical value.

Try the following:

1	$v = u + at$ (remember $at = a \times t$)		
Find v when			
a	$u = 3$	$a = 2$	$t = 5$
b	$u = 4$	$a = 1$	$t = 2$
c	$u = 16$	$a = 0$	$t = 5$
d	$u = 27$	$a = 15$	$t = 13$
2	$w = 3a - b^2$		
Find w when			
a	$a = 2$	$b = 1$	
b	$a = 7$	$b = 4$	
c	$a = 20$	$b = 5$	
3	$n = a/2 + 4bc$		
Find n when			
a	$a = 6$	$b = 2$	$c = 3$
b	$a = 12$	$b = 1$	$c = 1$
c	$a = 17$	$b = 1.5$	$c = 2.5$
4	The conversion of Celsius ($^{\circ}\text{C}$) to Fahrenheit ($^{\circ}\text{F}$) is given by the forumula		
$F = \frac{9}{5} C + 32$			
Use the formula to calculate the Fahrenheit equivalent of			
a	15°C	b	100°C
c	0°C	d	$- 40^{\circ}\text{C}$

Example

My electricity bill is calculated as:-

Standing charge £7.35

Unit cost 8.37 pence

Make the equation

A unit = i

Multiply by 8.37p = 8.37u

Add standing charge (in pence) = 735

My bill = B

Therefore **B = 8.37u + 735**

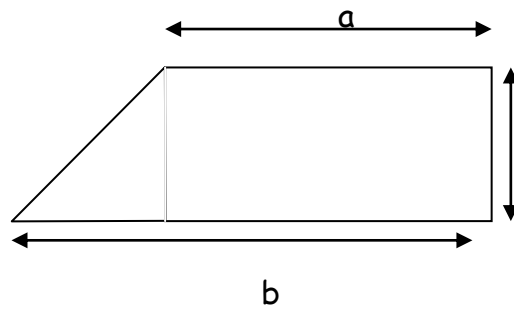
If I use 640 units, then:-

$$\begin{aligned} B &= 8.37 \times 640 + 735 \\ &= 5356.8 + 735 \\ &= 6091.8 \text{ pence} \\ &= \text{£}60.92 \end{aligned}$$

Try some for yourself

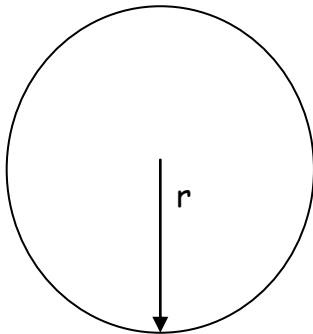
5	a	A gallon of petrol costs £1.98. Form an equation to find the cost in pounds of any number of gallons of petrol.
	b	Use your equation to find the cost of 10 gallons of petrol
6		I want to hire a bouncy castle for the village fete. The cost per day is £35 and I shall have to make a deposit of £35.
	a	Form an equation to calculate the bill.
	b	Use your equation to find the cost of 3 days' hire.
7		My phone bill has a quarterly charge of £18.72. Each unit costs 3.62p.
	a	Form an equation to work out my bill
	b	Use the equation to find the cost of 860 units.
Remember : the quarterly charge and unit charge must be in the same units.		

Common Mathematical Formulae in Use



$$\text{Trapezium} = \frac{1}{2} (a+b) \times h$$

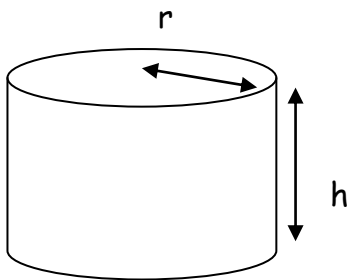
1	Find the area when	a	a = 2	b = 6	h = 3
		b	a = 3	b = 7	h = 2.5
		c	a = 3	b = 6	h = 3.5



$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2 \quad (\pi = 3.14)$$

2	Find C when r =	a) 5 cm	b) 10cm	c) 2.5cm
3	Find A when r =	a) 5cm	b) 10cm	c) 2.5cm



$$\text{Volume of cylinder} = \pi r^2 h$$

$$\text{Total surface area} = 2\pi r^2 + 2\pi r h$$

4	Find the Volume when	a	r = 5cm	h = 10cm
		b	r = 3cm	h = 8 cm
		c	r = 3.2 cm	h = 2.1cm
5	Find the total surface area when	a	r = 2cm	h = 4cm
		b	r = 10cm	h = 5cm
		c	r = 5.3cm	h = 4cm