

SYSTEMS OF EQUATIONS

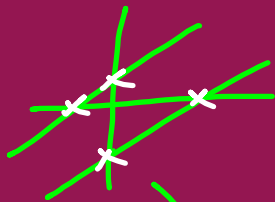
$$2x - 3y = 5$$

$$4x + 5y = 7$$

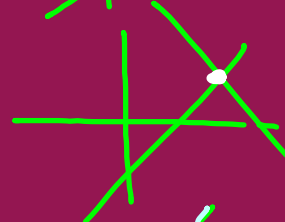
$$m_1 = -\frac{A}{B} = \frac{2}{3}$$

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

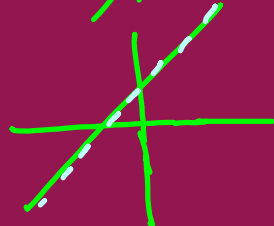
one solution



no solution
same slope
different intercepts



one solution
different slopes



infinitely many
same slopes
same intercepts

* Solutions in terms of graph

* 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.

$$(-50, 10)$$

-

Elimination

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

$$\begin{array}{r} 8x - 20y = -88 \\ + 15x + 20y = 65 \\ \hline 23x = -23 \\ \frac{23x}{23} = \frac{-23}{23} \\ x = -1 \end{array}$$

$$2(-1) - 5y = -22$$

$$-2 - 5y = -22$$

$$20 = 5y$$

$$4 = y$$

$$(-1, 4)$$

$$0 = 8$$

No solution

$$0 = 0$$

infinitely many
write eq. of line as solution

$$\text{Solution: } 3x + 4y = 11$$

SUBSTITUTION

- Solve for variable with smallest coefficient.

$$2x - 5y = -22$$

$$3x + 4y = 13$$

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

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

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

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

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

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

$$y = 4$$

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

$$x = 10 - 11$$

$$x = -1$$

$$(-1, 4)$$

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.

Determinant — a square array of numbers enclosed between vertical lines

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

— Solution is a single numerical value

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

CRAMER'S RULE

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

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

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

$$\boxed{(-1, 4)}$$

$$x = \frac{\begin{vmatrix} =_1 & y_1 \\ =_2 & y_2 \end{vmatrix}}{\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}}$$

$$y = \frac{\begin{vmatrix} x_1 & =_1 \\ x_2 & =_2 \end{vmatrix}}{\begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix}}$$