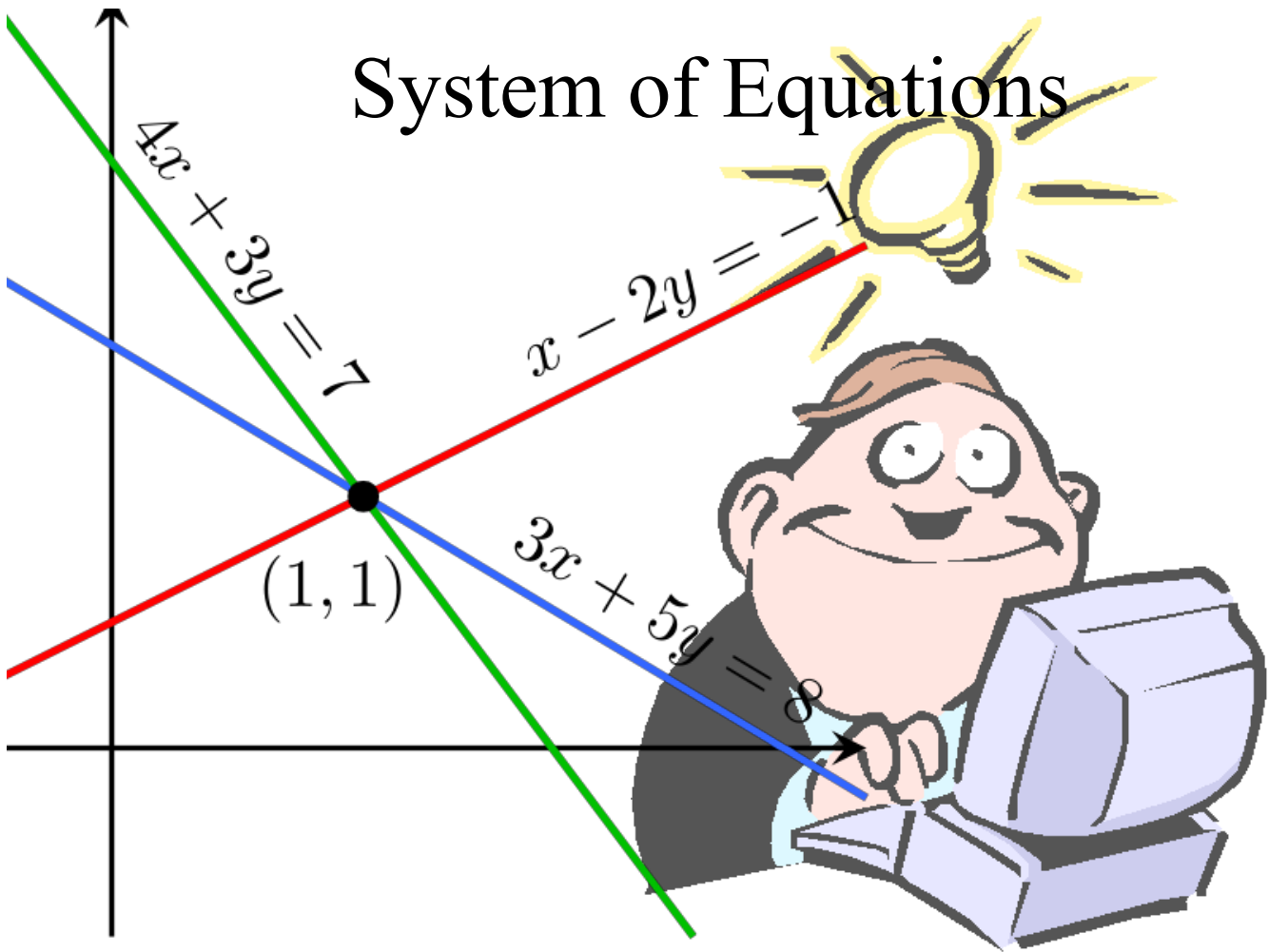


System of Equations



There are other ways to solve
Systems of Equations!

Elimination

Elimination is when you "eliminate" one of the variables.

Elimination by Addition

$$\begin{array}{r} y - 2x = 5 \quad \textcircled{1} \\ -y - 1x = 4 \quad \textcircled{2} \\ \hline \end{array}$$

$$\begin{array}{r} \textcircled{1} + \textcircled{2} \quad -3x = 9 \\ \quad \quad \quad \underline{-3} \quad \underline{-3} \\ \quad \quad \quad x = -3 \end{array}$$

$$\begin{array}{r} \text{Sub in } \textcircled{1} \quad y - 2x = 5 \\ \quad \quad \quad y - 2(-3) = 5 \\ \quad \quad \quad y + 6 = 5 - 6 \\ \quad \quad \quad y = -1 \end{array}$$

Make sure the corresponding variables, constants and equal signs are lined up.



x, y
 $(-3, -1)$

You must explain what you are doing.

Elimination by Addition

Consider the system

$$\begin{array}{r} 2x + 2y = 7 \quad \textcircled{1} \\ 1x - 2y = 5 \quad \textcircled{2} \end{array}$$

$$\begin{array}{r} \textcircled{1} + \textcircled{2} \\ \hline 3x = 12 \\ \frac{3x}{3} = \frac{12}{3} \end{array} \quad \left(4, -\frac{1}{2}\right)$$

Sub in $x=4$ into $\textcircled{2}$

$$\begin{array}{r} 1x - 2y = 5 \\ 1(4) - 2y = 5 \\ \hline \textcircled{4} - 2y = 5 - 4 \\ -2y = 1 \\ \frac{-2y}{-2} = \frac{1}{-2} \\ y = -\frac{1}{2} \end{array}$$

Elimination by Addition

Consider the system

$$\begin{array}{r} x - 2y = 5 \\ + \quad 2x + 2y = 7 \\ \hline \end{array}$$

← Lets add both equations
← to each other

Elimination by Addition

$$x + 3y = 14$$

$$\square -x + 4y = 7$$

Who would you eliminate??

Elimination by Subtraction

$$6x + 11y = -5 \quad \textcircled{1}$$

$$6x + 9y = -3 \quad \textcircled{2}$$

$$\begin{array}{r} 6x + 11y = -5 \quad \textcircled{1} \\ -6x - 9y = +3 \quad \textcircled{3} \\ \hline \end{array}$$

(1-1)

$$\textcircled{1} + \textcircled{3} \quad \frac{2y}{2} = \frac{-2}{2}$$

$$y = -1$$

Sub in $\textcircled{1}$ $6x + 11y = -5$

$$6x + 11(-1) = -5$$

$$6x - 11 = -5 + 11$$

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

$$x = 1$$

$$x - 2y = -12 \quad (1)$$

$$\begin{array}{r} \text{↗} \\ -2y - 6x = 16 \quad (2) \\ \text{↖} \end{array}$$

$$x - 2y = -12 \quad (1)$$

$$\underline{-6x - 2y = 16 \quad (2) \text{ opp}}$$

$$1x - 2y = -12 \quad (1)$$

$$\underline{+6x + 2y = -16 \quad (3)}$$

$$\textcircled{1} + \textcircled{3} \quad \frac{7x}{7} = \frac{-28}{7}$$

$$x = -4$$

$$(-4, 4)$$

Sub in (1)

$$\begin{array}{r} \text{↗} \\ x - 2y = -12 \\ \text{↖} \\ \textcircled{-4} - 2y = -12 + 4 \\ \underline{-2y = -8} \\ \frac{-2y}{-2} = \frac{-8}{-2} \quad y = 4 \end{array}$$

$$-3x - 5y = 10$$

$$-3x - 7y = 14$$

Elimination by Multiplication

$$3x + 2y = 12 \quad (1)$$

$$2x + 3y = 13 \quad (2)$$

$$(1) \times 2 \quad 6x + 4y = 24 \quad (3)$$

$$(2) \times -3 \quad -6x - 9y = -39 \quad (4)$$

$$(3) + (4) \quad \underline{-5y = -15}$$

$$y = 3$$

Sub in (2)

$$2x + 3y = 13$$

$$2x + 3(3) = 13$$

$$2x + 9 = 13 - 9$$

$$\frac{2x}{2} = \frac{4}{2}$$

$$x = 2$$

Make sure the corresponding variables, constants and equal signs are lined up.



You must explain what you are doing.

$$(2, 3)$$

Solve the following System of Equations

$$-3x + 2y = -3 \quad \textcircled{1}$$

$$9x - 4y = -9 \quad \textcircled{2}$$

$$\begin{array}{r} \textcircled{1} \times 3 \\ \hline -9x + 6y = -9 \quad \textcircled{3} \\ 9x - 4y = -9 \quad \textcircled{2} \\ \hline \end{array}$$

$$\textcircled{3} + \textcircled{2} \quad \quad \quad \frac{2y}{2} = \frac{-18}{2}$$

$$y = -9$$

Sub in $\textcircled{1}$

$$-3x + 2y = -3$$

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

$$-3x - 18 = -3 + 18$$

$$-3x = 15$$

$$\frac{-3x}{-3} = \frac{15}{-3} \quad x = -5$$

Make sure the corresponding variables, constants and equal signs are lined up.



You must explain what you are doing.

$(-5, -9)$

Try these:

1.

$$\begin{array}{r} x - 2y = 5 \\ + 2x + 2y = 7 \end{array}$$

2.

$$\begin{array}{r} 6x + 11y = -5 \\ 6x + 9y = -3 \end{array}$$

3.

$$\begin{array}{r} x + 2y = 6 \\ 3x + 3y = -6 \end{array}$$

$$\begin{array}{r} | x - 2y = 5 \quad \textcircled{1} \\ \text{Addition} \quad + 2x + 2y = 7 \quad \textcircled{2} \\ \hline \end{array}$$

$$\textcircled{1} + \textcircled{2}$$

$$\frac{3x}{3} = \frac{12}{3}$$

$$x = 4$$

$$\begin{array}{c} x, y \\ (4, -0.5) \end{array}$$

Sub in $\textcircled{1}$

$$\begin{array}{r} x - 2y = 5 \\ \textcircled{4} - 2y = 5 - 4 \\ \hline -2y = 1 \\ y = -0.5 \end{array}$$

$$6x + 11y = -5 \quad \textcircled{1}$$

Subt.

$$6x + 9y = -3 \quad \textcircled{2}$$

$$\begin{array}{r} 6x + 11y = -5 \quad \textcircled{1} \\ -6x - 9y = +3 \quad \textcircled{2} \\ \hline \end{array}$$

① + ②

$$\begin{array}{r} 2y = -2 \\ \hline y = -1 \end{array}$$

(1, -1)

Sub in ①

$$\begin{array}{l} 6x + 11y = -5 \\ 6x + 11(-1) = -5 \\ 6x - 11 = -5 + 11 \\ 6x = 6 \quad x = 1 \end{array}$$

$$x + 2y = 6 \quad (1)$$

$$3x + 3y = -6 \quad (2)$$

$$\textcircled{1} \times -3 \quad \begin{array}{r} -3x - 6y = -18 \quad (3) \\ 3x + 3y = -6 \quad (2) \\ \hline \end{array}$$

$$\textcircled{3} + \textcircled{2}$$

$$\begin{array}{r} -3y = -24 \\ \underline{-3} \\ y = 8 \end{array}$$

$$(-10, 8)$$

Sub in $\textcircled{1}$

$$\begin{array}{l} x + 2y = 6 \\ x + 2(8) = 6 \\ x + 16 = 6 - 16 \\ \textcircled{x + 16} \rightarrow 6 - 16 \\ x = -10 \end{array}$$

1.

$$\begin{array}{r}
 x - 2y = 5 \\
 + 2x + 2y = 7 \\
 \hline
 3x \quad = 12
 \end{array}$$

← Lets add both equations
← to each other

solve for x

ANS: (4, y)

$$x = 4$$

Now solve for y (HOW???)

- sub the value of x into one of the equations and solve for y

$$x - 2y = 5$$

$$4 - 2y = 5$$

$$- 2y = 1$$

$$y = \frac{-1}{2}$$

intersection point (4, - 0.5)

2.

Careful you are subtraction all of the second
(switch all signs on t second equation)

$$\begin{array}{r} 6x + 11y = -5 \\ -6x - 9y = +3 \\ \hline 2y = -2 \end{array}$$

$$y = -1$$

solve for x

$$\begin{aligned} 6x + 11y &= -5 \\ 6x + 11(-1) &= -5 \\ 6x - 11 &= -5 \\ 6x &= -5 + 11 \\ 6x &= 6 \\ x &= 1 \end{aligned}$$

Intersection (1, -1)

3.

Consider the system

$$\begin{array}{r} 3x + 6y = 18 \\ -3x - 3y = +6 \\ \hline 3y = 24 \end{array}$$

Now subtract the equations

$$y = 8$$

Sub into equation 1 (original) or the above

$$\begin{aligned} x + 2y &= 6 \\ x + 2(8) &= 6 \\ x + 16 &= 6 \\ x &= 6 - 16 \\ x &= -10 \end{aligned}$$

$$(-10, 6)$$

