By substitution The method is to re-arrange one of the equations in the form '***x*=**' or '***y*=**' and substitute the value of ***x*** or ***y*** into the second equation.

Example #1

$$3x - 5y = 2 \qquad \text{(i}$$

$$x + 2y = 3 \qquad \text{(ii}$$

re-arranging(ii $\quad x = 3 - 2y \qquad$ (iii

substituting into (i for $x \quad 3(3 - 2y) - 5y = 2$

$$9 - 6y - 5y = 2$$

$$9 - 2 = 6y + 5y$$

$$6y + 5y = 9 - 2$$

$$11y = 7$$

$$\underline{y = \frac{7}{11}}$$

substituting for y in (iii $\quad x = 3 - 2\tfrac{7}{11}$

$$x = 3 - \tfrac{14}{11}$$

$$x = 3 - 1\tfrac{3}{11}$$

$$\underline{x = 1\tfrac{8}{11}}$$

Example #2

$$2x - y = 3 \qquad \text{(i}$$
$$5x - 4y = 2 \qquad \text{(ii}$$

re-arranging (i $\quad y = 2x - 3$

substituting for y in (ii $\quad 5x - 4(2x - 3) = 2$

$$5x - 8x + 12 = 2$$
$$-3x = 2 - 12$$
$$-3x = -10$$
$$x = \frac{10}{3}$$
$$\underline{x = 3\tfrac{1}{3}}$$

substituting for x in (i $\quad y = 2\left(\frac{10}{3}\right) - 3$

$$= \frac{20}{3} - 3$$
$$= 6\tfrac{2}{3} - 3$$
$$\underline{= 3\tfrac{2}{3}}$$

Example #3

$$x - 2y = 7 \qquad \text{(i}$$
$$7x + 2y = 3 \qquad \text{(ii}$$

from (i $\quad x = 7 + 2y \qquad$ (iii

substituting for x in (ii $\quad 7(7 + 2y) + 2y = 3$

$$49 + 16y = 3$$
$$16y = 3 - 49$$
$$y = \frac{46}{16} = \frac{23}{8}$$
$$\underline{y = 2\,^7\!/_8}$$

substituting for y in (iii $\quad x = 7 + 2\left(\frac{23}{8}\right)$

$$x = 7 + \frac{46}{8} = 7 + 5\tfrac{3}{4}$$
$$\underline{x = 12\tfrac{3}{4}}$$

By elimination - Here one equation is altered to make one term in each equation the same(disregarding the +/- sign). These terms are then added or subtracted to eliminate them.

Example #1

$$2x - 3y = 5 \qquad \text{(i}$$

$$3x + y = 2 \qquad \text{(ii}$$

multiply (ii by 3, then add (i & (ii

$$2x - 3y = 5$$

$$\underline{9x + 3y = 6}$$

$$11x \qquad = 11$$

$$\underline{x = 1}$$

substituting for x in (i $\quad 2 - 3y = 5$

$$-3y = 5 - 2$$

$$-3y = 3$$

$$\underline{y = -1}$$

Example #2

$$5x - 2y = 1 \qquad \text{(i}$$
$$x - 3y = 3 \qquad \text{(ii}$$

multiply (ii by 5 and subtract

$$5x - 2y = 1$$
$$\underline{-(5x - 15y = 15)}$$

this becomes :

$$5x - 2y = 1$$
$$\underline{-5x + 15y = -15}$$
$$13y = -14$$

$$y = \frac{-14}{13}, \qquad \underline{y = -1\tfrac{1}{13}}$$

substituting for y in equation (ii

$$x - 3\left(\frac{-14}{13}\right) = 3$$
$$x + \frac{42}{13} = 3$$
$$x = 3 - \frac{42}{13}$$
$$x = 3 - 3\tfrac{3}{13}$$
$$\underline{x = -\tfrac{3}{13}}$$

Example #3

$$2x - 5y = 4 \qquad (i$$

$$3x + 6y = 3 \qquad (ii$$

multiply (i by 3 , multiply (ii by 2 then subtract

$$6x - 15y = 12$$

$$\underline{-\ (6x + 12y = 6)}$$

this becomes:

$$6x - 15y = 12$$

$$\underline{-\ 6x - 12y = -6}$$

$$-27y = 6 \qquad y = -\frac{6}{27}$$

$$\underline{y = -\frac{2}{9}}$$

substituting for y in (i

$$2x - 5\left(-\frac{2}{9}\right) = 4$$

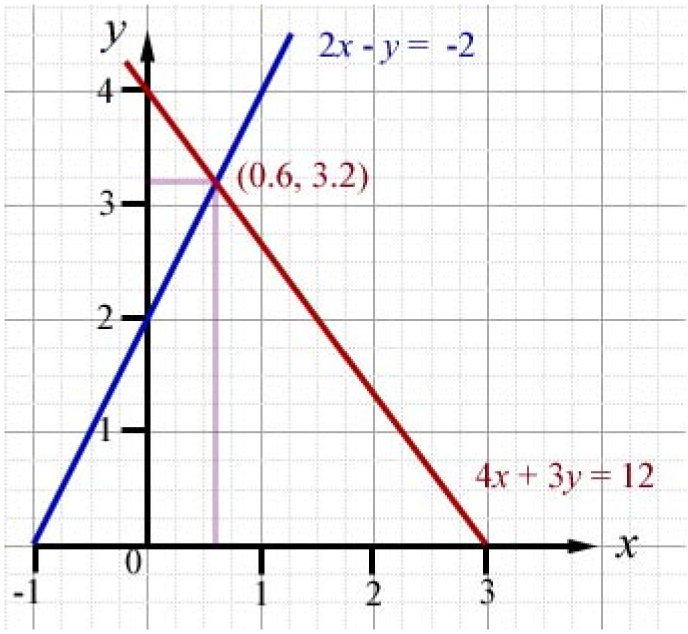
$$2x + \left(\frac{10}{9}\right) = 4 \qquad 2x = 4 - \left(\frac{10}{9}\right)$$

$$2x = \left(\frac{36}{9}\right) - \left(\frac{10}{9}\right)$$

$$2x = \frac{26}{9}$$

$$x = \frac{26}{18}, \qquad \underline{x = \frac{13}{9}} \quad (\text{or } 1\tfrac{4}{9})$$

Using graphs - For two separate functions, first write tables for x & y. Then draw the graphs. Where the graph lines intersect is the point that satisfies both equations. Simply read off the x and y values at the point.



The reader may wish to verify the result by one of the other methods given above.

Example - by a graphical method find the coodinates of a point that satisfies the equations $x+y=5$ and $y-2x=-2$

First draw your table, rearranging each equation to make 'y' the subject

x	1	2	3
y = 5-x	4	3	2
y = 2x-2	0	2	4

Then plot the coordinates for each function, drawing straight lines through points.

Where the lines cross gives the solution (2.3,2.7) One decimal place is usually sufficient.