Substitutions

What do you need to know?

Equations often use pictures or letters in place of numbers within calculations.

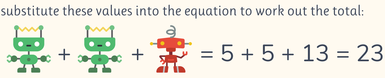
Substitution means replacing one thing with another. We can substitute numbers with pictures, with symbols or with letters! If a football player is injured during a match, they can be **substituted** for another player from the same team.

Pictorial equations are equations use **pictures** or **symbols** instead of numbers.

Take a look at the following pictorial equation:

If we give a value to what the different robots represent:

We can substitute these values into the equation to work out the total:



Algebraic equations use **letters** instead of numbers.

Here we have an equation containing one letter: **y**.

$$11y - 9$$

If we give a value to what **y** represents:

$$y = 7$$

we can substitute in the equation with that value.

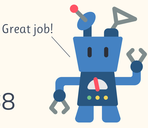
$$11y - 9 = 11 \times y - 9$$

$$11 \times 7 - 9$$

Therefore, the answer to our algebraic equation is:

$$\underbrace{11 \times 7}_{77} - 9 = 68$$

Remember!
When there is a number **next to** a letter, we need to **multiply** the two values together.



Watch out!

Make sure you use **BIDMAS** when working out the values of equations. You must always multiply or divide before adding or subtraction, unless there are brackets!

$11 \times 7 - 9 = 68$ ✓ $\overbrace{11 \times 7}^{77} - 9 = 68$ ✗ $\overbrace{11 \times 7 - 9}^{-2} = -22$

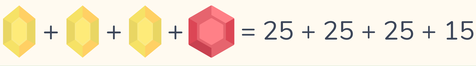
Example 1

Mia is playing a game with her friends. She has collected the following tokens:

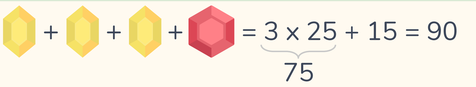
Each token is worth a different amount of points, so every symbol has a different **value.**

What is the total value of Mia's tokens?

To work this out, we need to **substitute** each of the tokens with their value in numbers.



We could also write this as:



$$\underbrace{3 \times 25}_{75} + 15 = 90$$

The total value of Mia's tokens is **90 points.** I wonder if she can costumise her avatar with those points!

Example 2

In my town there is a stall sells candy floss.
To work out how much money she will make in one day, the owner has written the equation below. **p** is the number of portions of candy floss that she sells in one day.

$$3p - 130 = ?$$

Today she sold 321 portions of candy floss. How much money did she make today?

To work out how much money she made on the stall, we need to substitute the **p** for the value **321**.
There is a 3 next to the **p**, so the equation is $3 \times p - 130$.

We can now substitute **321**:

$$3 \times 321 - 130 = ?$$

BIDMAS tells us that we need to multiply first:

$$321 \times 3 = 963$$

$$\begin{array}{r} 321 \\ \times \quad 3 \\ \hline 963 \end{array}$$

We can then subtract 130:

$$963 - 130 = 833$$

$$\begin{array}{r} 963 \\ -130 \\ \hline 833 \end{array}$$

Therefore, if p = 321 then 3p-130 = 833. So the owner of the stall has made £833 today!
Oh! there's a stick of candy floss left.... delicious!

Did you know?

The same algebraic equation can have different values. If the owner of the stal had only sold 50 portions of candy floss, she would use the same formula but the total would be just £20.

$$3 \times 50 - 130 = ?$$

$$150 - 130 = 20$$

Remember!

- To **substitute**, you replace the pictures or letters in an equation with a number.
- The **value** of a letter or picture can be a whole number, a negative number, or even a fraction.
- If there is a number **next to** a letter, you need to **multiply** the value of the letter by that number.
- Remember **BIDMAS** when working out the answer to an equation.