Substitution of values into a formula and constructing a table of values

Year 11 General Maths
Units 1 and 2

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Unit 1 and 2 General Mathematics course.

- Recap how to use substitution to solve for an unknown in an equation
- Understand the difference between an expression and an equation
- Know how to use a formula to construct a table of values:
    - By hand
    - Using a CAS

Recap

This is the first in a new chapter of work for the General Mathematics course. Whilst the chapter is new, the content is as old as time. You've been doing what I'm about to cover since Year 7.

The new work might include constructing a table of value. This will build on the algebra you have completed in previous years.

Substitution

I always come back to the same idea that substitution is when you take something off the (field) and put something in its place. Most people like sport.

Mathematics and equations are like the playing field. You take the letters off and you put numbers in their place.

The rest of it is all down to **BIDMAS**

Note: I'm not a sports lover at all.

BIDMAS

It's not **BODMAS**! Who ever heard of anything so silly!!

Brackets
Indices (floaty numbers)
Division
Multiplication
Addition
Subtraction

x^2

Expressions and equations

There is a difference between an expression and an equation.

Equations have an equals sign in them, expressions do not!

They can both have values substituted into them but the language changes.

Expressions are **evaluated** (for some stupid reason) and equations are **solved**

$2x + 7$

$x - 4$

$x^2 - 2x + 13$

$2x + 7 = 4$

$x - 4 = 6$

Examples of substituting

The cost of hiring a windsurfer is given by the rule:

$C = 40t + 10$

where C is the cost in dollars and t is the time in hours. How much will it cost to hire a windsurfer for 2 hours?

The most important part here is making sure you know what the letters stand for and the context of the problem.

Brackets
Indices
Division
Multiplication
Addition
Subtraction

F $C = 40t + 10$

S $C = 40 \times t + 10$

S $C = 40 \times 2 + 10$

S $C = 80 + 10$

S $C = \$90$

Examples of substituting

The cost of hiring a bobcat is:

$$C = 330 + 80t$$

where C is the cost, in dollars, and t is the time, in hours. How much will it cost to hire a bobcat for 10 hours?

Brackets
Indices
Division
Multiplication
Addition
Subtraction

$C = 330 + 80 \times t$

$C = 330 + 80 \times 10$

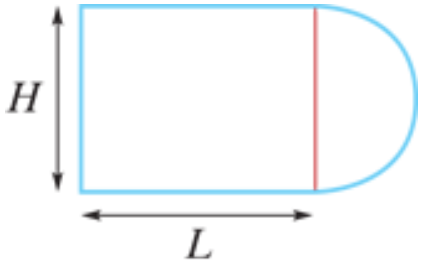
$C = 330 + 800$

$C = \$1130$

Examples of substituting

The perimeter of the shape shown can be given by the formula:

$$P = 2L + H\left(1 + \frac{\pi}{2}\right)$$



In this formula, L is the length of the rectangle and H is the height. Find the perimeter correct to one decimal place, if L=16.1 cm and H=3.2 cm.

Note: the symbol π is a number and can be found on your CAS.

Brackets
Indices
Division
Multiplication
Addition
Subtraction

$$P = 2 \times 16.1 + 3.2\left(1 + \frac{\pi}{2}\right)$$

$$P = 40.4 \text{ cm}$$

Substituting more than one value

It's perfectly possible to enter lots of values into the same formula and get lots of values out.

When we do this, we need some way to keep the data in some sort of order. Hence, we use a table of values. These tables show the values we are putting into an equation and the values we are getting out.

May times we like to think of numbers going into the equation as the **input** and the values coming out of the equation as the **output.**

$$C = 40t + 10$$

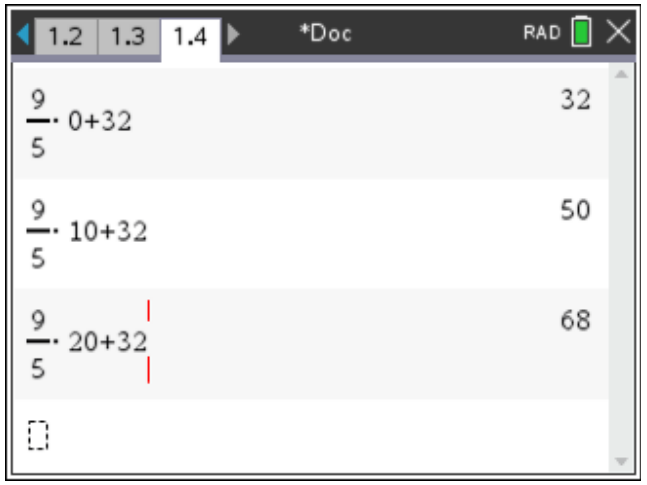
The letter *t* can take all sorts of values!

Example

The formula for converting degrees Celsius to degrees Fahrenheit is given by:

$$F = \frac{9}{5}C + 32$$

Use this formula to construct a table of values for F using values of C in intervals of 10 between C=0 and C=100.



C	0	10	20	30	40	50	60	...	100
F	32	50	68	.	.	.	.	.	.

Example

The formula for converting degrees Celsius to degrees Fahrenheit is given by:

$$F = \frac{9}{5}C + 32$$

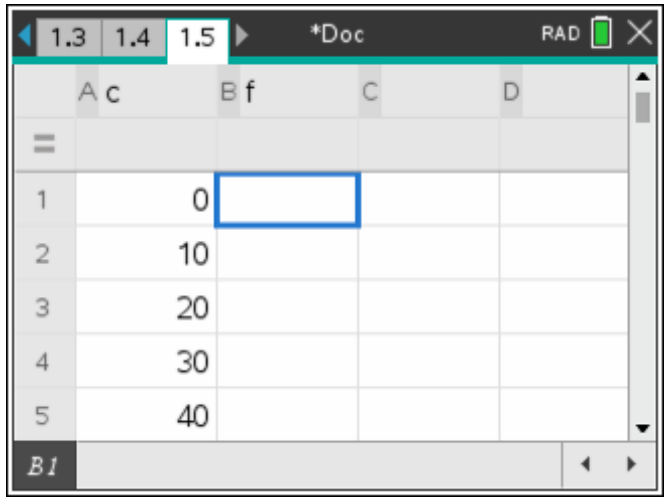
Use this formula to construct a table of values for F using values of C in intervals of 10 between C=0 and C=100.

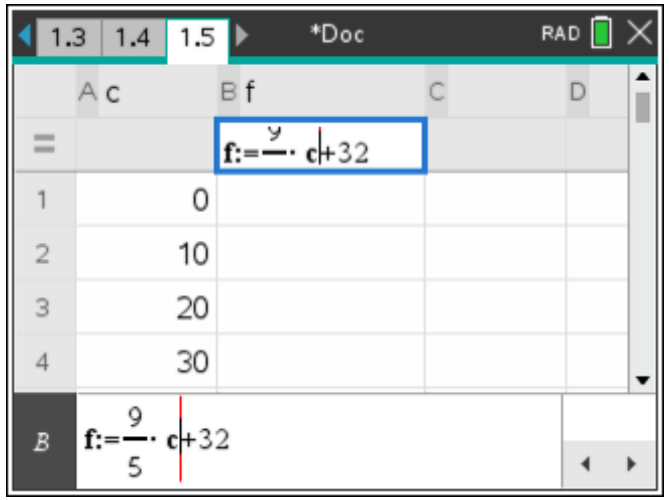
C	0	10	20	30	40	50	60	70	80	90	100
F	32	50	68	86	104	122	140	158	176	194	212

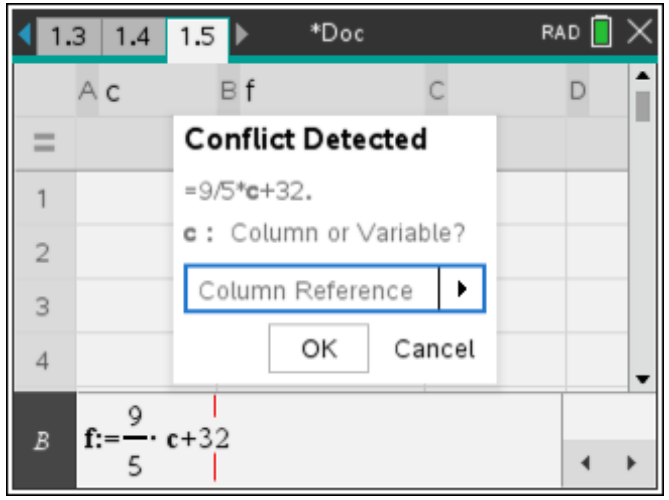
Using the CAS

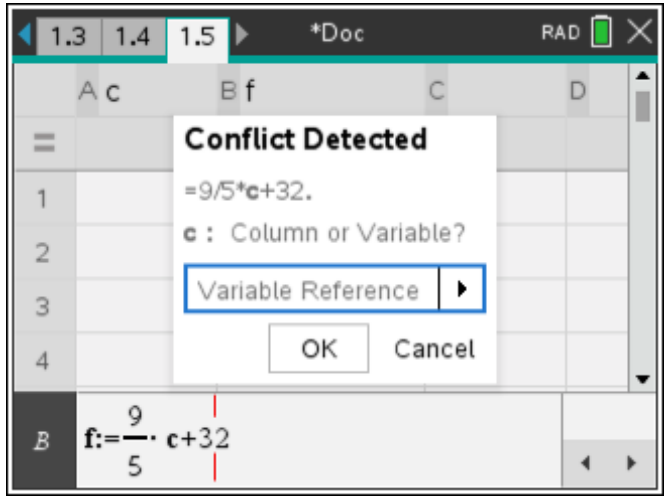
Using the CAS makes things a lot simpler using our **Lists and Spreadsheet** function!

$F = \frac{9}{5}C + 32$





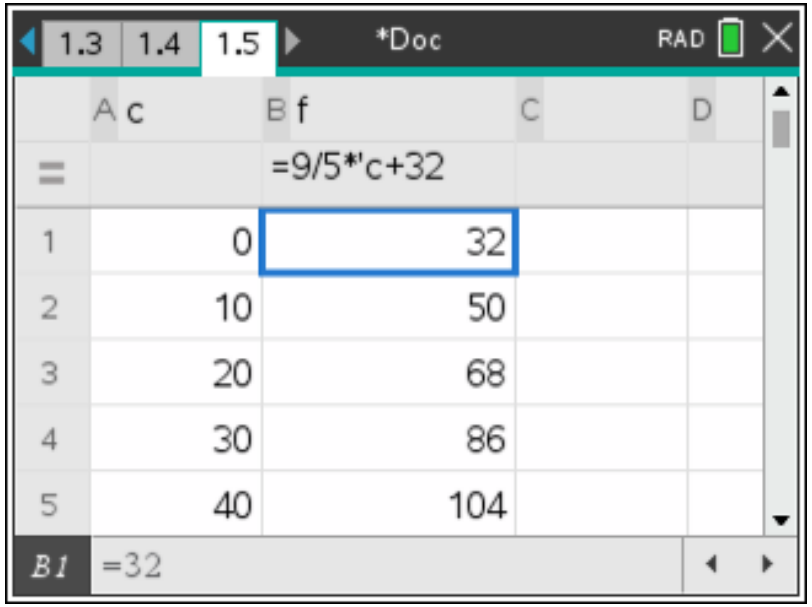




Using the CAS

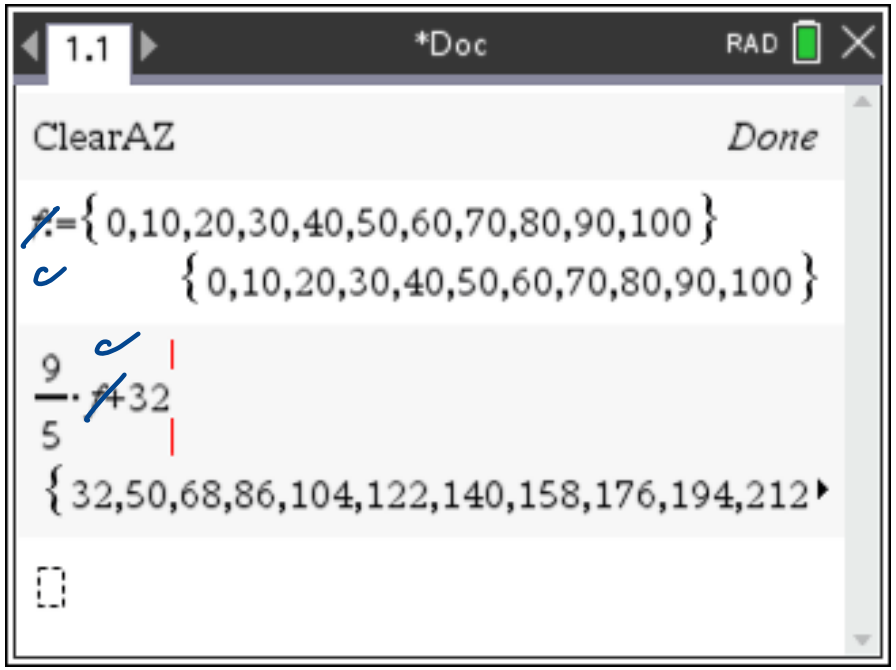
Using the CAS makes things a lot simpler using our **Lists and Spreadsheet** function!

And here is the completed table



Another way to use the CAS

Don’t worry if you don’t understand this as it’s not on the course … but I wanted to show you another way of doing it:



Work to complete

The work I am asking to be completed for this topic is shown below.

This is the minimum work which should be completed. The more questions which are answered the better your chance of success in exams. Questions towards the end of the exercises and in the Chapter Review are the best practice you can do.

Questions to complete:
Exercise 5A: 1, 3, 4, 7, 8, 9, 11, 13, 15, 17, 18, 19