

SYSTEMS OF EQUATIONS

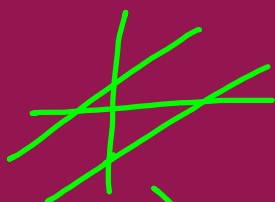
* Solutions in terms of graph

$$2x - 3y = 5$$

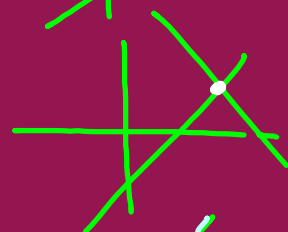
$$4x + 5y = 7$$

$$m_1 = -\frac{2}{3}$$

$$m_2 = -\frac{4}{5}$$



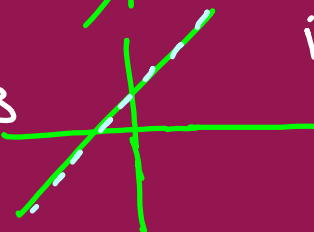
no solution
same slopes
different intercepts



1 solution
different slopes

$$2x - 3y = 5$$

$$4x - 6y = 13$$



infinitely many
same slopes
same intercepts

* Methods to solve

- graphing
- elimination
- substitution
- Cramer's Rule
- Matrix Equations

GRAPHING

$$8x + 20y = -200$$

$$800x - 55y = -40,550$$

Menu $\Rightarrow$ 3: Graph/Entry Edit
to change to standard form.

Elimination

$$\begin{array}{r} 3[2x - 5y = -22] \\ -2[3x + 4y = 13] \end{array}$$

$$\begin{array}{r} 6x - 15y = -66 \\ + -6x - 8y = -26 \\ \hline -23y = -92 \\ \frac{-23y}{-23} = \frac{-92}{-23} \\ y = 4 \end{array}$$

$$2x - 5(4) = -22$$

$$2x - 20 = -22$$

$$+20$$

$$2x = -2$$

$$x = -1$$

$$(-1, 4)$$

$$\begin{array}{r} 2x - 6y = 8 \\ -2x + 6y = 13 \\ \hline 0 + 0 = -5 \end{array}$$

No solution

$$0 = 0$$

infinitely many

SUBSTITUTION - Solve for variable with smallest coefficient.

$$2x - 5y = -22 \Rightarrow \frac{2x}{2} = \frac{5y}{2} - \frac{22}{2}$$

$$3x + 4y = 13$$

$$x = \frac{5}{2}y - 11$$

1) Isolate a variable.

2) Substitute that quantity into the

OTHER equation.

3) Solve for remaining variable

4) Sub answer into the $x =$ or $y =$ eq.

$$3\left(\frac{5}{2}y - 11\right) + 4y = 13$$

$$2. \left[\frac{15}{2}y - 33 + 4y = 13 \right]$$

$$15y - 66 + 8y = 26$$

$$\frac{23y}{23} = \frac{92}{23}$$

$$y = 4$$

$$x = \frac{5}{2}(4) - 11$$

$$x = 10 - 11$$

$$x = -1$$

$$(-1, 4)$$

Determinant — a square array of numbers enclosed between vertical lines

$$\begin{vmatrix} 2 & -5 \\ 3 & 8 \end{vmatrix} = 16 + 15 = 31$$

— Solution is a single numerical value

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

CRAMER'S RULE

$$\begin{aligned} 2x - 5y &= -22 \\ 3x + 4y &= 13 \end{aligned}$$

$$x = \frac{\begin{vmatrix} - & y_1 \\ - & y_2 \end{vmatrix}}{\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}}$$

$$y = \frac{\begin{vmatrix} x_1 & - \\ x_2 & - \end{vmatrix}}{\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}}$$

$$x = \frac{\begin{vmatrix} -22 & -5 \\ 13 & 4 \end{vmatrix}}{\begin{vmatrix} 2 & -5 \\ 3 & 4 \end{vmatrix}} = \frac{-88 + 65}{8 + 15} = \frac{-23}{23} = -1$$

$$y = \frac{\begin{vmatrix} 2 & -22 \\ 3 & 13 \end{vmatrix}}{\begin{vmatrix} 2 & -5 \\ 3 & 4 \end{vmatrix}} = \frac{26 + 66}{23} = \frac{92}{23} = 4$$

$$\boxed{(-1, 4)} \quad y = 4$$