

Algebra! What's the point?!

Algebra is a branch of mathematics that substitutes letters for numbers, and an algebraic equation represents a scale where what is done on one side of the scale is also done to the other side. We use algebraic skills in all sorts of situations, calculating time to carry out a task, profit, how much to budget for food etc.

Did you know?

The **algebra** originated from the Arabic word "al-jabr." Its history began in ancient Egypt and Babylon. The Persian mathematician Muhammed ibn Musa Al-Khwarizmi is credited as one of the forefathers of algebra.

Without a fundamental understanding of algebra, it can be argued that it is impossible to deal with geometry, statistics, and many other areas of mathematics.

Algebra originally referred to a surgical procedure, and still is used in that sense in Spanish, while the mathematical meaning was a later development.

"if $b=4$ then $3b$ is 34" This would be incorrect because...

In algebra we use letter and symbols to represent unknown quantities. We sometimes use the letter x this can be easily mistaken for the multiplication symbol. Therefore if we want to write $3 \times b$ we write $3b$. In the example above if we now say that $b=4$ then $3b = 3 \times 4 = 12$.

We could also write $3b = b + b + b$ If we think about this as b is a bag containing an unknown number of marbles.
If I have 3 bags then I have $b + b + b$ marbles



KS3 Spine ALGEBRA

"Change the side change the sign"

When we are solving equations we are trying to find the value of the **unknown** quantity.

If we think about $x + 12 = 23$ then we can think about this as "something plus 12 equals 23" in order to calculate the "something" we need to do the calculation $23 - 12$. We haven't *changed the sign* we have **undone** or reversed the operation.

$15 = 2x + 3$ means "a number is multiplied by 2 then we add 3, the result of this is 15" to undo or reverse this we first subtract 3 from both sides- **WE NEED TO KEEP IT BALANCED**.

Giving $12 = 2x$
then we need to divide both sides by 2.
 $6 = x$

"Use FOIL for expanding brackets"

At some point during secondary school you will be asked to expand brackets. One method used is FOIL, this stands for **First Outside Inside Last (FOIL)**. But ask WHY does this work? We could just as easily use OLIF or FOLI etc. Let's look at a number version to help see what we are doing.

$$23 \times 45$$

We can split this up into
 $(20 + 3) \times (40 + 5)$

Now let's look at it on a grid

x	20	3
40	800	120
5	100	15

So we have calculated

$$20 \times 40$$

$$20 \times 5$$

$$40 \times 3$$

$$3 \times 5$$

Does it matter if we had done these calculations in a different order? Try them see if you get the same answer

Basic Rules

$$bc = cb = b \times c$$

$$5h = 5 \times h$$

$$d \times d = d^2$$

$$f \times f \times f = f^3$$

$$a(b + c) = ab + ac$$

$$g + g + g + g = 4g$$

Test Me!

Each question matches the checklist of the basic skills
Find possible values for the missing number, there is more than one solution.

1. $\square + 5 = 12 - \square$

2. $\square + 8 = 15 - \square$

3. Find the next three terms in the sequence and describe the rule.

5, 8, 11, 14, 17.....

4. Draw the next pattern in the sequence. Explain what is happening.



5. I am thinking of a number, I add 4 to it then divide by 2. My answer is 7. What was my starting number? Can you show this using algebra?

6. The formula for calculating the cost of a taxi is £1.20 per mile plus a £2.00 fixed charge. How much will it cost to travel;

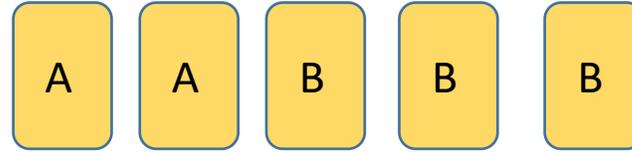
- 4 miles
- 22 miles
- Write the a formula to calculate the cost for any number of miles.

7. If $p = 5$, $f = 7$ and $g = 2$ find

- $p + f$
- pf
- $pf + g$

Challenge

1. You have five number cards turned over. The total of the cards is 20. What could the number be?

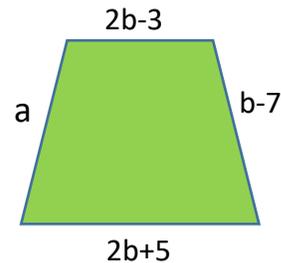


2. On a grid with axis -5 to 5 in both the x and y direction, plot all the pairs of whole numbers that add to 8. What do you notice?

3. The first 4 terms of a sequence are 6 10 14 18.

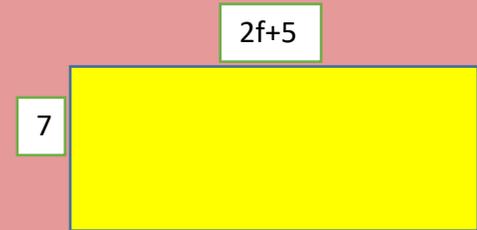
- Find the next three terms in the sequence
- Josh says that 214 is in the sequence. Is he correct? Explain your answer.

4. Write an expression for the perimeter of the shape.



Extend

Each question looks similar **BUT** you will have to do a different calculation using the skills you have. When you are answering the questions try and think or write down what is the **same** what is **different** about each question.



- Write an expression for the perimeter of the shape.
- If $f = 4$ what is the perimeter?
- Find an expression for the area of the shape.
- If the triangle and the rectangle have the same perimeter. Find the value of f .

