How much do I know?

1. Algebra

A formula for the cost of repairing a washing machine is **C** = 18**n** + 35, where **C** is the cost in £ and **n** is the number of hours spent.

1. How much would a repair that took 3 hours cost?
2. How much would it cost if it took half an hour to repair?
3. If the repair cost £80, how long did it take?

Answers:

1. £89
2. £44
3. 2 ½ hours

**What is this topic?**

Algebra is just a form of mathematical shorthand, so formulae are just a shorthand version of a connection between two or more ‘things’ (more properly called variables). In this case the variables are the number of hours **n** and the cost **C**. We can translate this into real life terms as £18 per hour plus a standing charge of £35.

To interpret the formula **C** = 18**n** +35, we need to remember that 18**n** means 18 x **n**. We don’t use multiplication signs in algebra as they can be confused with the letter **x**. (Neither do we use division signs; we use fraction notation. For example, **x** divided by **z** would be written $\frac{x}{z} .)$

So in this case, for part (a), we do 18 x 3 = 54, then add the 35 to give the answer £89. Similarly for part (b), we do 18 x ½ = 9, then add the 35 to give £44.

For part (c), we have to work backwards. Instead of multiplying by 18 and then adding 35, we have to subtract 35 and then divide by 18. So we do 80 – 35 = 45, then 45 $÷$ 18 = 2 ½.

**More examples**

We know that the area of a rectangle is found by multiplying the length by the width. If we use the letters **a** for area, **l** for length and **w** for width, that whole sentence can be written as:

**a** = **l** x **w** (or, more properly, **a = lw**)

We could also write the relationship between perimeter (**p**), length and width as:

**p** = 2**l** + 2**w**, or **p** = 2(**l** + **w**)

So if we are told that **l** = 10 and **w** = 6, using these two formulae we can work out that **a** = 60 and **p** = 32. We don’t put units in formulae, although you might need to put them in the answer.

The above examples are based on real life relationships, but a formula could be completely abstract – in which case you don’t know what the letters stand for, and it doesn’t matter. Just think of the letters as boxes into which you can put any number. For example, you could be given the formula:

**a** = 2**b** + 7**c**

and asked to work out the value of **a** when **b** = 5 and **c** = 3 [31].

**Notes**

* The word formula comes from the Latin; hence the plural is formulae instead of formulas. But I would always use ‘formulas’ with children.
* Variables are usually denoted by lower case letters in algebra, although there are exceptions (see Question 1). In print they are shown as bold, but you can’t do this in written work.

**Questions**

1. An approximation method of converting from degrees Celsius to degrees Fahrenheit is given by this rule:

**Multiply by 2 and add 30**

 Using **C** to stand for degrees Celsius and **F** to stand for degrees Fahrenheit, complete this formula:

 **F** = …..

 Use your formula to work out: (a) **F** when **C** = 30

 (b) **C** when **F** = 62

2. Here are some picture frame sizes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Height in cm | 10 | 12 | 14 | 16 |
| Length in cm | 16 | 20 | 24 | 28 |

 For each frame, the length is **twice** the height, **subtract** 4.

1. What is the length of a frame that has a height of 36cm?

For each frame, the length (**l**) is **twice** the height **(h**), **subtract** 4.

1. Write this in symbols **l** = …..
2. A new frame has its length **twice** its height. It is made with 126cm of wood. What is the length of this frame?

**Answers**

1. **F** = 2**C** +30

 (a) When **C** = 30, **F** = (2 x 30) + 30, = 60 + 30, = 90.

(b) When **F** = 62, 62 = 2**C** + 30. Working backwards, 2**C** = 62 – 30, **2C** = 32, so **C** = 16.

2. (a) If the height is 36cm, then the length is twice this (72cm) subtract

 4 to give 68cm.

 (b) **l** = 2**h** – 4

 (c) Here the formula is **l** = 2**h**.

 So the perimeter is 2**l** + 2**h**.

 Substituting in **l** for 2**h** gives perimeter = 3**l.**

 We know the perimeter is 126cm, so 3**l** = 126, so **l** = 42.

**Do you need more information?**

Refer to **Mathematics Explained for primary teachers** by Derek Haylock, Chapter 20, pages 248 – 263.