Cell references

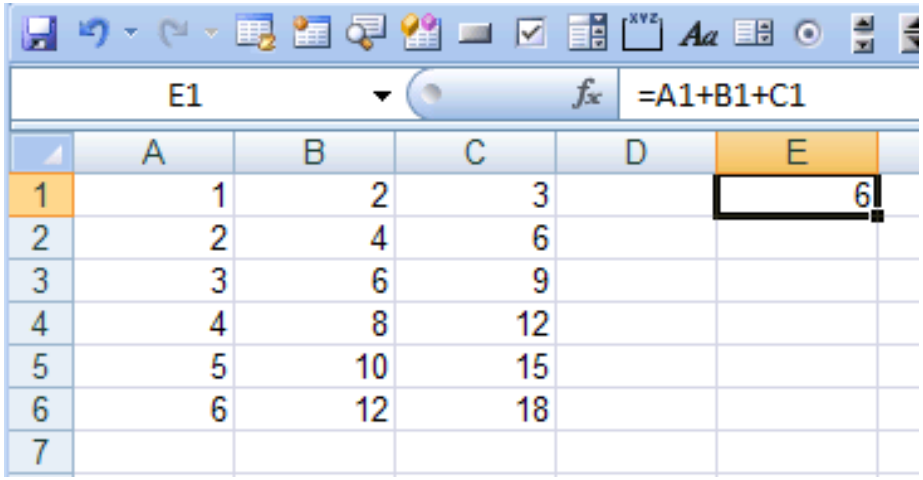
- A cell reference is the letter of the column followed by the number of the row where the cell is located. Example: A2, B5.
- There are several default assumptions made by Excel when you enter a cell reference:

a) Excel assumes the cell is on the same WS and in the same WB as the cell in which you enter the formula.

b) Excel assumes the reference is a **relative** reference, that means the cell reference changes when you copy the contents of a cell refering to it into another cell.

- You copy a cell or a range by RC on the cell or range and selecting: **Copy → select the destination cell(s) → Paste**

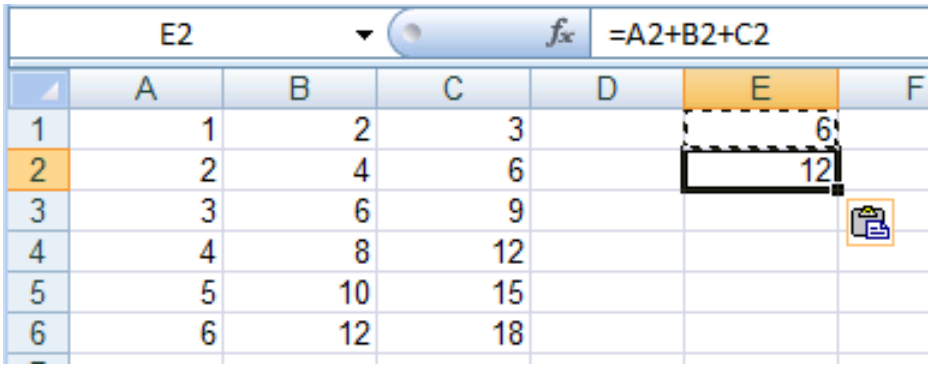
Example 1:



E1 | =A1+B1+C1

	A	B	C	D	E
1	1	2	3		6
2	2	4	6		
3	3	6	9		
4	4	8	12		
5	5	10	15		
6	6	12	18		
7					

Copy the content of cell E1 and paste into cell E2

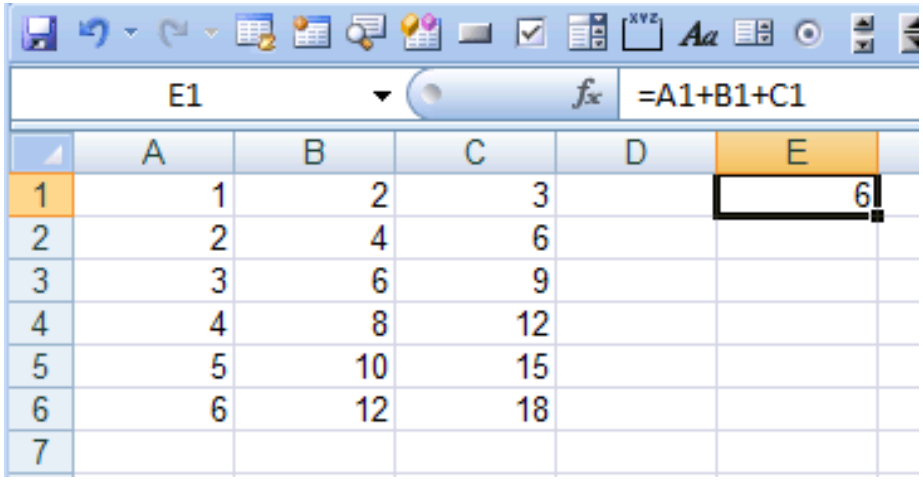


E2 | =A2+B2+C2

	A	B	C	D	E	F
1	1	2	3		6	
2	2	4	6		12	
3	3	6	9			
4	4	8	12			
5	5	10	15			
6	6	12	18			

All cell references have changed by 1 row. We get a different result!

Example 2:



E1 | =A1+B1+C1

	A	B	C	D	E
1	1	2	3		6
2	2	4	6		
3	3	6	9		
4	4	8	12		
5	5	10	15		
6	6	12	18		
7					

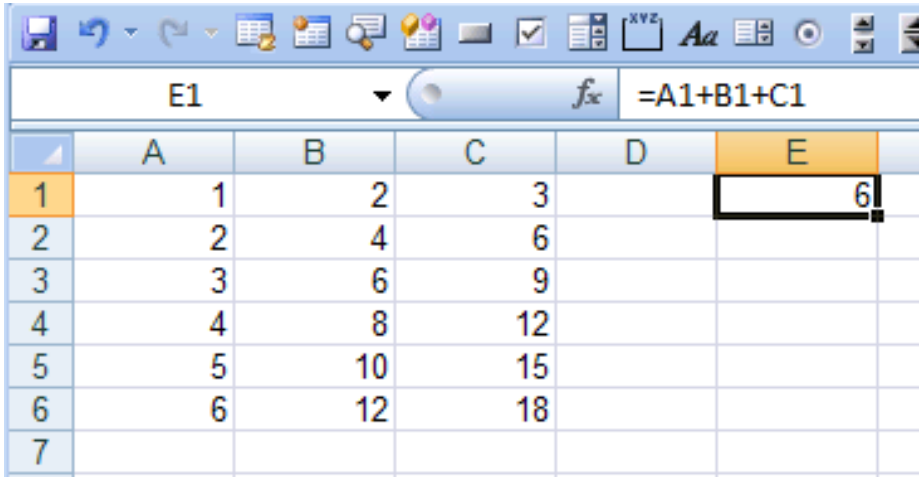
Copy the content of cell E1 and paste into cell G3

G3 | =C3+D3+E3

	A	B	C	D	E	F	G	H
1	1	2	3		6			
2	2	4	6					
3	3	6	9				9	
4	4	8	12					
5	5	10	15					
6	6	12	18					
7								

All cell references have changed by 2 rows and 2 columns!

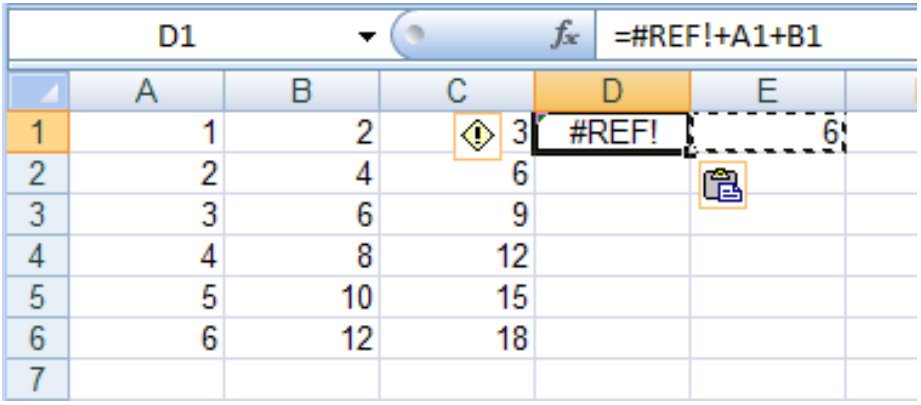
Example 3:



E1 | =A1+B1+C1

	A	B	C	D	E
1	1	2	3		6
2	2	4	6		
3	3	6	9		
4	4	8	12		
5	5	10	15		
6	6	12	18		
7					

Copy the content of cell E1 and paste into cell D1



D1 | =#REF!+A1+B1

	A	B	C	D	E
1	1	2	3	#REF!	6
2	2	4	6		
3	3	6	9		
4	4	8	12		
5	5	10	15		
6	6	12	18		
7					

We get an error message, because the row number can not be reduced by 1!

- Can we avoid that cell references change when we copy-paste them?

Yes! By adding a"**$**"-symbol before the column letter and/or the row number !

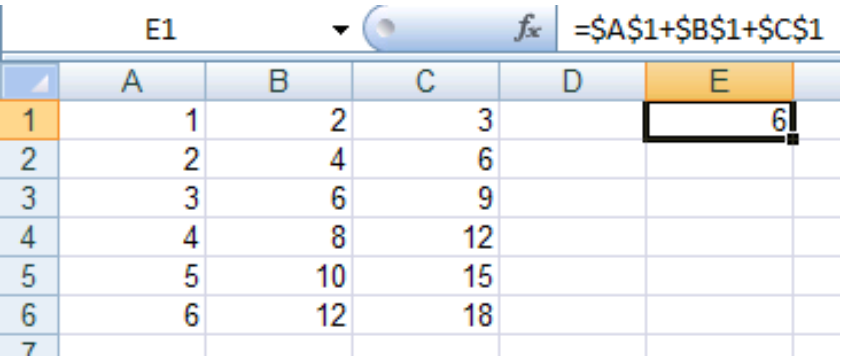
There are four possibilities:

= A1 ≡ changeable column and row (**relative reference**)

= A$1 ≡ changeable column, fixed row (**mixed reference**)

= $A1 ≡ fixed column, changeable row (**mixed reference**)

= $A$1 ≡ fixed column and row (**absolute reference**)



If you paste the content of E1 into any cell now, the **value and content** of the cell will remain unchanged!

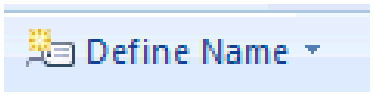
- Examples (check these out!)

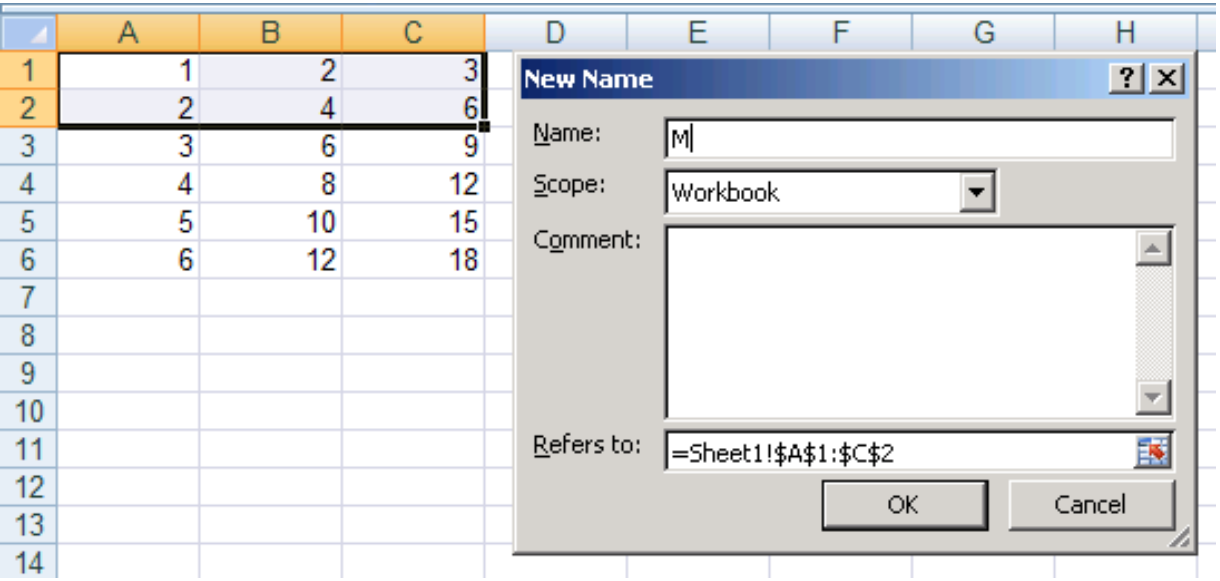
copy cell reference	paste cell reference	relative difference	formula being copied	final formula pasted cell
C5	D6	add one column add one row	=F4 =$F$4 =$F4	=G5 =$F$4 =$F5
C5	D3	add one column subtract 2 rows	=K7*B$7 =A3+$B7	=L5*C$7 =B1+$B5
C5	F11	add 3 columns add 6 rows	f(A1:B5) f(A$3:A7)	f(D7:E11) f(D$3:D13)
C5	F1	add 3 columns subtract 4 rows	=A3 =Z5	=#REF! =AC1

- f(...) indicates some function see below

=#REF! is an error message ≡ cell reference not valid

► Naming cells or ranges:

- You can attach a name of your choice to a cell or a range and then use it as variable in a formula instead of a lengthy reference:
- Select the cell or range to which you want to give a name.
- Select the Formulas tab and there select 



The name will also appear in the reference area. Now the range A1:C2 is called M!

Examples: if we now write

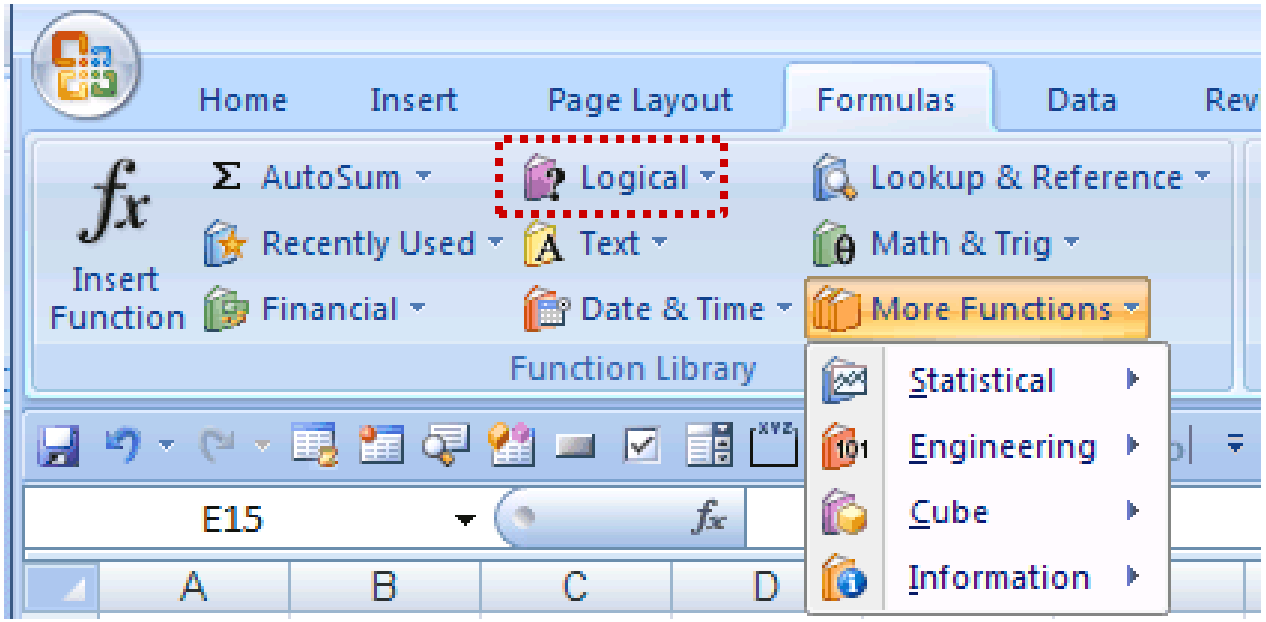
=Sum(M) → 18

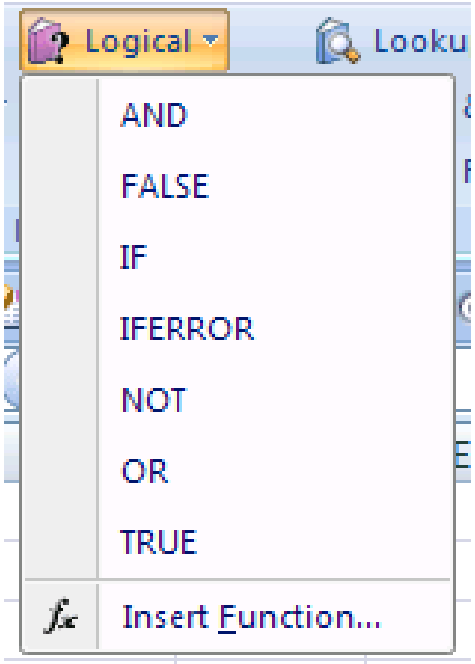
it will return the value 18, which is the sum of cells A1:C2!

Built-in Excel Functions I

► Excel is equipped with over 300 built-in functions.

- They are divided into 10 groups: logical, statistical, mathematical and trigonometric, date and time, financial, text, cube, lookup and reference, information and engineering.





- You can see all the different types by going to the **Formulas tab**!

- A Excel built-in function normally takes "something" as input and returns "something" as output.
- Notice that the "something" can be any kind of variable (text, number, date, time …)
- A function can also take several variables as input and may return several values as output.
- Syntax: =name(argument1;argument2; ….)

"name" is the name of the function

"argument1, argument2…" is a list of cells, ranges, other functions or formulae

- the number of arguments can vary, e.g.

zero arguments: =PI() → 3.1415926535898....
=TODAY() → 2010-10-12

one argument: =SQRT(B5) ≡ √B5 → 2 for B5=4
=SIN(PI()/2) → 1

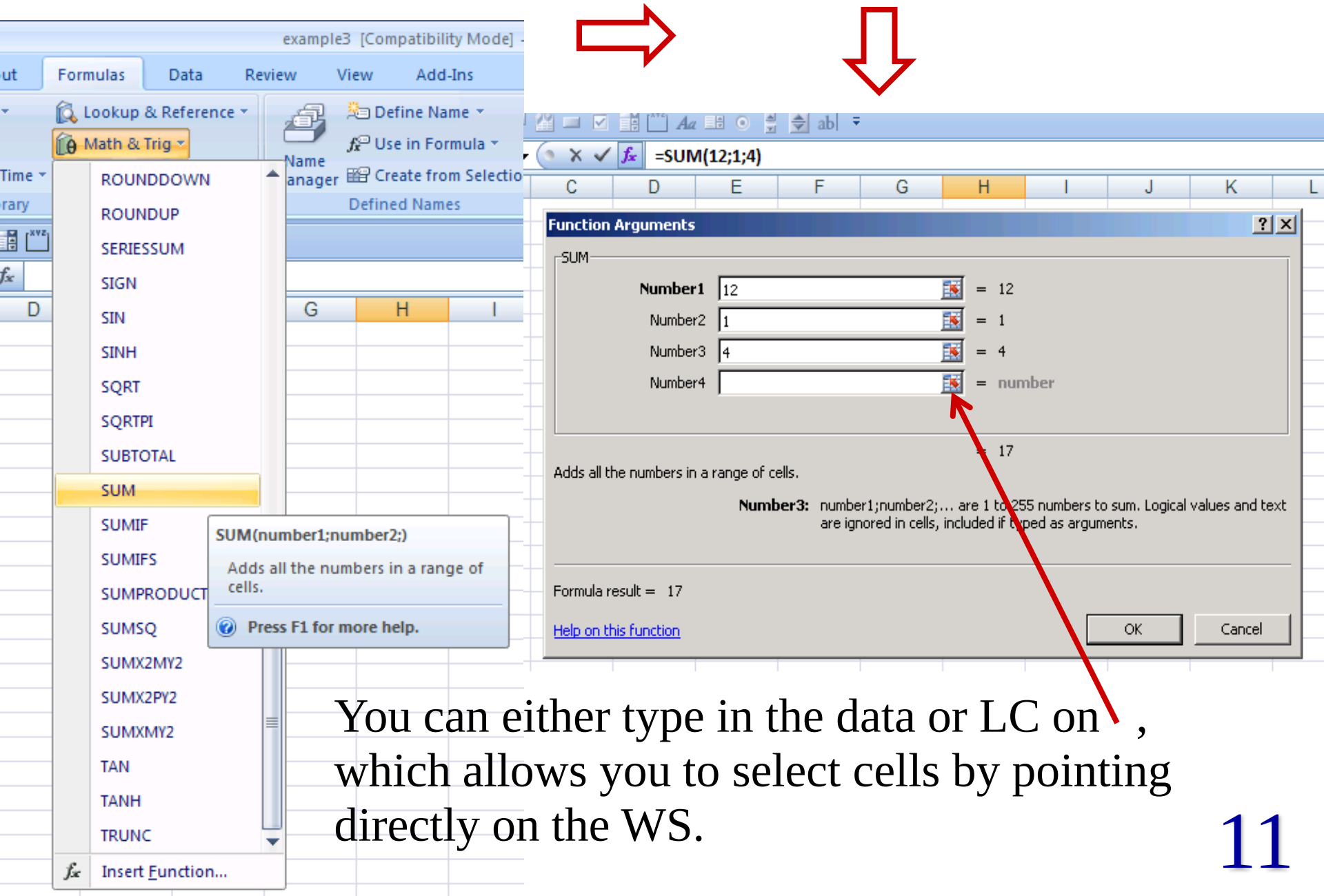
two arguments: =ROUND(PI(),3) → 3.142

=POWER(2,2) → 2*2=4

variable number: =SUM(C1:C10,B12,B5) → sums up the values of the cells C1,C2,...,C10,B12,B5

=AVERAGE(2,4,7,9,5,1) → 4,6667

- For functions that can have many arguments (like the SUM function), the maximum number of allowed arguments is 255. A range counts as one argument.
- When you use a function, you can either type the function‘s name directly on the WS or you can use the help that is provided in the Functions tab.
- For example, if you didn‘t know exactly how to use the function SUM from the previous page and wanted to find out more about it….



You can either type in the data or LC on , which allows you to select cells by pointing directly on the WS.

► Date & Time, Financial and Logical Functions

- Date & Time Functions

These are functions which deal with times and dates:

=TODAY() ≡ returns todays date

=NOW() ≡ returns todays date and the current time

- Financial Functions

These are functions with some financial applications, e.g.

=FV(rate,np,pmt,pv,type) ≡ future value of an investment

rate ≡ interest rate per period

np ≡ total number of payments

pmt ≡ payment made each period

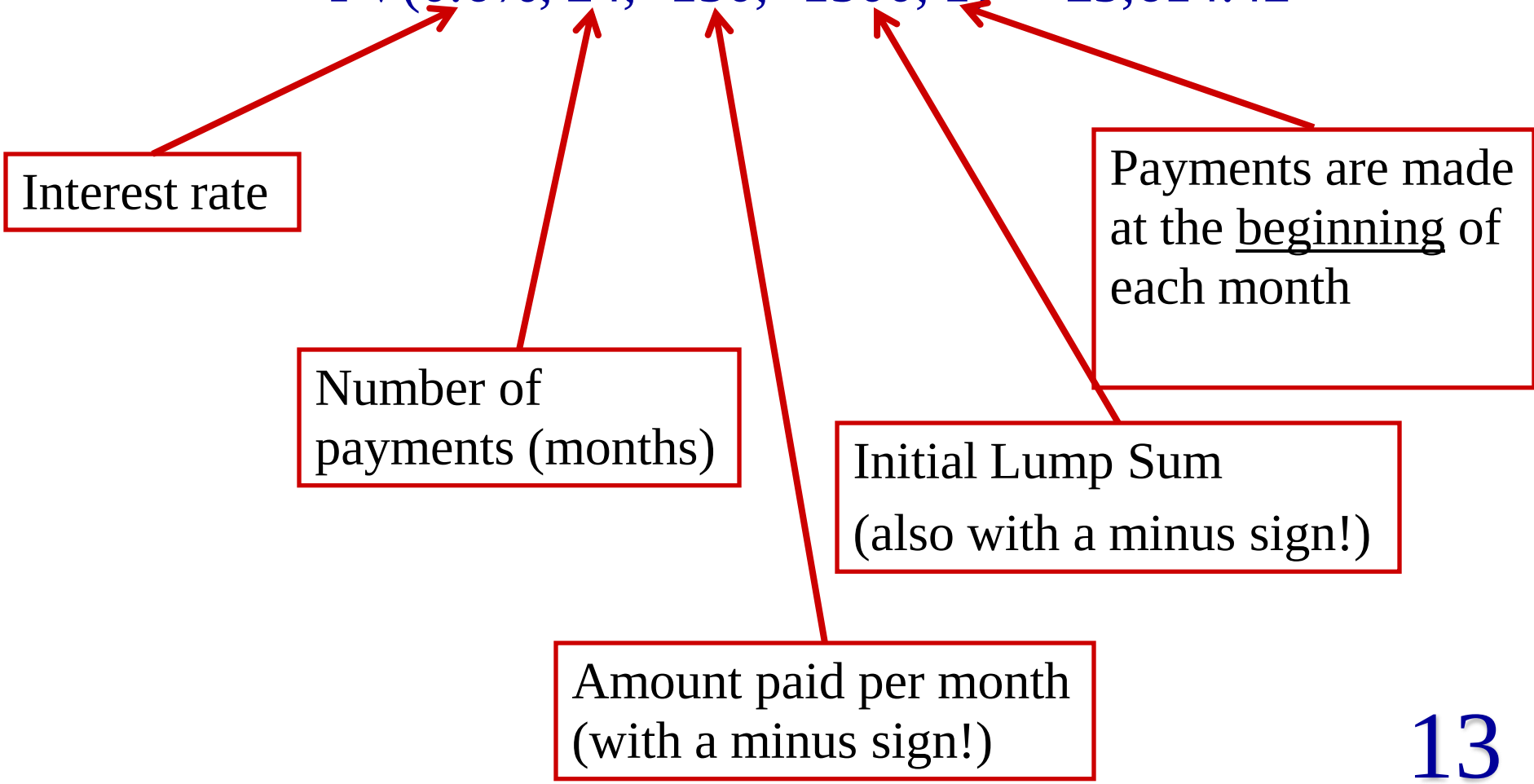
pv ≡ initial lump-sum, (optional, default is 0)

type ≡ indicates when payments are due, it is 1 if at the beginning of the period and 0 if at the end of the period (optional, default is 0)

Expl.: You deposit £1,500 into a savings account at a monthly interest rate of 0.6%. You plan to deposit £150 at the beginning of every month for the next 2 years.

How much money will be in the account after 2 years?

FV(0.6%, 24, -150, -1500, 1) → £5,614.42



- Logical Functions

These functions handle boolean values, i.e. TRUE or FALSE. There are 7 functions of this type, IF, IFERROR, NOT, AND, OR, FALSE() and TRUE().

The IF-function is used when you want to define a function that returns a different result depending on whether or not a condition is satisfied (see exercises 3, 4 of Lab Sheet 2).

Syntax: =IF(*condition*, value for true, value for false)

condition = expression1 *comparison operator* expression2

comparison operators: = ≡ equal to

< > ≡ not equal to

> ≡ greater than

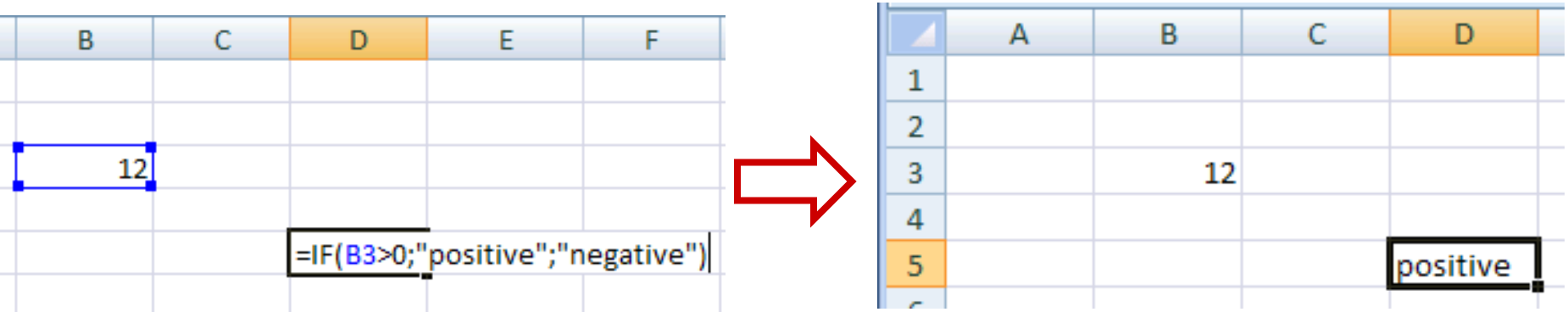
>= ≡ greater than or equal to

< ≡ less than

<= ≡ less than or equal to

Example: =IF(B3>0, “positive”, “negative”)

returns the text value “positive” if the value in the cell B3 is positive and otherwise the text value “negative”.



If we now change the value of B3 to -6, the value of the function will automatically change to “negative”.

More examples:

=IF((A1-B2)>=0, SQRT(A1-B2), “complex value”)

=IF(SUM(A1:A9)>0, 1, 0)

=IF(D6, “true”, “false”)

IF-functions can be nested up to seven times, which means that inside the argument of an IF-function (as condition or returned value) you can have further IF-functions.

Example: =IF(A1>-5, IF(A1<=5,1,0) , 0) produces the function:

$$f(A1) = \begin{cases} 0 & \text{for } A1 \leq -5 \\ 1 & \text{for } -5 < A1 \leq 5 \\ 0 & \text{for } A1 > 5 \end{cases}$$