Excel #2: No magic numbers

This lesson comes from programmers who long ago learned that everything entered into code must be defined and documented. Placing numbers into an equation is dangerous because later, no one remembers what each value represents or where it came from.

Your manager wants you to add a column to the sales example. She asks you to estimate a 5 percent increase in sales in each region.

Enter Forecast as the column heading.
Select the cell next to the 159 entry for the Midwest region.
Type the equals sign (=) on the keyboard.
Use the mouse to select the cell holding the 159 value.
Type the multiply symbol (*).
Enter: (1+0.05) to take the original value and add 5 percent)
Press the Enter key to end the formula.

Copy the formula to the other rows.
Drag the small square at the bottom-right of the cell until the selection box covers the last row of data above the total.

Copy the total formula from the Sales column to the forecast column.
Note that it is always better to sum the new values instead of using the forecast formula on the original total. Why? Because of round-off errors.

You should also extend the separator line to cover the new column.

Region	Sales	Forecast
Midwest	159	167.0
West	250	262.5
Southwest	393	412.7
Southeast	594	623.7
Northeast	492	516.6
	1888	1982.4

The problem with this spreadsheet is that nowhere does the reader know how the forecast was computed. Later, when your manager decides that 4 percent is a better estimate, you have to go back and edit every cell. Worse, someone else gets the spreadsheet and has to wade through every computation to see what you did, and then guess which number to change.

A better solution: Place the estimate of the percentage increase in a separate cell and label it.

Delete all of the forecast values—you can leave the total. Select them and press the Delete key.

Find a cell near the top of the spreadsheet (you might want to insert some blank rows).
Two rows above the Forecast column, enter 5
In the column next to it, enter: Percentage increase

Now create the new formula based on that cell.

Select the first forecast cell, next to the 159 entry.
Press the equals sign on the keyboard.
Use the mouse to select the 159 cell.
Press the multiply symbol (*).
Type: (1+
Select the cell holding the value 5 for the forecast.
Press the close parentheses key).
Press Enter to end the formula

Now, drag the formula from the first cell down to the other rows.

5 Percentage increase

Region	Sales	Forecast
Midwest	159	954.0
West	250	250.0
Southwest	393	#VALUE!
Southeast	594	567270.0
Northeast	492	123492.0
	1888	#VALUE!

What went wrong?

The problem is that you need a fixed or absolute cell reference for the 5 percent value.
Select the second forecast row and examine the formula.
You should see that Excel incremented the row value of the cell.
If the value 5 is stored in cell C3, the formula in the second row of the table will change it to C4. But, there is no value on that row.
To prevent Excel from modifying the cell when you copy the formula, you need to place a dollar sign ($) in front of the row and column name. For example, the cell reference should be C3 instead of just C3.

Select the cell with the first forecast value.
Press the F2 key to edit the formula.
You can manually enter the two dollar signs.
Or, you can move the cursor to the cell reference (use the mouse) and click the F4 key.
The F4 key cycles through the various options of dollar signs.
Move the cursor to the end of the cell reference (before the closing parentheses)
Enter /100, because user will enter the percentage as 5 instead of 0.05.
Click Enter to accept the formula.

Normally, you will press the F4 key to fix a cell as you are entering the formula the first time. You should probably practice it by re-entering the entire formula.

Once the cell value is fixed, you can drag the formula from the first row down to the other rows.

	5	Percentage increase

Region	Sales	Forecast
Midwest	159	167.0
West	250	262.5
Southwest	393	412.7
Southeast	594	623.7
Northeast	492	516.6
	1888	1982.4

Now you, or your manager, can change the forecast simply by entering a new value in the cell at the top of the spreadsheet.

When you look at the formula in any of the forecast cells, you will see cell references instead of magic numbers.

OK, the 1 and the 100 remain, but those are designed to simplify the formula and make it easier for the user to enter the data. They are standard mathematical terms and everyone should immediately recognize their purpose.

Since the original sales data is in integer values, you would never display the forecasts with decimal points. It would imply a level of accuracy that does not exist.

You might consider simply formatting the forecast cells, but that can lead to round-off error in the total. The overall total first adds the underlying (non-formatted) values, and then it is formatted. To avoid round-off error in the totals, you need to use the ROUND function on each calculation.

Select the first forecast cell and press the F2 key.
Move the cursor to just after the = sign and type ROUND(
Press the End key on the keyboard to move to the end of the formula.
Enter ,0) to round the value to zero decimal places.
When you are finished, your formula should look something like:
        =ROUND(B6*(1+C3/100),0)
But, you might have used different cells.
Press the Enter key to test and accept the formula.
If necessary, fix any errors.
Copy the formula to the other rows (but do not overwrite the total).

5 Percentage increase

Region	Sales	Forecast
Midwest	159	167
West	250	263
Southwest	393	413
Southeast	594	624
Northeast	492	517
	1888	1984

There is another major benefit to placing changeable values in separate cells.
You can lock the worksheet so that users do not accidentally alter your formulas.
They will only be able to change specified data values.

First, you unlock the cells that users will be allowed to change.
Second, you protect the worksheet.

Select the cell holding the 5 percent value.
Right-click and choose Format Cells.
Select the Protection tab and uncheck the Locked option.
Click the OK button.
Repeat the process for the five Sales entries in case someone needs to change the original data.

On the main menu, choose Tools/Protection/Protect Sheet
Enter test as the password and click the OK button.
When asked, enter test again and click the OK button.

Change the 5 percent value to 4.
Try to edit one of the forecast cells.

4 Percentage increase

Region	Sales	Forecast
Midwest	159	165
West	250	260
Southwest	393	409
Southeast	594	618
Northeast	492	512
	1888	1964

Note: if you leave protection turned on, you will have to store the password in a safe location. For assignments and testing, you can even write the password (test) into the spreadsheet. If you open the sheet next year and want to unprotect the sheet, you are not likely to remember it or remember where you stored it.

In complex spreadsheets, you should highlight the data-entry cells. Many people change the background color of cells that the user is allowed to change.

	4 Percentage increase

Region	Sales	Forecast
Midwest	159	165
West	250	260
Southwest	393	409
Southeast	594	618
Northeast	492	512
	1888	1964