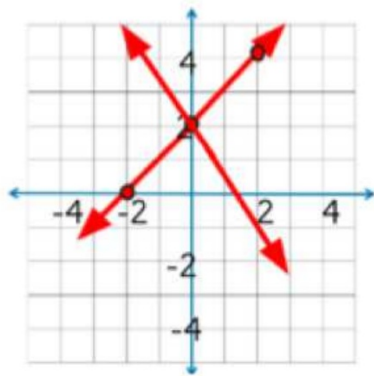


## 2x2 Systems of Equations & Inequalities

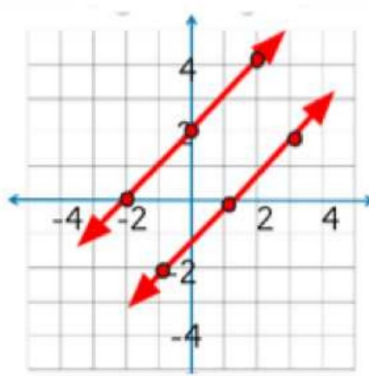


HW:

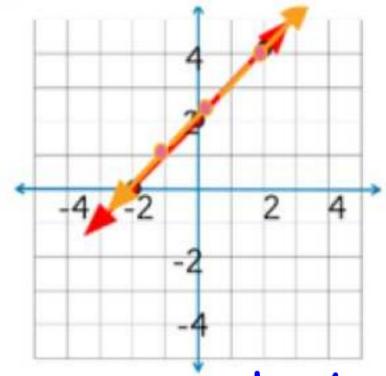
## 2x2 Systems of Equations - Types of Solutions



1  
solution



no  
solution



infinitely  
many  
solutions

ex: Solve the system graphically.

a)

$$y = mx + b$$

↑ slope      ↑ y-int.

$$x + 3y = 0 \rightarrow$$

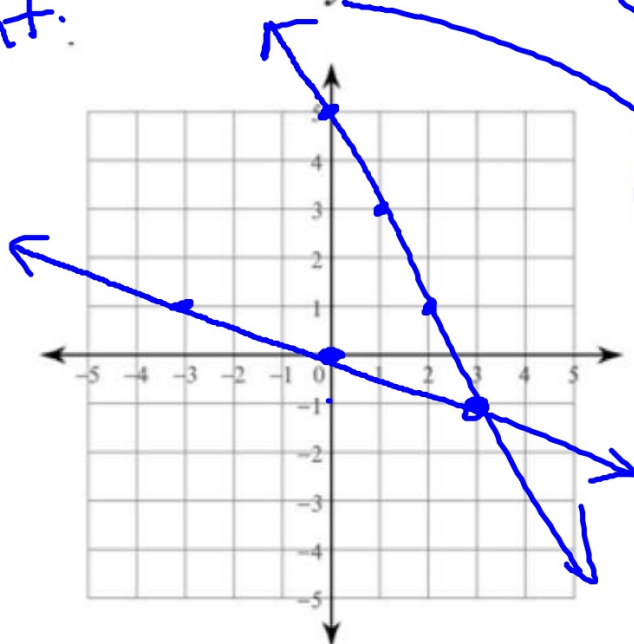
$$2x + y = 5$$

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

$$y = -\frac{1}{3}x$$

$$y = -2x + 5$$

$$(3, -1)$$



ex: Solve the system graphically.

b)

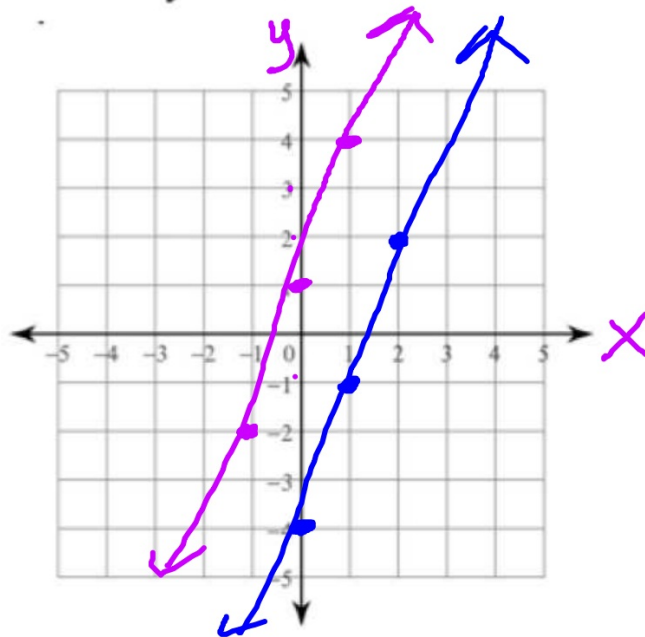
$$m = \frac{\text{rise}}{\text{run}}$$

$\emptyset$

$$y = \underline{3}x + 1$$

$$y = 3x - 4$$

y-int.



ex: Solve the system graphically.

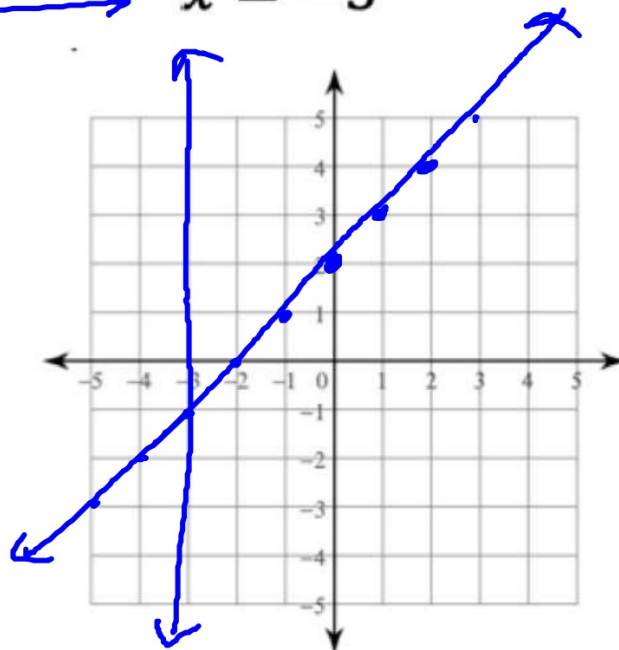
c)

$$y = x + 2$$

$$x = -3$$

vertical  
line

$(-3, -1)$



ex: Solve the system graphically.

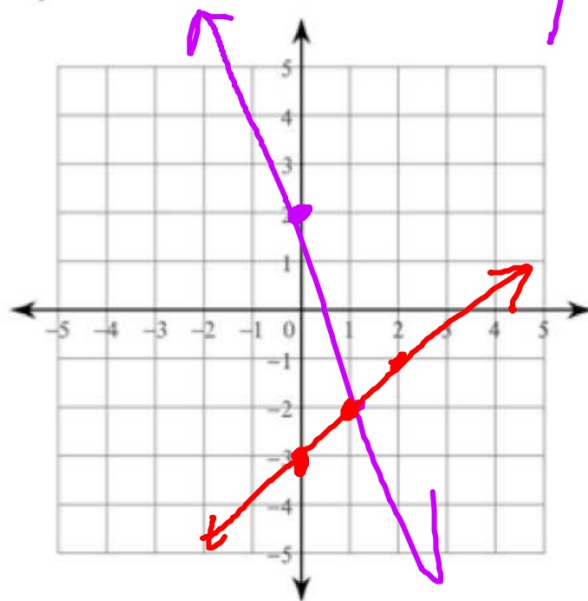
d)

$$4x + y = 2$$

$$x - y = 3$$

$$y = -\frac{4}{1}x + 2$$

$$y = x - 3$$



$(1, -2)$

ex: Solve the system algebraically by substitution.

a)  $x + 3y = 0 \rightarrow x = -3y$

$2x + y = 5$

$2(-3y) + y = 5$

$-6y + y = 5$

$-5y = 5$

$y = -1$

check:  
 $2(3) + -1 = 5$   
 $6 - 1 = 5 \checkmark$

$x = -3y$

$x = -3(-1)$

$x = 3$

$(3, -1)$



ex: Solve the system algebraically by substitution.

b)  $4x + 2y = 10$

$x - y = 13$

$\rightarrow x = (y + 13)$

$\rightarrow 4(y + 13) + 2y = 10$

$4y + 52 + 2y = 10$

$6y = -42$

$y = -7$

$x = y + 13$

$x = -7 + 13$

$x = 6$

$(6, -7)$

ex: Solve the system algebraically by substitution.

c)  $y = -5$

$$5x + 4y = -20$$

$$(0, -5)$$

$$5x + 4(-5) = -20$$

$$5x - 20 = -20$$
$$+20 \quad +20$$

$$\frac{5x}{5} = \frac{0}{5}$$

$$x = 0$$

ex: Solve the system algebraically by substitution.

d)  $y = 4x + 5$

$y = (4x - 3)$

$$\cancel{4}x - 3 = \cancel{4}x + 5$$

$$-3 \neq 5$$

false

no solution

ex: Solve the system algebraically by elimination.

$$\begin{array}{l} \text{a) } (x + 3y = 0) \\ -2 \quad 2x + y = 5 \end{array}$$

$$-2x - 6y = 0 \quad +$$

---

$$-5y = 5$$

$$y = -1$$

$$x + 3y = 0$$

$$x + -3 = 0$$

$$x = 3$$

1) Make opposites  
to eliminate a variable

2) Add equations  
together; solve for one  
variable

3) plug in to solve  
for the other variable

$$(3, -1)$$

ex: Solve the system algebraically by elimination.

$$\begin{array}{r} \text{b) } -11x - 4y = 36 \\ \quad \underline{-10x - 10y = 20} \end{array}$$

$$(-4, 2)$$

$$\begin{array}{r} (-x - y = 2) \cdot 4 \\ -11x - 4y = 36 \\ + 4x + 4y = -8 \\ \hline -7x = 28 \\ x = -4 \end{array}$$

$$\begin{array}{r} -x - y = 2 \\ -(-4) - y = 2 \\ 4 - y = 2 \\ -y = -2 \\ y = 2 \end{array}$$

ex: Solve the system algebraically by elimination.

$$^2 \text{ c) } (8x - 6y = -20)$$

$$-16x + 7y = 30$$

$$+ 16x - 12y = -40$$

---

$$-5y = -10$$

$$y = 2$$

$$(-1, 2)$$

$$8x - 6(2) = -20$$

$$8x - 12 = -20$$
$$+12 \quad +12$$

$$8x = -8$$
$$x = -1$$

ex: Solve the system algebraically using any method.

a)  $4x - y = 20$

$2(-2x - 2y = 10)$

$$4x - y = 20$$

$$-4x - 4y = 20$$

---

$$-5y = 40$$

$$y = -8$$

$$4x - (-8) = 20$$

$$4x + 8 = 20$$

$$4x = +12$$

$$x = +3$$

$$\boxed{(+3, -8)}$$

ex: Solve the system algebraically using any method.

$$\begin{array}{r} \downarrow \\ 2(4x + 5y = 13) \\ -8x - 10y = -26 \end{array}$$

$$+ 8x + 10y = 26$$

---

$$0 + 0 = 0$$

$$0 = 0 \checkmark \text{ true}$$

infinitely many  
solutions



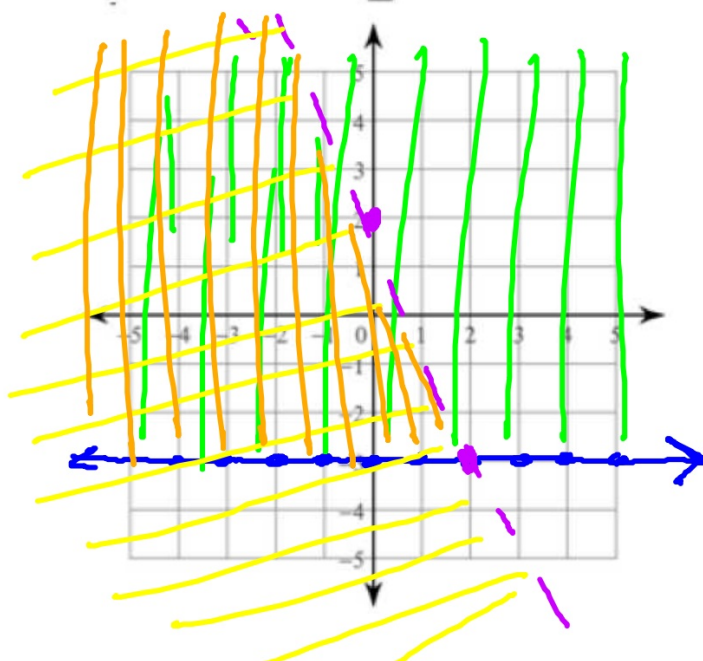
ex: Solve the system graphically.

a)

solid  
dotted

$$y \geq -3$$
$$y < -\frac{5}{2}x + 2$$

shading  
negative  
y-axis



ex: Solve the system graphically.

b)

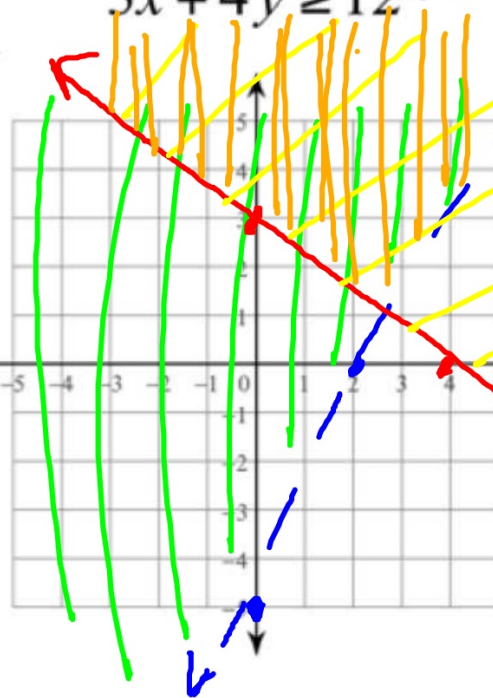
$$5x - 2y < 10$$

$$3x + 4y \geq 12$$

$$\begin{array}{rcl} 5x - 2y < 10 & & \\ -5x & & -5x \end{array}$$

$$\begin{array}{rcl} -2y < -5x + 10 & & \\ \hline -2 & & -2 \end{array}$$

$$y > \frac{5}{2}x - 5$$



$$3x + 4y \geq 12$$

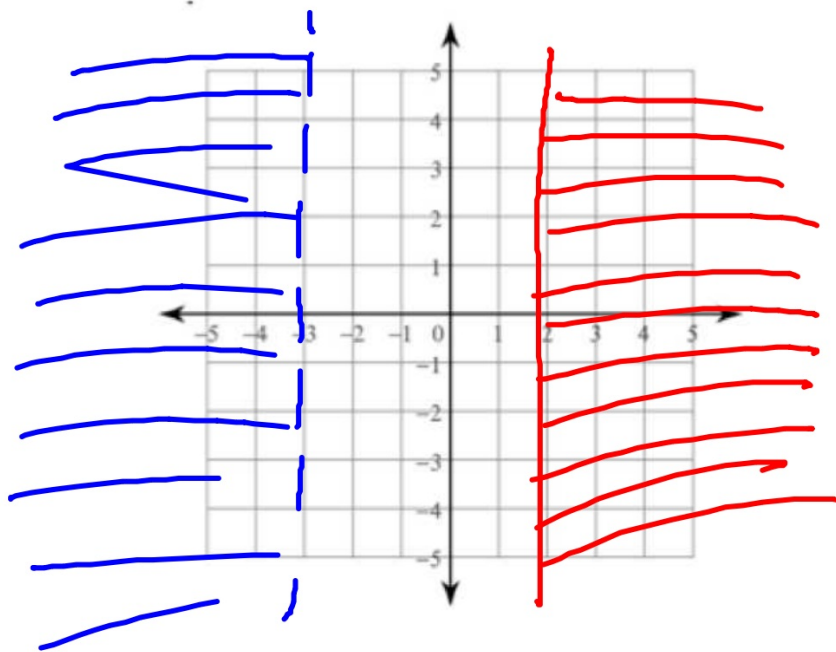
$$\begin{array}{rcl} 4y & \geq & -3x + 12 \\ \hline 4 & & 4 \end{array}$$
$$y \geq -\frac{3}{4}x + 3$$

ex: Solve the system graphically.

c)

$$x < -3$$

$$x \geq 2$$



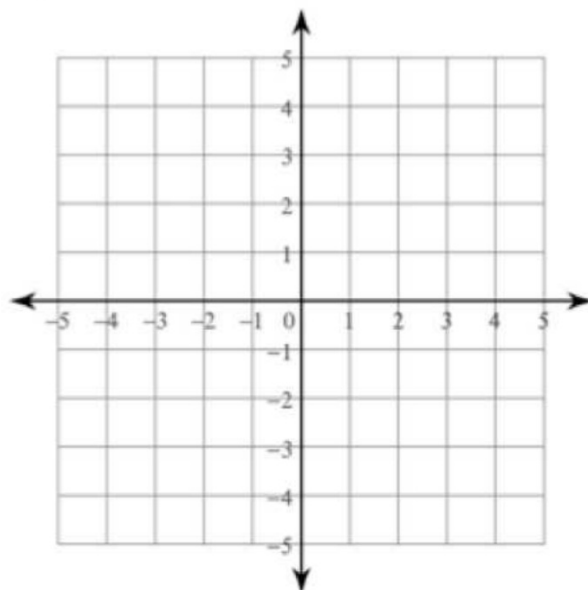
no  
solution

ex: Solve the system graphically.

d)

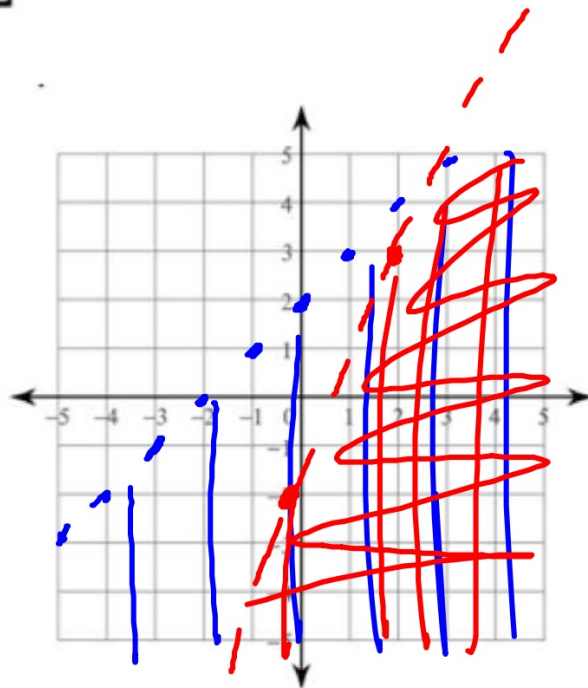
$$1 < y < 2$$

$$y \leq 3x + 4$$



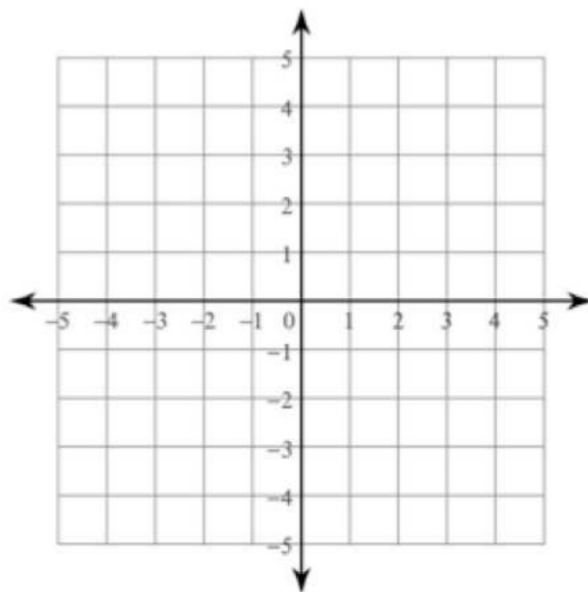
ex: Solve the system graphically.

e)  $y < x + 2$   
 $y < 5x - 2$



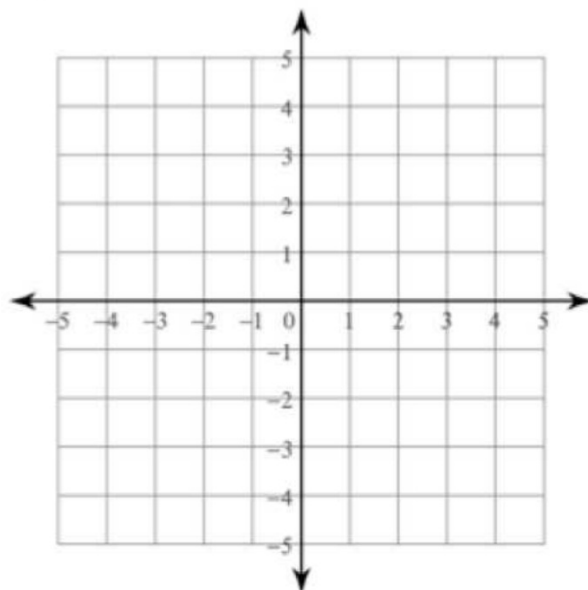
ex: Solve the system graphically.

f)  $2x - 3y \geq 6$   
 $6x - 9y < 6$



ex: Solve the system graphically.

g)  $2x - 3y \leq 6$   
 $6x - 9y < 18$



ex: Determine if each coordinate is a solution to the system below.

a)  $(0, 1)$  *yes*

b)  $(0, -3)$  *no*

c)  $(3, -1)$  *no*

d)  $(4, 4)$  *yes*

e)  $(0, 0)$  *no*

