

Is $(4, -1)$ a solution
for $\begin{cases} x+2y=2 \\ x-2y=6 \end{cases}$ $4+2(-1)=2 \checkmark$
 $4-2(-1)=6 \checkmark$

Evaluate. The ordered pair
must work in **both** equations
to be a solution

Is $(-4, 3)$ a solution?

$$-4+2(3)=2 \checkmark$$

$$-4-2(3)=6 \text{ No}$$

Not a
solution

SOLVING SYSTEMS OF EQUATIONS BY SUBSTITUTION

Find x and y :

$$y + x = 8 \quad \text{if } x = 5$$

Solve for x and y

$$y + x = 8 \quad \text{if } y = 3x$$

check it

$$4x + 3y = 4 \quad \text{if} \quad y = 2x - 7$$

Find x and y . Check it

$$x = 2.5$$

$$4x + 3y = 4 \quad \text{if } y = 2x - 7$$

$$x = 2.5 \quad y = -2$$

(check)

$$4(2.5) + 3(-2) = 4 \quad \checkmark$$

$$-2 = 2(2.5) - 7 \quad \checkmark$$

Substitution method

Take 1 of the equations and isolate a variable:

$$4x + 3y = 4$$

$$2x - y = 7 \quad *$$

$$-y = -2x + 7$$

$$y = 2x - 7$$

$$y = 2x - 7$$

substitute in

* substitute into the unused equation

$$4x + 3y = 4$$

$$2x - y = 7 \quad * \quad y = 2x - 7$$

$$4x + 3(2x - 7) = 4$$

$$2x - 3y = 6$$

$$x + y = -12$$

$$y = -x - 12$$

$$2x - 3(-x - 12) = 6$$

$$2x + 3x + 36 = 6$$

$$5x + 36 = 6$$

$$5x = -30$$

$$x = -6$$

$$2(-6) - 3(-6) = 6$$
$$-6 + -6 = -12 \quad \text{check}$$

solve for
x and y. Check.

$$-6 + y = -12$$

$$y = -6$$

check: $-6 + -6 = -12 \quad \checkmark$

$$2(-6) - 3(-6) = 6$$

$$-12 + 18 = 6 \quad \checkmark$$

$$3x - y = 0 \quad 3(2) - 6 = 0 \checkmark$$
$$4x + 3y = 26 \quad 4(2) + 3(6) = 26 \checkmark$$

solve for x any y. check, it.

$$\boxed{x=2} \quad \boxed{y=6}$$

$$-y = -3x$$

$$y = 3x$$

$$4x + 3(3x) = 26$$

$$13x = 26$$

$$\boxed{x=2}$$

$$3(2) - y = 0$$

$$6 - y = 0$$

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

$$\begin{cases} 5x - 4y = 9 \\ x - 2y = -3 \end{cases}$$

$$* x = 2y - 3$$

Now substitute $2y - 3$ for x in the other equation.

$$5(2y - 3) - 4y = 9$$

$$10y - 15 - 4y = 9$$

$$6y - 15 = 9$$

$$6y = 24$$

$$y = 4$$

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

$$x - 8 = -3$$

$$x = 5$$

check it

$$5(5) - 4(4) = 9$$

$$25 - 16 = 9 \quad \checkmark$$

$$5 - 2(4) = -3$$

$$5 - 8 = -3 \quad \checkmark$$

SOLVING SYSTEMS OF EQUATIONS BY ELIMINATION:

Both equations are in standard form.

You adjust each equation as needed to eliminate one of the variables. You decide which variable is easier to eliminate. You will add the 2 equations once you have set it up.

*** You must find x and y.

Don't do anything:

$$\begin{array}{r} 4x + 6y = 8 \\ + 2x - 6y = 4 \\ \hline 6x = 12 \end{array}$$
 *The y's will cancel if you add. Don't change anything.

$$6x = 12$$

$x = 2$ Substitute 2 in for x and find y.

$y = 0$. The solution is (2,0). CHECK IT!

solve for x and y. Check

$$\textcircled{a} \begin{aligned} 4x - 2y &= 7 \\ + x + 2y &= 3 \end{aligned}$$

$$\begin{aligned} 4(2) - 2\left(\frac{1}{2}\right) &= 7 \\ 8 - 1 &= 7 \checkmark \\ 2 + 2\left(\frac{1}{2}\right) &= 3 \checkmark \end{aligned}$$

$$\begin{aligned} 5x &= 10 & 2 + 2y &= 3 \\ \underline{x=2} & & \underline{2y=1} & \\ & & y &= \frac{1}{2} \end{aligned}$$

$$\textcircled{b} \begin{aligned} 3x - 2y &= 14 \\ 2x + 2y &= 6 \\ 5x &= 20 \\ \underline{x=4} & \end{aligned}$$
$$\begin{aligned} 3(4) - 2y &= 14 & 3(4) - 2(-1) &= 14 \checkmark \\ -2y &= 2 & 2(4) + 2(-1) &= 6 \checkmark \\ \underline{y=-1} & \end{aligned}$$

Multiply 1 Equation:

$$4x + 4y = 6$$

$$+ \begin{matrix} -2 \\ -2 \end{matrix} (2x + 5y = 12)$$

① you make it work!

② * Multiply the whole equation

$$\begin{array}{r} \hline + 4x + 4y = 6 \\ -4x - 10y = -24 \\ \hline \end{array}$$

③ * Rewrite it

$$-6y = -18$$

$$y = 3$$

* Plug into original equation

$$4x + 4y = 6 \quad 4(-1.5) + 4(3) = 6 \checkmark$$

$$2x + 5y = 12 \quad 2(-1.5) + 5(3) = 12 \checkmark$$

$$x = 3$$

$$4x + 4(3) = 6$$

$$4x + 12 = 6$$

$$4x = -6$$

$$x = -1.5$$

$$4x + 9y = 1 \quad 4(-2) + 9(1) = 1 \checkmark$$

$$-1(4x + 6y = -2) \quad 4(-2) + 6(1) = -2 \checkmark$$

$$+ \begin{array}{r} 4x + 9y = 1 \\ -4x - 6y = 2 \end{array}$$

$$3y = 3$$

$$x = 1$$

$$4x + 9(1) = 1$$

$$4x + 9 = 1 \quad 4x = -8$$

$$x = -2$$

Multiply Both Equations:

$$2x + 2y = 6$$

$3x + 5y = 12$ Choose which variable you want to eliminate. I will get rid of x.

$$\begin{array}{l} 3(2x + 2y = 6) \\ -2(3x + 5y = 12) \end{array} \Rightarrow \begin{array}{l} 6x + 6y = 18 \\ -6x - 10y = -24 \\ \hline -4y = -6 \\ \frac{-4}{-4} \Big/ \frac{-6}{-4} = \frac{-6}{-4} \\ y = \frac{3}{2} = 1\frac{1}{2} \end{array}$$

$2x + 2\left(\frac{3}{2}\right) = 6$
 $2x + 3 = 6$
 $2x = 3$
 $x = \frac{3}{2} = 1\frac{1}{2}$

$$2x + 2y = 6$$

$$3x + 5y = 12$$

$$2(1.5) + 2(1.5) = 6 \checkmark$$

$$3(1.5) + 5(1.5) = 12$$

$$4.5 + 7.5 = 12 \checkmark$$

Solve $\begin{cases} y = 3x - 2 \\ 15x - 5y = 10 \end{cases}$

$$15x - 5(3x - 2) = 10$$

$$15x - 15x + 10 = 10$$

$$0 = 0$$

infinite

Unique solutions

Solves to $x = x$

$$2x - y = 3$$

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

dependent system (same exact
infinite solutions line)

Solves to an answer that
is untrue:

$$2x - 3y = 18$$

$$-2x + 3y = -6$$

$$\hline 0 + 0 = 12 \quad (0 = 12)$$

no solution
inconsistent system (parallel lines)

$$\textcircled{a} \begin{aligned} -3x + 5y &= -7 \\ 6x - 10y &= -14 \end{aligned}$$

$$\textcircled{b} \begin{aligned} -2x + 4y &= 6 \\ -3x + 6y &= 8 \end{aligned}$$

$$\textcircled{a} \begin{aligned} -3x + 5y &= -7 \\ 6x - 10y &= -14 \end{aligned}$$

$$2(-3x + 5y = -7)$$

$$\begin{aligned} -6x + 10y &= -14 \\ + 6x - 10y &= -14 \end{aligned}$$

$$\textcircled{0 = -28} \quad \text{no solutions}$$

$$\textcircled{b} \begin{aligned} -2x + 4y &= 6 \\ -3x + 6y &= 8 \end{aligned}$$

$$\begin{aligned} -6x + 12y &= 18 \\ 6x - 12y &= -16 \\ \hline 0 &= 2 \end{aligned}$$

$$-3(-2x + 4y = 6)$$

$$2(-3x + 6y = 8)$$

$$\begin{aligned} 6x - 12y &= -18 \\ -6x + 12y &= 16 \\ \hline 0 + 0 &= -2 \end{aligned}$$

$0 = -2$
no solutions

