SIMULTANEOUS EQUATIONS 1

Solve the following system by three different methods: graphing, addition and substitution.

1) $\left.\begin{array}{l} 4x - y = 10 \\ 3x + 2y = 13 \end{array}\right\}$

2) $\left.\begin{array}{l} 3 + 4x = 2y \\ 2x - y = -1 \end{array}\right\}$

3) $\left.\begin{array}{l} \frac{x}{3} + \frac{y}{2} = 3 \\ \frac{x}{2} + \frac{y}{2} = 4 \end{array}\right\}$

4) $\left.\begin{array}{l} x - \frac{y}{3} = -1 \\ y - 3x = 3 \end{array}\right\}$

5) $\left.\begin{array}{l} \frac{x-1}{3} + \frac{y}{2} = 2 \\ 3x + y = 7 \end{array}\right\}$

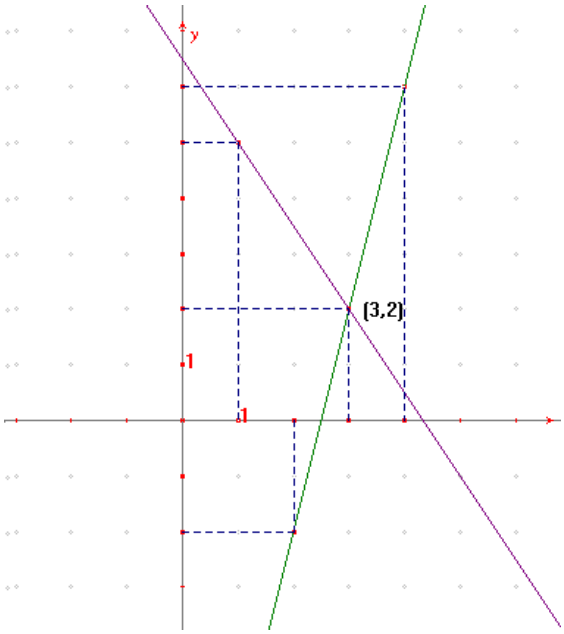
SOLUTION

1)

Graphing: $\left.\begin{matrix} 4x-y=10 \\ 3x+2y=13 \end{matrix}\right\} \rightarrow \left.\begin{matrix} y=4x-10 \\ y=\dfrac{13-3x}{2} \end{matrix}\right\}$

x	y
2	-2
4	6

x	y
3	2
1	5



Addition:

$\left.\begin{matrix} 4x-y=10 \\ 3x+2y=13 \end{matrix}\right\} \rightarrow \left.\begin{matrix} 8x-2y=20 \\ 3x+2y=13 \end{matrix}\right\}$

$11x=33 \Rightarrow x=\dfrac{33}{11}=3$

$4x-y=10 \Rightarrow 12-y=10 \Rightarrow y=2$

Substitution:

$\left.\begin{matrix} 4x-y=10 \\ 3x+2y=13 \end{matrix}\right\} \rightarrow \left.\begin{matrix} y=4x-10 \\ 3x+2(4x-10)=13 \end{matrix}\right\}$

$3x+8x-20=13 \Rightarrow 11x=33 \Rightarrow x=3$

$y=4x-10=12-10=2$

Solution: x = 3, y = 2

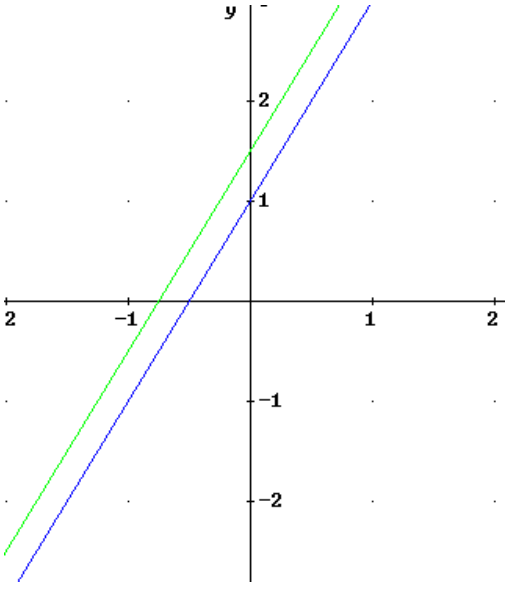
CONSISTENT INDEPENDENT SYSTEM

2) $\left.\begin{matrix} 3+4x=2y \\ 2x-y=-1 \end{matrix}\right\} \rightarrow \left.\begin{matrix} 4x-2y=-3 \\ 2x-y=-1 \end{matrix}\right\}$

Graphing: $\left.\begin{matrix} y=\dfrac{4x+3}{2} \\ y=2x+1 \end{matrix}\right\}$

x	y
0	3/2
-1	-1/2

x	y
0	1
-1	-1



Parallel lines, NO solution

Substitution:

$\left.\begin{matrix} 2x+1=y \\ 4x-2(2x+1)=2 \end{matrix}\right\} \rightarrow 0x=4$ No solution

Addition:

$\left.\begin{matrix} 4x-2y=-3 \\ 2x-y=-1 \end{matrix}\right\} \rightarrow \left.\begin{matrix} 4x-2y=-3 \\ -4x+2y=2 \end{matrix}\right\} \rightarrow 0x=-1$

NO SOLUTION, INCONSISTENT SYSTEM

3) $\left.\begin{array}{l}\frac{x}{3}+\frac{y}{2}=3\\ \frac{x}{2}+\frac{y}{2}=4\end{array}\right\}\rightarrow\left.\begin{array}{l}2x+3y=18\\ x+y=8\end{array}\right\}$

Graphing: $\left.\begin{array}{l}2x+3y=18\\ x+y=8\end{array}\right\}\rightarrow\left.\begin{array}{l}y=\frac{18-2x}{3}\\ y=8-x\end{array}\right\}$

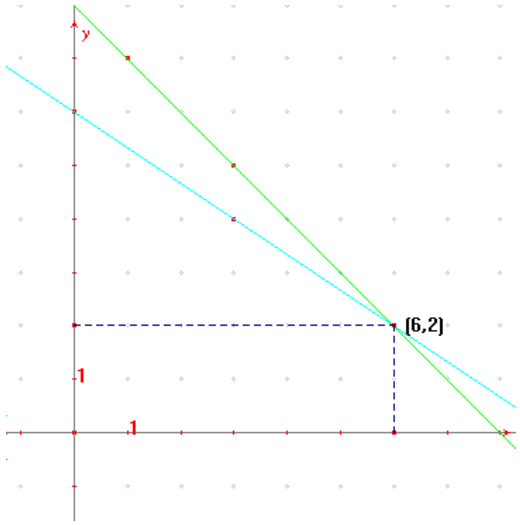
x	y
3	4
0	6

x	y
3	5
1	7

Addition:

$\left.\begin{array}{l}2x+3y=18\\ x+y=8\end{array}\right\}\rightarrow\left.\begin{array}{l}2x+3y=18\\ -2x-2y=-16\end{array}\right\}$

$y=2\Rightarrow x=8-2=6$



Substitution:

$\left.\begin{array}{l}2x+3y=18\\ x+y=8\end{array}\right\}\rightarrow y=8-x$

$2x+3(8-x)=18\Rightarrow 2x+24-3x=18$

$-x=18-24\Rightarrow x=6\rightarrow y=8-6=2$

Solution: x = 6, y = 2

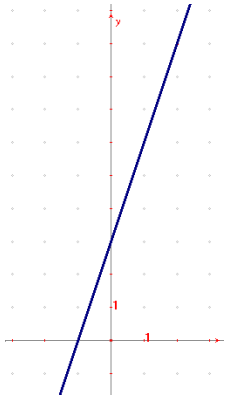
CONSISTENT INDEPENDENT SYSTEM

4)

Graphing: $\left.\begin{array}{l}3x-y=-3\\ -3x+y=3\end{array}\right\}\rightarrow\left.\begin{array}{l}y=3x+3\\ y=3x+3\end{array}\right\}$

x	y
2	9
0	3

x	y
2	9
0	3



The same line, infinite solutions

Addition:

$\left.\begin{array}{l}3x-y=-3\\ -3x+y=3\end{array}\right\}\rightarrow 0x=0$

Substitution:

$\left.\begin{array}{l}3x-y=-3\\ -3x+y=3\end{array}\right\}\rightarrow y=3x+3$

$3x-(3x+3)=-3\Rightarrow 0x=0$

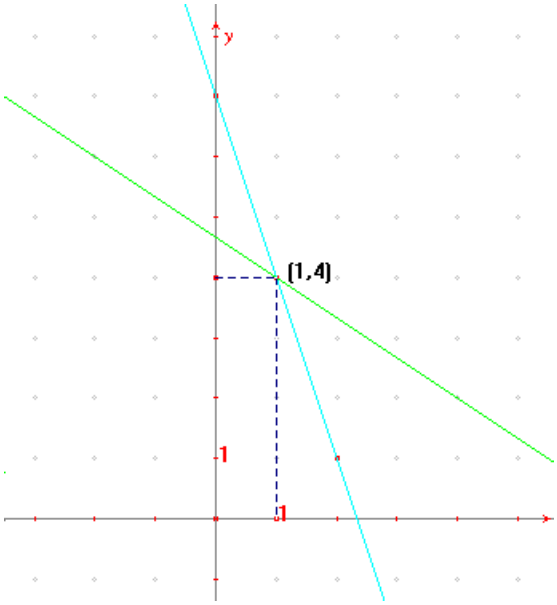
CONSISTENT DEPENDENT SYSTEM

5) $\left.\begin{array}{l}\frac{x-1}{3}+\frac{y}{2}=2\\ 3x+y=7\end{array}\right\}\rightarrow\left.\begin{array}{l}2x-2+3y=12\\ 3x+y=7\end{array}\right\}\rightarrow\left.\begin{array}{l}2x+3y=14\\ 3x+y=7\end{array}\right\}$

Graphing: $\left.\begin{matrix} 2x+3y=14 \\ 3x+y=7 \end{matrix}\right\} \rightarrow \left.\begin{matrix} y=\dfrac{14-2x}{3} \\ y=7-3x \end{matrix}\right\}$

x	y
1	4
7	0

x	y
2	1
0	7



Addition:

$$\left.\begin{matrix} 2x+3y=14 \\ 3x+y=7 \end{matrix}\right\} \rightarrow \left.\begin{matrix} 2x+3y=14 \\ -9x-3y=-21 \end{matrix}\right\}$$

$$7x=7 \Rightarrow x=1 \rightarrow 3+y=7 \rightarrow y=4$$

Substitution:

$$\left.\begin{matrix} 2x+3y=14 \\ 3x+y=7 \end{matrix}\right\} \rightarrow y=7-3x$$

$$2x+3(7-3x)=14$$

$$2x+21-9x=14$$

$$-7x=-7 \Rightarrow x=1$$

$$y=7-3x=7-3=4$$

Solution: x = 1, y = 4

CONSISTENT INDEPENDENT SYSTEM