

Simultaneous Equations

Comparison method

We use this when both equations are in the form $y = mx + c$

$$\begin{aligned} 1) \quad y &= x + 4 \\ y &= 3x - 1 \\ 3x - 1 &= x + 4 \\ 2x - 1 &= 4 \\ 2x &= 5 \\ x &= \frac{5}{2} \text{ or } 2.5 \end{aligned}$$

$$y = 6.5$$

Substitution Method

We use this method when one equation is in form $y = mx + c$ and the other is in form $ax + by = c$

1) Solve simultaneously

$$\begin{aligned} y &= 4x - 3 \\ 2x + y &= 9 \\ 2x + (4x - 3) &= 9 \\ 6x - 3 &= 9 \\ 6x &= 12 \\ x &= 2 \end{aligned}$$

$$\begin{aligned} y &= 4(2) - 3 \\ y &= 5 \end{aligned}$$

$$\begin{aligned} 2) \quad 2x - 3y &= 11 \\ y &= x - 4 \end{aligned}$$

$$\begin{aligned} 2x - 3(x - 4) &= 11 \\ 2x - 3x + 12 &= 11 \\ -x + 12 &= 11 \\ -x &= -1 \\ x &= 1 \end{aligned}$$

$$y = -3$$

3) The yearly health costs for an adult are \$500 more than for a child. The 50 adults and 40 children of a small town have a yearly health bill of \$52,000

Write a set of equations to model the situation above, and solve them simultaneously to find the yearly health cost for an adult and for a child.

Let cost for adult be A
cost for child be C

$$A = C + 500$$

$$50A + 40C = 52000$$

$$\Rightarrow 50(C + 500) + 40C = 52000$$

$$50C + 25000 + 40C = 52000$$

$$90C + 25000 = 52000$$

$$90C = 27000$$

$$C = 300$$

$$A = 800$$

A child costs \$300 and an adult costs \$800

Elimination Method

We use this method when both equations are in form $ax + by = c$

1) Solve simultaneously

$$3x - y = 37 \quad \dots (1)$$

$$2x + 3y = 10 \quad \dots (2)$$

$$9x - 3y = 111 \quad \dots (1) \times 3$$

$$\text{add} \quad \begin{array}{r} 9x - 3y = 111 \\ 2x + 3y = 10 \\ \hline 11x = 121 \end{array} \quad \dots (2)$$

$$11x = 121$$

$$x = 11$$

$$22 + 3y = 10 \quad y = -4$$

2) Solve simultaneously

$$5x + 4y = 14$$

$$2x + 7y = 38$$

Using C.C., from MENU select EQWA

then select Simultaneous F1

Select 2 variables F1

Write out the matrix showing the values of a,b,c for each equation.

$$\begin{bmatrix} 5 & 4 & 14 \\ 2 & 7 & 38 \end{bmatrix}$$

Solve to get $(x,y) = (-2,6)$