System ①

$x + y = 12$

$x - y = 24$

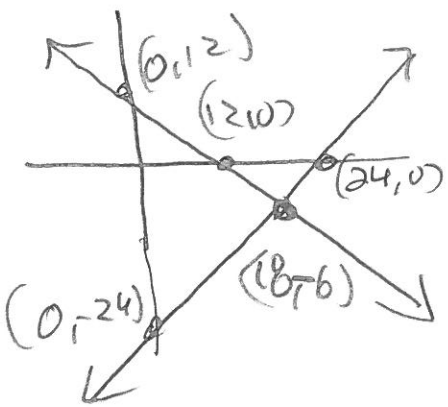
Since opposites already exist

① ADD to eliminate y terms

$$\begin{array}{r} 1x + y = 12 \\ 1x - y = 24 \\ \hline 2x \quad = 36 \end{array}$$

$$\frac{2x}{2} = \frac{36}{2} \longrightarrow \boxed{x = 18}$$

Sketch



② Now substitute $x = 18$ to find y

$$\begin{array}{r} 18 + y = 12 \\ -18 \quad\quad -18 \\ \hline y = -6 \end{array}$$

$$\begin{array}{r} 18 - y = 24 \\ -18 \quad\quad -18 \\ \hline -y = 6 \end{array}$$

$$\frac{-y}{-1} = \frac{6}{-1}$$

$$\boxed{y = -6}$$

Solution

$(18, -6)$

System ②

$2x+y=12$

$-2x+3y=-24$

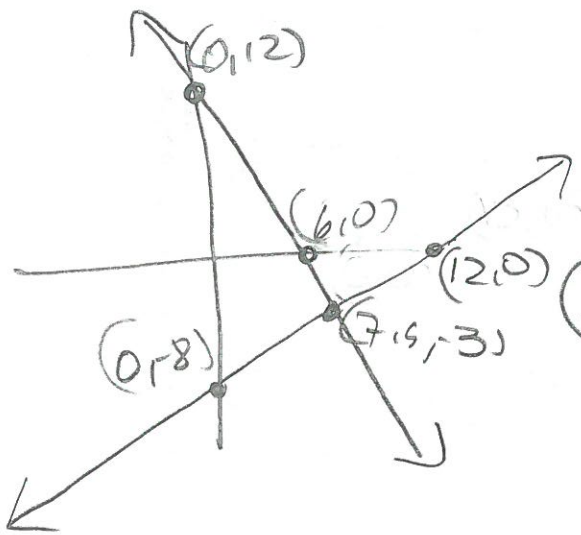
Since opposites already exist

① ADD to eliminate x terms

$$\begin{array}{r} 2x+y=12 \\ -2x+3y=-24 \\ \hline 4y=-12 \end{array}$$

$\frac{4y}{4}=\frac{-12}{4} \rightarrow \boxed{y=-3}$

Sketch



② Now substitute $y=-3$ to find x

$2x+-3=12$

$2x-3=12$

$+3 \quad +3$

$2x=15$

$\frac{2x}{2}=\frac{15}{2}$

$\boxed{x=7.5}$

OR $-2x+3(-3)=-24$

$-2x-9=-24$

$+9 \quad +9$

$-2x=-15$

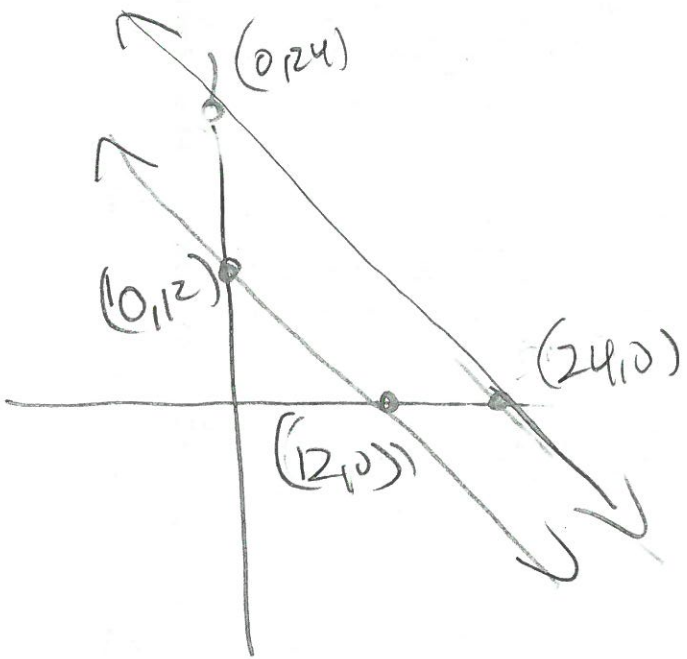
$\frac{-2x}{-2}=\frac{-15}{-2}$

$\boxed{x=7.5}$

$\boxed{\text{Solution } (7.5,-3)}$

System ③

$$x + y = 12$$
$$-x - y = 24$$



Solutions DO NOT EXIST

Since Opposites exist ADD to eliminate both x & y terms

$$\cancel{x} + \cancel{y} = 12$$
$$\cancel{-x} \cancel{-y} = 24$$
$$0 = 36$$

Since $0 \neq 36$, we know that no solutions exist because these lines are parallel

✓✓
$$x + y = 12$$
$$-x \quad -x$$
$$y = -1x + 12$$

$$-x - y = 24$$
$$+x \qquad +x$$
$$-y = x + 24$$

$$\frac{-y}{-1} = \frac{x + 24}{-1} \rightarrow y = -1x - 24$$

System ④

$2x+y=12$

$2x+3y=48$

Since we do not have opposites we need to get opposites

① Multiply either line by -1

② Add lines together to find y

③ use y to find x

① ②

$-1(2x+y=12)$

$2x+3y=48$

$-2x-y=-12$

$2x+3y=48$

$2y=36$

$\frac{2y}{2}=\frac{36}{2}$

$\boxed{y=18}$

③ $2x+18=12$

$2x+18=12$

$-18\ \ -18$

$2x=-6$

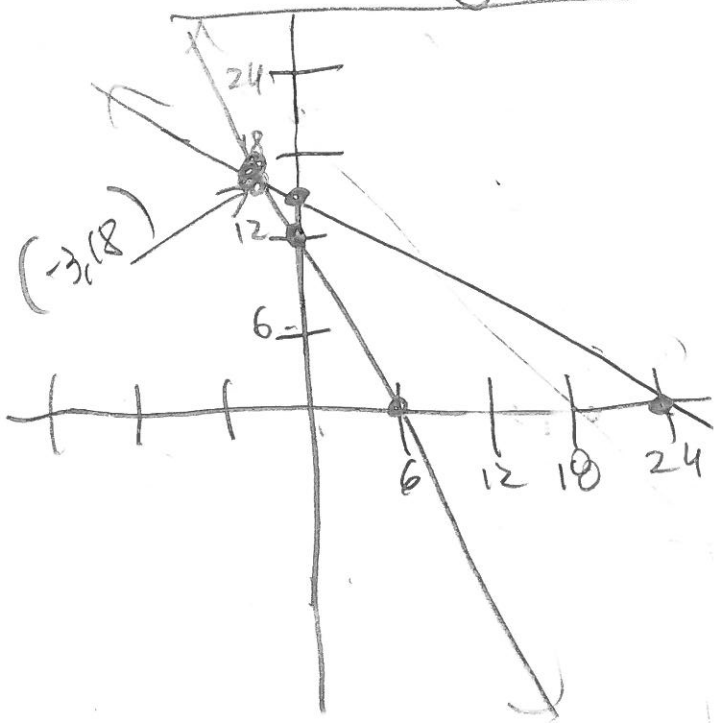
$\frac{2x}{2}=\frac{-6}{2}$

$\boxed{x=-3}$

$\boxed{(-3,18)}$

solution

Sketch system



System ⑤

$5x+2y=10$

$-10x-4y=-20$

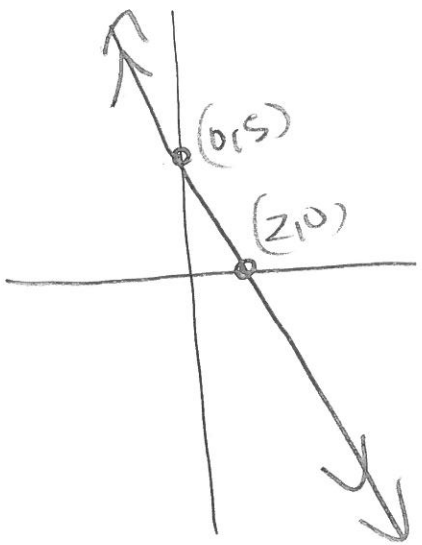
Since no opposites EXIST

Multiply to Eliminate terms

① Multiply line ① by 2 to eliminate terms

$2(5x+2y=10) \rightarrow 10x+4y=20$

Sketch of system



② Add lines to Eliminate terms

$10x+4y=20$

$-10x-4y=-20$

$0=0$ → this tells us that these lines are the same

✓✓ $5x+2y=10$

$-5x \quad -5x$

$2y=-5x+10$

$\frac{2y}{2}=\frac{-5x}{2}+\frac{10}{2} \rightarrow \boxed{y=\frac{-5}{2}x+5}$

✓✓ $-10x-4y=-20$

$+10x \quad +10x$

$-4y=10x-20$

$\frac{-4y}{-4}=\frac{10x}{-4}-\frac{20}{-4}$

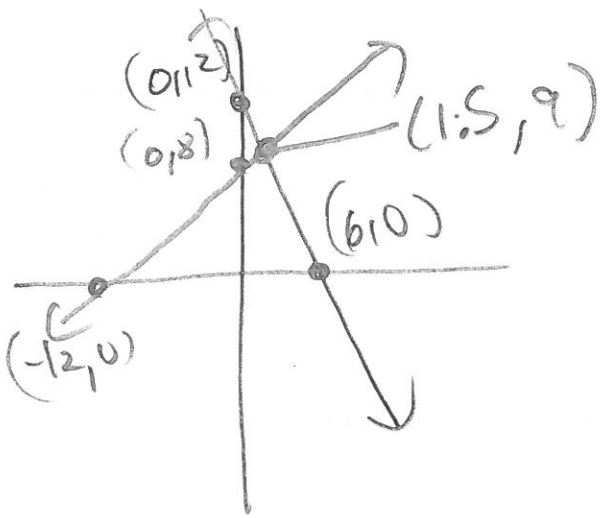
$y=-\frac{5}{2}x+5$

System ⑥

$2x + y = 12$

$-2x + 3y = 24$

Sketch of System



Since opposites already exist

① Add to diminate x terms

$$\begin{array}{r} 2x + y = 12 \\ -2x + 3y = 24 \\ \hline \end{array}$$

$4y = 36 \rightarrow \frac{4y}{4} = \frac{36}{4}$ $\boxed{y = 9}$

② Replace $y = 9$ to find x

$2x + 9 = 12$

$2x + 9 = 12$

$-9 \quad -9$

$2x = 3$

$\frac{2x}{2} = \frac{3}{2}$

$\boxed{x = 1.5}$

$-2x + 3(9) = 24$

$-2x + 27 = 24$

$-2x + 27 = 24$

$-27 \quad -27$

$-2x = -3$

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

$\boxed{x = 1.5}$

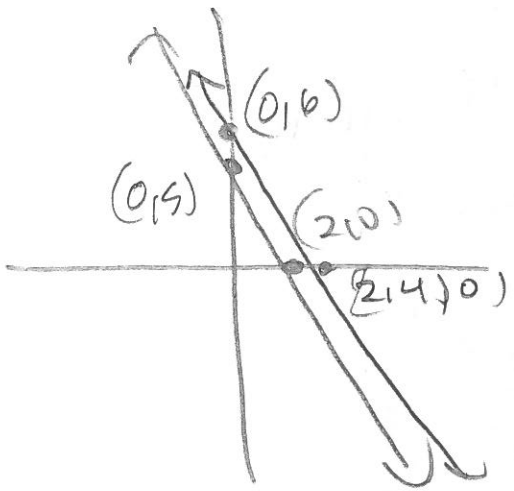
Solution
(1.5, 9)

System (7)

$5x+2y=10$

$-10x-4y=-24$

Sketch System



Since opposites do not exist

① GET OPPOSITES by multiplying line ① by 2

$2(5x+2y=10) \rightarrow 10x+4y=20$

② Add lines toget rid of terms

$10x+4y=20$

$-10x-4y=-24$

$0 \neq -4 \rightarrow$ False

these lines are parallel and no solution exists

✓✓ $-10x-4y=-24$

$+10x \quad +10x$

$-4y = 10x-24$

$\frac{-4y}{-4} = \frac{10x}{-4} - \frac{24}{-4}$

$y=\frac{5}{2}x+6$

✓✓ $5x+2y=10$

$-5x \quad -5x$

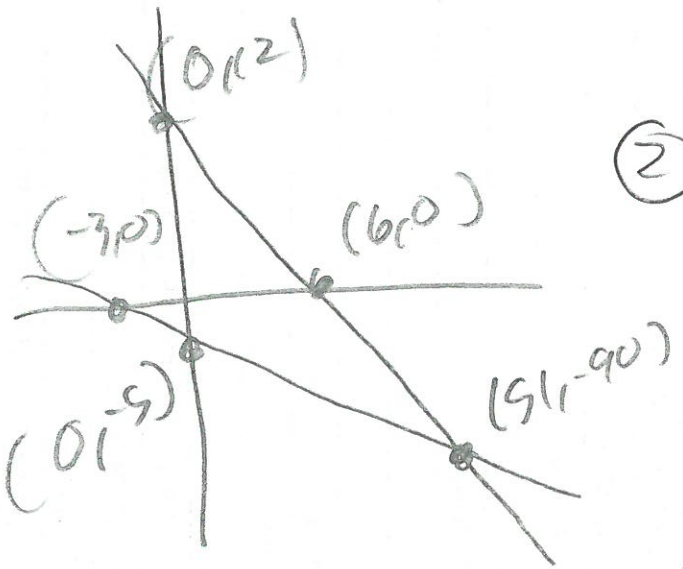
$2y=-5x+10$

$\frac{2y}{2} = \frac{-5x}{2} + \frac{10}{2} \rightarrow y=\frac{-5}{2}x+5$

System ⑧

$2x + y = 12$

$5x + 3y = -15$



Solution

$(51, -90)$

Since opposites do not exist, GET THEM to eliminate terms through multiplication

① multiply by -3 to Eliminate y term

$-3(2x + y = 12) \rightarrow -6x - 3y = -36$

② Add lines to eliminate y terms

$-6x - 3y = -36$

$5x + 3y = -15$

$-1x = -51$

$\frac{-1x}{-1} = \frac{-51}{-1} \rightarrow \boxed{x = 51}$

③ Replace $x = 51$ to find y

$2(51) + y = 12$

$102 + y = 12$

$-102 \quad -102$

$\boxed{y = -90}$

$5(51) + 3y = -15$

$255 + 3y = -15$

$-255 \quad -255$

$3y = -270$

$y = -90$