

# 13:03 | Solving Three Simultaneous Equations

Name: \_\_\_\_\_ Class: \_\_\_\_\_

## Example



If we have *three* unknown pronumerals, we can find them provided we have *three* equations we can solve simultaneously.

Find  $a$ ,  $b$  and  $c$  if:

$$\begin{aligned} a + 2b + 3c &= 4 & \textcircled{1} \\ 2a - b + 2c &= 14 & \textcircled{2} \\ 3a + b - c &= 12 & \textcircled{3} \end{aligned}$$

Firstly, eliminate one pronumeral from two different pairs of the equations.

Taking  $\textcircled{1} + 2 \times \textcircled{2}$ , eliminate  $b$ .

$$\begin{array}{r} a + 2b + 3c = 4 \\ 4a - 2b + 4c = 28 \\ \hline 5a \quad + 7c = 32 \end{array} \quad \textcircled{4}$$

Taking  $\textcircled{1} - 2 \times \textcircled{3}$ , eliminate  $b$ .

$$\begin{array}{r} a + 2b + 3c = 4 \\ 6a + 2b - 2c = 24 \\ \hline -5a \quad + 5c = -20 \end{array} \quad \textcircled{5}$$

The new equations formed,  $\textcircled{4}$  and  $\textcircled{5}$ , are *two* equations, with *two* unknown pronumerals.

Now solve these equations. Taking  $\textcircled{4} + \textcircled{5}$ , eliminate  $a$ .

$$\begin{array}{r} 5a + 7c = 32 \\ -5a + 5c = -20 \\ \hline 12c = 12 \\ c = 1 \end{array}$$

When you have found the value of one pronumeral, substitute back to find the others.

If  $c = 1$ , substitute into either  $\textcircled{4}$  or  $\textcircled{5}$  to find  $a$ , giving  $a = 5$ .

If  $a = 5$  and  $c = 1$ , substitute into either  $\textcircled{1}$ ,  $\textcircled{2}$  or  $\textcircled{3}$  to find  $b$ , giving  $b = -2$ .

The solution is  $a = 5$ ,  $b = -2$ ,  $c = 1$ .

## Exercise

1 Solve the following sets of simultaneous equations.

a  $a + b + c = 6$   
 $2a + b - c = 13$   
 $a + 2b + 3c = 7$

b  $2m + n + p = 3$   
 $m + 3n + 2p = 0$   
 $m - 2n - p = 3$

c  $5x + 2y + z = 0$   
 $3x + 4y + 2z = 14$   
 $2x + 5y - 4z = 21$

2 Find the cost of each drink, ice-cream and lolly if the cost of:

5 drinks, 3 ice-creams and 4 lollies is \$25

4 drinks, 5 ice-creams and 2 lollies is \$26

8 drinks, 6 ice-creams and 6 lollies is \$43.

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1 a  $a=3, b=5, c=-2$       b  $m=1, n=-3, p=4$       c  $x=-2, y=5, z=0$

2 Drink = \$2, ice-cream = \$3, lolly = \$1.50