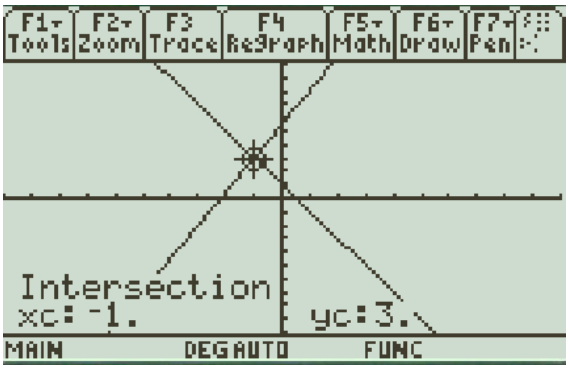
Solve: $2x + y = 1$ $5x - 2y = -11$

Solve for y. We will need it. $y = 1 - 2x$ $y = (5x + 11)/2$

1) Graphing
Graph the two equations. Make sure the intersection is visible. While looking at the graph, F5/5 (Intersection). First it asks for the two curves to intersect. The current curve number is in the upper right hand corner. Move from curve to curve using the up and down arrows. Press Enter when you are on a curve of interest. Lower bound is to the left of the intersection. Upper bound is to the right of the intersection.



2) Substitution
Solve one equation for a variable. Substitute it in the other equation. Solve the resulting equation. Solve for the other variable.

$y = 1 - 2x$

$5x - 2(1 - 2x) = -11$

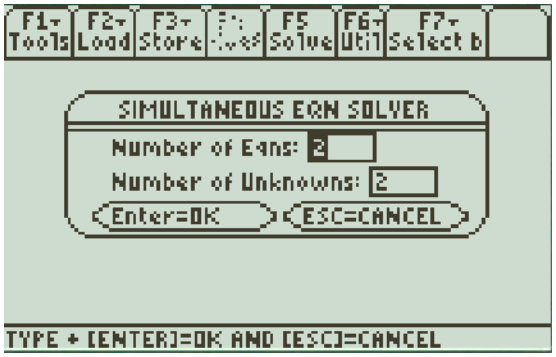
$5x - 2 + 4x = -11$

$9x = -9$

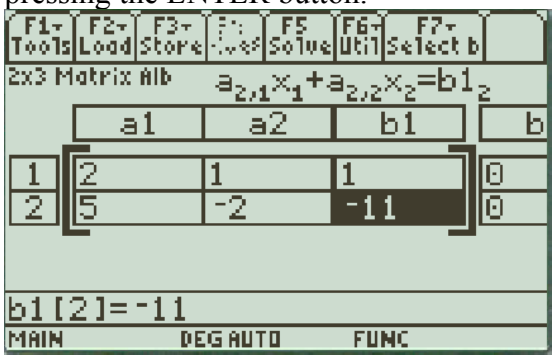
$x = -1$

$y = 1 - 2(-1) = 3$

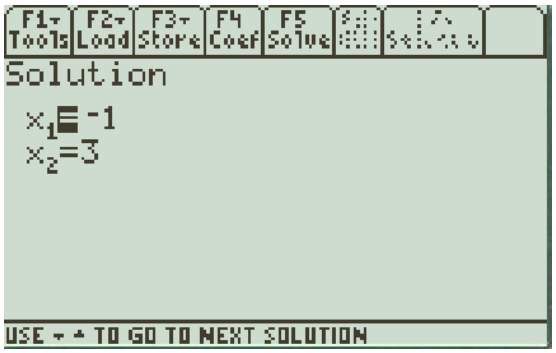
5) Apps/FlashApps/Simultaneous Eqn Solver (if no icons)
Apps/**Simultaneous Eqn Solver** (if icons)
Select *New*



Fill in the array by entering the number then pressing the ENTER button.



Press F5



Note that F4 allows you to reenter the coefficients. See what the other F keys let you do.

3) Addition/Subtraction

Line up the x's and y's. If necessary, multiply an equation first so that the coefficients agree. Add or subtract. Solve the resulting equation. Solve for the other variable.

$2(2x+y=1)$ so $4x+2y=2$

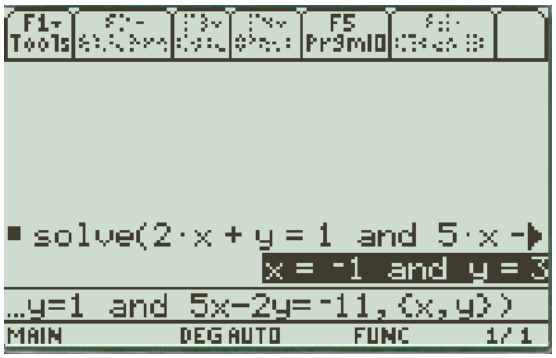
$5x-2y=-11$
$4x+2y=2$

Add the two equations.

$5x-2y+4x+2y=-11+2$

Simplify
$9x=-9$
$x=-1$
$y=1-2(-1)=3$

6) Solver



4) Cramer's Rule

Determinant:

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = (a)(d)-(b)(c)$$

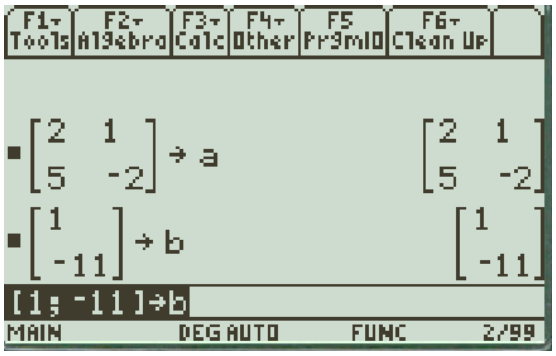
Solution by Cramer's rule

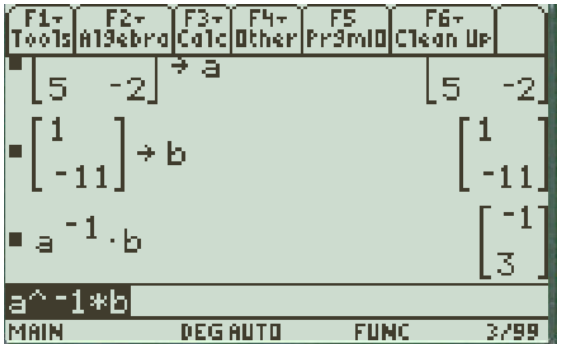
$$x=\frac{\begin{vmatrix} 1 & 1 \\ -11 & -2 \end{vmatrix}}{\begin{vmatrix} 2 & 1 \\ 5 & -2 \end{vmatrix}}=\frac{(1)(-2)-(1)(-11)}{(2)(-2)-(1)(5)}=\frac{9}{-9}=-1$$

$$y=\frac{\begin{vmatrix} 2 & 1 \\ 5 & -11 \end{vmatrix}}{\begin{vmatrix} 2 & 1 \\ 5 & -2 \end{vmatrix}}=\frac{(2)(-11)-(1)(5)}{(2)(-2)-(1)(5)}=\frac{-27}{-9}=3$$

Note: same denominator, replace appropriate column by RHS of original equations. The pattern is easier to see in the 3x3 case below.

7) Matrix Inverse (Chapter 16)





Note that row elements are separated by commas and rows themselves, by semi-colons. You must use square brackets for vectors. The matrix *a* is entered [2,1;5,-2].

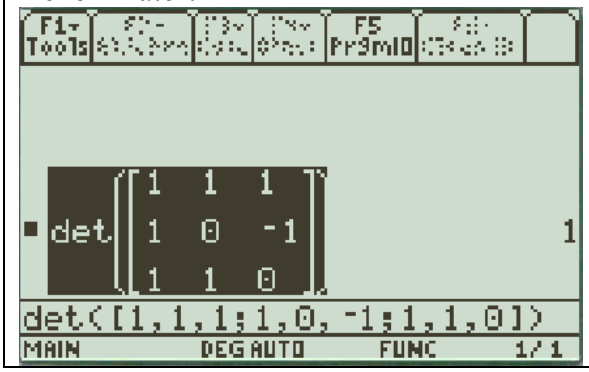
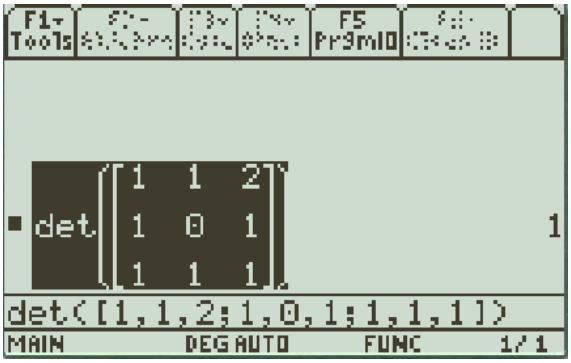
NxN equations

All but graphing can be used to solve higher order equations. We look at a 3x3 case.

Solve: $x + y + z = 2$, $x - z = 1$, $x + y = 1$ for x, y, and z.

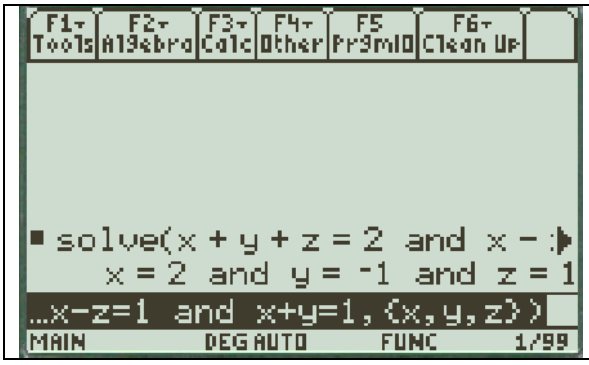
4) Cramer's Rule – we solve for x, y, and z. The determinants used in solving for z are shown. Note that they all have the same denominator so you only need to find it once.

$$x = \frac{\begin{vmatrix} 2 & 1 & 1 \\ 1 & 0 & -1 \\ 1 & 1 & 0 \end{vmatrix}}{\begin{vmatrix} 1 & 1 & 1 \\ 1 & 0 & -1 \\ 1 & 1 & 0 \end{vmatrix}} = \frac{2}{1} = 2 \qquad y = \frac{\begin{vmatrix} 1 & 2 & 1 \\ 1 & 1 & -1 \\ 1 & 1 & 0 \end{vmatrix}}{\begin{vmatrix} 1 & 1 & 1 \\ 1 & 0 & -1 \\ 1 & 1 & 0 \end{vmatrix}} = \frac{-1}{1} = -1 \qquad z = \frac{\begin{vmatrix} 1 & 1 & 2 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{vmatrix}}{\begin{vmatrix} 1 & 1 & 1 \\ 1 & 0 & -1 \\ 1 & 1 & 0 \end{vmatrix}} = \frac{1}{1} = 1$$

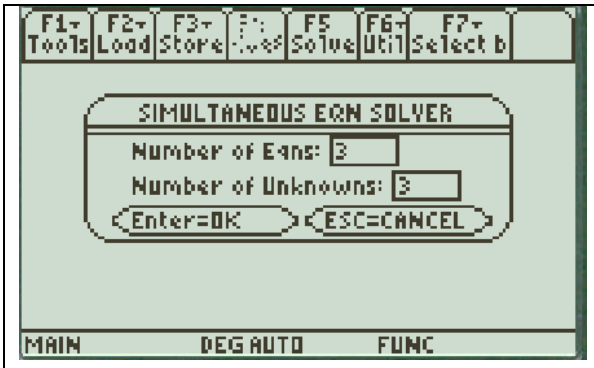
Denominator:	Numerator:
	

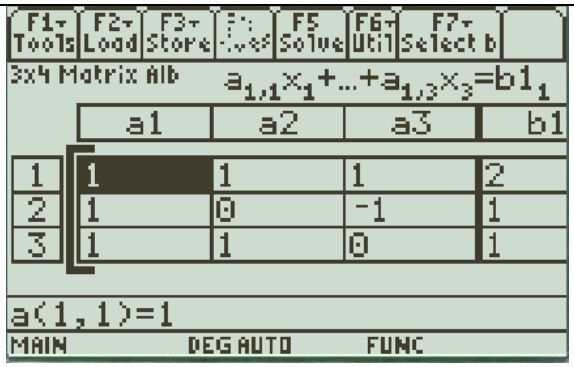
6) Solver

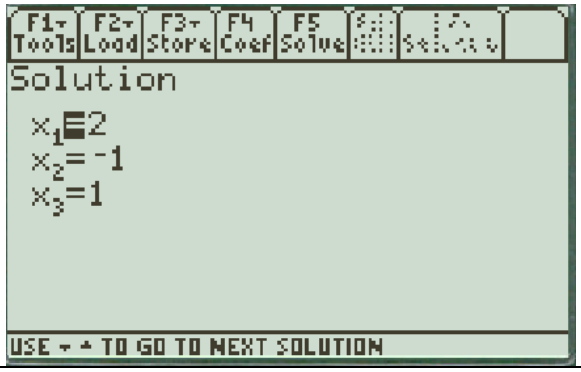
solve($x + y + z = 2$ and $x - z = 1$ and $x + y = 1$, {x,y,z})

	Pretty print shows the beginning of the equation in the image to the left and the command line shows the rest of it.

5) Simultaneous Eqn Solver







7) Matrix Inverse (Chapter 16)