

# Functions in Excel

# Excel Formulas

- You must have an equals sign ( = ) as the first character in a cell that contains a formula.
- The = sign tells excel that the contents of the cell is a formula
- Without the = sign, the formula will not calculate anything. It will simply display the text of the formula.

# Formulas - correct

formula with = sign

A screenshot of the Microsoft Excel interface. The title bar reads "Microsoft Excel - Book2". The menu bar includes "File", "Edit", "View", "Insert", "Format", "Tools", and "Data". The toolbar contains various icons for file operations and editing. The formula bar shows "CONCATENATE" and a red "X" icon, with the formula "=b1+b2+b3" entered. The spreadsheet grid shows columns A, B, C, and D, and rows 1 through 5. Cell B1 contains the value 3, B2 contains 2, and B3 contains 5. Cell B4 is selected and contains the text "total:" followed by the formula "=b1+b2+b3", which is circled in red. A red arrow points from the text "formula with = sign" to the equals sign in the formula bar.

	A	B	C	D
1		3		
2		2		
3		5		
4	total:	=b1+b2+b3		
5				

After pressing ENTER

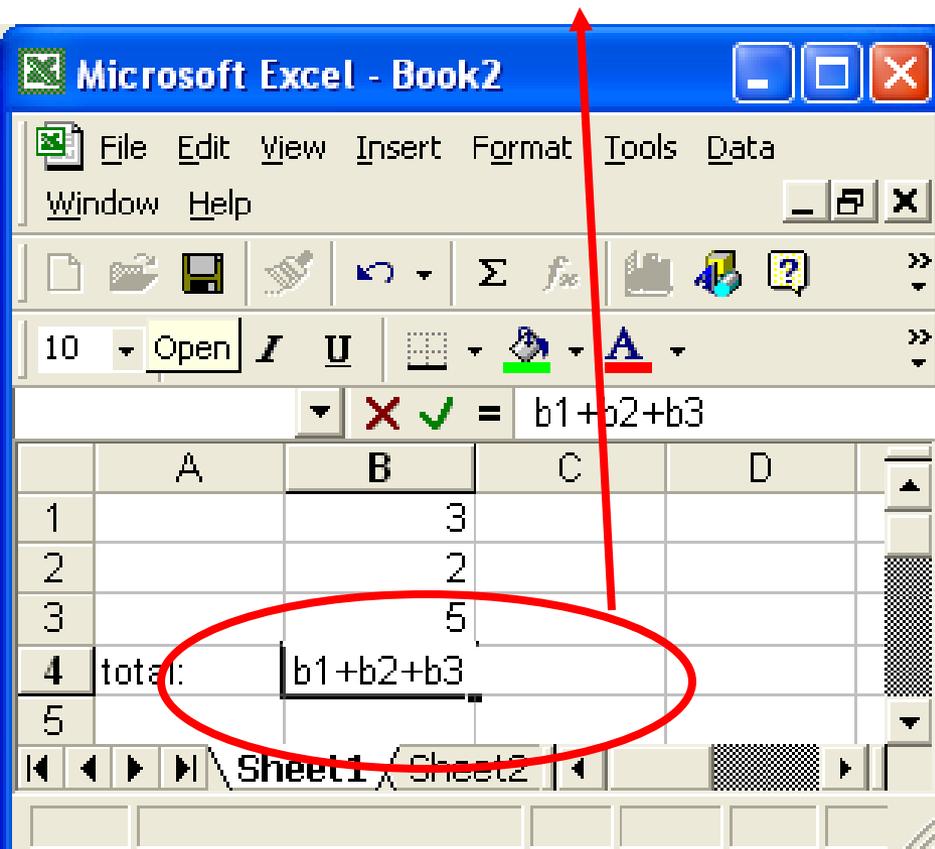
A screenshot of the Microsoft Excel interface, identical to the previous one but with the formula executed. The title bar reads "Microsoft Excel - Book2". The menu bar and toolbar are the same. The formula bar now shows "B4" and the result "= 10". The spreadsheet grid shows the same data as before, but cell B4 now contains the value 10, which is circled in red. A red arrow points from the text "After pressing ENTER" to the result in the formula bar.

	A	B	C	D
1		3		
2		2		
3		5		
4	total:	10		
5				

# Missing = sign

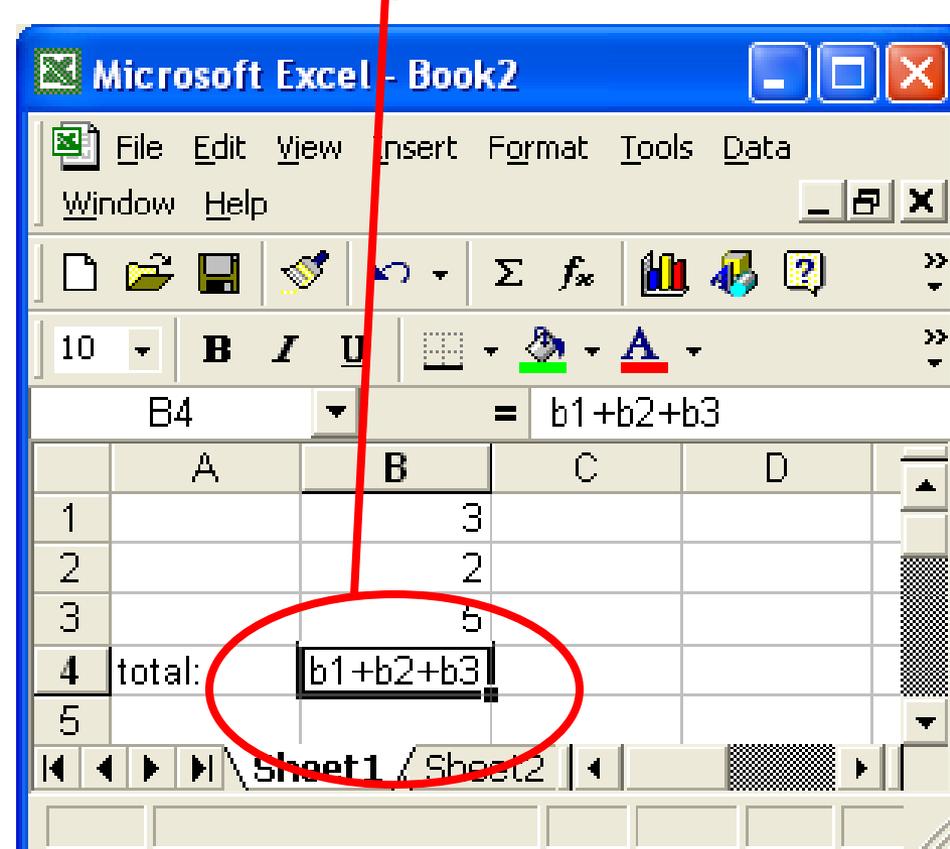
Missing = sign!

Before pressing enter



After pressing ENTER

(no change - not a function)



# Types of operations

- You can use any of the following operations in a formula:

operation symbol (Function) example

addition:	+ (Sum)	=a1+3 =sum(a1,3)
subtraction:	-	=100-b3
multiplication:	* (Product)	=a1*b1 =product(a1,b1)
division:	/	=d1/100
exponentiation	^	=a2^2
negation (same symbol as subtraction)	-	=-a2+3

# Explicit (literal) values and cell references

- You can use both explicit values and cell references in a formula
- An explicit value is also called a **literal value**
  - Formula with only cell references:  $=a1*b1$
  - Formula with only literal values:  $=100/27$
  - Formula with both cell references and literal values:  
 $=a1/100$

# Errors in Formulas

# Common Errors

- The following are some errors that may appear in a spreadsheet (there are others too).
  - #####
    - Cell is too narrow to display the results of the formula. To fix this simply make the column wider and the “real” value will be displayed instead of the ##### signs. Note that even when the ##### signs are being displayed, Excel still uses the “real” value to calculate formulas that reference this cell.
  - #NAME?
    - You used a cell reference in the formula that is not formed correctly (e.g. =BB+10 instead of =B3+10)
  - #VALUE!
    - Usually the result of trying to do math with a textual value. Example: =A1\*3 where A1 contains the word “hello”
  - #DIV/0!
    - Trying to divide by zero. Example: =3/A1 where A1 contains 0 (zero)
  - Circular Reference
    - Using a formula that contains a reference to the cell that the formula “lives in”. Example: putting the formula =A1+1 in cell A1 or putting the formula =SUM(A1:B2) in any of the cells A1, B1, A2, B2

# Order of Operations

# Complex formulas

- You can use several operations in one function
- You can group those operations with parentheses
- Examples

$$=3*2+1$$

$$=c1*(a1+b1)$$

$$=(100*a2-10)+(200*b3-20)+30$$

$$=(3+2*(50/b3+3)/7)*(3+b7)$$

# Order of operations

- When using several operations in one formula, Excel follows the order of operations for math.
  - first: all parentheses - innermost first
  - second: exponents (^)
  - third: all multiplication (\*) and division (/). Do these starting with the leftmost \* or / and work to the right.
  - fourth: all addition (+) and subtraction (-). Do these starting with the leftmost + or - and work to the right.

# Please Excuse My Dear Aunt Sally

- The sentence "Please excuse my dear aunt Sally" is a popular mnemonic to remember the order of operations:

<u>Mnemonic</u>	<u>Meaning</u>
– <b>P</b> lease	parentheses
– <b>E</b> xcuse	exponents
– <b>M</b> y <b>D</b> ear	multiplication and division (going left to right)
– <b>A</b> unt <b>S</b> ally	addition and subtraction (going left to right)

# Order of operations

- The value of

$$3 + 2 * 5$$

is

**13**

**NOT 25!**

# Order of operations

$$3 + (100 - 20) / 10 - 6 * 2 / 4 + 9$$

$$3 + 80 / 10 - 6 * 2 / 4 + 9$$

$$3 + 8 - 6 * 2 / 4 + 9$$

$$3 + 8 - 12 / 4 + 9$$

$$3 + 8 - 3 + 9$$

$$11 - 3 + 9$$

$$8 + 9$$

answer: 17

# Functions

# What is a function?

- A function is a "named operation"
- Functions have
  - a name
  - parentheses
  - parameters/arguments inside the parentheses
    - The words parameter and argument mean the same thing
    - you can have many parameters for one function separated with commas (,)
    - The number of parameters is one more than the number of commas.

# The SUM function

- Examples

<u>Function</u>	<u>Result</u>
=SUM(1,2,3,4,5)	15
=SUM(a1,b1,c1)	a1+b1+c1
=SUM(9,a1,b2,5,c1)	9+a1+b2+5+c1

# Terminology

## SUM(1,2,3,4,5)

- The **name** of the function is "SUM"
- The **parameters** or **arguments** to this function are 1,2,3,4 and 5
- The entire thing, i.e. SUM(1,2,3,4,5), is a **function call**
- The **value** of this function call is 15.  
Another way to say this is that this function call **returns** 15.

# Using a range as a parameter

- Ranges can be specified as a parameters to a function call.
- Both of the following function calls produce the same result as  $=a1+b1+c1+a2+b2+c2+a3+b3+c3+a4+b4+c4$  however the 2<sup>nd</sup> version uses a range and is much shorter.

without a range

=SUM(a1,b1,c1,a2,b2,c2,a3,b3,c3,a4,b4,c4)

with a range

=SUM(a1:c4)

# Function calls with multiple parameters

- You can include multiple ranges and cells as parameters
- Example: the following function call has 3 parameters. There are two ranges (a1:b2 and c4:c7), one number (100) and one cell reference (d3)

=SUM(a1:b2,100,c4:c7,d3)

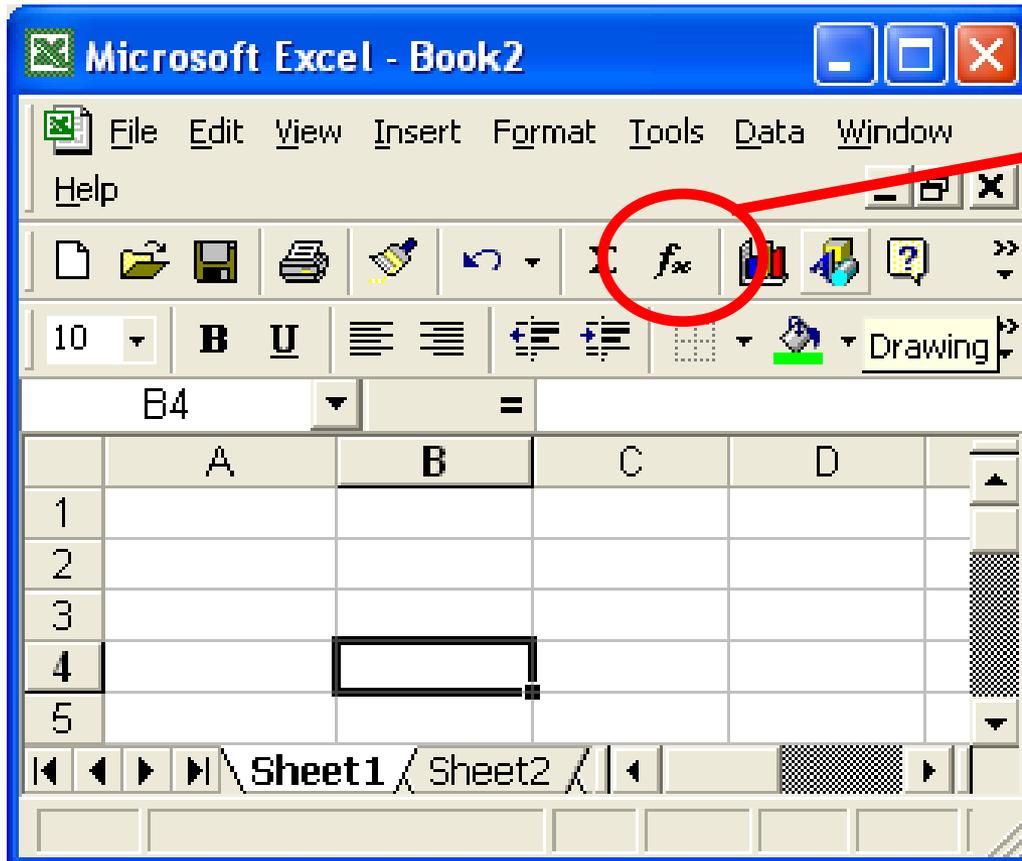
Is the same as:

=SUM(a1,a2,b1,b2,100,c4,c5,c6,c7,d3)

# Other Functions

# Other functions

- Click the function button to see the available functions:



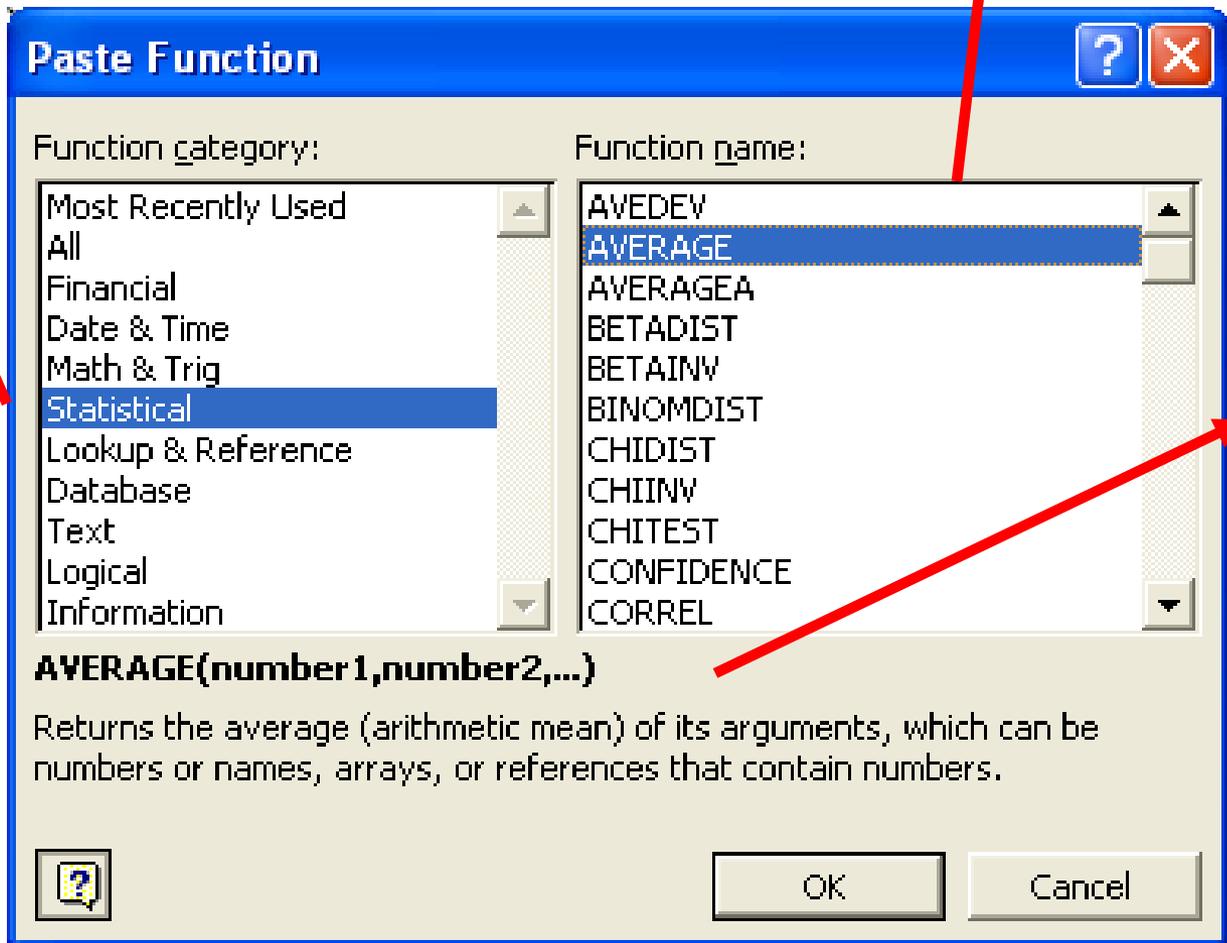
Function button  
brings up the  
function dialog box  
(see next slide)

Warning: this slide was created using Excel 2000. The dialog box in later versions of Excel looks a little different, but it has the same functionality.

# Function dialog box

categories  
(i.e. groups of functions)

Functions for the selected category



Description  
of currently  
selected  
function

# Function Editor

- Double click on the function name to get a dialog box that helps you enter values for the parameters of the function.  
(see next slide)

# Function Editor

Put values for the parameters in the edit boxes.

When you press OK, this will create the function call:

`AVERAGE(2,a1:c2,f13)`



AVERAGE

Number1	<input type="text" value="2"/>		= 2
Number2	<input type="text" value="a1:c2"/>		= {1,2,3;0,0,0}
Number3	<input type="text" value="f13"/>		= 0
Number4	<input type="text"/>		= number

= 2

Returns the average (arithmetic mean) of its arguments, which can be numbers or names, arrays, or references that contain numbers.

**Number3:** number1,number2,... are 1 to 30 numeric arguments for which you want the average.

 Formula result =2

# Example

- **AVERAGE**

<u>formula that contains a function</u>	<u>value</u>
=AVERAGE(2,4,10,4)	5
=AVERAGE(a1,f32)	$(a1+f32) / 2$
=AVERAGE(a1:c1)	$(a1+b1+c1) / 3$
=AVERAGE(a1:c1,10)	$(a1+b1+c1+10) / 4$

# Combining Functions and other values in a single formula

# Functions and other values

- You can combine functions, cell references and literal values to make a complex Excel formula

- Examples

=3 + b23 \* SUM(d20:g20)

=SUM(a1,100) \* AVERAGE(d10:j10)

=100 / ( AVERAGE(b2,c2,d30) + AVERAGE(f1:f20) )

# Data Types

# Data Types

- Numeric
  - values: any number
  - operators: + - \* / ^ %
  - sample functions: sum( ), average( ), max( ), min( ) etc.
- Text (AKA Character or String)
  - values: Any group of letters or numbers or special characters.  
Prefix value in cell with an apostrophe ( ' ) to force a text value
  - operators: & (concatenation)
  - sample functions: right( ), left( ), mid( ), lower( ), upper( ), len( ), etc
- Dates
  - values: dates and times
  - operators: N/A
  - sample functions: now( ), today( ), hour( ), minute( ), etc.
- Logical (AKA boolean)
  - values: true false
  - Operators: < > = <> <= >=
  - sample functions: if( ), and( ), or( ), not( ), isblank()

# Data Types for Values in Cells

- By default:
  - a cell that contains a number is treated as numeric data
  - a cell that contains a date is treated as date data (we'll see more about this later)
  - a cell that contains data which is not numeric and not a date is treated as "text"

# Functions In EXCEL

- [Math and trigonometry functions](#)
- [Engineering functions](#)
- [Statistical functions](#)
- Logical functions
- Add-in and Automation functions
- Cube functions
- Database functions
- Date and time functions
- Financial functions
- Information functions
- Lookup and reference functions
- Text functions

# Math and trigonometry functions

- **COS**

A	B
Formula	Description (Result)
=ACOS(-0.5)	Arccosine of -0.5 in radians, $2\pi/3$ (2.094395)
=ACOS(-0.5)*180/PI()	Arccosine of -0.5 in degrees (120)
=DEGREES(ACOS(-0.5))	Arccosine of -0.5 in degrees (120)

- **log**

Formula	Description (Result)
=LOG(10)	Logarithm of 10 (1)
=LOG(8, 2)	Logarithm of 8 with base 2 (3)
=LOG(86, 2.7182818)	Logarithm of 86 with base e (4.454347)

- **exp**

Formula	Description (Result)
=EXP(1)	Approximate value of e (2.718282)
=EXP(2)	Base of the natural log raised to the power of 2 (7.389056)

# Matrix Commands in Excel

Excel can perform some useful, albeit basic, matrix operations:

- Addition & subtraction;
- Scalar multiplication & division;
- Transpose (**TRANSPOSE**);
- Matrix multiplication (**MMULT**);
- Matrix inverse (**MINVERSE**);
- Determinant of matrix (**MDETERM**);

As well as combinations of these operations.

# Entering a Matrix

- Choose a location for the matrix (or vector) and enter the elements of the matrix.
- Highlight the cells of the matrix and choose **FORMULAS ► DEFINE NAME**.
- Enter a name for the matrix.
- You can now use the name of the matrix in formulae.

# Addition, Subtraction and Scalar Multiplication Etc.

To add two **named** 3 x 2 matrices A and B:

- Highlight a blank 3 x 2 results area in the spreadsheet. (If the results area is too small, you will get the wrong answer.)
- Type **=A+B** in the formula bar and press the **CTRL, SHIFT** and **ENTER** keys simultaneously.
- You must use the **CTRL, SHIFT,ENTER** keys if you want to perform a matrix computation. (If you don't do this, you will get an error message or the wrong answer.)

# Addition, Subtraction and Scalar Multiplication Etc. (Cont'd)

- If you click on any cell in the result, the formula  $\{=A+B\}$  will be displayed. In Excel, the  $\{ \}$  brackets indicate a matrix (array) command.
- For an example of scalar multiplication, see the Example Spreadsheet on the web page.

# Matrix Transpose

- Suppose  $A$  is a  $3 \times 2$  matrix.
- The transpose of  $A$ ,  $A'$ , will be  $2 \times 3$ .
- Select a  $2 \times 3$  results area, type **=TRANSPOSE(A)** in the formula bar and press **CTRL, SHIFT, ENTER**.
- Exercise: Choose  $A$  and  $B$  so that  $AB$  exists. Check that  $(AB)' = B'A'$  using MMULT (matrix multiplication).
- What do you think  $(ABC)'$  is equal to?

# Matrix Multiplication

- Suppose A and B are named 3 x 2 and 2 x 3 matrices.
- Then AB is 3 x 3 and BA is 2 x 2. This illustrates the fact that, in general, AB is not equal to BA, even if the matrices are conformable.
- Select a blank 3 x 3 area for the result AB.
- Type **=MMULT(A,B)** in the formula bar and press **CTRL, SHIFT, ENTER** to generate AB.

# Matrix Inverse

- Suppose B is a square 2 x 2 matrix.
- Select a 2 x 2 area for the inverse of B.
- Type **=MINVERSE(B)** in the formula bar and press **CRTL, SHIFT, ENTER**.
- If B is singular (non-invertible), you will get an error message.
- Suppose A and B have the same dimension and are both invertible. Show that  $(AB)^{-1} = B^{-1}A^{-1}$ .
- What do you think  $(ABC)^{-1}$  is equal to?

# Matrix Determinant

- Suppose  $A$  is a square matrix.
- The determinant of  $A$ ,  $\det(A)$  or  $|A|$ , is a scalar.
- Select a single cell, type `= MDETERM(A)` in the formula area and press **CTRL, SHIFT, ENTER** (or just **ENTER**).
- If  $A$  is singular, then  $\det(A) = 0$ .
- Exercise: Check that  $\det(AB) = \det(BA) = \det(A) \cdot \det(B)$ , where  $A$  and  $B$  are square matrices.

# mdeterm

A	B	C	D
Data	Data	Data	Data
1	3	8	5
1	3	6	1
1	1	1	0
7	3	10	2
Formula	Description (Result)	Formula	Description (Result)
=MDETERM(B2:D5)	Determinant of the matrix above (88)	=MDETERM({3,6;1,1})	Determinant of the matrix in the array constant (-3)
=MDETERM({3,6,1;1,1,0;3,10,2})	Determinant of the matrix as an array constant (1)	=MDETERM({1,3,8,5;1,3,6,1})	Returns an error because the array does not have an equal number of rows and columns (#VALUE!)

# Engineering functions

- complex

Formula	Description (Result)
=COMPLEX(3,4)	Complex number with 3 and 4 as the real and imaginary coefficients (3 + 4i)
=COMPLEX(3,4,"j")	Complex number with 3 and 4 as the real and imaginary coefficients, and j as the suffix (3 + 4j)
=COMPLEX(0,1)	Complex number with 0 and 1 as the real and imaginary coefficients (i)
=COMPLEX(1,0)	Complex number with 1 and 0 as the real and imaginary coefficients (1)

- hex2bin

Formula	Description (Result)
=HEX2BIN("F", 8)	Converts hexadecimal F to binary, with 8 characters (00001111)
=HEX2BIN("B7")	Converts hexadecimal B7 to binary (10110111)
=HEX2BIN("FFFFFFFF")	Converts hexadecimal FFFFFFFF to binary (1111111111)

- imdiv

Formula	Description (Result)
=IMDIV("-238+240i","10+24i")	Quotient of the two complex numbers in the formula (5 + 12i)

# Syntax

## CONVERT(number, from\_unit, to\_unit)

A	B
Formula	Description (Result)
=CONVERT(1.0, "lbm", "kg")	Converts 1 pound mass to kilograms (0.453592)
=CONVERT(68, "F", "C")	Converts 68 degrees Fahrenheit to Celsius (20)
=CONVERT(2.5, "ft", "sec")	Data types are not the same so an error is returned (#N/A)
=CONVERT(CONVERT(100,"ft","m"),"ft","m")	Converts 100 square feet into square meters (9.290304).

# Statistical functions

- median

A	
Data	
1	
2	
3	
4	
5	
6	
Formula	Description (Result)
=MEDIAN(A2:A6)	Median of the first 5 numbers in the list above (3)
=MEDIAN(A2:A7)	Median of all the numbers above, or the average of 3 and 4 (3.5)

# variance

A	
Strength	
1345	
1301	
1368	
1322	
1310	
1370	
1318	
1350	
1303	
1299	
Formula	Description (Result)
=VAR(A2:A11) )	Variance for the breaking strength of the tools (754.2666667)

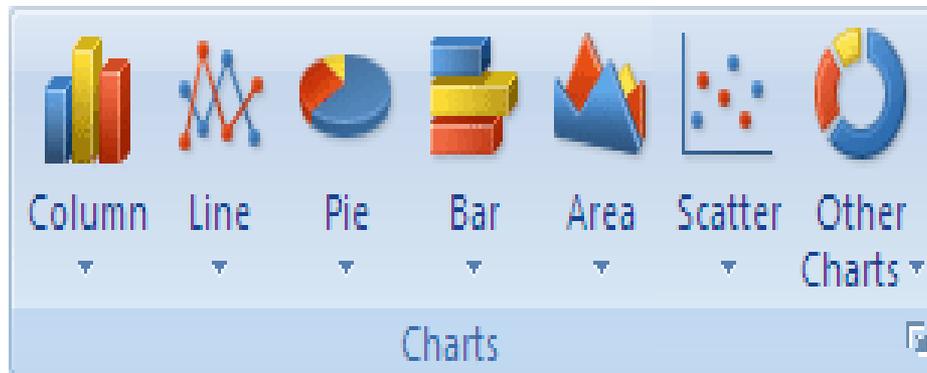
# Standard Deviation

Strength	
1345	
1301	
1368	
1322	
1310	
1370	
1318	
1350	
1303	
1299	
Formula	Description (Result)
=STDEV(A2:A11)	Standard deviation of breaking strength (27.46391572)

# Chart

- **Insert ► Charts**

- Click the chart type, and then click a chart subtype that you want to use.

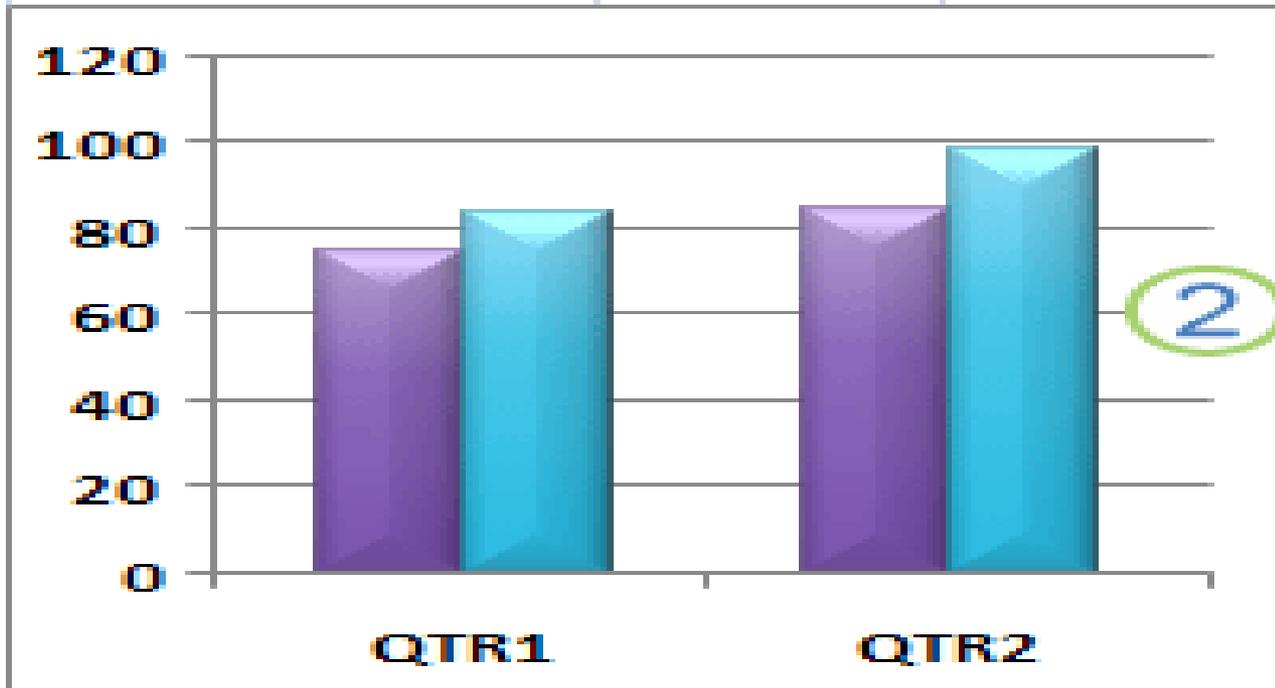


# Change the layout of chart elements

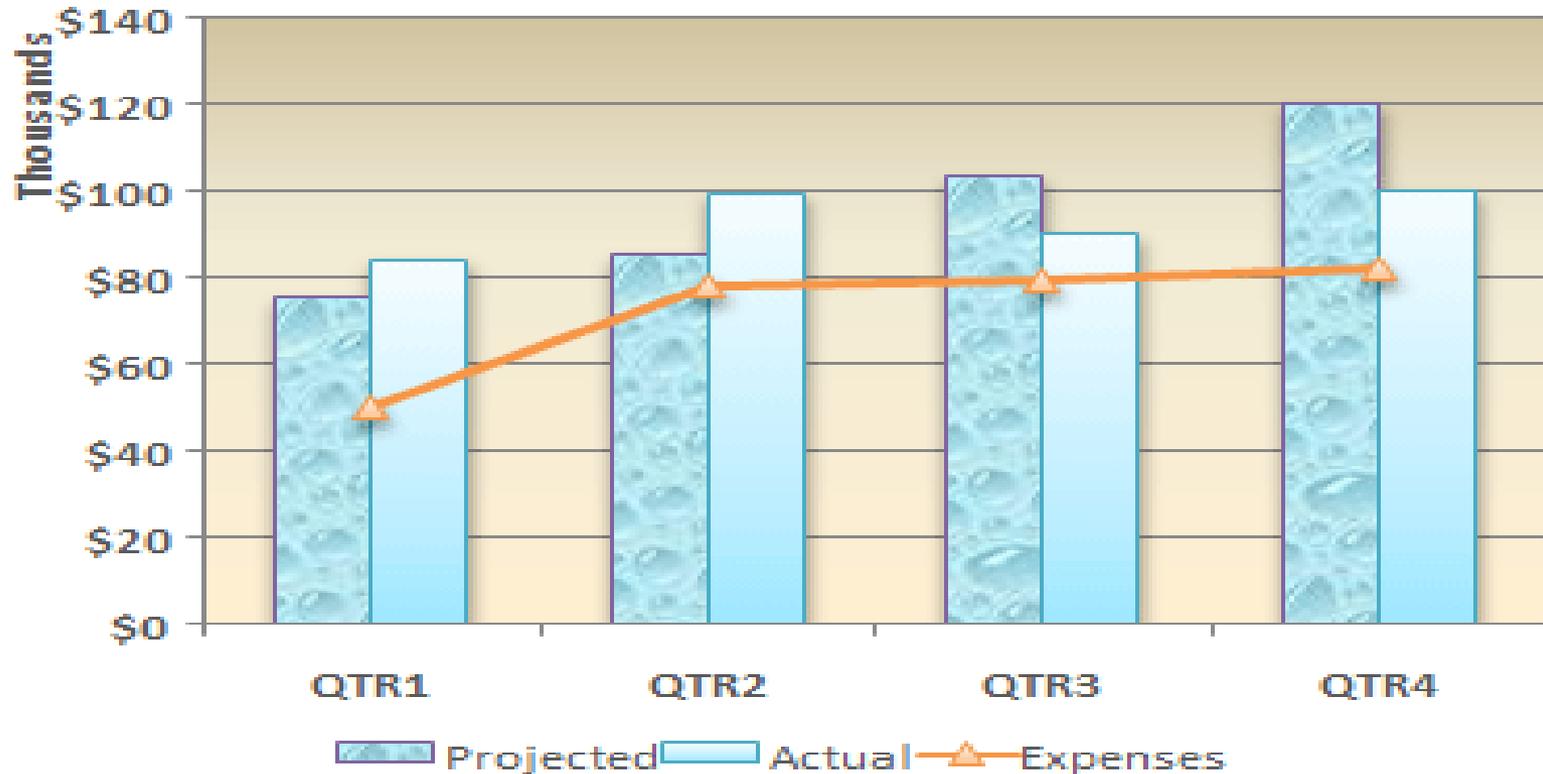
- On the **Layout** tab, do the one or more of the following:
  - In the **Labels** group, click the label layout option that you want.
  - In the **Axes** group, click the axis or gridline option that you want.
  - In the **Background** group, click the layout option that you want.

# Chart

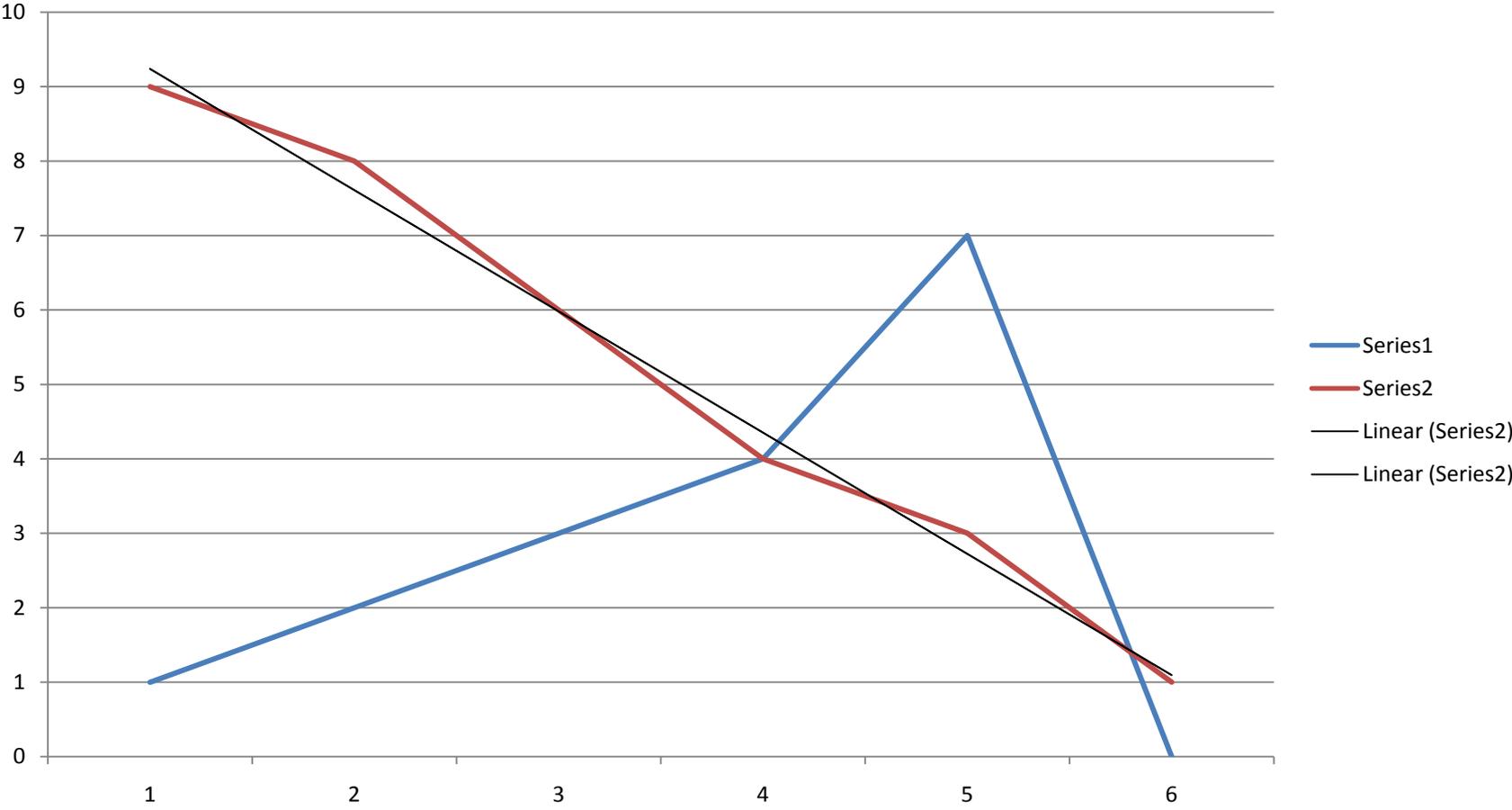
	QTR1	QTR2
Projected	75	85
Actual	84	99

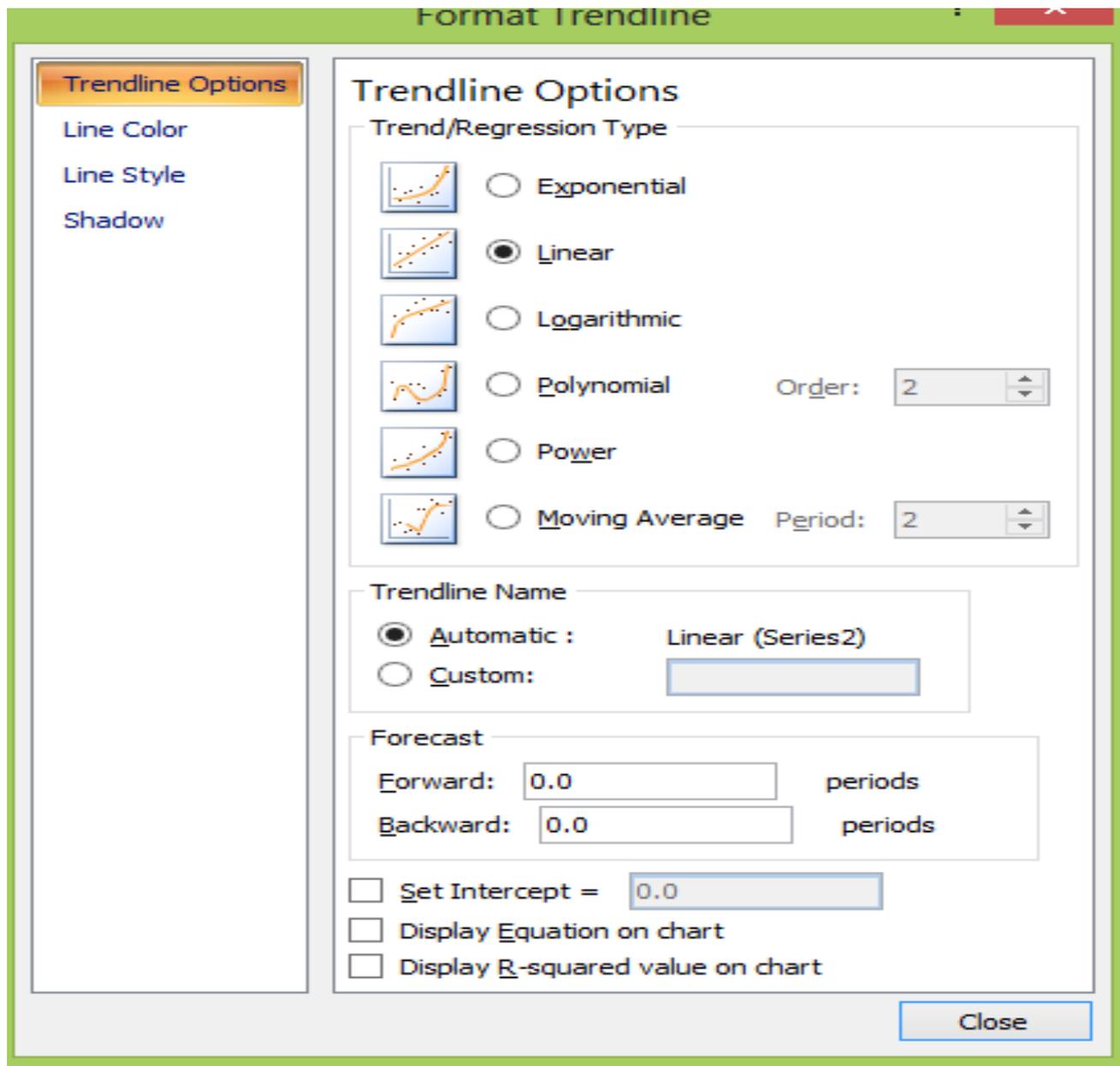


# Combination chart that uses a column and line chart type.



# Add Trendlines











# Text Functions

- Many functions are used to manipulate text values.
- The following are only some of them

right( )

left( )

mid( )

concatenate( )

lower( )

upper( )

len( )

# RIGHT, LEFT and MID functions

# RIGHT function

- The RIGHT function is used to isolate a specific number of “characters” from the right hand side of a text value.
- (example on next slide)

# RIGHT ( <text>, <numCharacters>)

## Formula View

	A	B
1	<b>SSN</b>	<b>Last 4 digits</b>
2	012345678	=RIGHT(A2,4)
3	0001112222	=RIGHT(A3,4)
4		

## Values View

	A	B
1	<b>SSN</b>	<b>Last 4 digits</b>
2	012345678	5678
3	0001112222	2222
4		

# RIGHT – numCharacters is optional

- The <numCharacters> parameter in the RIGHT function is optional. If you don't specify it the default is 1 (one).

## Formula View

	A	B	C	D	E
1	<b>Word</b>	<b>Calls to the "RIGHT" function</b>			
2	ABCDE	=RIGHT(A2,3)	=RIGHT(A2,2)	=RIGHT(A2,1)	=RIGHT(A2)

These produce the same results.

## Values View

	A	B	C	D	E
1	<b>Word</b>	<b>Calls to the "RIGHT" function</b>			
2	ABCDE	CDE	DE	E	E

# LEFT

- The LEFT function is the same as the RIGHT function, but it returns characters from the LEFT side of the value.

MID ( <text>, <startPosition>  
, <numCharacters>)

- MID is used to get values from the middle of some text.
- MID takes 3 parameters:
  - The original text
  - The position to start taking the new value from
  - The number of characters to take for the new value
- Example on next slide

Example: MID ( <text>, <startPosition>  
, <numCharacters>)

- This example extracts the second through the fourth characters from the original text value:

### Formula View

	A	B
1	ABCDEFGHIJKL	=MID(A1,2,3)

### Values View

	A	B
1	ABCDEFGHIJKL	BCD

Concatenation  
( & ) and  
CONCATENATE function

# Concatenation (&)

- Use & to combine (or concatenate) two different text values

## Formula View

	A	B	C
1	<b>FIRST NAME</b>	<b>LAST NAME</b>	<b>FULL NAME</b>
2	John	Doe	=A2&B2
3	Paul	Smith	=A3&B3
4	David	Washington	=A4&B4

## Values View

	A	B	C
1	<b>FIRST NAME</b>	<b>LAST NAME</b>	<b>FULL NAME</b>
2	John	Doe	JohnDoe
3	Paul	Smith	PaulSmith
4	David	Washington	DavidWashington

Notice that there is no space between the two values

# Concatenate many values

- You may concatenate many values together

## Formula View

	A	B	C	D
1	<b>FIRST</b>	<b>MIDDLE</b>	<b>LAST</b>	<b>FULL</b>
2	John	Quincy	Doe	=A2&B2&C2
3	Paul	Walker	Smith	=A3&B3&C3
4	David	Steven	Washington	=A4&B4&C4

## Values View

	A	B	C	D
1	<b>FIRST</b>	<b>MIDDLE</b>	<b>LAST</b>	<b>FULL</b>
2	John	Quincy	Doe	JohnQuincyDoe
3	Paul	Walker	Smith	PaulWalkerSmith
4	David	Steven	Washington	DavidStevenWashington

# Concatenation with "literal" values

- You can also concatenate "literal" values.
- You must include the literal values inside quotes
- For example to display spaces in the "full name" in the previous example you could use the following formula. Each space that you want to display must be included in quotes.

=A2&" "&B2&" "&C2

(Don't forget any of the &'s )

- See next slide ...

# Concatenating spaces - Example

- You can concatenate spaces into a formula

## Formula View

	A	B	C	D
1	<b>FIRST</b>	<b>MIDDLE</b>	<b>LAST</b>	<b>FULL</b>
2	John	Quincy	Doe	=C2&" "&B2&" "&A2
3	Paul	Walker	Smith	=C3&" "&B3&" "&A3
4	David	Steven	Washington	=C4&" "&B4&" "&A4

## Values View

	A	B	C	D
1	<b>FIRST</b>	<b>MIDDLE</b>	<b>LAST</b>	<b>FULL</b>
2	John	Quincy	Doe	Doe Quincy John
3	Paul	Walker	Smith	Smith Walker Paul
4	David	Steven	Washington	Washington Steven David

values  
contain  
spaces

# LEFT( ) with & in same formula

- You can combine the results of different function calls with concatenation.

## Formula View

	A	B	C
1	<b>FIRST</b>	<b>LAST</b>	<b>INITIALS</b>
2	John	Doe	=LEFT(A1)&LEFT(B1)
3	Paul	Smith	=LEFT(A2)&LEFT(B2)
4	David	Washington	=LEFT(A3)&LEFT(B3)

## Values View

	A	B	C
1	<b>FIRST</b>	<b>LAST</b>	<b>INITIALS</b>
2	John	Doe	FL
3	Paul	Smith	JD
4	David	Washington	PS
5			

# CONCATENATE Function

- You can use the CONCATENATE function instead of the ampersand (&).
- The following formulas are equivalent:

=A1&B1&C1

=CONCATENATE(A1,B1,C1)

- The CONCATENATE function can take as many parameters as you like.

# Logical (AKA boolean) values

# TRUE and FALSE

- A logical value can be one of only two values

TRUE

or

FALSE

# TRUE

- The following statements are TRUE:

Fish live in water.

Deer live on land.

- The following statements are also TRUE:

3 is greater than 2

2 is less than 3

2 is less than or equal to 3

2 is less than or equal to 2

3 is greater than or equal to 2

3 is greater than or equal to 3

2 is equal to 2

2 is not equal to 3

# FALSE

- The following statements are FALSE:

Fish live on land.

Deer live in water.

- The following statements are also FALSE:

2 is greater than 3

3 is less than 2

3 is less than or equal to 2

2 is greater than or equal to 3

2 is equal to 3

2 is not equal to 2

# Logical operators

- In Excel the following "operators" are used

<u>Operator</u>	<u>Meaning</u>
>	greater than
<	less than
>=	greater than or equal to
<=	less than or equal to
=	equal to
<>	not equal to

- Examples

3 > 2                    true

3 < 2                    false

# Logical Formulas

Formula View

Values View

Microsoft Excel - Book1

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A8 =

	A	B
1	Numerical Values	Logical formulas
2	1	=A2<A3
3	2	=A2>A3
4		=A2<=A3
5		=A2>=A3
6		=A2=A3
7		=A2<>A3
8		
9		

Sheet1 / Sheet2

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A7 =

	A	B	C
1	Numerical Values	Logical formulas	
2	1	TRUE	
3	2	FALSE	
4		TRUE	
5		FALSE	
6		FALSE	
7		TRUE	
8			
9			

Sheet1 / Sheet2

# Same formulas, different values

Formula View

Values View

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A8 =

	A	B
1	<b>Numerical Values</b>	<b>Logical formulas</b>
2	3	=A2<A3
3	2	=A2>A3
4		=A2<=A3
5		=A2>=A3
6		=A2=A3
7		=A2<>A3
8		
9		

Sheet1 / Sheet2

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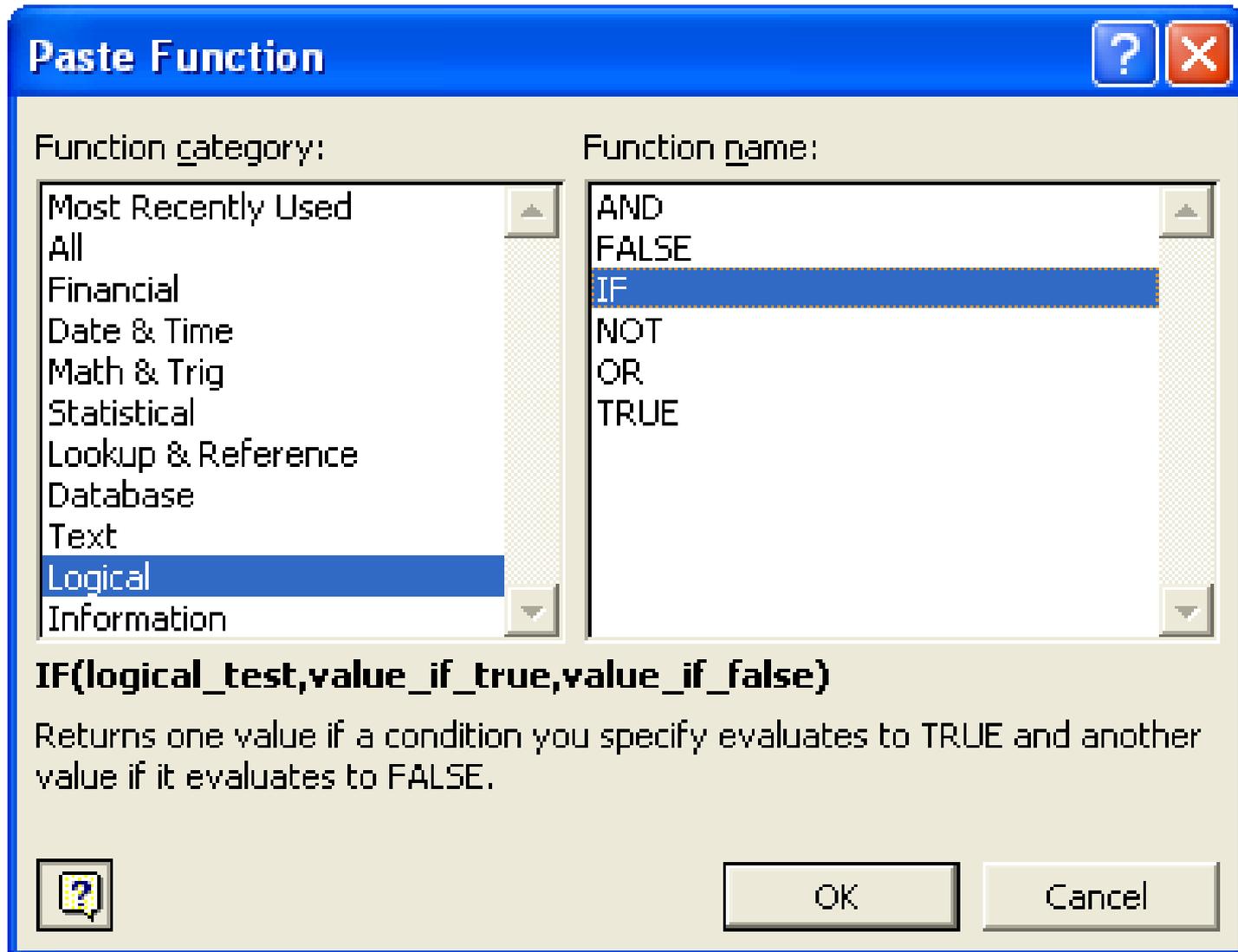
File Edit View Insert Format Tools Data Window Help

A8 =

	A	B	C
1	<b>Numerical Values</b>	<b>Logical formulas</b>	
2	3	FALSE	
3	2	TRUE	
4		FALSE	
5		TRUE	
6		FALSE	
7		TRUE	
8			
9			

Sheet1 / Sheet2

# IF Function



# Parameters for IF function

IF

Logical_test	a2>a3		= TRUE
Value_if_true	"I am happy."		= "I am happy."
Value_if_false	"I am sad."		= "I am sad."

= "I am happy."

Returns one value if a condition you specify evaluates to TRUE and another value if it evaluates to FALSE.

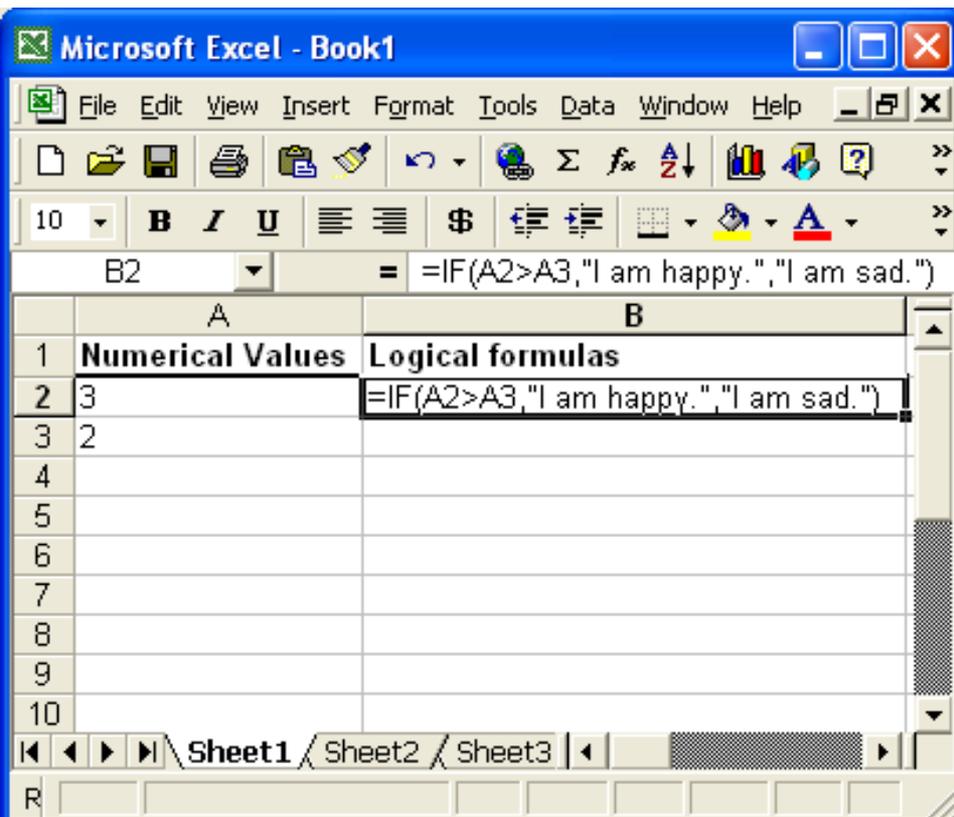
**Value\_if\_false** is the value that is returned if Logical\_test is FALSE. If omitted, FALSE is returned.

 Formula result =I am happy.

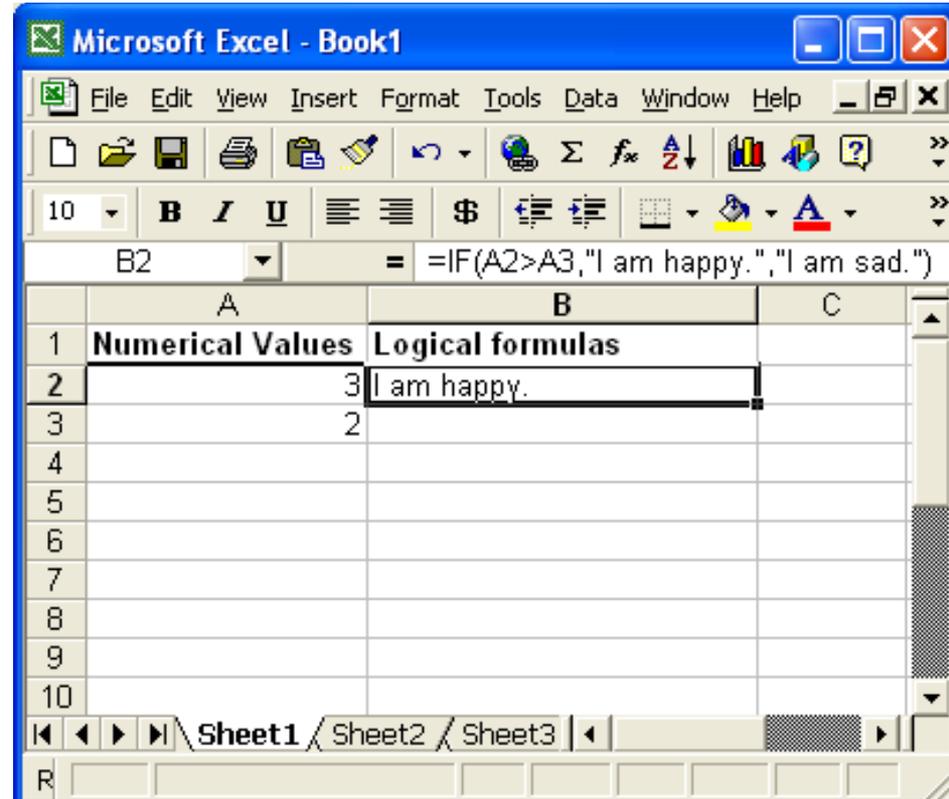
OK Cancel

# IF function

Formula View



Values View



# IF with a numeric result

IF

Logical_test	A2>A3	= TRUE
Value_if_true	500	= 500
Value_if_false	1000	= 1000

= 500

Returns one value if a condition you specify evaluates to TRUE and another value if it evaluates to FALSE.

**Value\_if\_true** is the value that is returned if Logical\_test is TRUE. If omitted, TRUE is returned. You can nest up to seven IF functions.

 Formula result = 500

OK Cancel

# IF with a numerical result

Formula View

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10 B \$

	A	B
1	Numerical Values	Logical formulas
2	3	=IF(A2>A3, 500, 1000)
3	2	
4		

Sheet1 Sheet2 S

Values View

Microsoft Excel - Book1

File Edit View Insert Format Tools Data Window Help

10 B \$

	A	B
1	Numerical Values	Logical formulas
2	3	500
3	2	
4		

Sheet1 Sheet2 S

AND

OR

NOT

# AND

- The following is TRUE

Fish live in water AND deer live on land.

- The following are all FALSE

Fish live in water AND deer live in water.

Fish live on land AND deer live on land.

Fish live on land AND deer live in water.

# AND function

AND

Logical1	A2 < A3		= TRUE
Logical2	B2 < B3		= FALSE
Logical3			= logical
Logical4			= logical
Logical5			= logical

= FALSE

Returns TRUE if all its arguments are TRUE; returns FALSE if any argument is FALSE.

**Logical4:** logical1,logical2,... are 1 to 30 conditions you want to test that can be either TRUE or FALSE and can be logical values, arrays, or references.

 Formula result =FALSE

OK Cancel

# AND

Formula View

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B9 =

	A	B
1	<b>Numerical Values</b>	
2	2	100
3	3	50
4		
5	<b>Logical formulas</b>	
6	=AND(A2<A3,B2<B3)	
7		

Sheet1 / Sheet2

Values View

Microsoft Excel - Book1

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B9 =

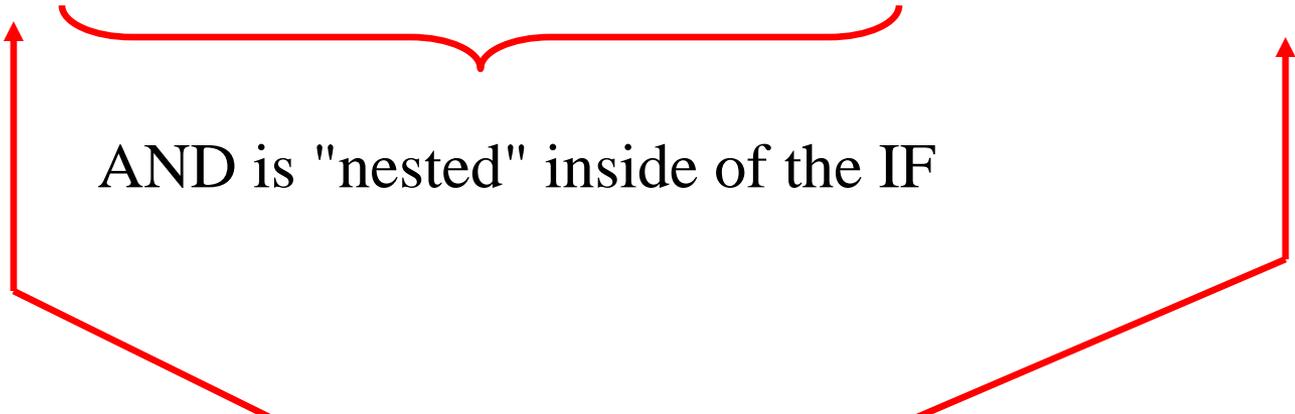
	A	B	C
1	<b>Numerical Values</b>		
2	2	100	
3	3	50	
4			
5	<b>Logical formulas</b>		
6	FALSE		
7			

Sheet1 / Sheet2

# IF with AND - nested function calls

- You can use an AND inside of an IF.
- This is called a NESTED FUNCTION CALL
- Example

=IF( AND (A2>A3,B2<>B3) , 500, 1000)



AND is "nested" inside of the IF

These parentheses "belong to" the if

# IF with AND - parameters

Parameters for IF function:

IF

**Logical\_test** AND(A2 < A3, B2 < B3) = FALSE

**Value\_if\_true** "I am happy" = "I am happy"

**Value\_if\_false** "I am sad" = "I am sad"

Returns one value if a condition you specify evaluates to TRUE and another value if it evaluates to FALSE.

**Value\_if\_false** is the value that is returned if Logical\_test is FALSE. If omitted, FALSE is returned.

Formula result = I am sad

OK Cancel

# IF with AND - spreadsheet views

Formula View

Values View

Microsoft Excel - Book1

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10 B I U \$

C6 =

	A	
1	<b>Numerical Values</b>	
2	2	100
3	3	50
4		
5	<b>Logical formulas</b>	
6	=IF(AND(A2<A3,B2<B3), "I am happy", "I am sad")	
7		

Sheet1 / Sheet2 / Sheet3

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10 B I U \$

C6 =

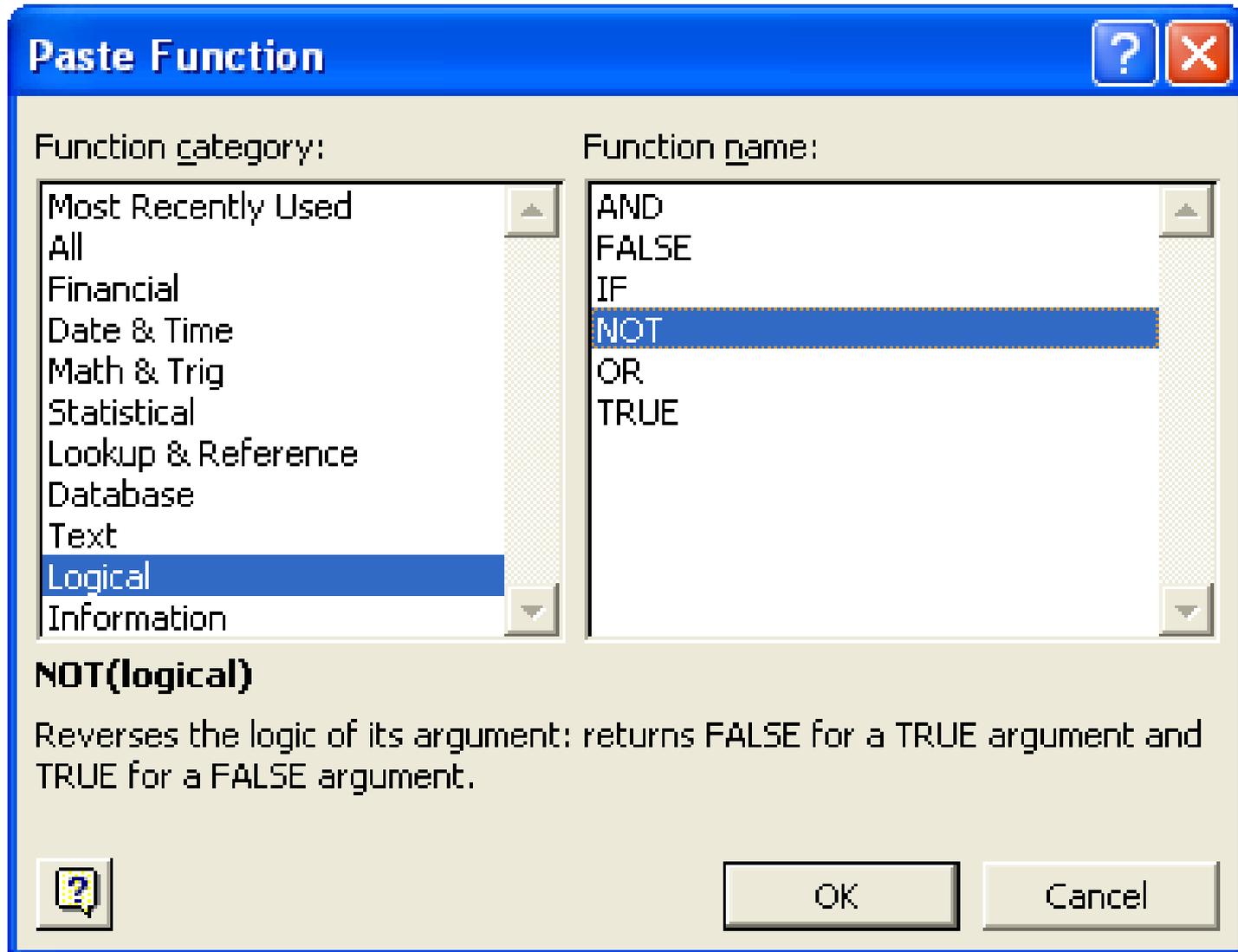
	A	B	C
1	<b>Numerical Values</b>		
2	2	100	
3	3	50	
4			
5	<b>Logical formulas</b>		
6	I am sad		
7			

Sheet1 / Sheet2 / Sheet3

# AND function

- Takes any number of parameters
- Returns TRUE if ALL of the parameters evaluate to TRUE otherwise returns FALSE.

# OR and NOT functions



# OR

- Takes any number of parameters
- Returns TRUE if ANY of the parameters evaluate to TRUE otherwise returns FALSE

# NOT

- Takes ONLY ONE parameter
- Returns the "opposite" of the value of the parameter
  - returns FALSE if the parameter value is TRUE
  - returns TRUE if the parameter value is FALSE

# Examples of Complex Nested Function Calls

- =IF(AND(A2>A3, OR(B2=B3,C2<C3)), 500, 1000)
- =IF(NOT(AND(A2>A3, OR(B2=B3,C2<C3))), 500, 1000)
- =IF(AND(A2>A3, NOT(OR(B2=B3,C2<C3))), 500, 1000)