

SYSTEMS OF EQUATIONS

$$2x + y = 13$$

$$5x - 4y = -1$$

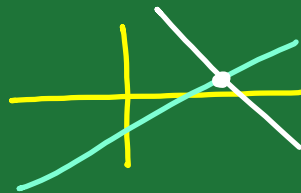
$$y = \frac{2}{3}x - 5$$

$$6x - 9y = 18$$

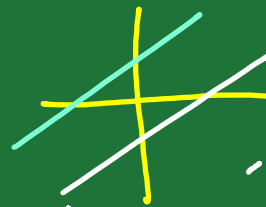
$$m_1 = \frac{2}{3} \quad m_2 = \frac{-6}{-9} = \frac{2}{3}$$

$$b = -5 \quad b = -2$$

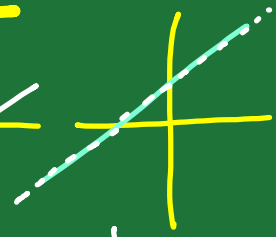
no solution



intersecting lines
one solution
different slopes



parallel
no solutions
same slopes
different intercept



same line
infinitely many
same slopes +
same intercept

ELIMINATION

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

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

$$y = 4$$

$$3x + 4(4) = 13$$

$$3x + 16 = 13$$

$$\frac{3x}{3} = \frac{-3}{3}$$

$$x = -1$$

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

$$15x + 7y = 7$$

$$-15x - 7y = 8$$

$$0 = 15$$

No solution

$$0 = 0$$

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

5 methods

- * Elimination
- * Substitution
- * Graphing
- * Cramer's Rule
- * Matrix Equation

SUBSTITUTION

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

$$3x + 4y = 13$$

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

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

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

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

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

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

$$y = 4$$

- 1) Isolate one variable.
(use term with smallest coefficient)
- 2) Substitute isolated variable in 2nd eq.
- 3) Solve for remaining variable.
- 4) Sub answer into isolated eq. to get 2nd variable.

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

$$x = 10 - 11$$

$$x = -1$$

$$(-1, 4)$$

CRAMER'S RULE

Determinant — a square array of numbers enclosed between vertical lines
= has a single numerical value

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

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

CRAMER'S RULE

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

$$3x + 4y = 13$$

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

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

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

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

$$\begin{aligned}8x + 20y &= -200 \\800x - 55y &= -40,550\end{aligned}$$