

Formulas are used in spreadsheets to perform calculations. A formula will usually refer to a value in another cell e.g. we may click on cell C1 and type:

$$= A1 * B1$$

Strangely, this formula is read by Excel as “multiply the value in the cell that is *two to the left*, by the value in the cell that is *one to the left*”. When we fill this formula down, the cells below will all follow suit and multiply the value in the cell *two to the left* by the value in cell *one to the left*. This is called ‘**relative referencing**’. The table shows the formulas that are created by filling down from cell C1.

	A	B	C
1	1	12	= A1 * B1
2	2	12	= A2 * B2
3	3	12	= A3 * B3
4	4	12	= A4 * B4

The above spreadsheet is effectively working out the 12 times table. The problem is, if we decide to change the design so that it calculates the 13 times table, we have to change cells B1, B2, B3 and B4. There is a quicker way.

It would be better if we could type the number 12 in cell B1 only. We want our formula in cell C1 to say “multiply the value in the cell *two to the left* by the value *in cell B1*”. We do this by placing a ‘\$’ sign before the parts of the formula that should stay the same when we fill down.

	A	B	C
1	1	12	= A1 * \$B\$1

Now when we fill down from cell C1, the formula will be copied to each cell, but the references after the \$ signs will not change.

	A	B	C
1	1	12	= A1 * \$B\$1
2	2		= A2 * \$B\$1
3	3		= A3 * \$B\$1
4	4		= A4 * \$B\$1

We can easily change our times table by altering only the value in cell B1. This is called ‘**absolute referencing**’.

Note. In this case, the reference B\$1 (rather than \$B\$1) would work, as we are always referring back from column C to column B.

Task 1 – Relative References

The data below shows the *Cost Price* and *Sell Price* for a few products sold in a toyshop. Tax is paid by the toyshop to the supplier and by the customer to the toyshop. We will use a tax rate of 10%.

- a. Open a new workbook in ‘Microsoft Excel’ and copy the data below:

	A	B	C	D	E	F
1	Item	Cost Price	Tax Paid	Sell Price	Tax Received	Tax Owning
2	Scooter	60		105		
3	Roller Blades	27		45		
4	Bike	99		180		
5	Ice Skates	45		85		

- b. Click on cell C2 and type the formula = **B2*0.1** (this will calculate 10% of the amount in B2).
- c. Fill down from cell C2 to cell C5. The formula should be copied to each cell.
- d. Repeat this process to calculate the tax received from the customer for each product (use 10% again).
- e. Calculate the tax owed to the government in cell F2, by subtracting the tax paid in cell C2 from the tax received in cell E2. Fill down the last two columns.
- f. Open the ‘Formulas’ tab and click on the ‘Show Formulas’ button. Excel will display the formula in each cell.
- g. Click the button again to hide the formulas.

Tax Paid	Sell Price	Tax Received	Tax owing
=B2*0.1	105	=D2*0.1	=E2-C2
=B3*0.1	45	=D3*0.1	=E3-C3
=B4*0.1	180	=D4*0.1	=E4-C4
=B5*0.1	85	=D5*0.1	=E5-C5

Task 2 – Changing Relative References

This spreadsheet created in Task 1 uses **relative referencing**. This is fine, unless the rate of tax changes.

- a. Change the spreadsheet so that it calculates the 'Tax Paid' and the 'Tax Received' at a rate of 20%.

Write down everything you had to do to make this change.

- b. Save the spreadsheet as "ES - References".

Task 3 – Creating and Changing Absolute References

We will now complete the same task using absolute referencing.

- a. Click on the 'Sheet 2' tab at the base of the page to move to a new blank worksheet. Copy the data below (you can copy and paste some of the data from your first sheet if you prefer).

	A	B	C	D	E	F
1	Tax Level	10%				
2						
3	Item	Cost Price	Tax Paid	Sell Price	Tax Received	Tax Owing
4	Scooter	60		105		
5	Roller Blades	27		45		
6	Bike	99		180		
7	Ice Skates	45		85		

- b. Click on cell C4 and type the formula = **B4*\$B\$1**.
- c. Fill down from cell C4 to cell C7. The formula should be copied to each cell, maintaining the absolute reference.
- d. Repeat this process to calculate the tax received from the customer for each product (range E4:E7).
- e. Calculate the tax owing as before. Either check your cells individually, or use the 'Show Formulas' button to check your formulas.

	A	B	C	D	E	F
1	Tax level	0.1				
2						
3	Item	Cost Price	Tax Paid	Sell Price	Tax Received	Tax owing
4	Scooter	60	=B4*\$B\$1	105	=D4*\$B\$1	=E4-C4
5	Roller blades	27	=B5*\$B\$1	45	=D5*\$B\$1	=E5-C5
6	Bike	99	=B6*\$B\$1	180	=D6*\$B\$1	=E6-C6
7	Ice skates	45	=B7*\$B\$1	85	=D7*\$B\$1	=E7-C7

- f. Change the tax level from 10% to 20%. Write down what happens.

- g. Save your work.

Task 4 - Summary

- a. Explain the difference between relative referencing and absolute referencing.

- b. How would you refer to the value in cell D3 from anywhere in the spreadsheet?
