

Essential knowledge

- Determine whether (x,y) is a solution
- Solve by substituting a known variable, an expression, graphically, by subtracting/ adding equations, by adjusting equations.

Key Vocabulary

- Substitute:** replace a variable with a numerical value
- LCM:** lowest common multiple (the first time the times table of two or more numbers match)
- Eliminate:** to remove
- Expression:** a maths sentence with a minimum of two numbers and at least one math operation (no equals sign)
- Coordinate:** a set of values that show an exact position.
- Intersection:** the point two lines cross or meet.

Prior learning links

- Understand & use algebraic notation (Y7)
- Brackets, equations & inequalities (Y8)
- Straight line graphs (Y9)
- Forming & solving equations (Y9)

Substituting known variables

Bob knows the point $x = 4$ lies on the line $3x + y = 14$. Find the value for y .

$$3x + y = 14 \quad 3(4) + y = 14$$

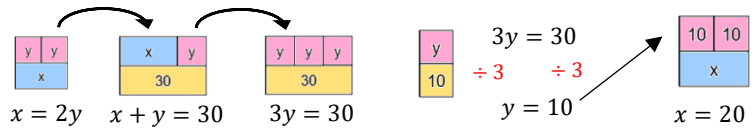
$$\begin{array}{r} 12 + y = 14 \\ -12 \quad -12 \\ \hline y = 2 \end{array}$$

Substituting in an expression

$$\begin{array}{l} x = 2y \\ x + y = 30 \end{array}$$

Pair of simultaneous equations

Substitute $2y$ in place of the x variable as they represent the same value



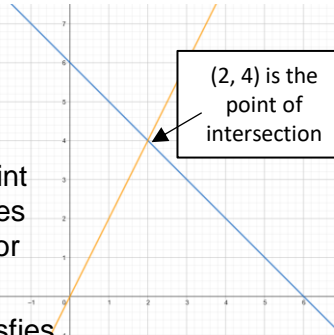
Solve graphically

$$\begin{array}{l} x + y = 6 \\ y = 2x \end{array}$$

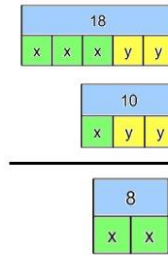
Linear equations are straight lines. The point of intersection provides the x and y solution for both equations.

The solution that satisfies both equations is

$$x = 2 \text{ and } y = 4$$



Solve by subtraction



$$\begin{array}{l} x = 4 \\ y = 3 \end{array}$$

$$\begin{array}{r} 3x + 2y = 18 \\ - (x + 2y = 10) \\ \hline 2x = 8 \\ \div 2 \quad \div 2 \\ \hline x = 4 \end{array}$$

$$\begin{array}{r} x + 2y = 10 \\ (4) + 2y = 10 \\ -4 \quad -4 \\ \hline 2y = 6 \\ \div 2 \quad \div 2 \\ \hline y = 3 \end{array}$$

Is (x, y) a solution?

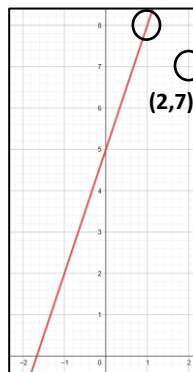
Does the coordinate (1,8) lie on the line $y = 3x + 5$?

$$\begin{array}{l} y = 3x + 5 \\ 8 = 3(1) + 5 \end{array}$$

As the substitution makes the equation correct the coordinate (1,8) **IS** on the line $y=3x+5$

Is (2,7) on the same line?

$$7 \neq 3(2) + 5 \quad \text{No } 7 \text{ does NOT equal } 6+5$$

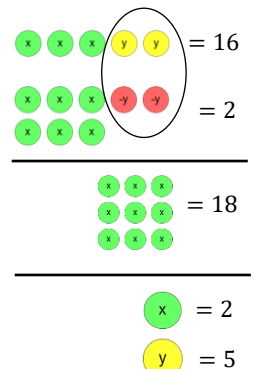


Solve by addition

$$\begin{array}{r} 3x + 2y = 16 \\ + (6x - 2y = 2) \\ \hline 9x = 18 \\ \div 9 \quad \div 9 \\ \hline x = 2 \end{array}$$

$$\begin{array}{r} 3x + 2y = 16 \\ 3(2) + 2(y) = 16 \\ 6 + 2y = 16 \\ -6 \quad -6 \\ \hline 2y = 10 \\ \div 2 \quad \div 2 \\ \hline y = 5 \end{array}$$

Addition makes zero pairs



Prior learning links

1. The equation $9x = 27$ has an answer of $x=3$. Write down five different equations with an answer of $x = 3$.
2. Ronald is x years old.
His friend Colin is 3 years older than than Ronald.
Colin is 19 years old.
 - a) Write down an equation for this information.
 - b) Solve your equation to find how old Ronald is.

Key Vocabulary

Use cover, look, write, check to write the definitions ...

Solution:

Substitute:

LCM:

Eliminate:

Expression:

Coordinate:

Intersection:

Substituting known variables

Bob knows the point $x = 4$ lies on that line. Find the value for y .

$$3x + y = 14 \qquad 3(4) + y = 14$$

$$\begin{array}{r} 12 + y = 14 \\ -12 \quad -12 \\ \hline y = 2 \end{array}$$

Substituting in an expression

- (1) $y = 2x$
- (2) $x + y = 6$
- } Pair of simultaneous equations

STEP 1

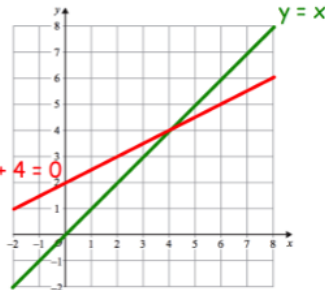
Equation (1) tells you that $y=2x$, so **substitute** this value of y into the second equation, i.e. replace y with $2x$ in $x + y = 6$.

STEP 2

Once you have found x in step 1, insert this value into $y = 2x$ to find the value of y .

Solve graphically

- a) Write down the coordinates of the point where the graphs of $y = x$ and $x - 2y + 4 = 0$ intersect.



- b) Use your answer to solve the simultaneous equations $y = x$ and $x - 2y + 4 = 0$

Solve by subtraction

Solve the following simultaneous equations by subtraction.

$$\begin{array}{r} 6x + y = 18 \\ 4x + y = 14 \end{array} \qquad \begin{array}{r} 8x + 7y = 39 \\ 8x + 2y = 34 \end{array}$$

$$\begin{array}{r} 4x + 2y = 10 \\ x + 2y = 7 \end{array} \qquad \begin{array}{r} 3x - 6y = 6 \\ 2x - 6y = 3 \end{array}$$

Is (x, y) a solution?

1. Is the point (3, 5) on the graph of $y = x + 2$?
2. Is the point (4, 2) on the graph of $y = x - 2$?
3. Is the point (6, 3) on the graph of $y = x + 3$?
4. Which of the following lines does the point (3, 6) lie on? (There may be more than one).

$$y = x + 2 \quad y = x + 3 \quad y = 2x \quad y = 3x$$

$$y = x + 5 \quad y = 4x - 6$$

5. Write down two functions whose graphs will pass through the point (2, 8).

Solve by addition

Solve the following simultaneous equations by addition.

$$\begin{array}{r} 9x - 4y = 19 \\ 4x + 4y = 20 \end{array} \qquad \begin{array}{r} 3x + 2y = 23 \\ 2x - 2y = 6 \end{array}$$

$$\begin{array}{r} 3x + 2y = 54 \\ 2x - 2y = 16 \end{array} \qquad \begin{array}{r} 3x - 3y = 9 \\ 2x + y = 12 \end{array}$$