SYSTEMS OF EQUATIONS
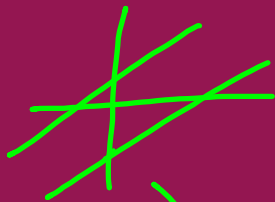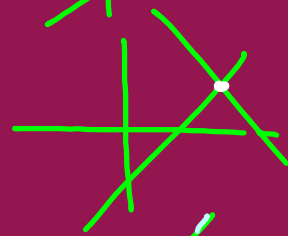
$2x - 3y = 5$
$4x + 5y = 7$

parallel
no Solution

(x, y)

infinitely
many

Solution:
$Ax + By = C$

* Solutions in
terms of graph

* Methods to solve
  - graphing
  - elimination
  - Substitution
  - Cramer's Rule
  - Matrix Equations

GRAPHING

$$8x + 20y = -200$$
$$800x - 55y = -49,550$$

Menu $\Rightarrow$ 3: Graph/Entry Edit — Menu - 3 - 3 - 1 - 3
   to change to standard form.
Use   Menu - Analyze Graph - Intersect

<u>Elimination</u>

$3[2x - 5y = -22]$
$-2[3x + 4y = 13]$

$6x - 15y = -66$
$+ -6x - 8y = -26$
_____
$$\frac{-23y}{-23} = \frac{-92}{-23}$$

$3x + 4(4) = 13$

$3x + 16 = 13$
$-16 -16$

$3x = -3$
$x = -1$

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

$y = 4$

~~~~~~

$6x - 8y = 22$
$-6x + 8y = 40$
_____
$0 = 62$

No Solution

$6x - 8y = 22$
$-6x + 8y = -22$
_____
$0 = 0$

infinitely many
solutions

SUBSTITUTION — Solve for variable with smallest coefficient.

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

$3x + 4y = 13$

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

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

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

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

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

$y = 4$

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

$x = 10 - 11$

$x = -1$

$(-1, 4)$

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 <u>square</u> array of numbers enclosed <u>between vertical lines</u>

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

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

— Solution is a single numerical value

<u>CRAMER'S RULE</u>

$$2x - 5y = -22$$
$$3x + 4y = 13$$

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

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

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

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

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