

# Basic Linear System

We know when students are just beginning their study of algebra, the basic concepts can be difficult to grasp. These activities are written for teachers to use in their basic algebra classes.

When you find other helpful exercises, add these to your own eActivities.

Good exercises encourage students!

This file includes eActivities on:

**Graph of Linear Equations <Intersection>** – Graph the equations and find the solution.

**Inverse Matrix** – Discover the inverse of a matrix by using row operations.

**Solve Linear System by Inverse Matrix** – Simply use the inverse matrix function to solve the equations!

**Solve Linear System by Row Operations** – And still another way to determine the solution!

## Graph of Linear Equations <Intersection>

Graph the equations and find the solution.

The first screenshot shows the title screen for the activity. It includes an example with the equations  $x+y=5$  and  $x+2y=6$ . Below the equations, it says "Open the graph window and drag and drop the equation." There are input fields for "Graph window" and "Calculator".

The second screenshot shows the graph window with the two lines plotted. The intersection point is marked with a small square. Below the graph, there are input fields for "Graph window" and "Calculator".

The third screenshot shows the "Try your own" section. It asks the user to "Find the intersection." and provides two sets of equations:  $x-y=5$  and  $x-2y=6$ ;  $2x-y=5$  and  $x-0.5y=6$ ;  $x-y=5$  and  $2x-2y=10$ . Each set has input fields for "Graph window" and "Calculator".

## Inverse Matrix

Discover the inverse of a matrix by using row operations.

The first screenshot shows the title screen for the activity. It includes an example with the matrix  $A = \begin{bmatrix} 4 & 2 \\ 5 & -3 \end{bmatrix}$ . Below the matrix, it says "Find  $A^{-1}$ ." There is a "Row Operation" input field and a "Calculator" button.

The second screenshot shows the row operations being performed on the augmented matrix  $[A | I]$ . The operations shown are:  $mRow(\frac{1}{4}, ans, 1)$ ,  $mRowAdd(-5, ans, 1, 2)$ , and  $mRow(-\frac{2}{11}, ans, 2)$ . Below the operations, there are input fields for "Row Operation" and "Calculator".

The third screenshot shows the "Try your own" section. It asks the user to "Find  $A^{-1}$  by row operation." and provides three matrices:  $A = \begin{bmatrix} 4 & 0 \\ 0 & 3 \end{bmatrix}$ ,  $A = \begin{bmatrix} 0 & 2 \\ 5 & 0 \end{bmatrix}$ , and  $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$ . Each matrix has input fields for "Calculator".

## Solve Linear System by Inverse Matrix

Simply use the inverse matrix function to solve the equations!

The first screenshot shows the 'Solve by Inv-Matrix' function. It displays an example system of equations:  $\begin{cases} 5x+2y=12 \\ 2x-7y=-3 \end{cases}$ . Below the equations, it shows the calculation with the inverse matrix:  $\begin{bmatrix} 5 & 2 \\ 2 & -7 \end{bmatrix}^{-1} \times \begin{bmatrix} 12 \\ -3 \end{bmatrix}$ . The result is shown as  $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$ , and the text states 'The result is (x=2,y=1)'. The second screenshot shows the 'Try your own.' section with three practice problems:  $\begin{cases} 5x-2y=12 \\ 2x+7y=-3 \end{cases}$ ,  $\begin{cases} 6x-2y=12 \\ 3x-y=-3 \end{cases}$ , and  $\begin{cases} x-2y-6=4x+y \\ 2x+7y-3=x-y \end{cases}$ . Each problem has a 'Calculator' button with a checkmark icon.

## Solve Linear System by Row Operations

And still another way to determine the solution!

The first screenshot shows the 'Solve by Matrix <Row Operations>' function. It displays the same example system of equations as the first section. Below the equations, it shows the row operation: 'Row Operation --->'. The text explains: 'As a result of the operation, the solution matrix is  $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 1 \end{bmatrix}$ . Then the answer is (x=2,y=1)'. The second screenshot shows the 'Edit Action Interactive' window with the augmented matrix  $\begin{bmatrix} 5 & 2 & 12 \\ 2 & -7 & -3 \end{bmatrix}$  and the following commands: `mRowAdd(-2, ans, 2, 1)`, `mRowAdd(-2, ans, 1, 2)`, `mRow(-1/39, ans, 2)`, and `mRowAdd(-16, ans, 2, 1)`. The third screenshot shows the 'Try your own.' section with three practice problems:  $\begin{cases} 5x+2y=12 \\ 2x-7y=-3 \end{cases}$ ,  $\begin{cases} 5x+2y=12 \\ 10x+4y=-3 \end{cases}$ , and  $\begin{cases} x+2y=x-y+12 \\ 2x=3y-3 \end{cases}$ . Each problem has a 'Calculator' button with a checkmark icon.