ffice Doc

MS-OFFICE 2016 - EXCEL
English version

Functions – Audit
Conditional formats – Protection
What-if tools

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Important comment related to functionalities using Excel functions

It is important to remind you that the format of numbers, dates and so on depend on the country set in Windows (Control Panel - Icon REGIONAL SETTINGS). These settings include the thousand separator (apostrophe or comma ?), the list separator (semi-colon or comma ?) etc.
For this documentation, the computer used for screen captures was set in **French(Swiss).**

Decimal symbol:	.
No. of digits after decimal:	2
Digit grouping symbol:	'
Digit grouping:	123'456'789
Negative sign symbol:	-
Negative number format:	-1.1
Display leading zeros:	0.7
List separator:	;
Measurement system:	Metric
Standard digits:	0123456789
Use native digits:	Never

Click Reset to restore the system default settings for numbers, currency, time, and date.

Reset

Digit grouping symbol

Thousand separator

'   for Switzerland
space for France
,   for the USA

List separator

Symbol used to separate the arguments in a function.

=IF(condition;true;false)

;   for France, Switzerland)
,   for England, USA

Numbers | Currency | Time | Date

Example

Short date: 27.11.2008

Long date: jeudi 27 novembre 2008

Date formats

Short date: dd.MM.yyyy

Long date: dddd d MMMM yyyy

What the notations mean:
d, dd = day; ddd, dddd = day of week; M = month; y = year

Calendar

When a two-digit year is entered, interpret it as a year between:

1930   and   2029

As installing *Multilanguage Packs* for Windows and Office becomes more and more frequent, the language of the Excel interface might be different from the one set in Windows. Therefore check.

FORMULAS AND FUNCTIONS :

BASIC CONCEPTS

1 An important reminder: relative and absolute references

As long as a formula is not copied there is not abs/rel problem. But as soon as the formula is copied a problem may occur. When Excel reads a reference, it does not read A1 or B5 but rather *the contents of the cell located two cells left of result cell.* Therefore when you copy a formula, in reality you copy the "path". If the cell's address changes but the "path" still falls on the correct cell, no problem. The cell reference is **relative.** But if you work with the contents of a cell *located at a specific place,* then inevitably the "path" will be wrong when you copy the formula because it will point to the wrong cell. Therefore you must tell Excel to *absolutely* use this cell. Hence the name **absolute** reference**.**

Two classical situations :

❶ When you copy a formula/function DOWN, the ROW NUMBER automatically adapts. It is the case in the screen capture below :

	A	B	C	D	E
1	**Adding a tax**				
2					
3	**VAT (TVA)**	**8.0%**			
4					
5	**Price/unit**	**Quantity**	**Basic Price** (No tax)	**VAT (TVA)**	**Total Price** (with all taxes)
6	**150**	5	750	60	810
7	**200**	10	2'000	160	2'160
8	**250**	12	3'000	240	3'240
9	**360**	20	7'200	576	7'776
10					
11			=A6*B6	=C6*$B$3	=D6+C6
12					

❷ When you copy a formula/function TO THE RIGHT, the COLUMN NUMBER automatically adapts. It is the case in the screen capture below :

18	**Gross Profit**	81'000	88'500	97'000	80'5(
19	**Estimated Tax**	16'200	17'700	19'400	16'1(
20	**Estimated Net**	64'800	70'800	77'600	64'4(
21					
22		=B18*$B$23			
23					
24	**Average tax rate - according to previous years**		20%		

Example 1 : B3 is an absolute reference
Example 2 : B24 is an absolute reference

How to add the $ signs ?

When you create the formula/function and you have clicked on the reference to *block* : F4 as many times as necessary to make sure the $ sign is correctly placed.
Afterwards : edit the formula (double-click, F2 …), place the cursor inside the reference to block and do the same (F4)

True to say, most of the time a formula/function is not copied *down and to the right.* This implies that usually one $ has no real purpose. But users do not care and leave the $ sign as it makes no real difference.

But caution, sometimes, blocking **must** be precise, especially when the formula/function is copied down and to the right. Examples :

B4			⋮	✕	✓	*fx*	=$A4*B$3			

	A	B	C	D	E	F	G	H	I	J	K
1	Back to primary school !										
2											
3		1	2	3	4	5	6	7	8	9	10
4	1	1	2	3	4	5	6	7	8	9	10
5	2	2	4	6	8	10	12	14	16	18	20
6	3	3	6	9	12	15	18	21	24	27	30
7	4	4	8	12	16	20	24	28	32	36	40
8	5	5	10	15	20	25	30	35	40	45	50
9	6	6	12	18	24	30	36	42	48	54	60
10	7	7	14	21	28	35	42	49	56	63	70
11	8	8	16	24	32	40	48	56	64	72	80
12	9	9	18	27	36	45	54	63	72	81	90
13	10	10	20	30	40	50	60	70	80	90	100

B8			⋮	✕	✓	*fx*	=$A8*$B$4*B$7		

	A	B	C	D	E	F
1	Renting houses, appartments …. We consider that the rental corresponds					
2	to a percentage of the market value.					
3						
4	Annuity	8%				
5						
6		Number of years				
7	Market value	1	3	6	9	12
8	200'000	16'000	48'000	96'000	144'000	192'000
9	300'000	24'000	72'000	144'000	216'000	288'000
10	400'000	32'000	96'000	192'000	288'000	384'000
11	500'000	40'000	120'000	240'000	360'000	480'000

2 Reminder : functions

The difference between a function and a formula

Both are used to calculate a mathematical result. For a formula *you* are the mathematician. *You* choose the cells to be added, multiplied etc… With a function, *Excel* is the mathematician. All you need is to select the right function to solve your problem and indicate the "arguments" or the elements needed by the function to work correctly. The order of the elements is set by Excel.

2.1 Name and arguments

A function starts with	**=**	
Is followed by its	name	
Then an open parenthesis	(	
Then the arguments	arguments	* *no space but separated with a comma*
Ended with a closing parenthesis	)	

✎ If the last parenthesis is omitted, Excel often adds it automatically.
   If the function needs no arguments, the parenthesis are simply empty (=TODAY() for instance).
   Capitalized letters makes no difference.
   Arguments are usually cell references but you may use named cells, other functions and so on.

2.2 Common functions such as SUM, AVERAGE, COUNT, MAX, MIN …

- Activate the result cell
- HOME Tab – EDITING Group – SUM Button :

- Click on the SUM button for a standard addition and on the triangle at its right for other functions such AVERAGE, MIN, MAX, COUNT …

✎ The COUNT function (labeled COUNT NUMBERS) counts the number of NON-EMPTY cells containing numbers (omit cells containing text).
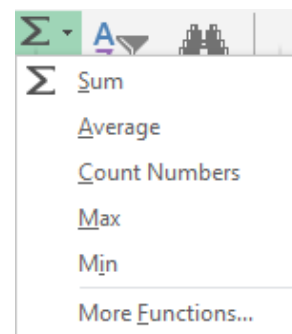
- The function is created (you do not have to type the codes). Excel analyses the surrounding cells to find the most appropriate range of cells to add. Click on the SUM button to validate or press the ENTER key.

2.3 Editing the function to modify it

Edit the cell contents (double-click, F2 …)
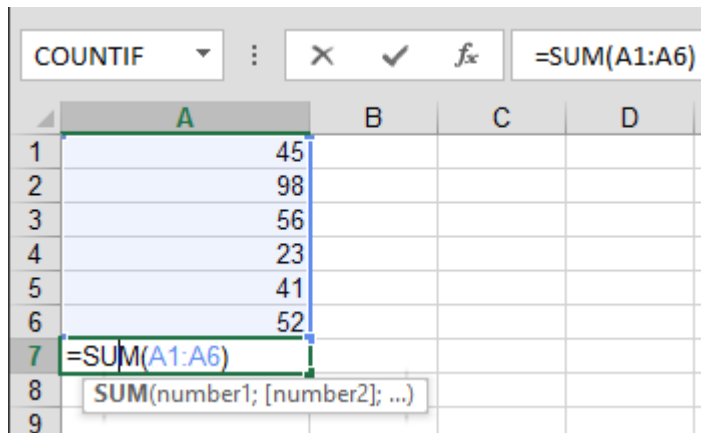
The references used in the function are circled, each one with a different color. You can click and drag the border to change cells. You can also click and drag the auto-fill handle to include additional cells

2.4 Functions and Status Bar

First check which functions are activated (right click the Status Bar).

By default when installing Office : AVERAGE, COUNT and SUM
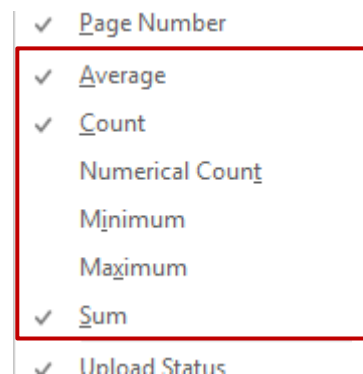
Select the required range of cells and the Status Bar will display the result
(caution, it is only an information – no copy-paste)

2.5 Building the function using a dialog box

- FORMULAS Tab – FUNCTIONS LIBRARY Group
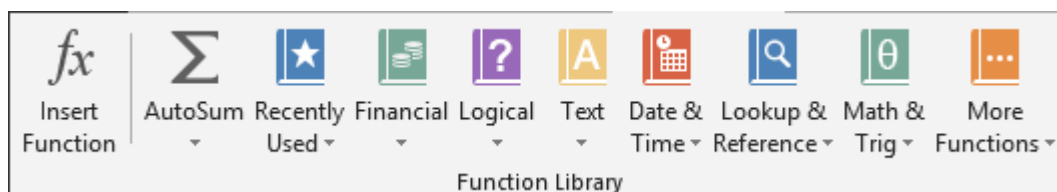
Excel functions are sorted out by category (to help the search).
If a function has recently been used, it is easy to retrieve : RECENTLY USED
(the last 10 are listed)

You can also widen out your search by clicking on the INSERT A FUNCTION button.

Here below the dialog box :
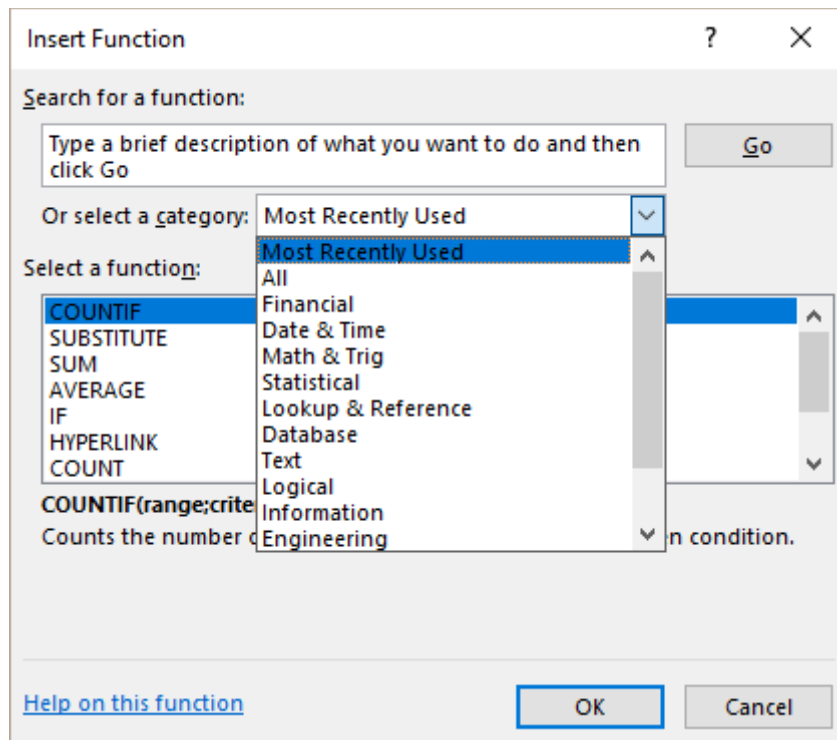
✎ Other access to this dialog box : the MORE FUNCTIONS option at the bottom of the drop-down
   list of the SUM button (HOME Tab)

You can type a short description about the kind of function you are looking for. Then press
the ENTER key and the box will list of the possible matching functions.

You may select a specific category or check the previously used functions through the MOST
RECENTLY USED category. The categories are equivalent to the buttons of the
FUNCTIONS LIBRARY group.

When you click on a given function, a short text description will be provided.

Do not hesitate to click on the blue information *Help on this function.* The online help will
automatically display help on this function. Handy and useful as there are lots of
explanations, details and samples.

Here below an example of « statistical » functions – the COUNTIF function – that counts the number of cells matching the given criteria :

| COUNTIF | ▼ | : | × | ✓ | fx | =COUNTIF(B2:B7;"No") |

	A	B	C	D
1	**Questions**	**John**	**Jack**	
2	Is your interest on current or historical information ?	Yes	No	
3	How long would you expect the MKC to hold items of interest (in months) ?			
4	How many newspapers do you read per week ?	1	3	
5	How many radio channels do you regularly listen to ?	1	2	
6	Are you a member of any professional organization ?	Yes	No	
7	Could it be used to get publications at reduced prices ?	No	No	
8				
9	*Number of* questions	6		
10				
11		John	Jack	All
12	*How many answers*	5		
13	*Questions not answered*	2:B7;"No")		

Function Arguments   ?   ×

COUNTIF

| Range | B2:B7 | 📊 | = {"Yes";0;1;1;"Yes";"No"} |
| Criteria | "No" | 📊 | = "No" |

= 1

Counts the number of cells within a range that meet the given condition.

        Criteria is the condition in the form of a number, expression, or text that defines which cells will be counted.

Formula result = 1

Help on this function   OK   Cancel

<u>Back into this box :</u> activate the cell containing the function and click on the Fx indication in the formula bar

fx | =COUNTIF(B2:B7;"Yes")

💣 *If the cell is empty* : clicking on the Fx indication will open the functions general dialog box to let you select the required one. *If the cell already contains a function* : back into the function dialog box.

2.6 Building the function manually, using the semi-auto list

A handy method, especially when you know the function because you have used it before but you are not sure about the order of the arguments, the argument spelling and so on.

- Activate the result cell and start typing the function name
- As soon as you start typing, Excel displays a list of functions starting with the typed characters :
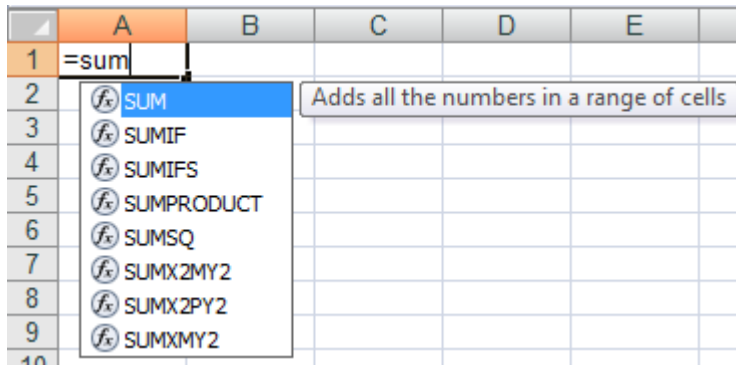
- Select the required function and double-click (or press the TAB key if it is the first one) (made a mistake ? BACKSPACE to revert to the list). If the function does not get displayed in the list, continue typing, it should appear when you type the first parenthesis :
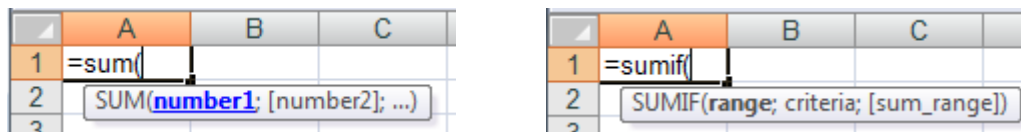
Excel displays the required arguments, the first one in bold characters.
Select the appropriate cell reference for each argument. Each argument must be separated with the Windows « list separator » : semi-colon sign for a French Windows and comma for an English Windows. As soon as you type the separator, the next argument is selected.
Arguments in brackets are optional (do not type the brackets).

Example : the previous COUNTIF function

2.7 Some error codes and their meaning

#DIV/0!	The function tries to divide using a 0 value or an empty cell.
#N/A	The function has no value for the given argument.
#NOM?	The function is not valid or the named reference does not exist.
#REF!	The function contains an invalid reference.
#VALUE!	The function contains an argument of the wrong type.

2.8 3D references

They are used to build a function such as SUM, PRODUCT … over multiple sheets, provided that the required cells are all located at the same address on each sheet :

- Click on the result cell
- Click on the SUM button or create the PRODUCT function …
- Click on the first sheet on the first required cell
- SHIFT + click on the last sheet of the group (impossible to use the CTRL key)
- Press the ENTER key to validate (caution : no navigation)

Most of the time you may simply copy the result formula across a table.
Caution : if this "consolidation" works on tables of different size, with a different location …
you should rather choose the DATA – CONSOLIDATE command.

2.9 Calculation options

Usually formulas and functions are instantly updated when one precedent is modified. But if the table is large, includes a lot of formulas, maybe you'll want to first make all the modifications and *then* update the worksheet.

In this case : FORMULAS Tab – CALCULATION Group
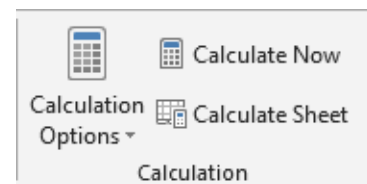
The CALCULATION OPTIONS button displays the following drop-down list :
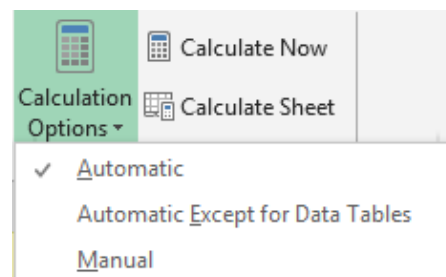
Caution, if you uncheck the Automatic calculation, updating will be manual using the two buttons located to the right : *Calculate Now (the whole workbook)* (or F9) or *Calculate Sheet* (SHIFT + F9)

3 Reminder : using names

Use

Quick navigation to a specific cell or range of cells

Fast indeed as one click and the named cell can be access from anywhere in the workbook.

Replacing the reference to a cell or range of cells while building a formula

As for instance : = B23*(C12-F34) fare clearer if = Tax*(Total-Discount).

By default, a name refers to an absolute cell or a range of cells
Names are linked to formulas/functions.

 FORMULAS Tab - DEFINED NAMES Group
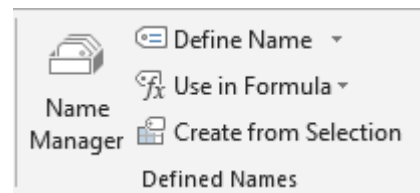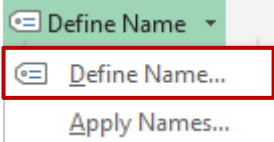
3.1   Assigning a name to a cell or a range of cells

- Select the required cell(s).

❶   Click in the *Name Box* and type
         directly the required name.
         Press ENTER to validate

❷
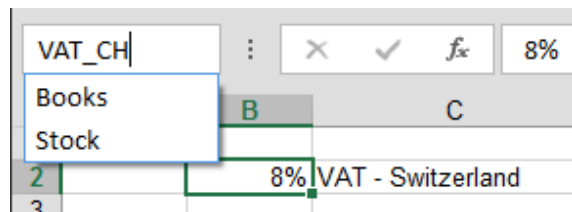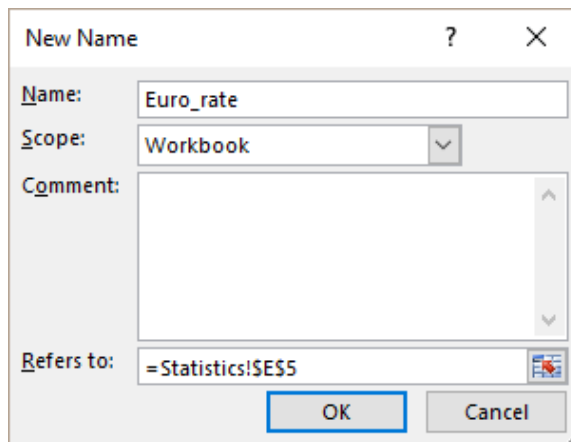
Type the name : *space and dash* are not accepted.
The name can include numbers but should not *start* with a number.

Click on the ADD button

✎ You can click on 🔣 to select the cell directly in the worksheet. Then click again on the same button or press ENTER to retrieve the box.

✎ When copying a cell, the name is also copied.

The reference can be external to the sheet : another sheet or even another workbook.

- Drop-down list of the DEFINE NAME button
- At topic « Refers to : » : delete the reference.
- Type the = sign
- Activate the destination sheet or workbook.
- The box will show the reference full path :

Refers to:	='[Relative and Absolute Ref.xlsm]TVA'!$B$4	🔣
	OK	Cancel
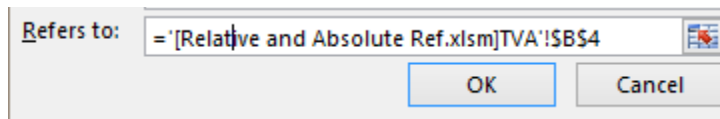
3.2   Navigating to a named cell or range of cells

❶

Fast and easy : select the required name from the drop-down list of the *Name Box*.

D6	⋮	
Euro_rate		B
VAT_CH		

❷
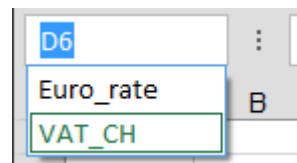
HOME Tab – EDITING Group – Drop-down list of the FIND & SELECT Button – GO TO Option   or faster: F5

Names are listed first.
Double-click

Go To	?	×

Go to:

Euro_rate
VAT_CH

Reference:

VAT_CH

| Special... | OK | Cancel |
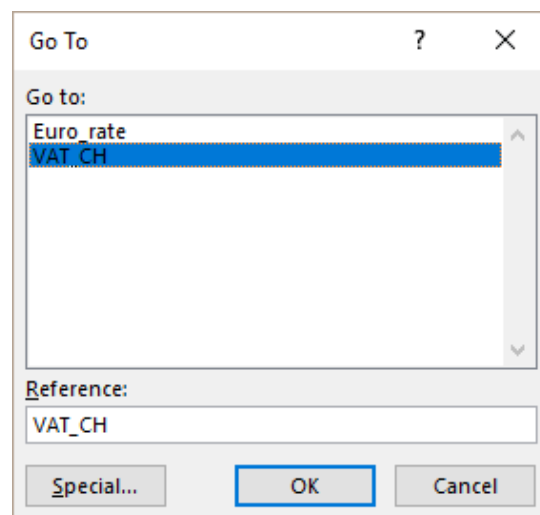
3.3   Using a name in a formula or function : paste a name

❶   Type the = sign and type the name
Carry on building the formula or function as usual

❷   Click into a result cell   -   *no need to type the = sign.*
*You cannot display the drop-down list of names of the Name Box, because once the =
sign has been typed, Excel works in the « math mode » and the drop-down list now
displays Excel functions.*

Consequently, click on the USE IN FORMULA button
(FORMULAS Tab – DEFINED NAMES Group) :

Select the required name :
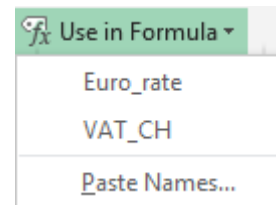
Excel inserts the name into the formula or the function
you are building :

❸   When building a formula or a function, click on the required reference. If it happens to be
a named cell, Excel automatically uses the name rather than the address. Handy.

3.4   Pasting all the workbook names into the current worksheet
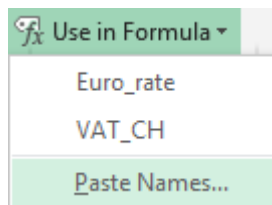
Click on the PASTE NAMES options and then on the PASTE LIST button

The list of names and their references is pasted into the current worksheet, starting at the
position of the active cell :

| 7 | CH_VAT_Rate | =Sheet2!$D$3 |
| 8 | Euro_rate | =Sheet2!$D$2 |

3.5   Managing names

- NAME MANAGER Button
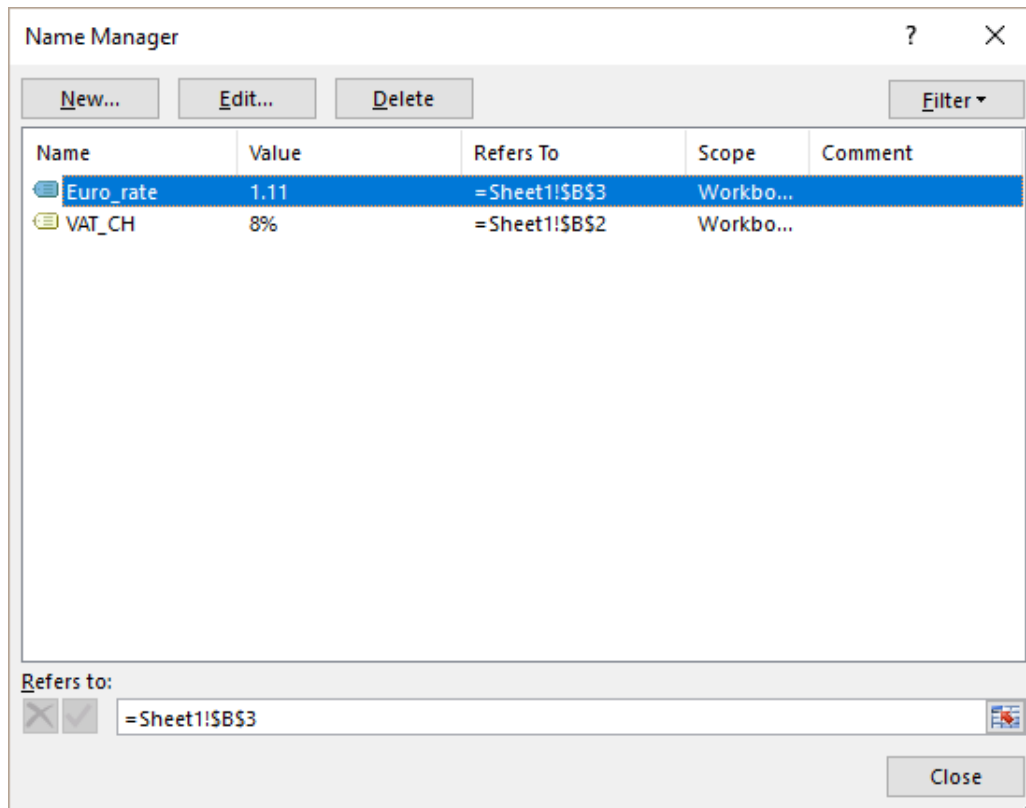
The buttons are clear : select the required name and you can edit it, delete it …

3.6   The cell has been used several times before you named it

You'll want to *APPLY A NAME.* This will replace the references with their names ("amount" instead of A3).

No selection   The operation is performed for the whole worksheet
A selected range of cells   The operation is applied to the range formulas/functions
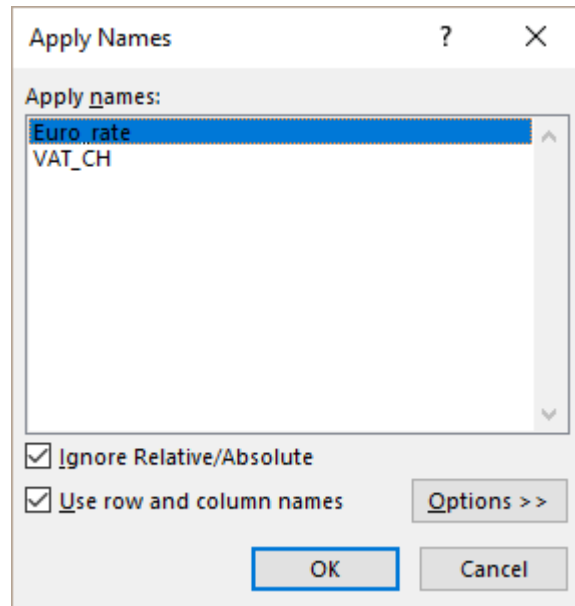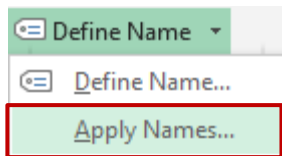
Multiple selection is possible (click on all required names)

3.7 Special and less common : naming the rows and columns of a table

An Excel worksheet often contains labels describing the data. They are usually located at the top and at the right of a table. As in the table here below :

	A	B	C	D
1	Sales	Hardware	Software	Services
2	HP	100	200	300
3	Compaq	200	250	200
4	Dell	300	150	350

- Select the whole table – including the label row and column

Create from Selection   Remove Arr

Defined Names

Create from Selection (Ctrl+Shift+F3)

Automatically generate names from the selected cells.

Many people choose to use the text in the top row or the leftmost column of a selection.
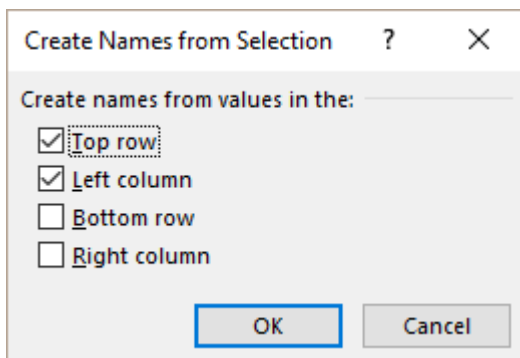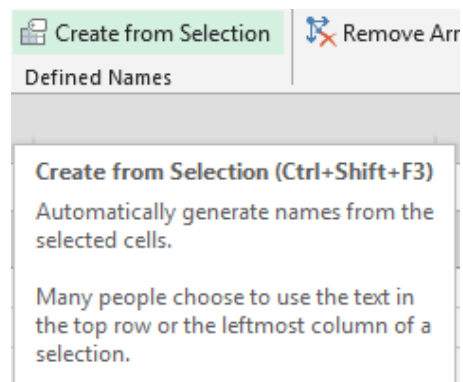
The ranges of cells are
automatically named.
Go to the name "Software" and
Compaq, Hp and Digital sales will
be automatically selected :

| Software | ⋮ | ✕ | ✓ | *fx* | 200 |

	A	B	C	D
1	*Sales*	*Hardware*	*Software*	*Services*
2	*HP*	100	200	300
3	*Compaq*	200	250	200
4	*Dell*	300	150	350

You can then enter named range in a formula : such as *=SUM(Compaq)   or
=SUM(hardware).*

You can refer to a specific cell in the table by simply indicating the corresponding row and
column label, separated with a space. This space is called *the intersection operator.* While
you are typing, the referred named cells are colored :

	A	B	C	D	E
1	*Sales*	*Hardware*	*Software*	*Services*	
2	*HP*	100	200	300	
3	*Compaq*	200	250	200	
4	*Dell*	300	150	350	
5					
6	*Compaq sales for Software are :*			=Compaq Software	
7				▤ Software	

The result when you
validate : 250

Note : the row or the column containing the labels cannot be numbers only

EXAMPLES OF FUNCTIONS

1 The CONCATENATE function

In French CONCATENER.

Syntax : CONCATENATE(Text1 ;[Text 2] …)

But also   =Ref_cell&Ref_cell ….
The & sign is called a concatenation operator

This function is used to "merge" the contents of two or more cells.

Important to mention : when you merge the contents of cells, you should always add the *space.* The space sign must always be placed between quotes.

Example :

	First name	Last Name	Age	Full name
2	**First name**	**Last Name**	**Age**	**Full name**
3	Charles	Bloom	37	Charles Bloom
4	John	Bonnet	36	John Bonnet
5	Edna	Evans	35	Edna Evans
6	Peter	Ford	38	Peter Ford
7	Mike	Olaf	40	Mike Olaf
8	Franck	Siny	29	Franck Siny
9	Luke	Skinner	42	Luke Skinner
10	Keith	Smith	31	Keith Smith

=A2&" "&B2
or
=CONCATENATE(A2;"

New 2013 : please note that often it is now possible to replace a CONCATENATE function as well as other text functions with the FLASH FILL feature (DATA Tab)

Type in the first cell what result you need

	A	B	C
1	FirstName	LastName	Name
2	John	Evans	John Evans
3	Peter	O'Neil	
4	Luke	Smith	
5	Mark	Greenaway	

Select this cell – Option FLASHFILL and the column is automatically filled !

	A	B	C
1	FirstName	LastName	Name
2	John	Evans	John Evans
3	Peter	O'Neil	Peter O'Neil
4	Luke	Smith	Luke Smith
5	Mark	Greenaway	Mark Greenaway

2 The contrary of the CONCATENATE function : split the contents of one cell over two or more cells

Really there is no need for a function as Excel provides a Wizard.

Select the cell(s)

DATA Tab – DATA TOOLS Group – TEXT TO COLUMNS Button

Convert Text to Columns Wizard - Step 1 of 3   ?   ✕

The Text Wizard has determined that your data is Delimited.

If this is correct, choose Next, or choose the data type that best describes your data.

Original data type

Choose the file type that best describes your data:
- ⦿ Delimited   - Characters such as commas or tabs separate each field.
- ◯ Fixed width   - Fields are aligned in columns with spaces between each field.

Preview of selected data:

```
2 Charles Van Dyck
3 Edna Evans
4 Franck Siny
5 John Bonnet
6 Keith Smith
```

Cancel   < Back   Next >   Finish

Fixed width : you will have to set the number of characters for each column
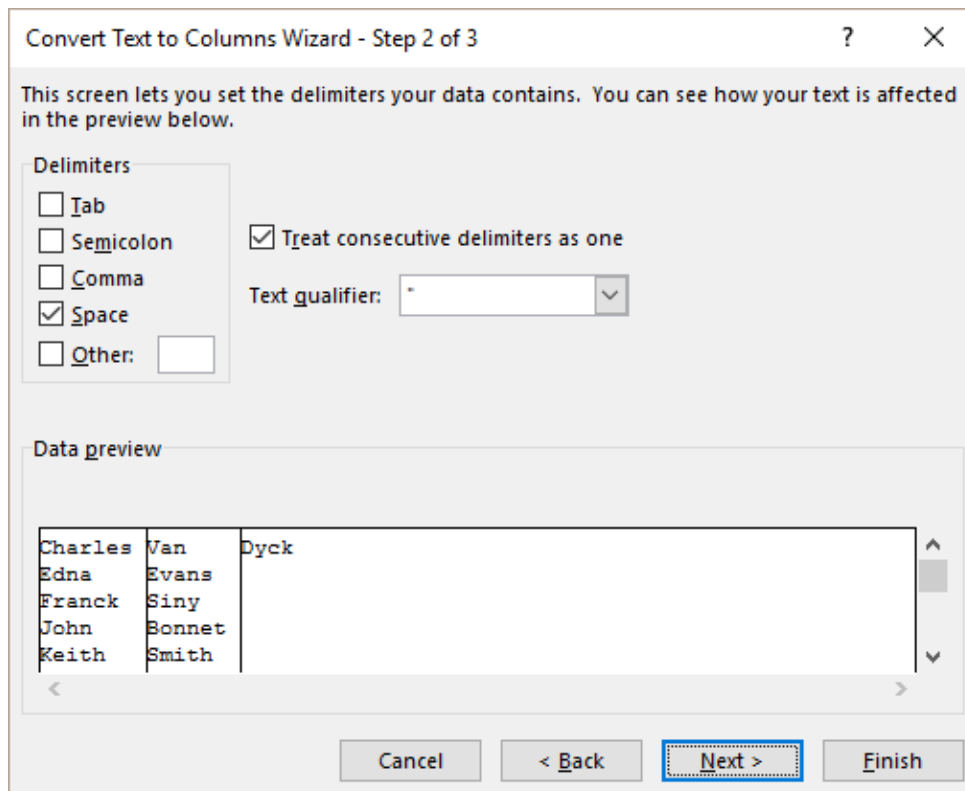
Check the separator

Please note that the word « Dyck » ends up into a third column because of the space after « Van ». There is nothing that can be done to prevent this.
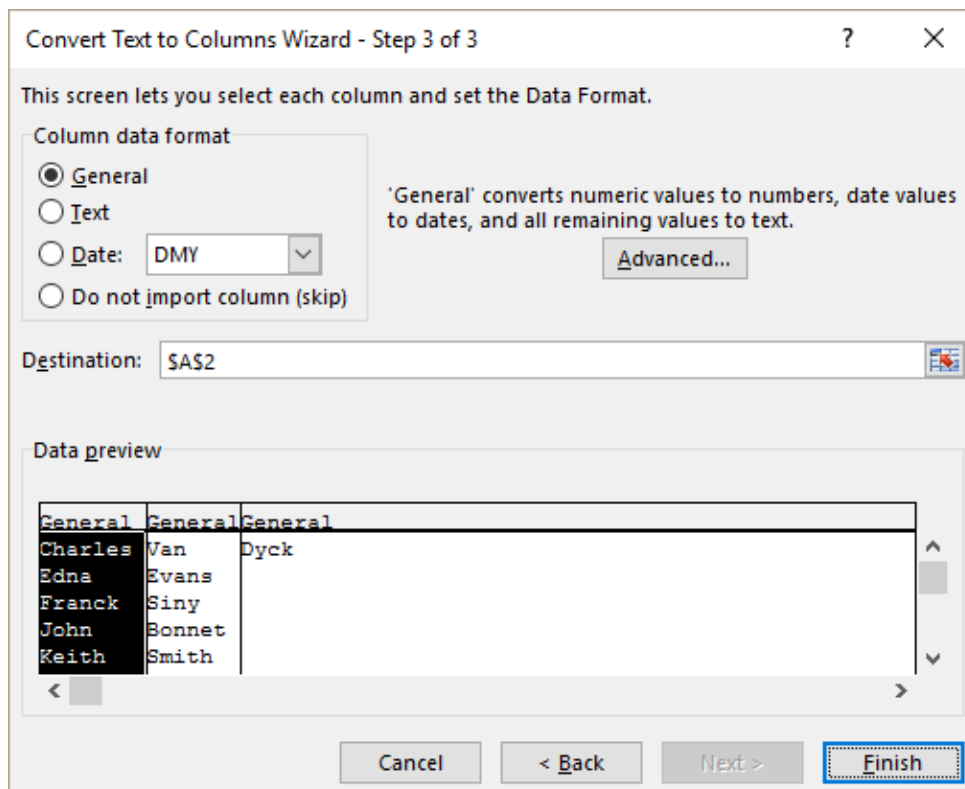
You may manage the column format according to the type of data they include : click on the ADVANCED button and set the decimal and thousand separator for a column full of figures, a date format for a column with dates …

You may exclude a given column from the distribution : select the column and turn on the DO NO IMPORT COLUMN (SKIP) option.

The destination cell is by default the first cell of the selection. Here the proposition was $A$1. This implies that the result might well *overwrite* the source cells. If you do not want any overwriting, make sure to change the destination cell.

Here below the result : satisfying except the « Dyck » record that needs fine-tuning.

Charles	Van	Dyck
Edna	Evans	
Franck	Siny	
John	Bonnet	
Keith	Smith	
Luke	Skinner	
Mike	Olaf	

3 « Statistical » functions : COUNT, COUNTA, COUNTBLANK, COUNTIF and COUNTIFS

In French : NBVAL, NB.VIDE, NB.SI

Syntax : COUNTA(range), COUNTBLANK(range) et COUNTIF(range ;criteria)

The COUNT function is included in the list of standard functions displayed by the drop-down list of the SUM button.

Here below a table showing stock updates :

	Book	Stock
17	Book	Stock
18	book 1	400
19	book 2	not available
20	book 3	800
21	book 4	900
22	book 5	not available
23	book 6	600
24	book 7	800
25	book 8	900
26	book 9	

The COUNTA, COUNTIF, COUNTBLANK functions can lead to the following results :

number of books whose stock is a value	6	=COUNT(B18:B26)
number of book whose stock is indicated (value or "not available")	8	=COUNTA(B18:B26)
number of books whose stock is "not available"	2	=COUNTIF(B18:B26;"not available")
number of books whoses stock is above or equal to 850	2	=COUNTIF(B18:B26;">=850")
number of books whose stock is not indicated	1	COUNTBLANK(B18:B26)

✎ Please note that the criteria (COUNTIF function) is always between quotes, even though the criteria is a numeric value such as « >=850 ».

Here after a helpdesk question : Members of my team can be absent (holidays or illness). I am in charge of keeping track of these absences. I apply a different color when it is a holiday or an illness. How can I count colored cells ?

The tip ? In the C45 cell, the letter H was typed. It is invisible because the font color is the same as the fill color. Same for the violet cells (letter I).
At the bottom of the table, it is now easy to count the cell containing the letter H or I …

The COUNTIFS function

Introduced in the 2007 release – To add but combining several criteria

In French NB.SI.ENS

Syntax : COUNTIFS(range_criteria1;criteria1;[range_criteria2;criteria2] …)

	A	B	C	D	E	F
31	**COUNTIFS**					
32	**Rented car**	**Month**		*Number of cars by month*		
33	Alfa Romeo	January				
34	Mercedes	February				
35	Mercedes	February		**Alfa Romeo**	January	4
36	Jeep	January		Alfa Romeo	February	1
37	Mercedes	February		Alfa Romeo	March	1
38	Alfa Romeo	January		**Jeep**	January	2
39	Jeep	March		Jeep	February	1
40	Alfa Romeo	January		Jeep	March	2
41	Jeep	February		**Mercedes**	January	2
42	Alfa Romeo	March		Mercedes	February	4
43	Mercedes	January		Mercedes	March	0
44	Mercedes	February				
45	Alfa Romeo	January				
46	Jeep	March				
47	Mercedes	January				
48	Alfa Romeo	February				
49	Jeep	January				

=COUNTIFS(**$A$33:$A$49;D35**;**$B$33:$B$49;E35**)

* Really, I would rather go for a pivot table …

4 The SUMIF function

In French : SOMME.SI

Syntax : SUMIF(range ;criteria ;[sum_range]

The COUNTIF function counts with a criteria while the SUMIF function <u>adds</u> with a criteria :

Example (based on the stock update of the previous topic) :

Total of stock when indicating 900	1800	=SUMIF(B18:B26;900)
Total of stock when indicating above or equal to 800	3400	=SUMIF(B18:B26;">=800")

In the above example, the range to add is the same as the range where the criteria are to be found. Therefore the last argument [sum_range] can be omitted.

Here below a different example, where the last argument cannot be omitted .

E19	f_x	=SUMIF($A$19:$A$27;D19;$C$19:$C$27)			
	A	B	C	D	E
18	Book	Location	Stock	Total stock for :	
19	Lord of the Rings	Geneva	400	Harry Potter	1900
20	Harry Potter	Geneva	500	Lord of the Rings	2200
21	Harry Potter	Lausanne	800	Eragon	1900
22	Lord of the Rings	Lausanne	900		
23	Eragon	Geneva	400	Why are the ranges of cells absolute ?	
24	Harry Potter	Neuchâtel	600	To easily recopy the function !!!!	
25	Eragon	Neuchâtel	800		
26	Lord of the Rings	Neuchâtel	900	Using names ?	1900
27	Eragon	Lausanne	700		2200
28				=SUMIF(Books;D19;Stock)	1900
29					

To mention :

- Both ranges are absolute references to secure copying the function. On the other hand, the criteria cell has been left a relative reference. Indeed, this allows the function to "fall" on the next book title when you copy the function.

- The function would be easier to read and understand if the range of cells were named ranges. Moreover named ranges are always absolute references, which would be appropriate here.

✎ As for COUNTIF, the values for the *criteria* argument must always be typed between quotes, even though the criteria is a numeric value such as « >200000 ».

✎ SUMIF can at times point to a whole column (A:A) rather than a range of cells. Handy to avoid adding the $.

5 The SUMIFS function

Introduced in the 2007 release. To count by combining several criteria
In French SUMIFS

Syntax : SUMIFS(range_to_add;range_criteria1;criteria1;[range_criteria2;criteria2] …)

	A	B	C
4	**SUMIFS**		
5	**Books on films**	**Place**	**Stock**
6	Harry Potter	Geneva	400
7	Lord of the Rings	Geneva	500
8	Harry Potter	Lausanne	800
9	Lord of the Rings	Lausanne	900
10	Eragon	Geneva	400
11	Harry Potter	Neuchâtel	600
12	Eragon	Neuchâtel	800
13	Lord of the Rings	Neuchâtel	900
14	Eragon	Lausanne	700
15			

Stock total : "both the name of the book and the place where it is stocked"

Harry Potter	Geneva	400
Harry Potter	Lausanne	800
Harry Potter	Neuchâtel	600

=SUMIFS(**$C$6:$C$14**;**$A$6:$A$14;D7**;**$B$6:$B$14;E7**)

	A	B
16		
17	**SUMIFS**	
18	**Books on films**	**Stock**
19	Eragon	400
20	Eragon	500
21	Eragon	700
22	Harry Potter	200
23	Harry Potter	300
24	Harry Potter	500
25	Lord of the Rings	300
26	Lord of the Rings	500
27	Lord of the Rings	500

Stock of books by name and by stock number >= 500   Criteria must be labeled : ">="&500 or the cell ref

Eragon	1200
Harry Potter	500
Lord of the Rings	1000

Criteria :

500

=SUMIFS(**$B$19:$B$27**;**$A$19:$A$27;D20**;**$B$19:$B$27;">="&$D$25**)

6 The IF function

In French : SI.

Syntax : IF(condition ;true ;false)   or   IF(logical_test ;value_if_true ;[value_if_false])
Users call it rather : IF … Then … Else

Logical tests can be

> or <	Greater than / Less than
<>	Different from
>= or <=	Greater than or equal to / Less than or equal to

Examples of actions (true/false values) :

Display a number (a constant)	Type the number
Display a text	Type the next between quotes
Display the result of a formula	Type the formula
Display the content of a cell	Select the cell
Display "nothing"	Type 2 quotes ("")

Absolute references

It is very important to secure the calculation when you recopy a formula or a function. If necessary the required references should be made absolute references (reminder : F4)

Example 1 – with no absolute references

C3			✕ ✓	ƒx	=IF(B3<=1000;50;"")		

	A	B	C	D
1	**Bank account**			
2	Year	Out	Fee	
3	2008	650	50	
4	2009	850	50	
5	2010	740	50	
6	2011	1100		
7	2012	1550		
8	2013	1420		
9	2014	840	50	
10	2015	1200		
11	2016	1350		
12	**Exercise**			
13				
14	Your bank charges Frs 50.- per year for your credit card but only if you have			
15	not used it a lot ! So if the expenses are lower or equal to Frs 1'000			
16	throughout the year, the bank will charge you Frs 50.--. If above = free !			
17	Calculate for each year whether the charge fee is due or not.			

Example 2 – with some absolute references

B9	fx	=IF(B7<=$B$39;$B$40;$B$41)			

⊿	A	B	C	D	E	F
1		MURPHY	EVANS	SMITH	MARTIN	ROBBINS
2		June	June	June	June	June
3	Basic Salary	5000	5000	5000	5000	5000
4						
5	Sales	10000	7896.5	11500	10000	8036
6	Miscellaneous	456	875	750	541	796
7	Total Sales	10456	8771.5	12250	10541	8832
8						
9	Bonus Rate	2%	2%	3%	3%	2%
10	Salary with Bonus	5209.12	5175.43	5367.5	5316.23	5176.64
11						
12	Ref Amount	10'500				
13	Rate if below	2%				
14	Rate if above	3%				
15	**Exercise**					
16						
17	Our company applies the following salary calculation : each employee receives a given bonus rate of					
18	2% whatever his/her total sales. But if the employee reaches a special target (here 10,500) then the					
19	bonus is slightly higher. Then, the bonus (normal or special) is added to the basic salary.					
20						
21	Calculate the bonus rate according to the employee total sales. The rest will be done automatically.					

7 The OR function

In French : OU.

Syntax : OR(logical_value_1 ;[logical_value_2] ;…)

The OR function is often combined with the IF function.

C22	fx	=IF(OR(B22>30000;B22<25000);"problem";"")			

⊿	A	B	C	D	E	F
21		Expenses	Result			
22	January	25'000				
23	February	24'800	problem			
24	March	30'000				
25	April	32'000	problem			
26	May	33'000	problem			
27	June	27'000				

If the expenses are below 25'000, the figure is too low, there must be an error **or**.
If the expenses are above 30'000, the figure is too high, there must be an error.

Otherwise, the expenses are as usual, therefore the situation is normal. The cell can simply remain empty.

8 The AND function

In French : ET.

Syntax : AND(logical_value_1 ;[logical_value_2] ;…)

The AND function is often combined with the IF function.

D27	▼	⋮	✕	✓	*fx*	=IF(AND(B27>=50000;C27>=70);"summer workers";"")

◢	A	B	C	D	E	F
26		Expenses	Number of employees	Audit		
27	January	25'000	45			
28	February	24'800	44			
29	March	30'000	50			
30	April	32'000	55			
31	May	33'000	58			
32	June	27'000	49			
33	July	50'500	80	summer workers		
34	August	60'000	90	summer workers		
35		50'000	71	*summer workers*		
36						
37	* This is really just a little example to practice combining AND / IF functions as					
38	the AND conditions leave out this possibility, which would produce a funny result :					
39	==> expenses = 50'000 and workers >70					

If the expenses are above 50'000 **and** the number of employees above 70, the excess of our expenses come from our seasonal workers. Otherwise, the expenses are as usual, therefore the situation is normal. The cell can simply remain empty.

9 Nested IF functions

They allow **more than one test** on the cell contents and set what to do according to the test result.

Example 1 : if with 3 possibilities rather than the usual 2 :

C6	⋮	×	✓	fx	=IF(B6<25000;"check accounting";IF(B6>30000;"to be reduced";"normal"))

	A	B	C	D	E	F	G	
2								
3	We need 3 possibilities : check accounting - to be reduced - normal							
4								
5		**Expenses**	**Audit**					
6	January	25000	*normal*					
7	February	24800	*check accounting*					
8	March	30000	*normal*					
9	April	32000	*to be reduced*					
10	May	33000	*to be reduced*					
11	June	27000	*normal*					
12								
13	**Exercise**							
14								
15	If expenses are below 25'000 - impossible - there is certainly an error, somewhere. Check accounting books							
16								
17	If expenses are above 30'000 - they must be reduced							
18								
19	Otherwise : normal							
20								

Example 2 : IF functions combined with the AND functions

E23	⋮	×	✓	fx	=IF(AND(C23="E";D23<=5000);B23*10%;IF(AND(C23="E";D23>5000); B23*15%;B23*25%))

	A	B	C	D	E	F	G
21			**Price**				
22	**Designation**	**Price**	**Origin** **E = Europe**	**Weight** **in gr.**	**Tax**	**Total**	
23	**Product 1**	100	E	4000	10	110	
24	**Product 2**	200	E	6000	30	230	
25	**Product 3**	500	NOT E	3000	125	625	
26	**Product 4**	300	NOT E	8000	75	375	
27							
28	**Exercise**						
29							
30	Calculate tax knowing that :						
31	Origin E and weight below or equal to 5000 gr			10%			
32	Origin E and weight above 5000 gr			15%			
33	Other origin and any weight			25%			

🖉   Nested functions can include other functions, not only IF functions.

   5, 6 …conditions in cascade are always read and applied in order : when a condition is met, Excel ignores the others and automatically applies the corresponding action. But please note that such conditions can often be replaced by a VLOOKUP function, which eventually proves to be a far better choice.

10 The VLOOKUP function

In French : RECHERCHEV

Syntax : VLOOKUP(lookup_value ;table_array ; col_index _num ;[range_lookup])

The main characteristics of this function :

- The "index" column must always be the first column of the selected table (not necessarily the first column of the list)
- The function cannot read B, I, J, L … it can only COUNT the table columns.
- The function cannot work "backwards" : it always reads data from the "index" column to the right
- If the last argument is set on *Exact match* : the order of the index column is indifferent – if the last argument is set on *Approximate match* : the index column must be sorted (ascending order).

Example 1

Here is a file containing the names of the employees, their salaries etc....

	A	B	C	D	E
1	AVS Nr	NAME	FIRST NAME	DATE OF ENTRY	GROSS SALARY
2	123.25.563.588	FERNAL	Alain	23.janv.03	25'000
3	123.52.123.698	MAGNE	Charles	14.mai.01	15'000
4	125.23.587.458	TRANSEN	Jean	12.févr.07	15'000
5	146.96.256.546	DE PAUL	Vincent	15.nov.99	9'000
6	156.98.569.231	HAULIT	Amélie	25.août.01	8'000
7	263.12.258.147	LESBAINS	Amélie	25.août.01	6'000
8	281.65.259.515	DRAK	Ulla	23.janv.03	10'000
9	281.96.145.119	LEDEB-HOCHET	Raphaël	12.févr.07	8'000
10	598.56.458.952	PASBON	Vincent	15.nov.97	8'000
11	963.56.231.258	HIBULAIRE	Pat	16.mars.08	10'000
12	987.56.231.247	HACHOU	Pat	16.mars.00	7'000

Somewhere else in the workbook you need to refer to the gross salary, searching from the employee AVS number

VLOOKUP(A11;List-salary'!$A$2:$E$12;2;FAUX)

The lookup value	The list	Second column of	**Security**
	The first column	the list/table,	**FALSE or 0 :**exact match
Caution : not the table cell !	of the selected table is the "index" column *	starting from the "index" column	**TRUE or 1 or omitted** : approximate match
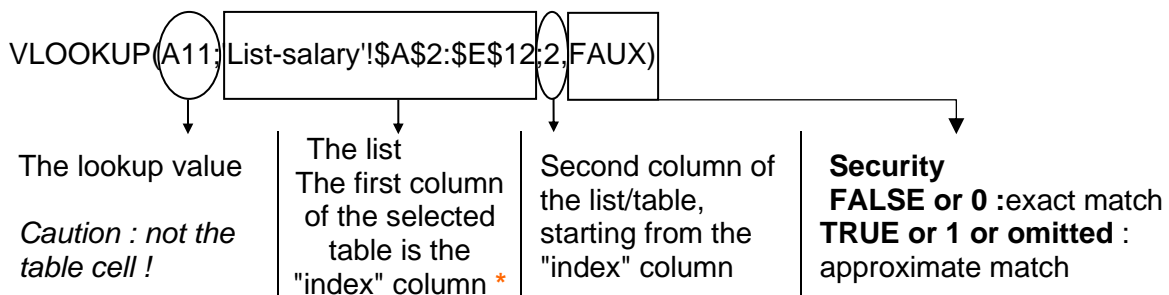
* *Important* : the « index » column is always the 1st column of your **selected table** and not necessarily the first column of the *list* itself !

The list must always be absolute references. Indeed, if the lookup value changes (because you copy the function), the table array should not adapt automatically.

Exact match	If the searched value is not found in the "index" column, the function returns the following error code : #N/A.	
Approximate match	If the searched value is not found in the "index" column, the function returns the closest match (see example below) In this case, the "index" column **MUST BE** sorted by ascending order	

	A	B	C	D	E	F	G
3	AVS Nr.	Who ?					
4	281.65.259.515						
5	156.98.569.231						
6	598.56.458.952						
7	598.56.458.953						
8							
9							
10	AVS Nr.	With exact match					
11	281.65.259.515	DRAK					
12	156.98.569.231	HAULIT					
13	598.56.458.952	PASBON					
14	598.56.458.953	#N/A					
15							
16							
17	AVS Nr.	With approximative match					
18	281.65.259.515	DRAK					
19	156.98.569.231	HAULIT					
20	598.56.458.952	PASBON					
21	598.56.458.953	PASBON					
22							
23							
24	AVS Nr.	Exact match and named range					
25	281.65.259.515	DRAK					
26	156.98.569.231	HAULIT					
27	598.56.458.952	PASBON					
28	598.56.458.953	#N/A					

=VLOOKUP(A11;'List-salary'!$A$2:$E$13;2;FALSE)
False could be replaced by 0

=VLOOKUP(A11;'List-salary'!$A$2:$E$13;2)
Approximative match = omitted or True

=VLOOKUP(A11;list;2)
List = the name of the salary list

Example 2

When you type an amount in one of 4 pre-set foreign currencies, the foreign amount is automatically converted into Swiss Francs.

	A	B	C	D	E	F	G
1	Currency	Amount in foreign currency	Amount in SFR				
2	$ Mexico	1'000	3000		*Fully invented change rate !*		
3	Kr Sweden	1'000	5000		$ United States	2	
4	$ United States	1'000	2000		$ Mexico	3	
5	Kr Sweden	1'000	5000		£ England	4	
6	£ England	2'000	8000		Kr Sweden	5	
7	$ Mexico	5'000	15000				
8	Kr Sweden	4'000	20000				
9	$ United States	1'000	2000				
10	£ England	2'000	8000				
11	$ Mexico	8'000	24000				
12	EURO	1'000	#N/A		=B2*VLOOKUP(A2;$E$3:$F$6;2;0)		

Example 3 – let the function return the APPROXIMATE MATCH

(A given code must be assigned to each sale, according to a list of sales « slices ») :

💣 Reminder : in this case it is compulsory to sort the "index" column in the table BY ASCENDING
ORDER.

IMPORTANT IF YOU REGULARLY NEED TO ADD RECORDS TO THE LIST (table_array)
If you know beforehand that records will be added to the list, it would be advisable to *name
this list (table_array)* and use this name in the function rather than its references.
Consequently, you will not be forced to modify each occurrence of the function to make sure
that the VLOOKUP function searches the correct range of cells (long and annoying). You'll
want to adapt the references of the list name and all the functions occurrences will be
automatically updated.

The function main weakness

As the function can only *counts* the table columns, changing the columns order, adding or
removing columns can easily generate errors.

11   The HLOOKUP function

In French : RECHERCHEH

Syntax : HLOOKUP(lookup_value ;table_array ;row_index_num ;[range_lookup])

To use when the table is to be "read" in rows rather than in "columns". This is not very
frequent.

| C2 | : | × | ✓ | fx | =HLOOKUP(B2;$A$17:$L$18;2) |

⊿	A	B	C	D	E	F	G	H
1	**Month**	**Sales**	**Code**					
2	January	3542	600					
3	February	4563	800					
4	March	4123	700					
5	April	4236	700					
6	May	5412	900					
7	June	3256	500					
8	July	4593	800					
9	August	2356	300					
10	September	1236	100					
11	October	3524	600					
12	November	3625	600					
13	December	1452	100					
14								
15								
16	Table							
17	Sales	1000	1500	2000	2500	3000	3500	400
18	Code	100	200	300	400	500	600	70

Main characteristics of the function :

Except the fact that the list (table_array) is read in rows rather than in columns, it has the same characteristics as the VLOOKUP function.

12   The LOOKUP function

In French : RECHERCHE

Syntax : LOOKUP(lookup_value ;lookup_vector ;[result_vector])
The function has another syntax for array calculations. Not covered in this chapter.

The LOOKUP function has different characteristics than the previous two functions and that is why it can sometimes be an interesting alternative.

Main characteristics of the function :

- The function is set on approximate match by default - *this cannot be modified* - therefore the "index" column MUST BE SORTED BY ASCENDING ORDER (if not, more risk of #N/A values)

- If the lookup value is smaller than the first and therefore the smallest value in the "index" column; the function return the #N/A error code

- Instead of indicating the *number* of the "return" column - as for the VLOOKUP/HLOOKUP functions - *the return column is a range of cells*

The return column is a range of cells set manually - If you later on insert or delete columns in the list/table; the function still works fine.
The function can search backwards.

Weak points

No exact match

13 The INDEX function

In French : INDEX

Syntax : INDEX(table,row_num;column_num)

This function returns the content located at a given intersection.
Here below an example :

This function is rarely used to find an intersection that you would have to type manually. It is usually combined with *form controls* such as a *Combo Box* or a *List Box*. As shown in the following screen capture .

❶ The table into which the function will search the intersection. The labels are not included in the selected range of cells. This is optional, but if you omit the labels, the rows and columns are easier to *count* (the Food/Industry intersection will be 1/1 with labels not included and 2/2 if they are).

❷ The intersection comes from the user's choice in the two form controls : *List Box.* Here below the control properties :

Input range : the list items. For the first one, it is sufficient to select the cells A6 to A11, directly in the table. For the second one, it is not possible because list items must always be vertically typed. Consequently, the required items were copied-pasted outside the table onto the worksheet and placed vertically (number ❸). Eventually the column should be hidden.

Linked cell : when the user selects a given item from the drop-down list, Excel does not memorize the choice. Therefore, impossible to use it into any formula. Unless a *linked cell* is set where the user's choice will be stored. But it would not be advisable to set a cell that everyone can see, so the linked cell is usually the cell BELOW the control.

Drop down lines : number of lines for the list items.

Then build the INDEX function : =INDEX(**B6:G11**;**C16**;**C17**). **B6:G11** i.e. the table to search - **C16** i.e. its contents, namely **2** for the choice in the screen capture and **C17** i.e. **3** for the choice in the screen capture.

The rest is nothing but usual math calculations.

14 The MATCH function

In French : EQUIV

Syntax :MATCH(lookup_value;lookup_array;type)

The MATCH function returns the row number for a given intersection. (it is the opposite of the INDEX function) :

Example :

For the cases where the type can be "relative" and not "exact" : see exercises.

The function is rarely used on its own as in the above example. It is often combined with the INDEX function, as in the next screen capture :

	A	B	C	D	E	F	G	H	I	J	K	L
16												
17												
18	**Salesmen**	**Sale**		Highest sale		Luke		INDEX(B19:B27;MATCH(MIN(C19:C27);0);1)				
19	John	123'500		Lowest sale		Paul		INDEX(B19:B27;MATCH(MAX(C19:C27);C19:C27;0))				
20	Hector	42'600										
21	Kevin	32'960		Let's take a closer look at this function !								
22	Luke	124'563		MATCH will help us to find on which row in the Sale column can the best sale be found								
23	Martin	4'578										
24	Patrick	12'456		=MATCH(lookup_value=max_sale;array;type)								
25	Paul	2'666		Position of best sale :			4	MATCH(MAX(C19:C27);C19:C27;0)				
26	Peter	26'666										
27	Keith	54'578		INDEX will help us to retrieve the name in front of this 4th position !								
28												
29				=INDEX(lookup_column wich is SALESMEN;nr_row which is this 4 position;nr_col which is column SALESMEN								
30				Best salesman :		Luke		INDEX(B19:B27;MATCH(MAX(C19:C27);C19:C27;0);1)				
31												
32				Same for the lowest sale								

15 The EXACT function

In French : EXACT

Syntax : EXACT(text1;text2)

This function is used to compare two cells. It returns TRUE if the content of the cells is identical and FALSE it not :

In the above screen capture the columns to compare are next to each other, therefore the function is not really useful. But it becomes a handy tool when you need to compare very long extractions from a data base.

16 The SUBTOTAL function

Subtotals can be generated automatically when you define a *table,* or through the SUBTOTAL command (DATA Tab – OUTLINE Group). The SUBTOTAL function can be built manually, which at times, can be very interesting :

◢	A	B	C	D	E	F	G
1	**Inv. Date**	**Customer Nr.**	**Qty**	**Price/Piece**	**Amount**	**Salesman**	**Product**
17	01.08.17	12	6	25.00	150.00	JOHN	Languages
18	10.08.17	4	4	3.00	12.00	BRUNO	Office
19	13.09.17	5	3	49.50	148.50	BRIAN	Office
20	17.10.17	7	8	29.90	239.20	PETER	EAO
21	02.11.17	8	2	18.60	37.20	JOHN	Office
22	30.12.17	9	7	88.90	622.30	BRUNO	Languages
23	31.12.17	10	8	25.00	200.00	BRUNO	Langages
24							
25	**How many sales ?**				**Sum of sales**		
26	22				8'064.30		
27	=SUBTOTAL(2;A2:A23)				=SUBTOTAL(9;E2:E23)		

If you filter, the function ignores the hidden rows :
(Which would not be the case if using a standard function such as SUM, COUNT …).
Example : filter on Daniel :

◢	A	B	C	D	E	F	G
1	**Inv. Da** ▾	**Customer N** ▾	**Qty** ▾	**Price/Pie** ▾	**Amou** ▾	**Salesm** ⊤	**Product** ▾
9	16.04.17	3	3	73.25	219.75	BRUNO	EAO
11	01.05.17	4	12	99.90	1'198.80	BRUNO	Languages
12	02.05.17	9	13	100.30	1'303.90	BRUNO	Office
18	10.08.17	4	4	3.00	12.00	BRUNO	Office
22	30.12.17	9	7	88.90	622.30	BRUNO	Languages
23	31.12.17	10	8	25.00	200.00	BRUNO	Langages
24							
25	**How many sales ?**				**Sum of sales**		
26	8				4'159.15		
27	=SUBTOTAL(2;A2:A23)				=SUBTOTAL(9;E2:E23)		

Syntax of the function :
=SUBTOTAL(*function_number ;range)*

=subtotal(

SUBTOTAL(**function_num**; ref1; ...)

- 1 - AVERAGE
- 2 - COUNT
- 3 - COUNTA
- 4 - MAX
- 5 - MIN
- 6 - PRODUCT
- 7 - STDEV.S
- 8 - STDEV.P
- 9 - SUM
- 10 - VAR.S
- 11 - VAR.P
- 101 - AVERAGE
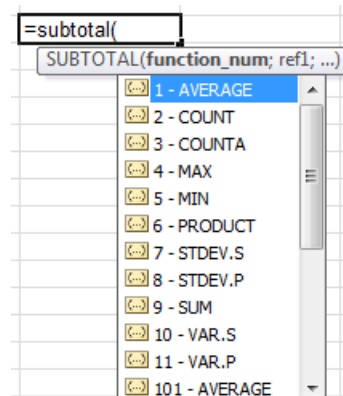
Function_num (includes hidden values)	Function_num (ignores hidden values)	Function
1	101	AVERAGE
2	102	COUNT
3	103	COUNTA
4	104	MAX
5	105	MIN

6	106	PRODUCT
7	107	STDEV
8	108	STDEVP
9	109	SOMME
10	110	VAR
11	111	VARP

When used with a list in autofilter mode, you can ignore the numbers 101 to 111. These functions are to be used with manually hidden rows/columns :

	A	B	C	D	E	F	G
1	invoice date	product	salesn	area	sales	commission	payment
2	01.01.2017	SOFTWARE	JOHN	WEAST	5'000	750	01.02.2017
23	22.01.2017	HARDWARE	MAX	NORTH	6'800	1'020	22.02.2017
24	23.01.2017	TRAINING	LUKE	SOUTH	3'800	570	23.02.2017
25	24.01.2017	HARDWARE	JOHN	SOUTH	7'300	1'095	24.02.2017
26	25.01.2017	SOFTWARE	LUKE	WEAST	9'200	1'380	25.02.2017
30	29.01.2017	TRAINING	PETEF	SOUTH	9'900	1'485	01.03.2017
31	30.01.2017	TRAINING	KEITH	EAST	8'600	1'290	02.03.2017
32	31.01.2017	SOFTWARE	JOHN	WEAST	1'800	270	03.03.2017
33							
34	How many sales ?						
35	31	=SUBTOTAL(2;$A$2:$A$32)					
36	8	=SUBTOTAL(102;$A$2:$A$32)					

17 The financial PMT, IPMT and PPMT (and PV) functions

In French : VPM, INTPER and PRINCPER (and VA)

PMT   Calculates the payment for a loan, based on constant payments and a constant interest rate.

IPMT   Returns the interest payment for a given period for an investment, based on periodic, constant payments and a constant interest rate.

PPMT   Returns the payment on the principal for a given investment based on periodic, constant payments and a constant interest rate.

PV   Returns the present value of an investment : the total amount that a series of future payments is worth now.

Syntax : PMT(rate ;nper ;pv ;[fv] ;[type])

Rate   The interest rate per year. If payment is done by quarter → (rate/4), if done by month → (rate/12) etc …

Nper   The total number of payments for the loan

Pv   Present value. What you intend to borrow (now).

Fv   Future value or a cash balance you want to attain after the last payment is made. If this argument is omitted, it implies that the cash balance is 0 (there is no more any amount left). But there are cases where the cash balance should not equal 0 (the famous accounting 1 for instance). In this latter case, indicate which cash balance you required.

This calculation method is applied to small private credits in Switzerland and to a mortgage in France.

The screen capture here below shows a reimbursement schedule for a French mortgage. The **PMT** function will calculate the constant annuity you will have to pay over the given number of periods. The **IPMT** and **PPMT** functions will extract (from this constant annuity), the *interest* and *principal (what you really re-imburse)* parts. Rather than showing the result of this extraction for a specific year, the re-imbursement schedule shows the extraction for each period (here every two years). Hence, you will work on a handy synoptic view of all your future payments. Caution : this implies the use of absolute references.

	A	B	C	D	E
1		**Clever Bank**			
2					
3	Amount	400'000			
4	Rate	4.00%			
5	Number of years	20			
6					
7		**Reimbursement Schedule**			
8		**Year**	**Interest**	**Reimbursement**	**Fixed Annuity**
9		1	fr. -16'000.00	fr. -13'432.70	fr. -29'432.70
10		3	fr. -14'903.89	fr. -14'528.81	
11		5	fr. -13'718.34	fr. -15'714.36	
12		7	fr. -12'436.05	fr. -16'996.65	
13		9	fr. -11'049.12	fr. -18'383.58	
14		11	fr. -9'549.02	fr. -19'883.68	
15		13	fr. -7'926.51	fr. -21'506.19	
16		15	fr. -6'171.61	fr. -23'261.09	
17		17	fr. -4'273.50	fr. -25'159.20	
18		19	fr. -2'220.51	fr. -27'212.19	
19		20	fr. -1'132.03	fr. -28'300.67	
20					
21		=IPMT($B$4;A9;$B$5;$B$3)			
22			=PPMT($B$4;A9;$B$5;$B$3)		
23				=PMT($B$4;$B$5;$B$3)	

Example with PV :

	A	B	C
1			
2	Amount I could pay	fr. 30'000.00	*by year*
3	How many years ?	20	
4	At which rate ?	4%	
5	How much can I borrow ?	fr. -407'709.79	
6			
7		=PV(B4;B3;B2)	
8		=PV(rate;nper;pmt)	

18 Rounding functions

In English ROUND – ROUNDDOWN – ROUNDUP and TRUNC.
In French ARRONDI – ARRONDI.INF, ARRONDI.SUP and TRONQUE

Syntax : ROUND(number ;num_digits) – num_digits = number of decimal digits

	A	B	C	D	E	F
24	number	=ROUND	=ROUNDDOWN	=ROUNDUP		=TRUNC
25	52.121	52.12	52.12	52.13		52.12
26	52.122	52.12	52.12	52.13		52.12
27	52.123	52.12	52.12	52.13		52.12
28	52.124	52.12	52.12	52.13		52.12
29	52.125	52.13	52.12	52.13		52.12
30	52.126	52.13	52.12	52.13		52.12
31	52.127	52.13	52.12	52.13		52.12
32	52.128	52.13	52.12	52.13		52.12
33	52.129	52.13	52.12	52.13		52.12
34						
35	* ROUNDDOWN and TRUNC seem identical. Indeed, at least for us, normal users.					
36	Apparently there should be a difference in some advanced math calculations but					
37	sorry I do not know more about it.					

All three functions round a result. The TRUNC function eliminates the digits after the set number of digits and is equivalent to the ROUNDDOWN function.

💣 **Do not mix this type of rounding with the rounding *format* buttons**

This style **HIDES** decimal digits but behind the format, they are not removed and will be used in calculations. This can lead to a minor result difference when you use 2 numbers showing the same decimal digits

Typed data	Rounded data	Multiplied by 5
123.256	123.26	616.280
123.259	123.26	616.295

3 functions use the multiple and return the nearest multiple number of a of the set number.

In English : MROUND, FLOOR and CEILING
In French : ARRONDI.AU.MULTIPLE. PLANCHER and PLAFOND

Syntax : =MROUND(number;multiple).

number	=MROUND	=FLOOR	=CEILING
3	3	3	3
4	3	3	6
5	6	3	6
6	6	6	6
7	6	6	9
8	9	6	9
9	9	9	9
10	9	9	12
11	12	9	12

To solve the famous problem of rounding to the 5 centimes below or above, use this MROUND function and set 0.05 as the multiple.

BEFORE

	A	B	C	D	E	F
			Rounding to 0.05 cts sup/inf			
6		Windows	Word Basics 1	Word Basics 2	Excel Basics 1	Excel Basics 2	Powe
7	Purchase price	13.50	21.50	42.70	21.70	18.50
8	Profit rate : 33%	4.46	7.10	14.09	7.16	6.11
9	Retail price	17.96	28.60	56.79	28.86	24.61

AFTER

	A	B	C	D	E	F
			Rounding to 0.05 cts sup/inf			
6		Windows	Word Basics 1	Word Basics 2	Excel Basics 1	Excel Basics 2	P
7	Purchase price	13.50	21.50	42.70	21.70	18.50
8	Profit rate : 33%	4.46	7.10	14.09	7.16	6.11
9	Retail price	17.95	28.60	56.80	28.85	24.60

=MROUND(SUM(B7:B8);0.05)

Notes
You can also round up/down to 5 centimes using the function : **INT(20****number*+**0.5)/20**.
To obtain Fr. 17.95 enter =INT(20*SUM(B16:B17)+0.5)/20**.**

You can even use a standard rounding, using the following calculation :
=ROUND(*number**2;1)/2.

💣 Caution ! In the above examples, the numbers to round up/down to 5 centimes are positive. If the number is a negative value, you must set a negative multiple or Excel will refuse the formula and return the error code #NAME.

Therefore = MROUND(17.94;0.05) shows 17.95 and
MROUND(-17.94;-0.05) shows –17.

If the results to round up/down to 5 centimes can be either positive of negative, you will
have to use the above mentioned INT function or =ROUND(*number**2;1)/2. Caution : if
the multiple is other than 0.05, neither of them will work.

19 Other interesting mathematical functions

19.1 The ABS function

In French : ABS

Syntax : ABS(number)

Returns the absolute value of a number, a number without its sign

=ABS(46.77)	*46.77*
=ABS(-46.77	*46.77*

19.2 The INT function

In French : ENT

Syntax : INT(number)

Rounds a number down to the nearest *integer (whole number).* Example :

	A	B	C	D
15				
16	Today's date	:	18.11.2016	
17				
18	My date of birth	:	05.04.1961	
19				
20	It was a	:	mercredi	
21				
22	How long have I been living ….	:	20316	
23				
24	How long in a number of full years	:	55	
25				
26	=INT((C23/365.25))			
27	Usual rounding ? ROUND(55.24;0)=55 but ROUND(55.66;0)=56 ! A ROUNDDOWN(division;0) is really more appropriate !			

19.3 The MOD – ISEVEN – ISODD functions

In French : MOD, EST.PAIR / EST.IMPAIR

Syntax : MOD(number ;divisor) – ISEVEN(number)

Returns the remainder after a number is divided by a divisor

=MOD(25 ;4)	1	(6*4=24)
=MOD28 ;4)	0	(7*4=28)

The ISEVEN / ISODD functions return the values TRUE or FALSE

MOD or ISEVEN/ISODD are handy to test if a number is *odd* or *even*. If the number is even, MOD with 2 as the divisor will always return 0 and if the number is odd, the remainder will always be 1. The other two functions will return TRUE or FALSE when they test if the number is odd or even. The three functions can be used to make a test when using an IF function for instance.

27	Today only plates with an odd number can drive in town			
28	Name	Plates	Can drive with ISODD	Can drive with MOD
29	Dupond	GE 12001	can drive	can drive
30	Dupont	GE 92222	no	no
31	Durand	GE 372854	no	no
32	Grand	GE 22666	no	no
33	Grosjean	GE 444445	can drive	can drive
34	Martin	GE 71451	can drive	can drive
35	Michel	GE 410658	no	no
36				
37			=IF(MOD(C29;2)=1;"can drive";"no")	
38			=IF(ISODD(C29);"can drive";"no")	

Special case when MOD can be used :

43	A case where the MOD function is VERY, VERY INTERESTING : subtracting "negative" hours		
44			
45	In	Out	Working time
46	08:00	12:00	04:00
			normal subtraction : OK
47			
48	23:00	05:00	###############
			normal subtraction : a disaster !
49			
50	23:00	05:00	06:00
51			same but adding the MOD function **=MOD(B42-A42,1)**

Why and how ? …. Well … is there a mathematics genius around …. ?

Caution : do not mix up the above functions with the EVEN / ODD functions. Those simply return the nearest *even or odd* number   =EVEN(23)=24

In French : CONVERT

Syntax : CONVERT(number ;from_unit ;to_unit)

Weight and mass	From_unit or to_unit
Gram	"g"
Slug	"sg"
Pound mass (avoirdupois)	"lbm"
U (atomic mass unit)	"u"
Ounce mass (avoirdupois)	"ozm"

Converts a number from one measurement system to another (Fahrenheit degrees to Celsius degrees, inches to cm, grams to ounces and so on ….). Run the help file. A table with all the conversion codes will be displayed. Here after the beginning of it :

Distance	From_unit or to_unit
Meter	"m"
Statute mile	"mi"
Nautical mile	"Nmi"
Inch	"in"
Foot	"ft"
Yard	"yd"
Angstrom	"ang"
Pica (1/72 in.)	"Pica"

Codes are always placed between quotes

Example :

	C	D
	1	inch
	0.0254	cm
=CONVERT(C2;"in";"m")		

Time	From_unit or to_unit
Year	"yr"
Day	"day"
Hour	"hr"
Minute	"mn"
Second	"sec"

20 Text functions

	A	B	
3	=LEFT(number_or_text;number_of_characters)	Returns the number of specified characters from the cell left side	GAUCHE
4	Smith John	Smith	
5	1000.56	1000	
6			
7	=RIGHT(number_or_text;number_of_characters)	Returns the number of specified characters from the cell right side	DROITE
8	Smith John	John	
9	1000.56	56	
10			
11	=UPPER(text)	Displays the cell contents in uppercase	MAJUSCULE
12	=LOWER(text)	Displays the cell contents in lowercase	MINUSCULE
13	=PROPER(text)	Displays the cell contents with the 1st letter of each word in uppercase	NOMPROPRE
14	paul	PAUL	
15	PAUL	paul	
16	paul dupont - avenue aubert 43	Paul Dupont - Avenue Aubert 43	
17			
18	=LEN(number_or_text)	Returns the number of characters in the cell	NUMCAR
19	Dupont	6	
20	1000	4	
21			
22	=FIND(character_to_be_found;string_of_text)	Returns the character's position in the string of text	TROUVE
23	Charles Dupont	1	
24	Function is case sensitive. If you type c instead of C the function will return an error. SEARCH function works the same but is not case sensitive		
26	=SEARCH(character_to_be_found;string_of_text)	Returns the character's position in the string of text	CHERCHE
27	Charles Dupont	1	
28			
29	=MID(text;start_num;num_char)	Returns the characters from a start point across a number of characters	STXT
30	Charles Dupont	Charles	
31		(from char 1 : 7 characters)	
32			
33	=TRIM(text)	Remove all unnecessary spaces but always leaving one space between words	SUPPRESPACE
34	Charles Dupont de Neuilly sur Seine	Charles Dupont de Neuilly sur Seine	

31					
32	=EXACT(vaue_or_text1;value_or_text2)	Compares two numbers or two strings of text and return TRUE or FALSE			EXACT
33	List 1	List 2		Exact ?	
34	XL45	AB89		FALSE	
35	PC56	VN91		FALSE	
36	TS67	GZ67		FALSE	
37	XL45	XL45		TRUE	
38	PC56	PC56		TRUE	
39	XO59	XL45		FALSE	
40	XL45	PC56		FALSE	
41	PC56	UT34		FALSE	

	A	B	
36	=DOLLAR(number;number_decimal_digits)	To convert a number into a text label but adding the default currency symbol	FRANC
37	1000	1'000.00 fr.	
38	=VALUE(string_of_text)	To convert a text label into a number	CNUM
39	1000	1000	

41	=FIXED(number; number_deicmal_digits;with or without commas)	Rounds a number tot the specified number of decimals and returns the result as text with or without commas	CTXT
42	=FIXED(1235.569;2;FALSE)	1'235.57	

21 Functions linked to dates

21.1 Subtracting dates

	A	B	C	D
16	Today's date	:	18.11.2016	
17			=TODAY() function	
18				
19	My date of birth	:	05.04.1961	
20			Typed manually	
21				
22	It was a	:	mercredi	
23			Simple cell format : jjjj	
24				
25	How long have I been living	:	20316	days

21.2 Adding daily totals

	A	B	C	D	E	F	G	H	I	J	K
1	Name	Maïté Tijico	Morning				Afternoon				Day
2	Week	2	from	to	total		from	to	total		Total
3	Monday	09.01.2017	08:00	12:00	04:00		13:30	17:30	04:00		08:00
4	Tuesday	10.01.2017	08:00	12:00	04:00		13:30	17:30	04:00		08:00
5	Wednesday	11.01.2017	08:00	12:00	04:00		13:30	17:30	04:00		08:00
6	Thursday	12.01.2017	08:00	12:00	04:00		13:30	17:30	04:00		08:00
7	Friday	13.01.2017	08:00	12:00	04:00		13:30	17:30	04:00		08:00
8	Saturday	14.01.2017									
9	Sunday	15.01.2017									
10	Total										16:00

Why 16 ?

Simply because hours, with a standard hour format such as *hh :mm,* always work on a 24 turn basis

Here after the default calculation :
8:00 + 8:00 + 8:00 = 24:00 consequently 0. The remainder is 8:00 + 8:00 = 16:00

Solution :

:00	08:00
	40:00

The sum was not modified but we applied another format, one that allows a decimal addition : [h]:mm :ss (the last ss was removed)

21.3 Multiplying with an hourly rate

Continuing the above example

	40:00	Standard addition	SFr.	66.67
Hourly rate	SFr. 40.00			
Week total		Standard multiplication **but add** ***24** at the end	SFr.	1'600.00

The reason is the following : the hour or date format is only a "format". Behind there is a decimal number (for example 12:00 = 0.5 – because 12 is half 24 and 24 is 1). Consequently, if you need to multiply such a result with another decimal number, you must first turn it into a decimal number also – by multiplying it by 24.

21.4 The YEAR(), MONTH(), DAY(), EOMONTH() functions

In French : ANNEE(), MOIS(), JOUR(), FIN.MOIS()

Some date functions will extract the year, the month, the day … out of a given date and users wonder what is their real use. Answer : these functions are often used to create a test when you set a condition for an IF function.

❶ Here below a little example. Humorous but it illustrates the above principle :

	A	B	C	D
19		**Extracting the year**	**Extracting the month**	**Extracting the day**
20	18.11.2016	2016	11	18
21				
22		=YEAR(A20)	=MONTH(A20	=DAY(A20)
23				
24				
25	**Example of use**			
26	28.03.2017			
27	29.03.2017			
28	30.03.2017			=IF(AND(MONTH(A26)=4 ;DAY(A26)=1);"April's Fool !!!";"")
29	31.03.2017			
30	01.04.2017	**April's Fool !!!**		
31	02.04.2017			
32	03.04.2017			
33	04.04.2017			

❷ Action perform whether it is the last day of the month or not …..

EOMONTH(start_date;number_of_months)	Returns the serial number of the last day of required month (then you simply format it) - current if *number_of_months = 0* - next month if *number_of_months = 1* …
current date =TODAY()	18.11.2016
last day of current month	30.11.2016

Example : a time-sheet. You type the first day of the current month and the rest of the month is filled, stopping automatically at 30 or 31.

	A	B	C	D	E	F	G	H
1	01.01.2017							
2	02.01.2017		=IF(EOMONTH(A1;0)-A1=0;"";A1+1)					
3	03.01.2017							
4	04.01.2017		If the month last day - the previous date = 0					
5	05.01.2017		Then the cell remains empty					
6	06.01.2017		Else add one (day)					
7	07.01.2017							
8	08.01.2017							
9	09.01.2017							
10	10.01.2017							
11	11.01.2017							
12	12.01.2017							
13	13.01.2017							
14	14.01.2017							
15	15.01.2017							
16	16.01.2017							
17	17.01.2017							
18	18.01.2017							
19	19.01.2017							
20	20.01.2017							
21	21.01.2017							
22	22.01.2017							
23	23.01.2017							
24	24.01.2017							
25	25.01.2017							
26	26.01.2017							
27	27.01.2017							
28	28.01.2017							
29	29.01.2017							
30	30.01.2017							
31	31.01.2017							

Caution : this formula does not manage the case of February 28th ! The function will generate an error on cell A30 & A31. Why ? Beause the result of + 1 on the "empty" previous cell (*"empty in quotes because it contains a function)* will be #VALUE!

Therefore the correct function would rather be :

=IF(A2="";"";IF(EOMONTH(A2;0)-A2=0;"";A2+1))

21.5 Retrieving the week number : WEEKNUM()

In French NO.SEMAINE()

Syntax : WEEKNUM(date)

=WEEKNUM(date)	Returns the week number in the year	
	25.12.2017	53
	26.12.2017	53
	27.12.2017	53
	28.12.2017	53
	29.12.2017	53
	30.12.2017	53
	31.12.2017	53
	01.01.2017	1
	02.01.2017	1
	03.01.2017	1
	04.01.2017	1

Very useful with a conditional format that grays out one week out of two in a time-sheet.

● Important : this function works with January 1st being the first day in the year, whatever its position in the week. But according to European standards, the first week in the year is the week where a minimum of 4 days or more falls into the new year. Consequently, the function could well return a wrong value according to this European standard. In this case, simply add 1 to the function.

21.6 The NETWORKDAYS()and WORKDAY() functions

In French NB.JOURS.OUVRES and SERIE.JOUR.OUVRE
Syntax : NETWORKDAYS (start_date ;end_date ;[holidays])
*WORKDAY (start_date ;days ;[holidays])   * days = working days*

B39	fx	=NETWORKDAYS(A41;A42;A43:A44)

	A	B
37		
38	=NETWORKDAYS(start_date;end_date;holidays)	Returns the number of working days between two dates excluding Saturdays/Sundays/Indicated Holidays
39		20
41	01.12.2017 starting date	
42	31.12.2017 end date	
43	25.12.2017 holidays	
44	31.12.2017	

B47	fx	=WORKDAY(A50;A51;A52:A53)

	A	B
46	=WORKDAY(start_date;number_days;holidays)	Returns the day (as a serial number) corresponding to the start date + indicated working days + indicated holidays
47		42962
48	namely	14.08.2017
49		
50	01.01.2017 starting date	
51	160 working days	
52	14.04.2017 holiday	
53	17.04.2017 holiday	

In English and in French ...   DATEDIF

Syntax : DATEDIF(start_date ;end_date ;type)

Type can have the following values :

"y"	*Years*
"m"	*Months*
"d"	*Days*
"ym"	*Months if both dates belong to the same year*
"yd"	*Days if both dates belong to the same year*
"md"	*Days if both dates belong to the same month*

◢	A	B	C	D
13				
14	Birth	05.04.1961		
15	Today	18.11.2016		
16				
17	DATEDIF	55	total of years (full)	
18		=DATEDIF($B$16;$B$17;"y")		
19		667	total of months (full)	
20		=DATEDIF($B$16;$B$17;"m")		
21		20316	total of days (full)	
22		=DATEDIF($B$16;$B$17;"d")		
23		55 years 7 months 13 days		
24		=DATEDIF(B16;B17;"y")&" years "&DATEDIF(B16;B17;"ym")&" months "&DATEDIF(B16;B17;"md")&" days"		

The last example is the most interesting one : using concatenation and the type argument, the final result is expressed in years-months-days.

When to use ? for instance to calculate how long a person has been working in a company

Name	Entry date	Working in the company
SMTH	05.04.1961	58 years 7 months 25 days
DURANT	01.01.2002	17 years 10 months 29 days
DUPONT	01.01.2008	11 years 10 months 29 days

💣 This function is special as it is « hidden ». Indeed it will not be listed in the general list of functions and typing the beginning of it won't display the help tooltip. No topic on this function in the help file either. Why ? One book did mention that it was for compatibility reasons, especially with Lotus 1-2-3.   ??

22 Information functions

Information functions are very handy when the cell value should generate a special result. It can answers questions such as : *is the cell empty, is the cell value an odd or even number, does its function return an error value such as #N/A or DIV#0* ?.

10	Simple example with an ISBLANK :	(a form to fill in)	
11			
12	The quality check will be performed by :		
13			
14	[...]		
15			
16	*At the bottom of the form*		
17	**You have not filled in the name of the person in charge (quality check)**		
18			

10	Simple example with an ISBLANK :	(a form to fill in)	
11			
12	The quality check will be performed by :		John Smith
13			
14	[...]		
15			
16	*At the bottom of the form*		
17	**Thanks for filling the present form**		

Here below a few information functions (for an exhaustive list see Excel)

=ISEVEN / ISODD	is the cell value an even or odd number ?
=ISNONTEXT	any content other than text (blank – number - error)
=ISTEXT	only text
=ISFORMULA	is the cell content a formula or a function ?
=ISNA	#N/A error value
=ISERR	#NUM!, #DIV/0! … values but not #N/A
=ISERROR	any error value

Sometimes you can replace the test with the IFERROR function :

B5	▼	:	×	✓	fx	=B3/B4		
◢	A	B	C	D	E	F	G	
1	The amount is must be divided. The divisor can be missing and it is not an error …							
2								
3	**Amount**	100	200	300	400	500	600	
4	**Divisor**	5	4			4	6	
5	**Result**	20	50	#DIV/0!	#DIV/0!	125	100	

The formula (but it can also be a function) is modified :

B5		▾	⋮	×	✓	_fx_	=IFERROR(B3/B4;"")		

◢	A	B	C	D	E	F	G
1	Changed :						
2							
3	Amount	100	200	300	400	500	600
4	Divisor	5	4			4	6
5	Result	20	50			125	100

With a VLOOKUP function, it is very common !

D12		▾	⋮	×	✓	_fx_	=VLOOKUP(B12;$F$12:$G$29;2)		

◢	A	B	C	D	E	F	G
9							
10	Simple VLOOKUP			but it is quite correct …		AVS/AI/APG rate	
11							
12	AVS John		⚠	#N/A	#N/A	8500	5.12%
13	AVS Peter			#N/A	#N/A	15000	5.24%
14	AVS Mark	58'684.00		9.50%	SFr. 5'574.98	19200	5.36%
15						21300	5.48%
16						23400	5.60%
17						25500	5.73%
18						27600	5.97%
19	_VLOOKUP returns #N/A simply because the cells B11 and B12_					29700	6.21%
20	_are blank …_					31800	6.46%
21						33900	6.70%
22						36000	6.94%
23						38100	7.19%
24						40200	7 55%

D19		▾	⋮	×	✓	_fx_	=IFERROR(VLOOKUP(B19;$F$12:$G$29;2);"")		

◢	A	B	C	D	E	F	G
9							
10	Simple VLOOKUP			but it is quite correct …		AVS/AI/APG rate	
11							
12	AVS John		at	#N/A	#N/A	8500	5.12%
13	AVS Peter			#N/A	#N/A	15000	5.24%
14	AVS Mark	58'684.00		9.50%	SFr. 5'574.98	19200	5.36%
15						21300	5.48%
16						23400	5.60%
17	with no #N/A					25500	5.73%
18						27600	5.97%
19	AVS Jean		at			29700	6.21%
20	AVS Pierre	34'067.00		6.70%	SFr. 2'282.15	31800	6.46%
21	AVS Marcel	58'684.00		9.50%	SFr. 5'574.98	33900	6.70%
22						36000	6.94%
23						38100	7.19%
24						40200	7 55%

Note : in the above situation, you could also opt for a ISBLANK function …

FUNCTIONALITIES

RELATED TO FUNCTIONS

1 Using audit tools to check formulas/functions

FORMULAS Tab – FORMULA
AUDITING Group
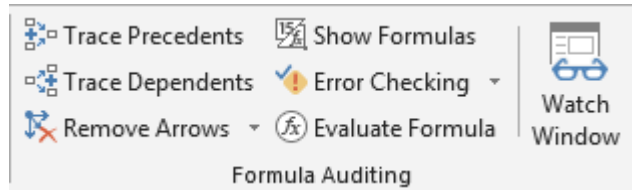
1.1 Showing the formulas rather than the results

The SHOW FORMULAS button.

Other access but longer :

OFFICE Button – EXCEL OPTIONS Button – Category ADVANCED – Topic DISPLAY
OPTIONS FOR THIS WORKSHEET – Option SHOW FORMULAS IN CELLS INSTREAD OF
TEIR CALCULATED RESULTS

1.2 Tracing precedents and dependents

It is easy to retrieve the references of a formula/function and consequently the source of an
error result. Colorful arrows are displayed and point to the cell containing the formula.

- Activate the result cell
- TRACE PRECEDENTS Button

- TRACE DEPENDENTS Button

The cell showing 750 is used in cell showing 60 and 810

- REMOVE ARROWS Button
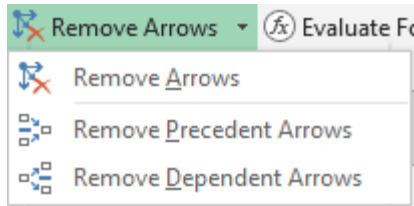
✎ If you move the result cell, copy it or delete rows/column in the worksheet .... all arrows are removed.

✎ When the precedent or dependent belongs to another workbook, a dotted line will be displayed. Double-click on it and a "GO TO" dialog box will be displayed that indicates the name of the workbook. Double-click to open it. (it must be currently opened).

	2'000	152
12	3'000	228
20	7'200	547

1.3 Analyzing a cell showing an error such as #VALUE, #NAME, #DIV, #NUM ...

In the screen capture below, relative references have been used instead of absolute references, and this has generated the error code.

- Select the cell in error

2	Adding a tax				
4	VAT (TVA)	8.0%			
5					
6	Price/unit	Quantity	Basic Price (No tax)	VAT (TVA)	Total Price (with all taxes)
7	150	5	750	60	810
8	200	10	2'000	0	2'000
9	250	12	3 0	#VALUE!	#VALUE!
10	360	20	7'200	36'000	43'200

The red arrows (from D9 to E9)	Links the error cell to its dependants (formulas referring to this error cell)
The blue arrows (from B6 and C9 to D9)	Links the error cell to its dependents

Removing the arrows : as for the precedents/dependents of a "normal" cell

Other possible analysis :

You can also use the options of the error tag. It is only displays when Excel detects an incoherent formula. The suggested options include help, showing the calculation steps …)ö
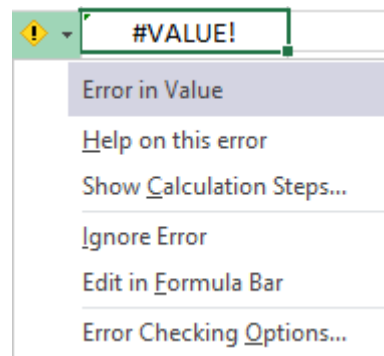
1.4   Tracing error cells without selecting any cell

Your table is a rather large one and you want to make sure that no formula has generated an error.

- The active cell must be at the top of the sheet. Then click on the ERROR CHECKING button (or first option of the drop-down list)

| **Help on this error** | The Help File is run and opens where the error code is explained |
| **Show Calculation Steps** | Runs the step by step evaluation : every reference and its value is analyzed separately. Explained later |

Ignore Error	No correction and the next error is selected
Edit in Formula Bar	Activates the formula bar for a manual correction
Options	Open the default EXCEL OPTIONS at the error tracking options (list of all errors tracked by Excel)
Previous - Next	The active cell is moved to the previous or next error

1.5 Evaluation of a formula

This can be handy when the function is a long and complex one.

- Select the cell containing the formula or the function.
- Click on the EVALUATE FORMULA button (or the *Show Calculation Steps* button in the error tracking dialog box)
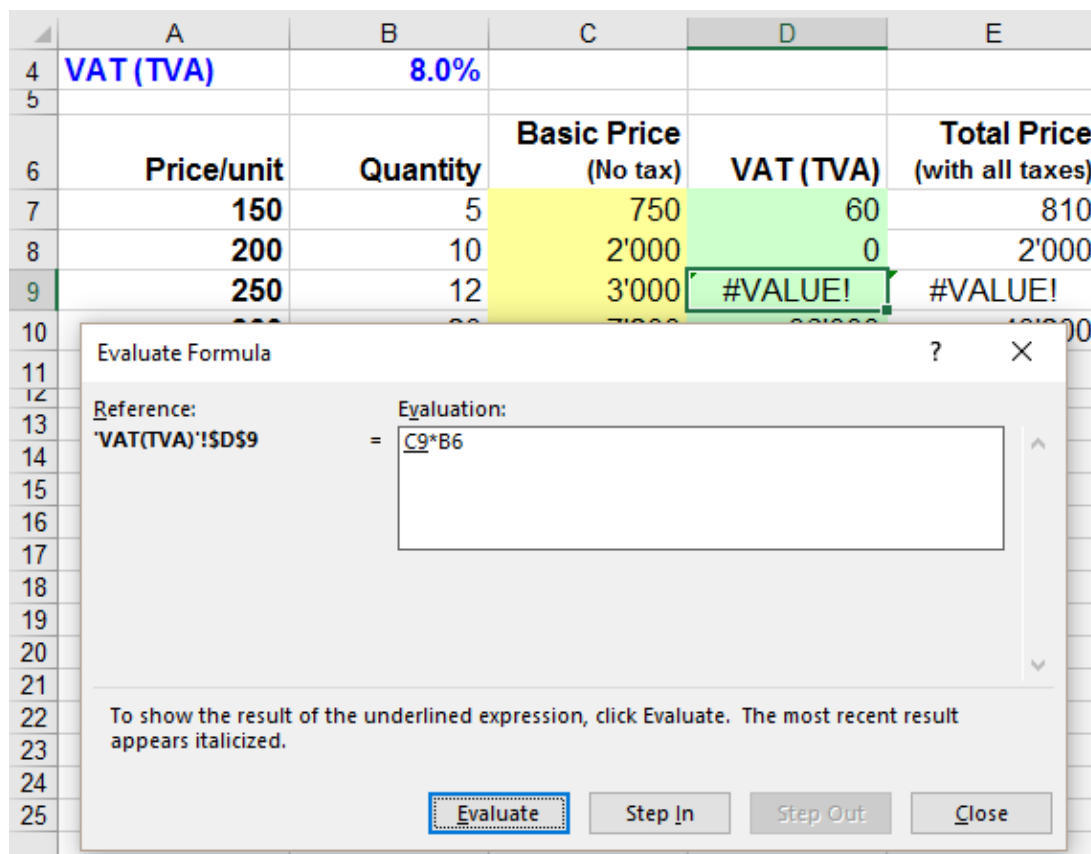
Evaluate	When you click, each reference is replaced with its value
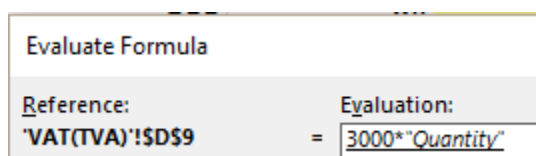
You can see here that multiplying a figure by a label is the origin of the error.

Step In   The underlined reference is developed when you click

C7 is the result of A7*B7 and the value of A7 is 150.
Once the reference has been fully developed, click on the STEP OUT button. Before analyzing B4 Excel will analyze B7 first. Click on the STEP OUT button and Excel will analyze B7 …

1.6 The WATCH WINDOW : to keep the content of a cell (its address, value, function …)

Aim : when you are working with a large and complex table, your various navigations can take you far away from a given cell and its contents. Therefore, it could be handy to memorize some cells and their contents to keep the information at hand. The collected references can also belong to workbooks other than the active one. Note : if the cells are named, then the Watch Window will be of greater use.

- Select the cell (optional but better)
- WATCH WINDOW Button

- To memorize a cell : click on the ADD WATCH button
- The active cell is suggested : *accept or change.*

✎ Note that cell B4 has been named TVA while B5 has no name. It makes no difference but reading will be made so much easier if the important cells are named.

☀ Workbooks need to be opened if you wish to collect some of their references. When you close them, make sure to save them or the Watch Window will be automatically emptied.

✎ The Watch Window does not allow to copy-paste the memorized value or formula. It simply works like a memory to check.

The buttons of the Audit toolbar use arrows. But Excel can also **_select_** the precedents, the cells generating an error result etc…

- HOME Tab – EDITING Group – Drop-down list of the FIND & SELECT Button – GO TO SPECIAL Option
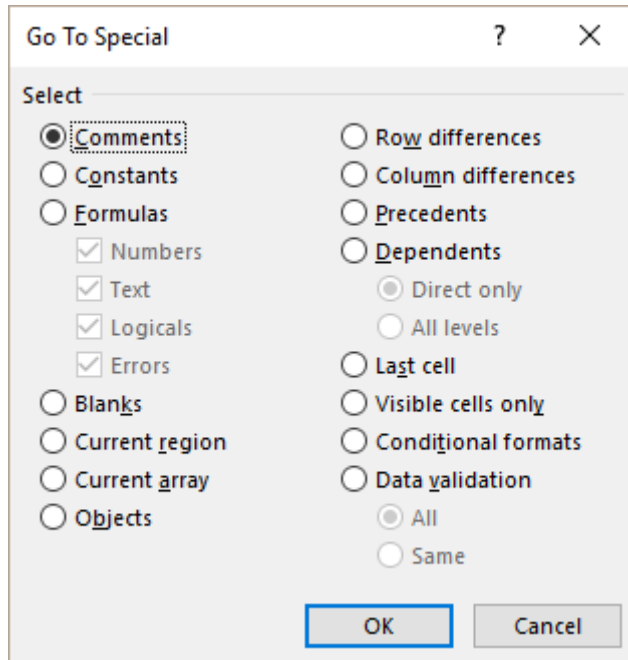
2 Conditional formats

Microsoft has placed this functionality on the HOME Tab and has consequently made it a functionality that every user should master (first level at least). This topic will remind you of simple conditional formatting and add the conditional formats linked to functions.

2.1 Reminder : creating a conditional format

HOME Tab – STYLES Group
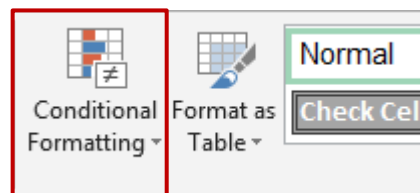
Drop-down list of the CONDITIONAL
FORMATTING button :
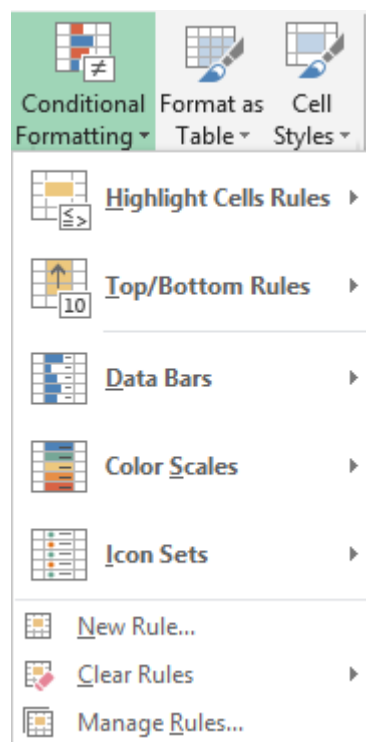
Some easy samples to help you understand how conditional formats work : :

Section :
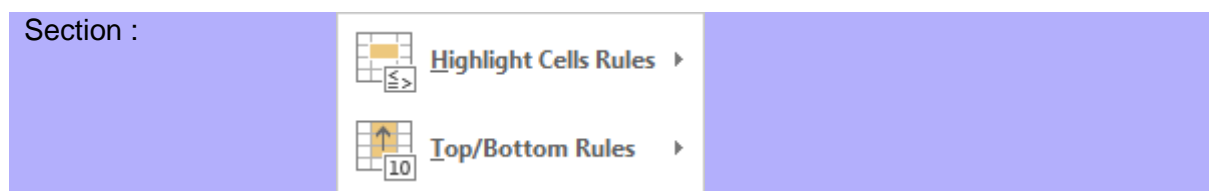
Excel source sheet :

3	Turnover	16.11.2016	28.02.2014	31.03.2014	30.04.2014	31.05.2014	30.06.2014
4	Systems	150'000	10'000	115'000	90'000	98'000	114'000
5	Software	95'000	40'000	50'000	48'000	36'000	42'000
6	Hardware	25'000	10'000	7'500	9'800	10'000	11'000
7	Services	63'000	50'000	47'000	59'000	48'000	55'000
8	Total	333'000	110'000	219'500	206'800	192'000	222'000
9							
10							
11	Expenses	16.11.2016	28.02.2014	31.03.2014	30.04.2014	31.05.2014	30.06.2014
12	Salaries	109'000	98'000	93'000	95'000	83'000	96'000
13	Telephone	7'500	6'000	4'500	6'300	7'200	5'000
14	Rent	25'000	10'000	25'000	25'000	25'000	25'000
15	Total	141'500	114'000	122'500	126'300	115'200	126'000
16							
17	Profit	191'500	-4'000	97'000	80'500	76'800	96'000
18	in % of Turnover	58%	-4%	44%	39%	40%	43%
19							
20	Average - 6 months	37%					

Highlight Cells Rules – Greater than

Select the required range of cells

☙ I typed 50**%** (you may type 0.5 but caution not 50)

Highlight Cells Rules – A date occurring …

Highlight Cells Rules – Duplicate values …

✎ MAX value : simply type 1
MIN value : select Top/Bottom Rules – Bottom 10 Items and type 1

Top/Bottom Rules – Above average

Data Bars help you see the value of a cell relative to other cells. The length of the data bar represents the value in the cell. A longer bar represents a higher value, and a shorter bar represents a lower value.

Color Scales are visual guides that help you understand data distribution and variation. A two-color or three-color scale helps you compare a range of cells by using a gradation of two or three colors. The shade of the color represents higher or lower values.

The three-color scale helps to set three categories : high values – intermediate values and low values.

Data Bars

31.01.2017	
114'000	
85'000	
11'000	
55'000	
220'000	
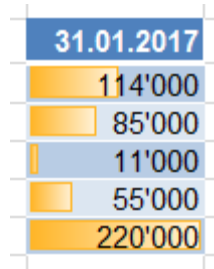
Color Scales

Caution, color scales go from the highest to the lowest value. Here Red-Yellow-Green *:*

HIV - Evolution in Switzerland (source : Office Fédéral de la Statistique)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Men deaths	112	116	134	125	94	95	100	70	56	9
Women deaths	65	57	55	52	29	36	39	32	14	3

The color shading is applied according to the cell value. This help to create « groups ».

Section
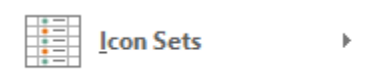
Icon Sets are used to annotate and classify data into three to five categories separated by a threshold value. Each icon represents a range of values.

These sets are difficult to use, even though they look so attractive …

- Colors are always applied from the top value to the lowest one.

- The number of icons is important.

  Indeed, if you select a 4 icon set and apply it to 6 cells, Excel will re-use 2 of the 4 icons. This in turn might affect the set's readability.

- Caution when using a set with arrows as the arrow direction does not necessarily mean that the values are going up or down.

  Sometimes chart icons will be more appropriate :

Example :

Salesman	Dept	Years in the company	Years in the company	
BRUNO	EAO	0	✖	0
BRIAN	EAO	4	✖	4
JOHN	Office	8	✖	8
JULES	EAO	7	✖	7
PIERRE	Langues	1	✖	1
MARC	EAO	3	✖	3
SANDRA	Langues	24	✔	24
REBECCA	Langues	31	✔	31
LAURENT	EAO	13	!	13

Legend   X = below 10 / ! = between 10 and 20 / ✔ = above 20

Interest : it is so easy to sort or filter on icons …

2.2   Reminder : managing the formats

The commands located at the bottom of the drop-down list of the CONDITIONAL FORMAT button :

- New Rule…
- Clear Rules   ▶
- Manage Rules…
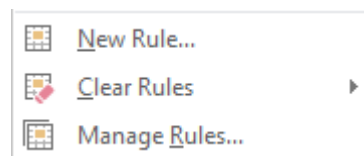
New Rule   A dialog box will be displayed. It includes all the above rules but also other rules to create formats based on formulas and functions.

This is not covered in this documentation

Clear Rules   You can remove a rule to :
The selected cells
The whole sheet
A table (a list defined as a table)
A pivot table

Manage Rules   A standard dialog box to create a new rule (the NEW RULE dialog box will be displayed), to modify an existing rule, to delete a rule :
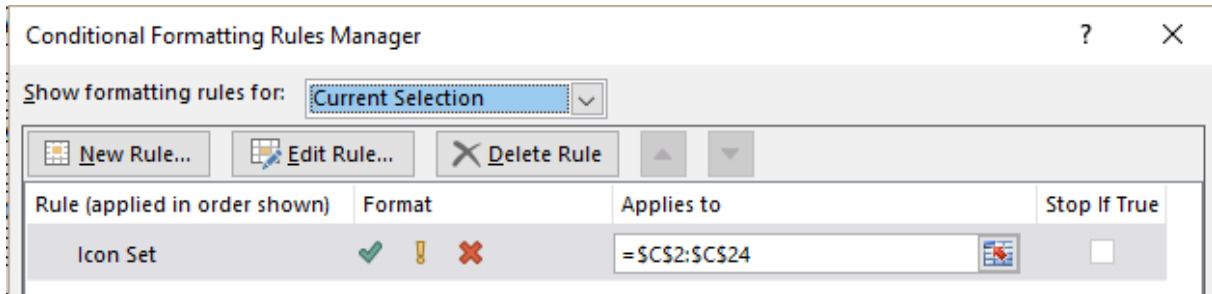
Why would you want to work with this dialog box ?

For instance you can work with rules *without having to first select the required range of cells*. You select from the SHOW FORMATTING RULES FOR pull-down menu.

And you can also *slightly modify an existing rule* :
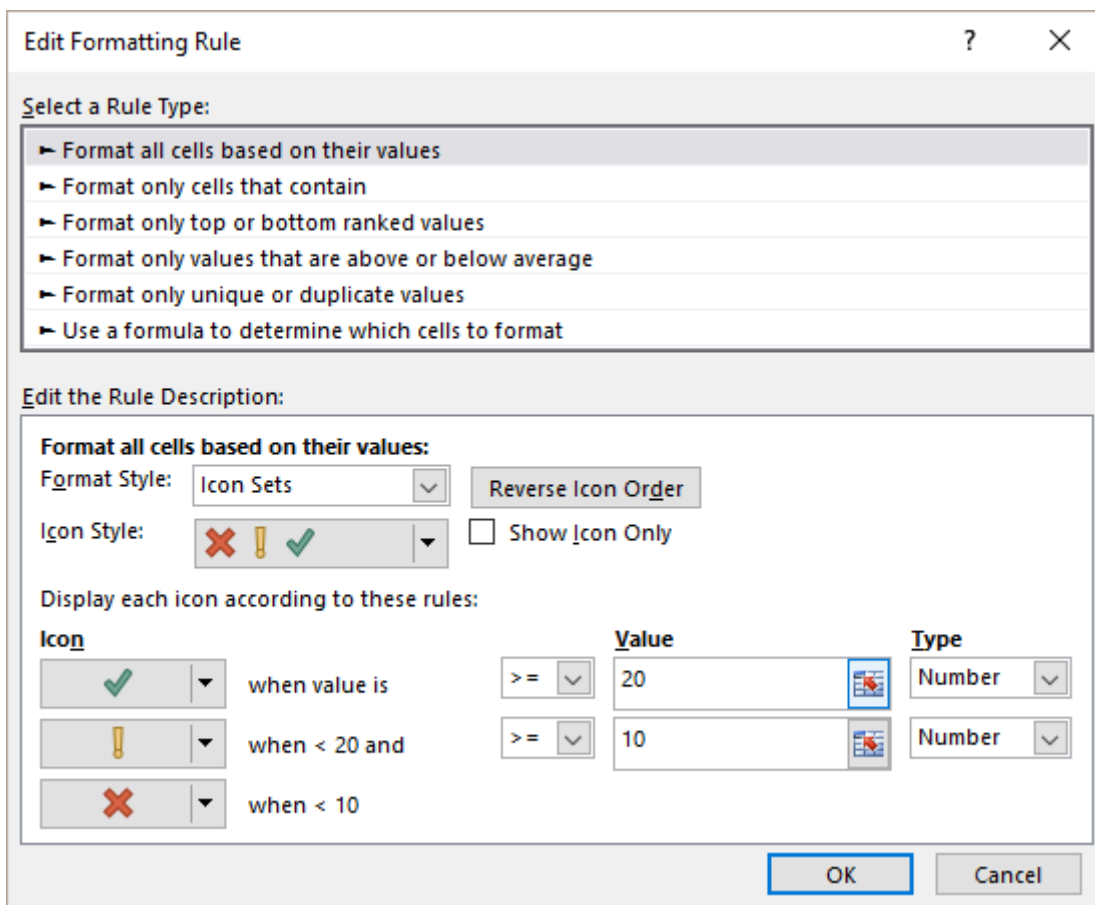
You may change the reference values, revert the icon order, show the icons only …

2.3 Conditional formats related to functions

A standard example : a conditional format applied to dates

A monthly schedule. How can you apply a special format (fill, font ..) to week-ends to make sure they stand out in the list ? This should not be done manually if the sheet is used every month because the week-ends will never fall on the same cells each month. _Answer_ : a conditional format testing if the date to format is a Saturday or Sunday (or any other day).

Explanations about the function : =WEEKDAY($A6;2)>=6

The whole function = _the condition_ of the conditional format. Therefore no need to introduce an IF, the conditional format _is an "if" by itself._

WEEKDAY() Returns the number of the day in the week

Caution : by default, the function works with a Judeo-Christian « count » where the first day of the week is SUNDAY (1) and the last one SATURDAY(7).

The function has an additional argument, _Type_ to switch to a standard « count », namely MONDAY =1. Type will be 2

Automatic help when you type the function :

Why **$**A6	When you click on the cell, the reference will be absolute (by default)
	Impossible to work with a full absolute reference because the test must be applied to each cell containing a date and not always the A2 cell.
	Work on the cell as if you were copying a formula/function. Consequently we removed the $ sign blocking the 2, to let the format test the next cell down. We left the $ sign blocking A because whatever the range of cells to which the conditional format is applied, the test is always on column A.
>=6	The day to be tested (*Saturday* and *Sunday* – *therefore 6 and 7 for type 2*)

Here after the result :

	A	B
5	**Date**	**Sales**
6	01.01.2017	229
7	02.01.2017	230
8	03.01.2017	560
9	04.01.2017	490
10	05.01.2017	780
11	06.01.2017	450
12	07.01.2017	620
13	08.01.2017	950
14	09.01.2017	630
15	10.01.2017	120
16	11.01.2017	850
17	12.01.2017	630
18	13.01.2017	420
19	14.01.2017	320
20	15.01.2017	130
21	16.01.2017	920

You can use other functions on the same principle.

For instance ISODD(ROW()) or ISEVEN(ROW()) + fill will apply a given fill color only on even or odd rows (handy to improve the reading of a table). ROW() returns the row number in the Excel sheet.
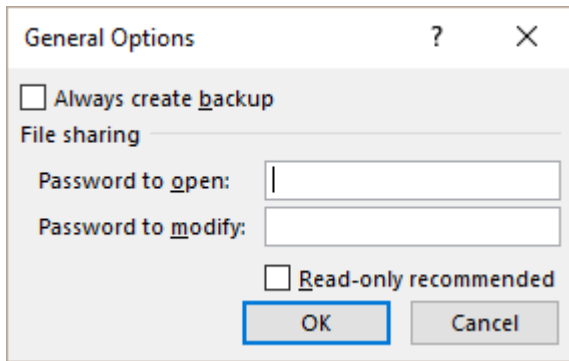
3 Protection

3.1   Protecting the access to a workbook

This is set when you save the workbook :

Click on the TOOLS button, located at the bottom of the saving dialog box :

Tools ▼	Save	Cancel

Map Network Drive...
Web Options...
General Options...
Compress Pictures...
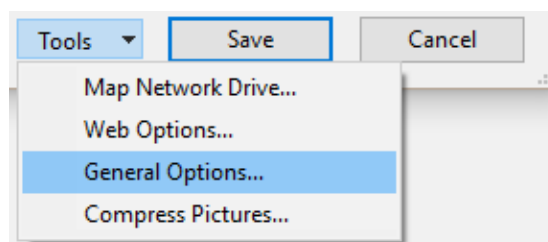
Password to open   Only the user who knows the password can open and work into the workbook

Password to modify   Only the user who knows the password can work into the workbook but anyone can create a copy of the workbook that will be renamed and saved as required

Read-only recommended   Nothing more than a simple advice given to the user. No real protection.

3.2   The Mark as Final command

The workbook can be opened, saved … but all editing options are disabled. It is a *forced* read-only mode.

- **OFFICE Button – PREPARE – MARK AS FINAL**
- Excel warns you that the workbook will be first saved. Accept
- A dialog box warns you that all editing options will be disabled

- The corresponding icon is displayed in the Status Bar
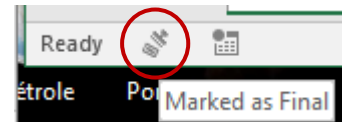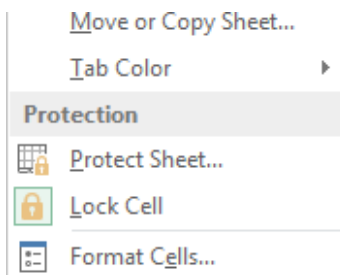

When the file is opened, the message bar displays the following information :
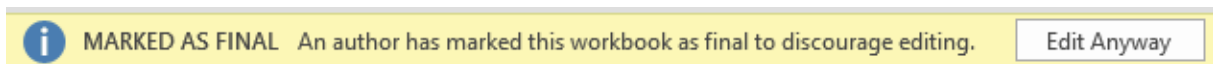
Caution : this is NOT a real protection command as anyone can go back to the Office dialog box and turn off the command.

3.3   Internal protection : worksheets, workbook

The options are located in the HOME Tab – CELLS Group – Drop-down list of the FORMAT Button :

3.3.1 _Assigning the proper status when you need to protect or free just a few cells_

Make a difference between the cell status and the active protection !

1. **The cell status.**
   When you protect the sheet you simply validate the cell status. By default the status is _locked_. As long as there is no _active_ protection, you or anyone else can freely work on the sheet.

2. **The active protection**
   The protection validates the prepared status.

Steps

- Select the required cells if they are to be unlocked. Or select the whole sheet, unlock all cells and then select the required cells to be locked.
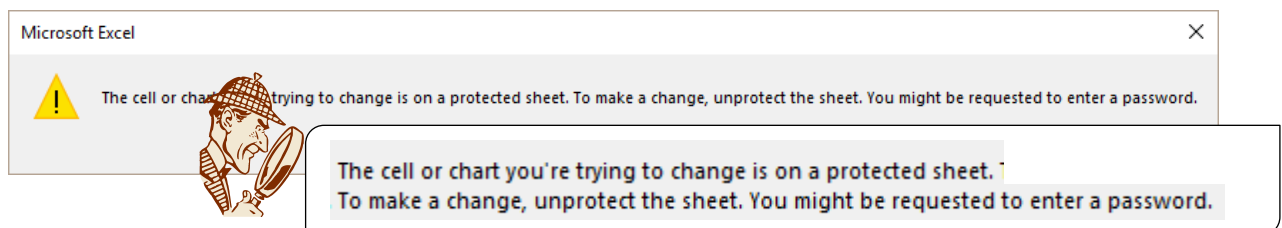- Option FORMAT CELLS
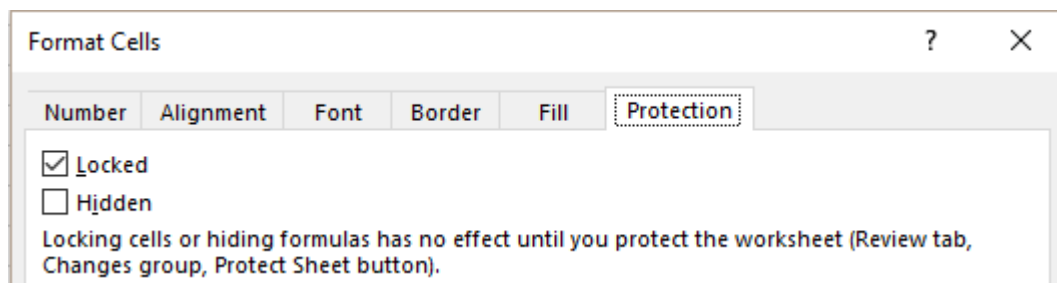
Hidden : caution, this only hides what is displayed in the formula bar

- Option PROTECT SHEET – With or without a password – Validate without changing the other default settings.

Navigation

Access to free cells through the TAB key

Here below the warning message that will be displayed if you attempt to modify a protected cell :

Removing the protection

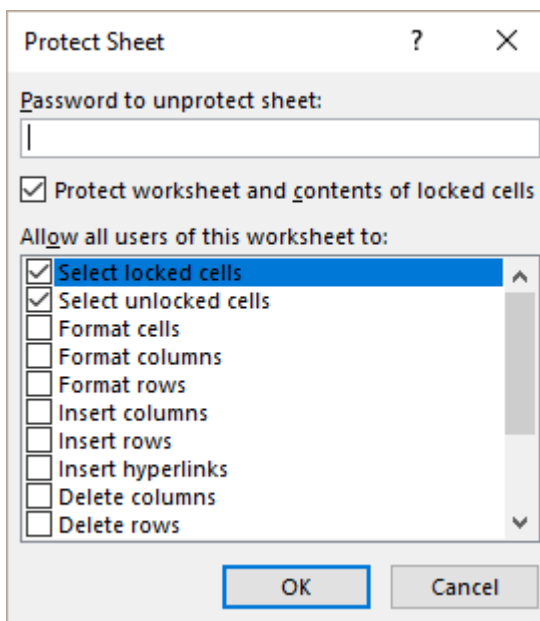The option turns into UNPROTECT SHEET. (password if necessary)

Week points

No visual indication of which cell is locked and which is unlocked.
No command to print a list of locked cells

3.3.2   *Protecting the worksheet but giving access to specific functionalities*

- Option PROTECT SHEET


Check the **commands** you need to give access to.

Command	Condition
Select locked / unlocked cells	By default, if you can select, you can also copy-paste into another workbook. Unchecking both commands is similar to turning on the preventing selecting and copying command in an Acrobat PDF file. Acrobat was the only one to provide this possibility. Excel does the same since the 2003 release.
Format cells	None
Format columns / rows (*autofit, hide …*)	None
Insert columns / rows	Inserting is possible with no special condition. But if you wish to type data into the new cells, it is necessary to check that the whole row or column located top or left has been ***unlocked*** through FORMAT – CELLS – PROTECTION Tab
Insert hyperlinks	The cell must have been ***unlocked*** through FORMAT – CELLS – PROTECTION Tab
Delete columns / rows	All cells must have been ***unlocked*** through FORMAT – CELLS – PROTECTION Tab

| Sort	All <u>rows</u> and <u>columns</u> must have been ***unlocked*** through FORMAT – CELLS – PROTECTION Tab *Or* The range of cells must have been set as a free range through : REVIEW Tab – CHANGES Group – ALLOW USERS TO EDIT RANGES Button. 💣 Caution : the cells content can now be freely modified
Use AutoFilter	The autofilter mode must be active
Use PivotTable reports	You must have created the pivot table. Then the user can use it
Edit objects	None
Edit scenarios	You may *modify* them. If the option is left unchecked you can simply *show* a given scenario.

Access to free cells by pressing the TAB key.

3.4 Protection that Microsoft associate to sharing and reviewing

- REVIEW Tab – CHANGES Group
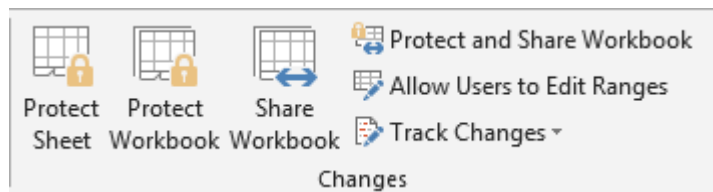
Some of the above options can be used for a "simple" protection.

3.4.1 Protecting the workbook
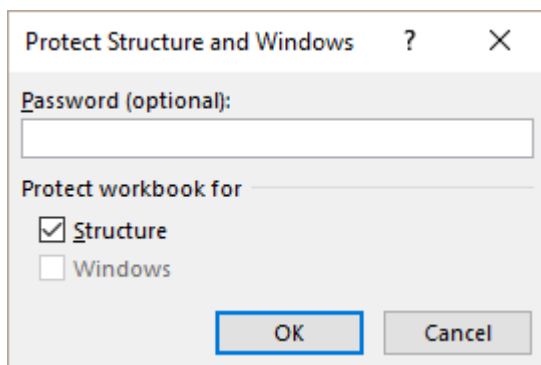
<u>Structure</u>
The sheets cannot be copied, moved, deleted, renamed or unhidden (when a sheet has been hidden).
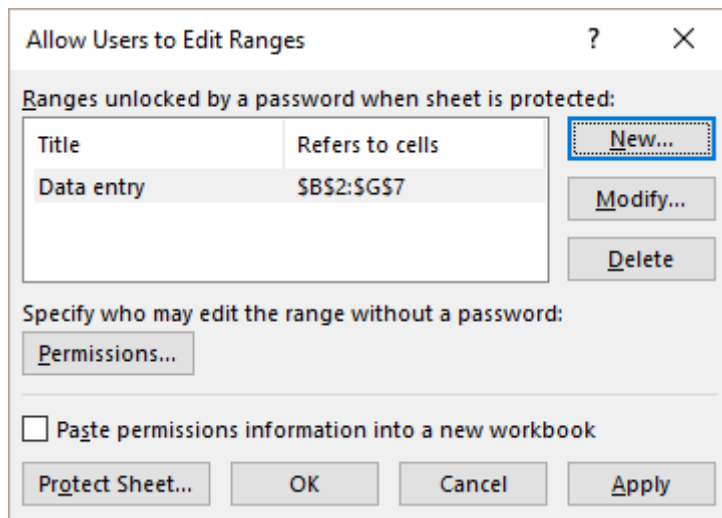But the sheets can be copied or moved *into another workbook*

<u>Window</u>
The windows buttons disappear (minimize on used, full screen…).
All other options are available

3.4.2 Setting ranges of cells that can be left free when the worksheet is in active protection

- Select the range(s) of cells (optional but more comfortable)
- ALLOW USERS TO EDIT RANGES Button

- Click on the NEW button. The selected range is automatically displayed. In case of no prior selection, click in the sheet to manually highlight the range now.

  Do not forget to name the range. You are not allowed to use the space or the dash but underscore is permitted.

The range(s) is memorized. You may modify, delete … as you need.

Permissions …   For network users. Select the users.

Paste permissions …   A new workbook is created, it indicates the free range(s) of cells, the permissions granted to this user or this group of network users. You may save this file and distribute it to every user from the list.

	A	B	C	D
1	Permissions for	[Data.xlsx]Sheet1		
2				
3	Range Title	Range of Cells	Password Protected	Users and Groups
4	Data entry	=$B$2:$G$7	No	-
5				

Good points about this functionality

You can list, print …the free range(s).
You may grant permissions to specific users.

IF-FUNCTIONALITIES

1 Custom views

Purpose

Save the view mode, the printing settings etc.... without having to save them in separate sheets. *An example : your receive a file with a lot of hidden columns/lines. You unhide all of them and work on it but you should re-send the file in its original format.*
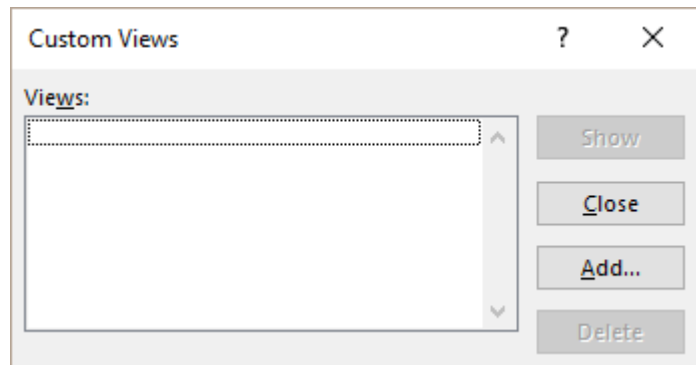
1.1   Creating a custom view

Prepare the required view, it can include

- ◆ The window size and position
- ◆ A screen splitting and/or frozen panes
- ◆ A specific active cell
- ◆ A zoom percentage
- ◆ A selected range of cells
- ◆ Hidden rows or columns
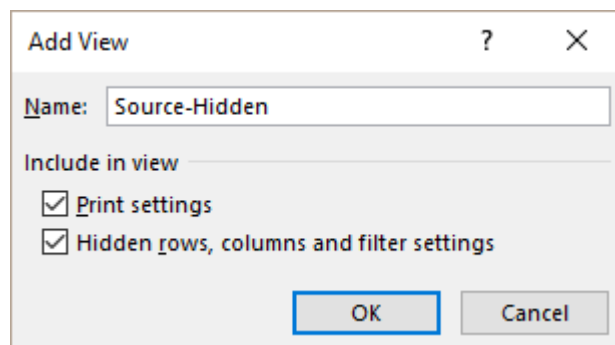- ◆ An outline
- ◆ A filtered list
- ◆ A specific print area

💣 The file setup (orientation for example) cannot be included in a custom view.

VIEW Tab – WORKBOOK VIEWS Group – CUSTOM VIEWS Button
(The box lists the created views).

🖉 Advice : the current view should be made the *first* custom view, in order not to lose them when you create other views.

Click on the ADD button to create the view :

Do the same for the next views.

- VIEW Tab – WORKBOOK VIEWS Group – CUSTOM VIEWS Button.
- Click on the view to show or to delete.
- SHOW or DELETE Button.

1.3 Printing a custom view

Show the view and print

2 Scenarios

Purpose

Save every result of one or more formulas when some of their precedents are changed so that each "possibility" or scenario can be easily retrieved.

2.1 Creating a scenario

Example : You need to borrow Frs. 200'000 at the rate of n% over n periods. Several offers are available. You would like to be able to consult, print each offer without having to create a separate sheet for each case.

Here below the beginning of your sheet with the data :

	A	B	C	D	E
1	IBB BANK (Geneva) SA				
2			**Exercise**		
3	**Amount**	400'000	Create more than one scenario - up to your choice		
4	**Interest rate**	1%	Some examples		
5	**Duration in years**	20	- Same bank but rate 2%		
6	**Annuity to pay**	fr. 22'166.13	- Same bank but amount 300000		
7			- Other bank and duration 25 years		
			Etc ...		
8	Re-imbursement schedule				
9	Year	Interest	Re-imbursement	Annuity	
10	1	fr. 4'000.00	fr. 18'166.13	fr. 22'166.13	
11	2	fr. 3'818.34	fr. 18'347.79		
12	3	fr. 3'634.86	fr. 18'531.27		
13	4	fr. 3'449.55	fr. 18'716.58		
14	5	fr. 3'262.38	fr. 18'903.74		
15	6	fr. 3'073.35	fr. 19'092.78		
16	7	fr. 2'882.42	fr. 19'283.71		
17	8	fr. 2'689.58	fr. 19'476.55		
18	9	fr. 2'494.81	fr. 19'671.31		

- DATA Tab – DATA TOOLS Group – Drop-down list of the WHAT-IF ANALYSIS Button – SCENARIO MANAGER Option

The box lists the already saved scenarios or indicates that no scenario has been yet saved.

Here the source values have been saved as the *first* scenario, in order not to lose them when creating the other scenarios. We strongly advise you to do the same.
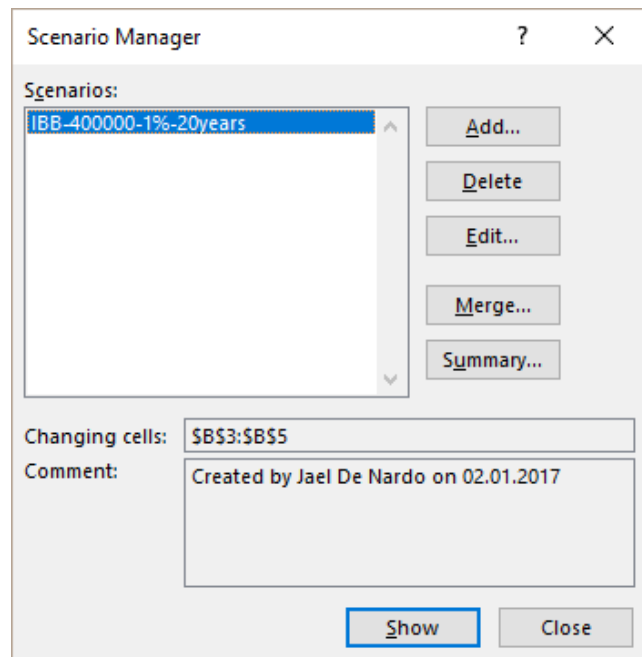
- Click on the ADD button to save the next scenario:

Changing cells : you can select cells containing text, only to make the scenario changes more easy to find and understand.

Hide : hides the name of the scenario when the sheet or the workbook is in active protection

If a selected cell contains a formula, Excel will inform you that when showing the scenario the formula will be replaced with a value.

- The next dialog box will let you set the values of the scenario :

- Click on the OK button. The SCENARIO MANAGER dialog box indicates the saved scenarios and provides buttons to show, edit, delete …. any of them.

Show	To show the selected scenario.
Delete	To delete the selected scenario.
Edit	To change the settings of the selected scenario.
Merge	To import the scenarios from another sheet into the current one.
Summary	A sheet will be created, displaying a report on the various scenarios (list of all changing cells, result cells).

✎ The summary is interesting because it shows in one table only the changing cells in the created scenarios and their result cells – that is the cells affected by the change of value. The result cells are freely chosen by the user.

Here below an example : the summary for the result cell B6

Scenario Summary

		Current Values:	IBB-400000-1%-20years	IBB-400000-2%-20years	IBB-300000-1%-20yea
Changing Cells:					
	$B$3	400'000	400'000	400'000	300'0(
	$B$4	1%	1%	2%	1'
	$B$5	20	20	20	2
Result Cells:					
	$B$6	fr. 22'166.13	fr. 22'166.13	fr. 24'462.69	fr. 16'624.5

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

If the changing cells / result cells have been named, the name will be automatically retrieved and displayed instead of $A$2, which would make the report far easier to read and understand.

	G	H	I	J	K
1	By scenario author	(All)			
2					
3	**Row Labels**	**Amount**	**Rate**	**Years**	**Annuity**
4	IBB-300000-1%-20years	300000	1%	20	CHF 16'625
5	IBB-400000-1%-20years	400000	1%	20	CHF 22'166
6	IBB-400000-1%-25years	400000	1%	25	CHF 18'163
7	IBB-400000-2%-20years	400000	2%	20	CHF 24'463

The labels of the pivot table have been renamed, some formatting (number, percentage …) has been applied to the table

2.2   Printing scenarios

Show the required scenario and print the worksheet.
To obtain a synoptic view of the scenarios, generate a summary report that you will print.

3 Single and double entry tables

An interest, a monthly reimbursement must be calculated for a loan. You wish to represent the various possibilities when the rate varies 5,5%, 6%, 6,5%, 7%..... and also when the amount varies 55'000, 60'000, 65'000, 70'000 … A table showing every possibility can be created.

3.1   Single entry table

- Type the data (amount, rate …).
  The cell containing the changing data will be called the *row input cell*. In the screen capture below it will be B4 (5%).

2	**Loan**	
3	Amount borrowed	400000
4	Rate	1%
5	Duration	20 (years)
6	A given year	1

- Type in line the formula(s) using the entry cell.
   (here first the fixed annuity(PMT), the part of interest (IPMT) and the part of reimbursement (PPMT).

  Left of formula(s) type in column the values that should vary and be substituted to that of the entry cell (here the changing rates).

		Annuity	Interests	Re-imbursement
8		**Annuity**	**Interests**	**Re-imbursement**
9		PMT	IPMT	PPMT
10	standard rate : 1%	SFr. -22'166.13	SFr. -4'000.00	SFr. -18'166.13
11	0.75%			
12	1.00%			
13	1.25%			
14	1.50%			
15	1.75%			
16	2.00%			
17	2.25%			
18	2.50%			

Take a few minutes to format the results.

- Select the range of cells including the changing values and the formula(s) : DATA Tab – DATA TOOLS Group – Drop-down list of the WHAT-IF-ANALYSIS Button - DATA TABLE Option.

  Under "Column Input Cell" indicate the entry cell.
  You can click directly in the sheet or use the button located at the right of the box.

Result :

		Annuity	**Interests**	**Re-imbursement**
8		PMT	IPMT	PPMT
9		PMT	IPMT	PPMT
10	standard rate : 1%	SFr. -22'166.13	SFr. -4'000.00	SFr. -18'166.13
11	0.75%	-21612.25278	-3000	-18612.25278
12	1.00%	-22166.12596	-4000	-18166.12596
13	1.25%	-22728.15585	-5000	-17728.15585
14	1.50%	-23298.29435	-6000	-17298.29435
15	1.75%	-23876.48982	-7000	-16876.48982
16	2.00%	-24462.68725	-8000	-16462.68725
17	2.25%	-25056.82831	-9000	-16056.82831
18	2.50%	-25658.85149	-10000	-15658.85149

Apply a global format to make the table nice to read and understand.

✎ You can create a table where the values to be substituted are typed in line.

**Modifications** : you can change any value, the table is automatically updated.

The result is called an array.

3.2 Double entry table

You proceed just as explained above.
Here below the table to create :

- Type all the values that will be used in the formula.
  The cells containing the data that will vary (here the rate and the amount) are the two *input cells.*

- Type the formula using the above values.

- Under the formula and right of it, type the values to be substituted to those of the entry cells.
  If you wish to hide the result of the formula, you can use the customized number format [;;;].

- Select the range of cells including the wanted results but also the formula and the values to be substituted.

- DATA Tab – DATA TOOLS Group – Drop-down list of the WHAT-IF ANALYSIS Button – DATA TABLE Option.
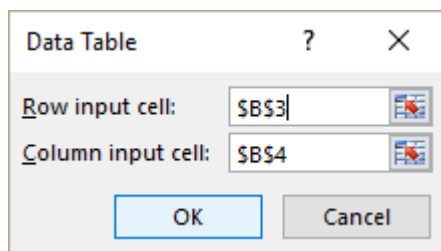
Once again, apply the format of your choice to the table results.

4 Goal seek and solver

4.1   Goal seek

This command allows you to find the result produced by a formula if you change only one of its precedents.

Example : you know how to use the PMT function and you have calculated the fixed annuity asked by a bank if you borrow a given sum (a small amount in Switzerland for a "crédit à la consommation", much bigger in France for a mortgage). The figure you first thought of produces a fixed annuity that does not correspond to your actual means (too high or too low). You can set the exact annuity you can afford and let the goal seek function find the corresponding amount.

- DATA Tab – DATA TOOLS Group – Drop-down list of the WHAT-IF ANALYSIS Button – GOAL SEEK Option
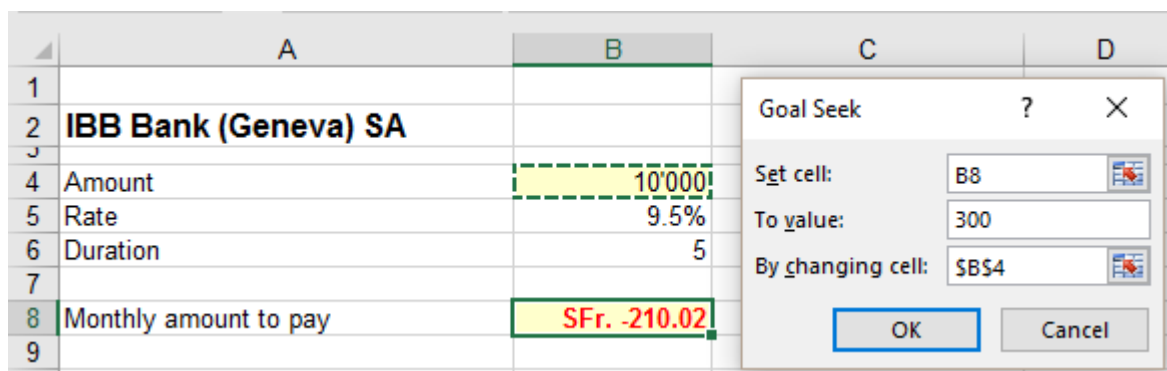
Set cell	The cell containing the formula.
To value	Set the required value.
By changing cell	Indicate the precedent to modify.

Excel does the calculation and tells you if a solution is found :

⊿	A	B	C	D	
1					
2	**IBB Bank (Geneva) SA**		Goal Seek Status	? ✕	
3					
4	Amount	-14'284	Goal Seeking with Cell B8	Step	
5	Rate	9.5%	found a solution.		
6	Duration	5		Pause	
7			Target value: 300		
8	Monthly amount to pay	SFr. 300.00	Current value: SFr. 300.00		
9				OK	Cancel
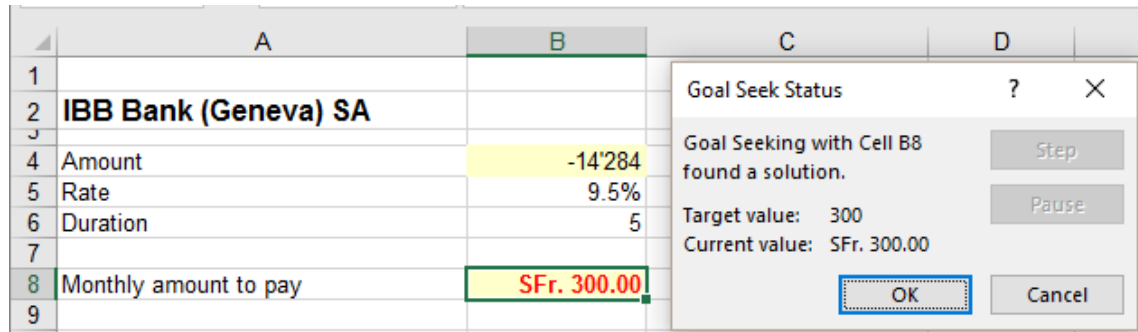
Click on OK and the solution found replaces the old values.

💣* If you want to keep you original, work on a copy !

4.2   The solver

The Solver is an add-in to activate : FILE - OPTIONS – ADD-INS – Display the *Excel Add-ins* list. Its button will be added to DATA – ANALYSIS Group

The case is similar but this time Excel needs to modify more than just one cell. Excel needs to work on various cells to work out the best solution to your problem. Moreover you can add constraints (for example Excel is not allowed to modify a given cell above a certain value).

In fact, the solver is mainly used for **optimizing complex mathematical equations !** Here after a non-mathematical example, just to explain how the solver works.

⊿	A	B	C	D	E
1		**Tasty recipe for "petits pains au lait"**			
2					
3	**Product**	**Fat proportion**	**Basic recipe**	**Proportions**	**Total fat**
4		**per Kg**		**for 10 Kg**	**in grm**
5	butter	800.00 grm	0.125 Kg	1.25 Kg	1'000.00 grm
6	flour	4.00 grm	0.500 Kg	5.00 Kg	20.00 grm
7	milch	27.00 grm	0.250 Kg	2.50 Kg	67.50 grm
8	yeast	0.00 grm	0.015 Kg	0.15 Kg	0.00 grm
9	egg	175.00 grm	0.060 Kg	0.60 Kg	105.00 grm
10	sugar	0.00 grm	0.050 Kg	0.50 Kg	0.00 grm
11	salt	0.00 grm	0.010 Kg	0.10 Kg	0.00 grm
12					
13	Total			10.10 Kg	1'192.50 grm
14					
15	**Exercise**				
16					
17	The composition must be modified so that the total proportions are 10 Kg.				
18	But the fat total must be equal to 1000				
19					
20	The change of proportions must also respect the following constraints :				
21	*Maximum values : butter <= 1.45 - flour <= 5.3 - milk <= 2.8 - yeast <=0.18 - sugar <=0.8 but salt = 0.10*				
22	*Minimum values : butter >= 1 - flour >=4.7 - milk >=2.2 - yeast >=0.10 - sugar >=0.2*				
23					

- Select the target cell
- DATA Tab – ANALYSE Group – SOLVEUR Button

Set Objective	Cell that can represent a set data but also a maximum or minimum value (given the table formulas and other constraints)
Variable Button	Cells whose figures can be modified to reach the set target. Caution, only cells containing constants and not formulas.
Constraints	To add constraints on how Excel is allowed to modify given cells.
	You can add 2 constraints by - *inferior and superior limits* + 100 additional constraints). The constraints can affect a cell or a range of cells, named or not, containing constants or formulas.

Example : inferior limit of price per unit fixed
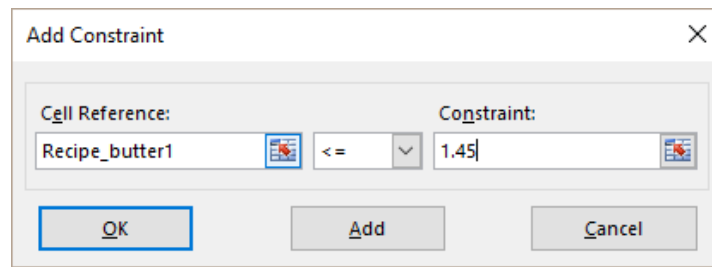
Options Button   *Advanced* mathematical options.

Reset All Button   Settings are all reset.

Load/Save Button   One or more *templates* can be defined in the workbook. They can then be loaded in the solver.

Solve Button   Run the solver

The result in our example :

	A	B	C	D	E
1	**Tasty recipe for "petits pains au lait"**				
3	**Product**	**Fat proportion**	**Basic recipe**	**Proportions**	**Total fat**
4		**per Kg**		**for 10 Kg**	**in grm**
5	butter	800.00 grm	0.125 Kg	1.00 Kg	802.77 grm
6	flour	4.00 grm	0.500 Kg	5.03 Kg	20.13 grm
7	milch	27.00 grm	0.250 Kg	2.53 Kg	68.33 grm
8	yeast	0.00 grm	0.015 Kg	0.18 Kg	0.00 grm
9	egg	175.00 grm	0.060 Kg	0.62 Kg	108.78 grm
10	sugar	0.00 grm	0.050 Kg	0.53 Kg	0.00 grm
11	salt	0.00 grm	0.010 Kg	0.10 Kg	0.00 grm
12					
13	**Total**			10.00 Kg	1'000.00 grm

Without having to close the dialog box, the following options are possible :
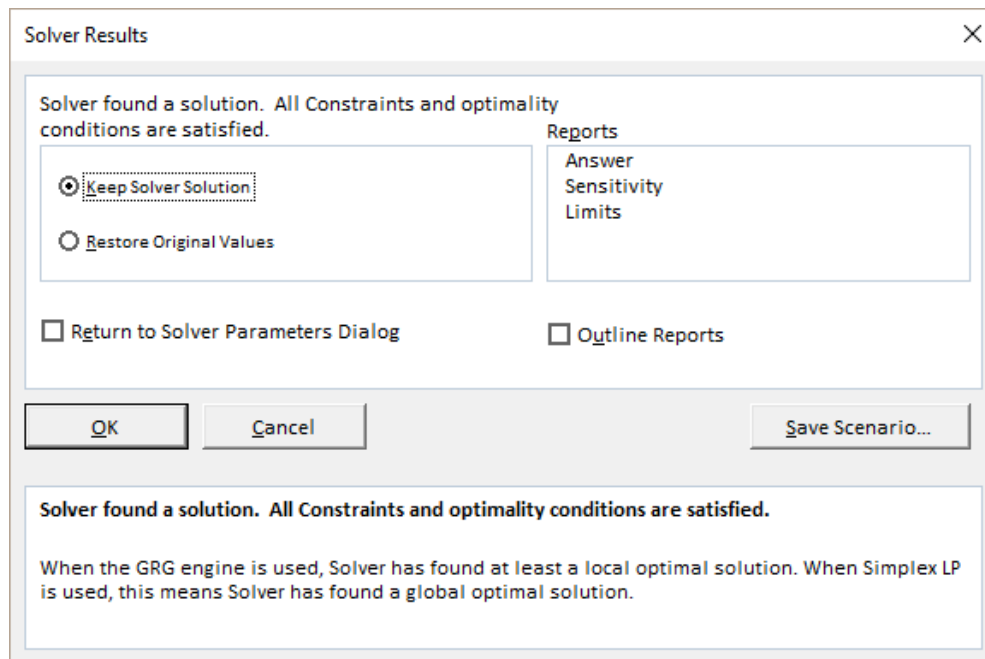
| **Keep Solver Solution** | ✎ Excel replaces the original table with the new values. If you wish to keep the source table, work on a copy or use the next *Save Scenario* option. |

Save Scenario
To save the solution as a scenario that you will be able to retrieve whenever you want. Once the scenario is saved, the same box comes up again to allow you to apply the solution to the table or not.
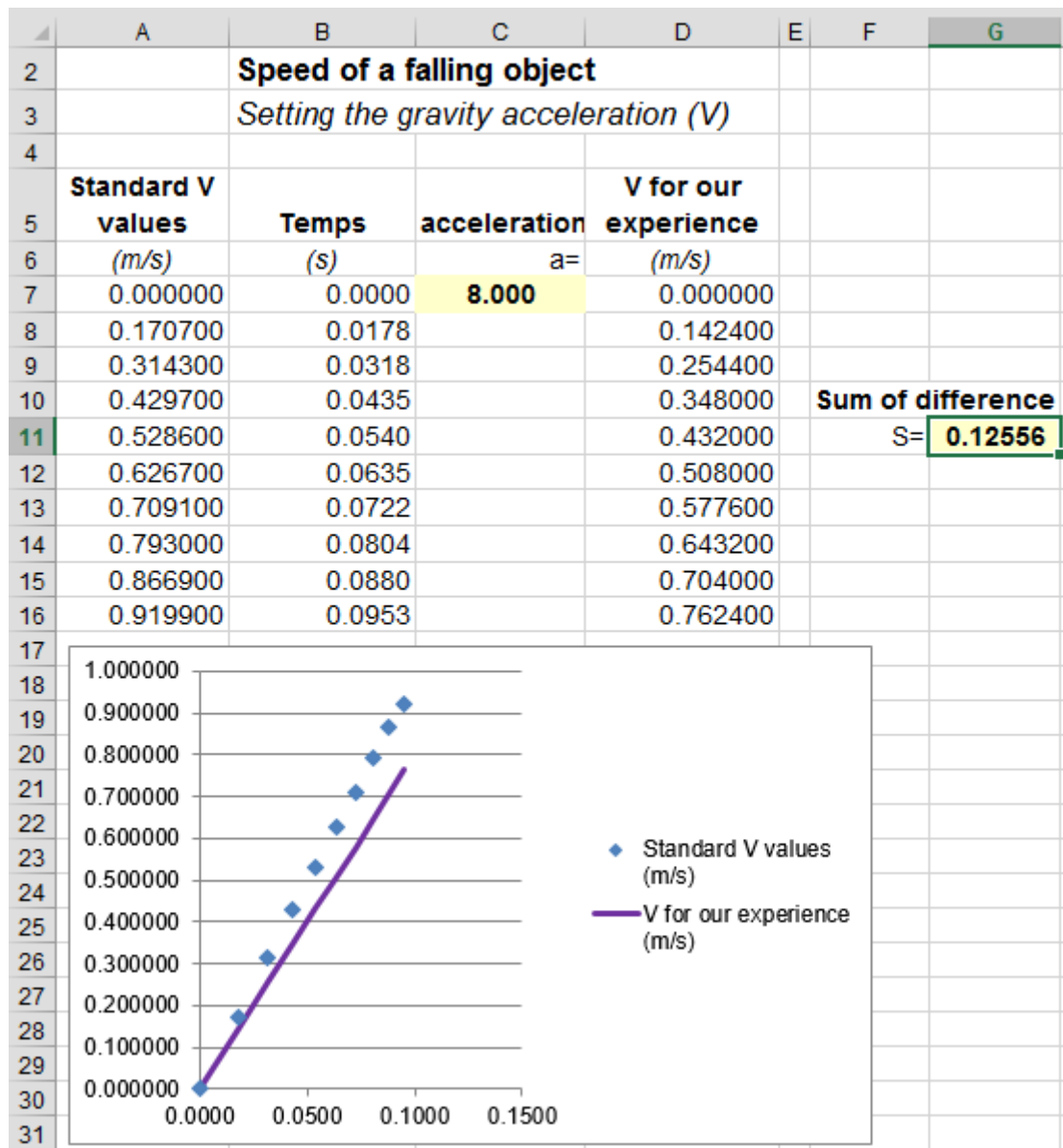*To retrieve the saved scenario : DATA Tab – DATA TOOLS Group – Drop-down list of the WHAT-IF-ANALYSIS Button –SCENARIO MANAGER Option.*

Rapports
Various analysis reports. You can choose one or more if you hold down the CTRL key when clicking. They will help to show the relation between the initial values and the solver values, how narrow is the gap etc....

Here below an example of a « Answer » report :

Here below one mathematical example (the easiest I have been able to find on Internet …) :

	A	B	C	D	E	F	G
2		**Speed of a falling object**					
3		*Setting the gravity acceleration (V)*					
4							
5	**Standard V values**	**Temps**	**acceleration**	**V for our experience**			
6	*(m/s)*	*(s)*	a=	*(m/s)*			
7	0.000000	0.0000	**8.000**	0.000000			
8	0.170700	0.0178		0.142400			
9	0.314300	0.0318		0.254400			
10	0.429700	0.0435		0.348000		**Sum of difference**	
11	0.528600	0.0540		0.432000		S=	**0.12556**
12	0.626700	0.0635		0.508000			
13	0.709100	0.0722		0.577600			
14	0.793000	0.0804		0.643200			
15	0.866900	0.0880		0.704000			
16	0.919900	0.0953		0.762400			

Here below some explanations :

Speed of a falling object
Setting the gravity accelaration (V)

$$v = a.t$$

Speed   =   acceleration * falling speed

Elements :
A previous experience has already set the standard values (column A)
For this experience we shall multiply the falling speed by an **approximative accelaration value**
The result of our experience (**our V result**) is therefore found in column D

The problem : it is necessary to find an accurate acceleration value so that our
final results will match the standard values
If we just "try" to set the accelaration to 8, 8.5, 9, 9.5 ….. the chart shows that we are
off the standard values.

We need to use the SUMXMY2 function that will return the diffrerence between the standard
values and our values. This différence should be as near 0 as possible.

We use the solver to find the exact acceleration value that will produce a 0 gap
This will ensure that our values are practically identical to the standard values.

Solver :

	A	B	C	D	E	F	G	H	I
4									
5	**Standard V values**	**Temps**	**acceleration**	**V for our experience**					
6	(m/s)	(s)	a=	(m/s)					
7	0.000000	0.0000	**9.800**	0.000000					
8	0.170700	0.0178		0.174436					
9	0.314300	0.0318		0.311632					
10	0.429700	0.0435		0.426289			**Ecart quadratique**		
11	0.528600	0.0540		0.529187		S=	**0.00030**		
12	0.626700	0.0635		0.622284					
13	0.709100	0.0722		0.707542					

Solver Parameters   ✕

Se̲t Objective: |$G$11| [icon]

To: ◯ Max   ◯ Mi̲n   ◉ Value Of: | 0 |

By Changing Variable Cells:
|$C$7| [icon]

Su̲bject to the Constraints:

| | ∧ | Add |

| | | Change |

Result and corresponding chart :

	A	B	C	D	E	F	G
1		**Speed of a falling object**					
2		Setting the gravity acceleration (V)					
3							
4							
5	**Standard V values**	**Temps**	**acceleration**	**V for our experience**			
6	(m/s)	(s)	a=	(m/s)			
7	0.000000	0.0000	**9.800**	0.000000			
8	0.170700	0.0178		0.174436			
9	0.314300	0.0318		0.311632			
10	0.429700	0.0435		0.426289		**Ecart quadratique**	
11	0.528600	0.0540		0.529187		S=	**0.00030**
12	0.626700	0.0635		0.622284			
13	0.709100	0.0722		0.707542			
14	0.793000	0.0804		0.787900			
15	0.866900	0.0880		0.862378			
16	0.919900	0.0953		0.933917			

5 Forecast sheet – with a chart automatically created

Here after an Excel sheet showing a list of sales. But it stops at the end of the month (31.1.2017). The next month is "missing"

Excel 2016 includes a forecast exponential smoothing feature. Several functions are available, as FORECAST.ETS() for example.

For more explanations : Internet …

	A	B
1	Date	Sales
2	01.01.2017	3'240'325
3	02.01.2017	2'741'349
4	03.01.2017	2'987'427
5	04.01.2017	3'456'892
6	05.01.2017	3'740'738
7	06.01.2017	3'979'178
8	07.01.2017	4'160'454

Click inside any of the two columns
DATA Tab – FORECAST Group

What-If
Analysis

Forecast
Sheet
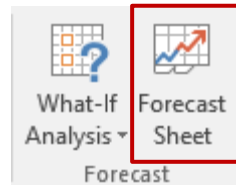
Forecast

Create Forecast Worksheet

Use historical data to create a visual forecast worksheet

Forecast End   28.02.2017

◢ Options

Forecast Start   31.01.2017

☑ Confidence Interval   95%

Seasonality
◉ Detect Automatically
○ Set Manually   12

Timeline Range   Sales!$A$1:$A$32

Values Range   Sales!$B$1:$B$32

Fill Missing Points Using   Interpolation

Aggregate Duplicates Using   Average

If necessary adjust the settings (in the above example, the default prevision ends 26.02.2017)

Create   Cancel

CREATE Button

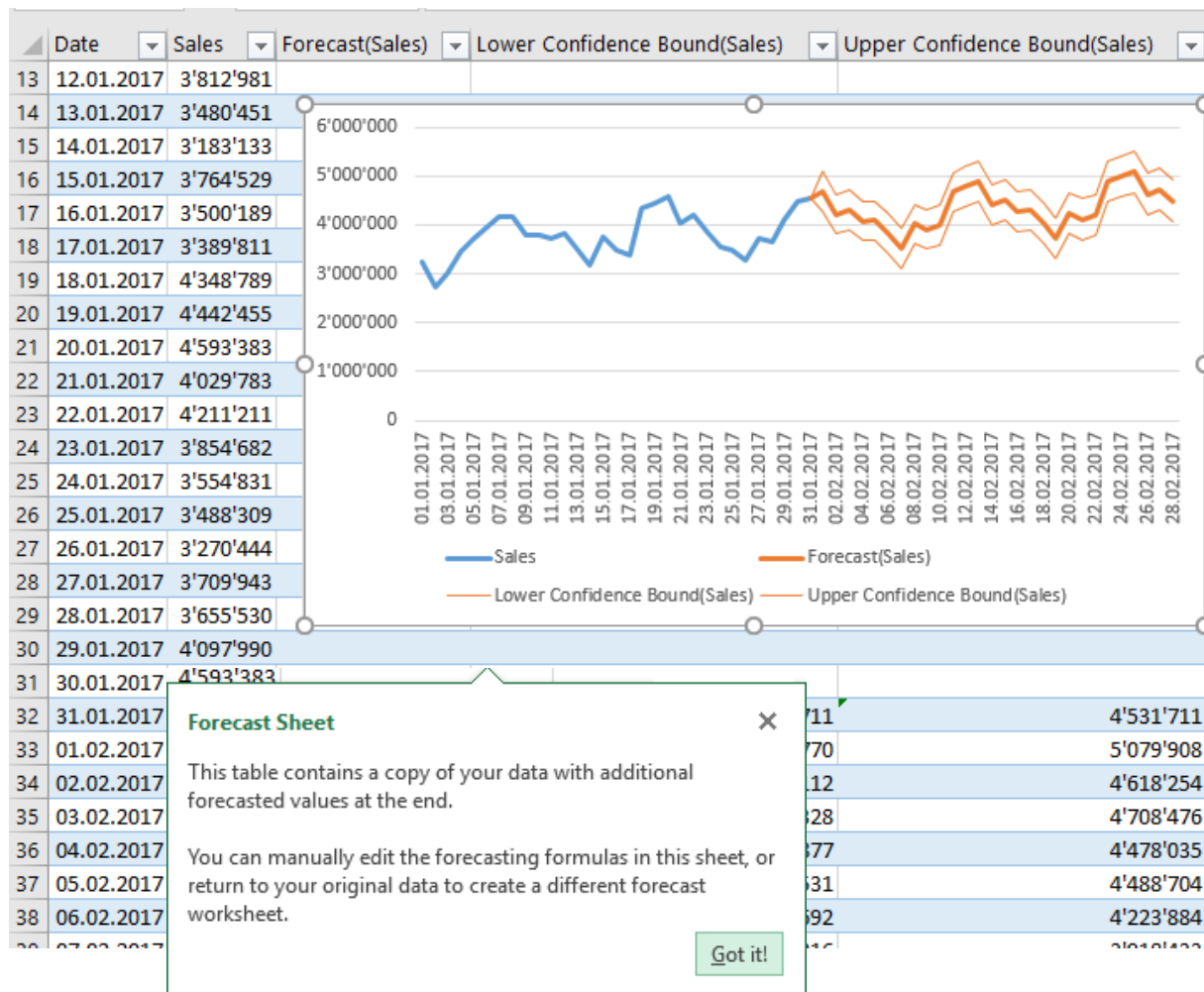|	Date	Sales	Forecast(Sales)	Lower Confidence Bound(Sales)	Upper Confidence Bound(Sales)
13	12.01.2017	3'812'981			
14	13.01.2017	3'480'451			
15	14.01.2017	3'183'133			
16	15.01.2017	3'764'529			
17	16.01.2017	3'500'189			
18	17.01.2017	3'389'811			
19	18.01.2017	4'348'789			
20	19.01.2017	4'442'455			
21	20.01.2017	4'593'383			
22	21.01.2017	4'029'783			
23	22.01.2017	4'211'211			
24	23.01.2017	3'854'682			
25	24.01.2017	3'554'831			
26	25.01.2017	3'488'309			
27	26.01.2017	3'270'444			
28	27.01.2017	3'709'943			
29	28.01.2017	3'655'530			
30	29.01.2017	4'097'990			
31	30.01.2017	4'593'383			
32	31.01.2017			'11	4'531'711
33	01.02.2017			'70	5'079'908
34	02.02.2017			.12	4'618'254
35	03.02.2017			28	4'708'476
36	04.02.2017			77	4'478'035
37	05.02.2017			31	4'488'704
38	06.02.2017			92	4'223'884

Forecast Sheet

This table contains a copy of your data with additional forecasted values at the end.

You can manually edit the forecasting formulas in this sheet, or return to your original data to create a different forecast worksheet.

Got it!

Excel creates a new sheet automatically placed before the sheet containing the source data. The data is copied and set as a *table.* Excel then adds the chart that was suggested in the previous dialog box.

Math explanations about how the forecasted values are calculated : I am no statistician and I will let this to the professionals …