SOLVING SYSTEMS OF LINEAR EQUATIONS BY
Graphing, Substitution, and Elimination

There are different ways to solve a system of linear equations, including graphing, substitution, and elimination. Let's review each method to solve the system of equations to the right.

$$x + 2y = 4$$
$$3x = 5 + y$$

GRAPHING

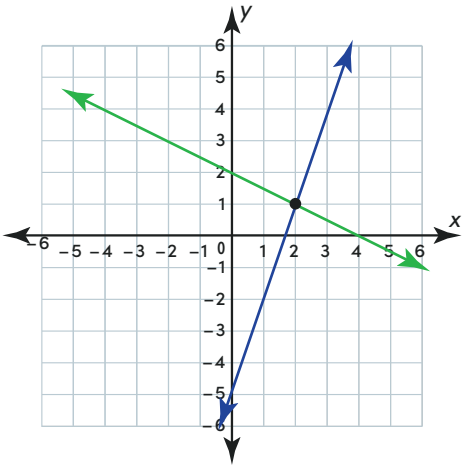
Graph each line and find where the lines intersect.

First, write each equation in slope-intercept form.

$$x + 2y = 4$$
$$2y = -x + 4$$
$$y = -\frac{1}{2}x + 2$$

$$3x = 5 + y$$
$$y = 3x - 5$$

Then, graph both equations on the same coordinate plane and find the point where the lines intersect.



The solution is the point of intersection: (2, 1)

SUBSTITUTION

Solve either equation for one of the variables.

Solve the first equation for x.

$$x + 2y = 4$$
$$x + 2y - 2y = 4 - 2y$$
$$x = 4 - 2y$$

Since $x = 4 - 2y$, substitute $4 - 2y$ for x in the second equation. Then, solve for y.

$$3x = 5 + y$$
$$3(4 - 2y) = 5 + y$$
$$12 - 6y = 5 + y$$
$$12 - 6y + 6y = 5 + y + 6y$$
$$12 = 5 + 7y$$
$$12 - 5 = 5 + 7y - 5$$
$$7 = 7y$$
$$1 = y$$

Substitute $y = 1$ into either equation and solve for x.

$$x + 2y = 4$$
$$x + 2(1) = 4$$
$$x + 2 = 4$$
$$x + 2 - 2 = 4 - 2$$
$$x = 2$$

Since $x = 2$ and $y = 1$, the solution is (2, 1).

ELIMINATION

Set up your equations so you can add or subtract them to eliminate a variable term.

Start by moving the y term in the second equation to the other side of the equal sign.

$$3x - y = 5 + y - y$$
$$3x - y = 5$$

To get opposite coefficients for y, multiply each side of the second equation by 2.

$$x + 2y = 4$$
$$2(3x - y = 5)$$

$$x + 2y = 4$$
$$6x - 2y = 10$$

Add the equations together to eliminate the y term. Then solve for x.

$$x + 2y = 4$$
$$+\ 6x - 2y = 10$$
$$7x + 0y = 14$$
$$7x = 14$$
$$x = 2$$

Plug $x = 2$ back into either equation and solve for y.

$$x + 2y = 4$$
$$2 + 2y = 4$$
$$2 + 2y - 2 = 4 - 2$$
$$2y = 2$$
$$y = 1$$

Since $x = 2$ and $y = 1$, the solution is (2, 1).