You are probably much better at these than you previously thought.

For example, if you were told “I took 10 hours excluding stops, to drive Melbourne to Canberra, and it is 663 km driving distance, should I replace the car?” You would likely say “Yes!” because you have already worked out that the car only averaged 66.3 km per hour, which is very slow over a good road like the Hume Highway.

Communication by voice, in writing, using visuals and by ‘being present’ are aspects of successful working in all walks of life, whether in Business, government, health sector, Arts, Services or Community.

Sometimes problems set by clients or supervisors need clear interpretation and analysis before they can successfully be solved. With this in mind, to prevent misunderstandings and be confident in dealing with the language of mathematics, particularly algebra, you are recommended to

* Read and work through the next few pages of this guide


* Watch these highly-recommended videos:
  http://patrickjmt.com/averages-and-word-problems-basic-example/
There are two steps to solving math word problems:

1. Translate the wording into a numeric equation that combines smaller "expressions"

   For example:
   The sum of two consecutive integers is 15. Find the numbers.
   
   • “sum” = +
   • The first integer = \( n \)
   • The second integer = \( n + 1 \)
   • The sum = 15

   Therefore, the relevant equation is:
   \[ n + (n + 1) = 15 \]

2. Solve the equation and apply the findings to uncover the answer.

   • \( n + (n + 1) = 15 \) (lose the brackets and sum the commons)
   • \( 2n + 1 = 15 \) (subtract 1 from both sides)
   • \( 2n = 14 \) (divide both sides by 2)
   • \( n = 7 \)

   So, the first number (\( n \)) is 7 and the second (\( n + 1 \)) is 8
   Check: \( 7 + 8 = 15 \) correct

Suggestions:

- Read the problem entirely; get a feel for the whole problem.

  “Suppose one painter can paint the entire house in twelve hours, and the second painter takes eight hours. How long would it take the two painters together to paint the house?”

  The painters paint at different rates but we need a “constant” of some sort to solve this problem, so the idea would be to find out how much each can paint in the same time (1 hour) and then use this figure to calculate the answer.

- List information and the variables you identify
  o Painter one
    o Time taken by painter one = 12 hours
  o Painter two
    o Time taken by painter two = 8 hours

- Define what answer you need, as well as its units of measure.
  I need to find the number of \textbf{hours} it would take to paint a house if both painters worked together.

- Work in an organized manner. Working clearly will help you think clearly.
  o Draw and label all graphs and pictures clearly
  o Note or explain each step of your process; this will help you track variables and remember their meanings

- Look for the "key" words
  Certain words indicate certain mathematical operations. In this case the word \textit{together} indicates that addition (+) will need to be used at some stage.
MATHS WORD PROBLEMS

Let’s solve the problem:

If painter one can paint a house in 12 hours then in one hour painter one can paint $\frac{1}{12}$ of a house. If painter two can paint a house in 8 hours then in one hour painter two can paint $\frac{1}{8}$ of a house. If they are working together then they can paint $\frac{1}{12}$ of a house and $\frac{1}{8}$ of a house ($x$):

$$\frac{1}{12} + \frac{1}{8} = x,$$

Now let’s find a common denominator for these two fractions and solve for $x$.

$$\frac{2}{24} + \frac{3}{24} = \frac{5}{24}$$

So, in one hour the two painters together can complete 5 of the 24 sections of the house. How many hours will it take to complete all 24 sections?

$$\frac{24}{5} = 4 \text{ and } 4/5 \text{ OR } 4.8 \text{ hours}$$

A house painted in just less than 5 hours, now that’s working hard!

MATH EXPRESSIONS AND ASSOCIATED KEY WORDS:

**Addition (+)**

Key words for addition:
- increased by;
- more than;
- combined together;
- total of;
- sum;
- added to

The key words in use:

What is the sum of 8 and y?  
$$8 + y$$

Express the number (x) of apples increased by two.  
$$x + 2$$

Express the total weight of Fred the dog (x) and Cyrus the cat (y).  
$$x + y$$

**Subtraction (-)**

Key words for subtraction:
- less than,
- fewer than,
- reduced by,
- decreased by,
- difference of

The key words in use:

What is four less than y?  
$$y - 4$$

What is nine less than a number (x)?  
$$x - 9$$

What if the number (x) of pizzas was reduced by 6?  
$$x - 6$$

What is the difference of my weight (x) and your weight (y)  
$$x - y$$
MATHS WORD PROBLEMS

Multiplication (X or * or integers and/or pronumerals next to each other e.g. 5y, 7*x, xy)

Key words for multiplication:
- of,
- times,
- multiplied by

The key words in use:
What is y multiplied by 13          13y or 13*y or 13
Three runners averaged "y" minutes; express their total running time. 3y
I drive my car at 55 miles per hour. How far will I go in "x" hours? 55x

Division (/ or ÷)

Key words for division:
- per,
- a,
- out of,
- ratio of,
- quotient of,
- percent (divide by 100)

The key words in use:
What is the quotient of y and 3? y/3 or y ÷ 3
Three students rent an apartment for $"x"/month. What will each have to pay? x/3
"y" items cost a total of $25.00; express their average cost. 25/y

More Vocabulary and Key Words

- "Per" means "divided by"
as in "I drove 100 kilometres on seven and a half litres of petrol, so I got seven and a half litres per hundred kilometres." (Also 7.5l/100km)

- "a" sometimes means "divided by"
as in "When I filled up, I paid $14.90 for ten litres of petrol, so the petrol was $1.49 a litre, or $1.49/litre

- "less than"
If you need to translate "1.5 less than x", the temptation is to write "1.5 - x". DON'T! Put a "real world" situation in, and you'll see how this is wrong: "He makes $1.50 an hour less than me." You do NOT figure his wage by subtracting your wage from $1.50. Instead, you subtract $1.50 from your wage

- "quotient/ratio of" constructions
If a problems says "the ratio of x and y", it means "x divided by y" or x/y or x ÷ y

- "difference between/of" constructions
If the problem says "the difference of x and y", it means "x - y"

http://www.latrobe.edu.au/students/learning ©Student Learning, La Trobe University, January 2016
What if the number \((x)\) of children was reduced by six, and then they had to share twenty dollars? How much would each get? \(\frac{20}{(x-6)}\)

What is 9 more than \(y\)? \(y + 9\)

What is the ratio of 9 more than \(y\) to \(y\)? \(\frac{(y + 9)}{y}\)

What is nine less than the total of a number \((y)\) and two? \((y + 2) - 9\)

The length of a football field is 30 metres more than its width "\(y\)"; express the length of the field in terms of its width \(y\). \(y + 30\)