

Algebraic Methods of Solving a Pair of Linear Equations

Created: Saturday, 16 July 2011 12:28 | Published: Saturday, 16 July 2011 12:28 | Written by [Super User](#) | [Print](#)

Pair of linear equations

A pair of the linear equation is in the following form-

$$a_1x + b_1y + c_1 = 0$$

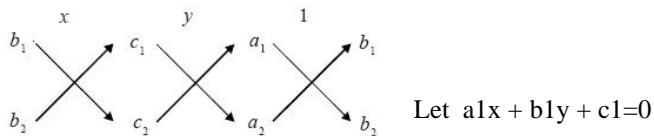
and

$$a_2x + b_2y + c_2 = 0$$

The most commonly used algebraic methods of solving a pair of [linear equations](#) in two variables are –

- Substitution method
- Elimination method
- [Cross Multiplication method](#)

Cross Multiplication Method



Let $a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

$$a_2x + b_2y + c_2 = 0$$

be a system of [simultaneous linear equations](#) in two variables x and y such that $a_1/a_2 \neq b_1/b_2$

i.e. $a_1b_2 - a_2b_1 \neq 0$. Then the system has a unique solution given by

$$x = \frac{(b_1c_2 - b_2c_1)}{(a_1b_2 - a_2b_1)}$$

$$\text{and } y = \frac{(c_1a_2 - c_2a_1)}{(a_1b_2 - a_2b_1)}$$

Here are the steps which we follow while solving a pair of linear equations by cross multiplication method:

Step I – Obtain the two equations.

Step II – Shift all terms on LHS in the two equations to introduce zeros on RHS i.e., write the two equations in the following form:

$$a_1x + b_1y + c_1 = 0$$

$$a_2x + b_2y + c_2 = 0$$

Step III – In the above system of equations there are three columns viz.

column containing x i.e. $\begin{pmatrix} a_1 \\ a_2 \end{pmatrix}$

column containing y i.e. $\begin{pmatrix} b_1 \\ b_2 \end{pmatrix}$

and column containing constant terms i.e. $\begin{pmatrix} c_1 \\ c_2 \end{pmatrix}$

To obtain the solution, write x, -y and 1 separated by equality signs as shown below:

$$\frac{x}{\begin{matrix} b_1 & c_1 \\ b_2 & c_2 \end{matrix}} = \frac{-y}{\begin{matrix} a_1 & c_1 \\ a_2 & c_2 \end{matrix}} = \frac{1}{\begin{matrix} a_1 & b_1 \\ a_2 & b_2 \end{matrix}}$$

In the denominator of x leave column containing x and write remaining two columns in the same order, in the denominator of -y leave column containing y and write the remaining two columns. Similarly, in the denominator of one write columns containing x and y.

Step IV – To obtain the denominators of x, -y and 1, cross multiply the numbers and subtract the product. Applying this, we get

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{-y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Step V – Obtain the value of x by equating first and third expression in step IV. The value of y is obtained by equating second and third expression in step IV.

To get a more clear idea, let's explain with an example:

Example: Solve the following system of equations by using the method of cross multiplication:

$$x + y = 7$$

$$5x + 12y = 7$$

The given system of equations is

$$x + y - 7 = 0$$

$$5x + 12y - 7 = 0$$

By cross – multiplication, we get

$$\frac{x}{\begin{matrix} 1 & -7 \\ 12 & -7 \end{matrix}} = \frac{-y}{\begin{matrix} 1 & -7 \\ 5 & -7 \end{matrix}} = \frac{1}{\begin{matrix} 1 & 1 \\ 5 & 12 \end{matrix}}$$

$$\frac{x}{1 \times (-7) - 12 \times (-7)} = \frac{-y}{1 \times (-7) - 5 \times (-7)} = \frac{1}{1 \times 12 - 5 \times 1}$$

$$\frac{x}{-7 + 84} = \frac{-y}{-7 + 35} = \frac{1}{12 - 5}$$

$$\frac{x}{77} = \frac{-y}{28} = \frac{1}{7}$$

$$x = 77/7 \text{ and } y = -28/7$$

$$x = 11 \text{ and } y = -4$$

Try these questions now:

1. Solve the following system of equations by using the method of cross multiplication:

$$2x + 3y = 17$$

$$3x - 2y = 6$$

(Answer: $x = 4$ and $y = 3$)

2. Solve the following system of equations by using the method of cross multiplication:

$$2x - y = 3$$

$$4x + y = 3$$

(Answer: $x = 1$ and $y = -1$)

Now try it yourself! Should you still need any help, [click here](#) to schedule live online session with e Tutor!

.....

About eAge Tutoring :

[eAgeTutor.com](#) is the premium online tutoring provider. Using materials developed by highly qualified educators and leading content developers, a team of top-notch software experts, and a group of passionate educators, eAgeTutor works to ensure the success and satisfaction of all of its students.

[Contact us](#) today to learn more about our guaranteed results and discuss how we can help make the dreams of the student in your life come true!

Reference Links :

http://en.wikipedia.org/wiki/Linear_equation

<http://en.wikipedia.org/wiki/Cross-multiplication>

http://en.wikipedia.org/wiki/Simultaneous_equations

Category:ROOT

[Joomla SEF URLs by Artio](#)