$\boxed{\text{Solving Systems of equations by Substitution}}$

* unfortunately some systems when graphed will have a solution (intersection) at a a fraction.
* For these examples, to be the most accurate we will use the Substitution method to solve.

Substitution method -

* When given a system of equations in two variables, such as x, & y, you will solve for one variable & "substitute" in for the other.

Steps

1. If not already isolated (solved for one variable), pick either x, or y to isolate & solve for.

2. Once one variable is isolated, substitute whatever that variable equals in to your second equation.

Example

$$\begin{cases} y = 2x+4 \\ 2x-3y=4 \end{cases}$$

$y = \boxed{2x+4}$ $\quad 2x-3y=4$

* $2x-3(2x+4)=4$

or x.

3. Once you "substitute", you should have only ~~one variable~~ either x, or y.

* Now you need to solve for the variable that remains & you will have it equal to a #.

* After substitution step

$$2x-3(2x+4)=4$$

$$2x-6x-12=4$$

$$-4x-12=4$$

$$\quad +12 \quad +12$$

$$-4x=16$$

$$\frac{-4x}{-4}=\frac{16}{-4}$$

$$\boxed{x=-4}$$

4. Your final step will be to take your result from step 3 $(x=-4)$, & plug it in to either of the two equations given in the system.

Example

Original equation $y = 2x+4$

$$y=2(-4)+4$$

$$y=-8+4$$

$$\boxed{y=-4}$$

Solution: $x=-4$, $y=-4$ OR $(-4,-4)$

Warm-up

① Solve $3(x+5)=30$

$3x+15=30$

② Solve using graphing

$$\begin{cases} y=2x+2 \\ y=x-1 \end{cases}$$

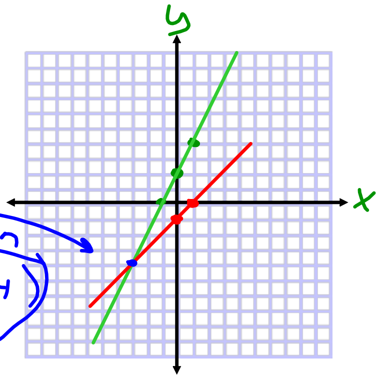
$y=2x\boxed{+2}$ y-int.

Slope $=\frac{2}{1}$

$y=x\boxed{-1}$ y-int

Slope $=\frac{1}{1}$

solution $(-3,-4)$



Example

$$\begin{cases} \boxed{y=4x+3} \\ x+y=12 \end{cases}$$

Solve using substitution.

① Done, solved y

② substitute.

③ $x + 4x+3 = 12$

$5x+3=12$

$-3-3$

$\frac{5x}{5}=\frac{9}{5}$

$x=\frac{9}{5}$

④ $y=4x+3$

$x=\frac{9}{5}$

$\frac{4}{1}\cdot\frac{9}{5}=\frac{36}{5}$

$3=\frac{5\cdot 3}{5}=\frac{15}{5}$

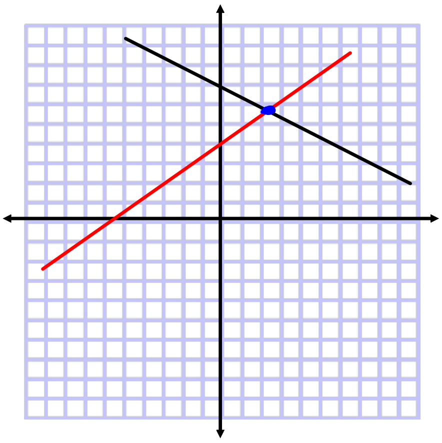
$y=\frac{4}{1}\left(\frac{9}{5}\right)+3$

$y=\frac{36}{5}+3$

$y=\frac{36}{5}+\frac{15}{5}$

$x=\frac{9}{5}$ $y=\frac{51}{5}$

$\left(\frac{3}{2}, \frac{11}{2}\right)$



Ex

$$\begin{cases} y = \boxed{4x+3} \\ x + y = 10 \end{cases}$$

① Isolate for 1 variable

$y = 4x + 3$

② Substitute $y = 4x+3$ into our other equation.

$x + (4x+3) = 10$

③ Solve for the variable.

$x + 4x + 3 = 10$

$5x + 3 = 10$

$-3 \quad -3$

$\frac{5x}{5} = \frac{7}{5}$ $x = 7/5$

④ plug into one of the original equations.

$y = 4x + 3$

$x = \frac{7}{5}$

$y = \frac{4}{1}\left(\frac{7}{5}\right) + 3$

$3 = \frac{5 \cdot 3}{5}$

$y = \frac{28}{5} + 3$

$3 = \frac{15}{5}$

$y = \frac{28}{5} + \frac{15}{5}$

$$\boxed{y = \frac{43}{5} \quad x = \frac{7}{5}}$$