03 - Formulas and Functions

1. Formula Basics

A formula is an equation that you use to perform calculations.
A formula ***returns*** a ***result***.

Sample
The formula: **= 1 + 1**
Returns: **2**

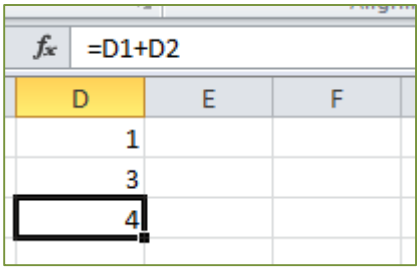
Formula Requirements
You can type a formula in a cell or in the Formula Bar
A formula always begins with an = sign.
You have to press the ENTER key to let Excel know you're finished typing a formula.
(Don't click on another cell to try and tell Excel you're finished typing a formula).

(Following the = Sign) Formulas Can Contain

Constants – (for example: **222**, **46**, **NY, NY37**)
Basic Math Operators – (**+ - * /**)
Cell Address(es) – (for example: **B12, C22**)
Parenthesis – (more on parenthesis below)
Functions – (for example: **=NOW()**)

2. Create a Workbook with Some Simple Formulas

Manually Create a Simple Formula



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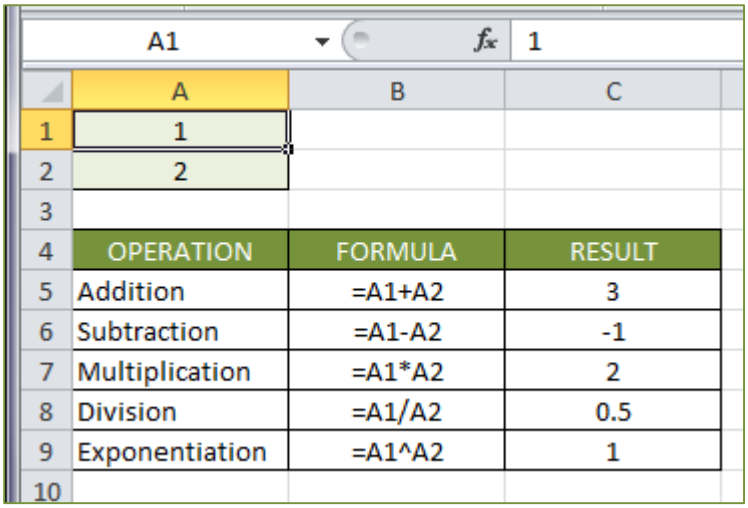
Create Formulas by Pointing and Clicking

Remember – use the **Enter Key** to let Excel know the formula is finished. Don't click in another cell to try and tell Excel you've completed the formula – if Excel is still in edit mode (insertion point blinking in the Cell or Formula Bar) it will think you're still writing the formula.

Create the formulas in Column C by pointing and clicking.



3. Precedence

How to use parenthesis in formulas

Please Excuse My Dear Aunt Sally (precedence.xlsx)

FORMULA	RESULT
=2+3*4	14
=(2+3*4)	14
=(2+3)*4	20
=2+(3*4)	14

4. Introduction to Functions

Functions

Use them to replace parts of more complicated formulas with an easy to use, built-in, formula. Excel has about 340 built-in functions available.

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Sample

To find the average value of the contents of 4 cells use the AVERAGE function.

	A	B	C
1	1	=(A1+A2+A3+A4)/4	2.5
2	2	=AVERAGE(A1,A2,A3,A4)	2.5
3	3		
4	4		
5			

Syntax

Function syntax is always: FUNCTIONNAME()

Arguments

Sometimes functions have Arguments – information that the function uses to return the result

Examples

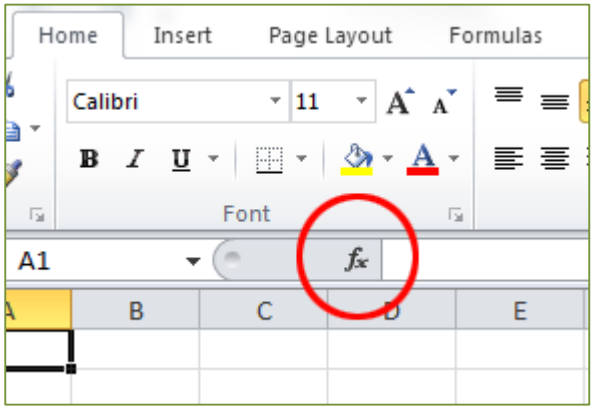
FUNCTION	NUMBER of ARGUMENTS	RESULT
=PI()	0	3.141592654
=SQRT(9)	1	3

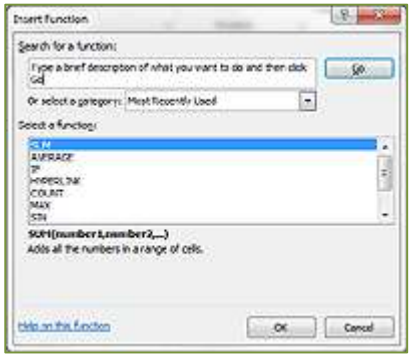
Comparing a Formula and Function

A formula does not necessarily have to include any functions, or it can include many functions,

Function Help

Click the Function Button (fx)





Opens the Insert Function dialog box and gives basic information about a function.

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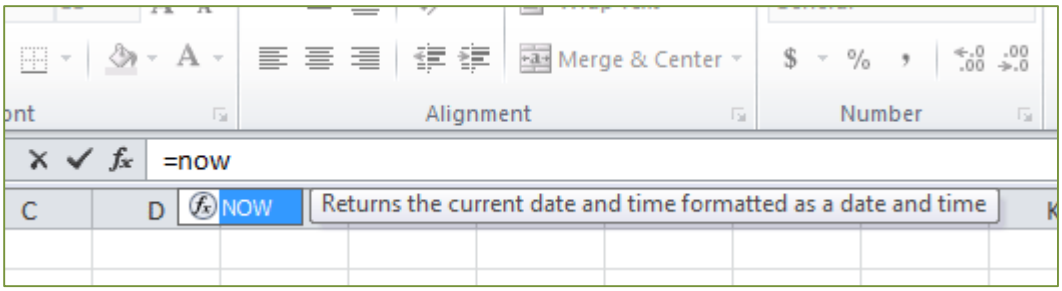
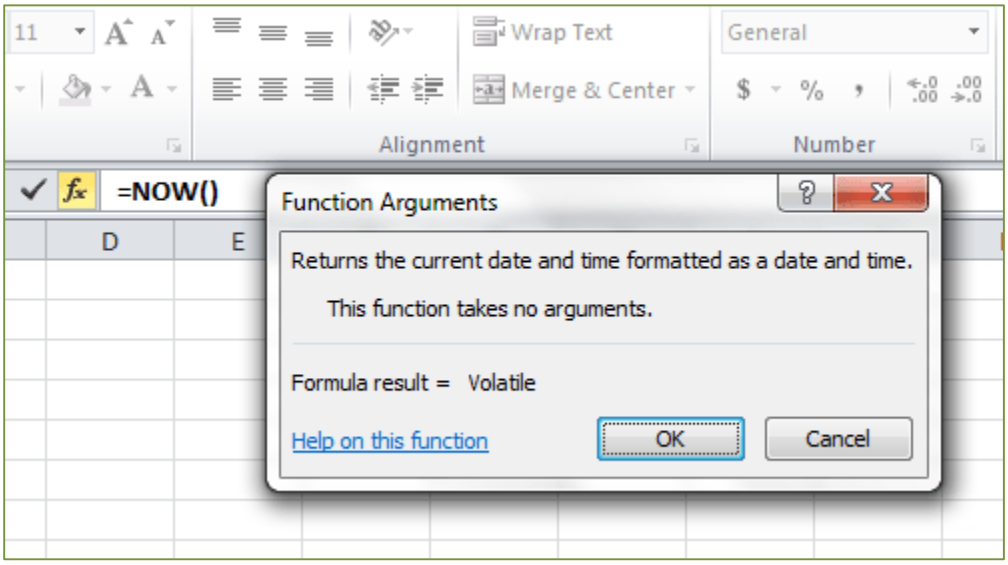
Function Tool Tip – appears as you type a function name in the Formula Bar



Function Arguments and Function Help Page

Click on the Function Button (fx) when the insertion point is blinking on a function name in the Formula Bar. This exposes the Function Arguments dialog box and includes a Help on this function link. Click on the link to open a detailed help page for that function.



5. Some Simple Excel Functions – Illustrating Arguments

Function Parts Review

FUNCTIONNAME(argument(s))

Functions with No Arguments - Examples

=PI()

=NOW()

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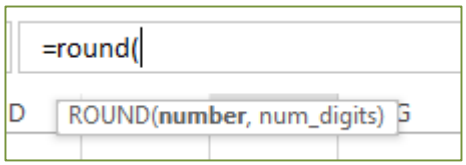
Functions with One Argument - Examples

=SQRT(*number*)
=INT(*number*)
=ABS(*number*)
=ROMAN(*number*)

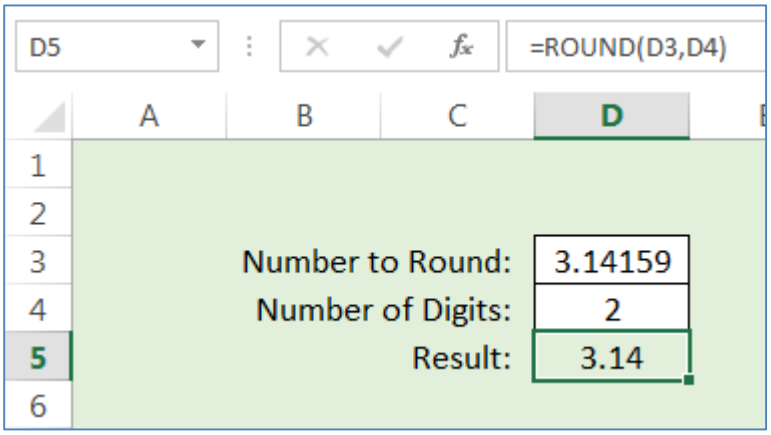
Function with Two Arguments – Examples

=ROUND(*number, num_digits*)
=MOD(*number, divisor*)

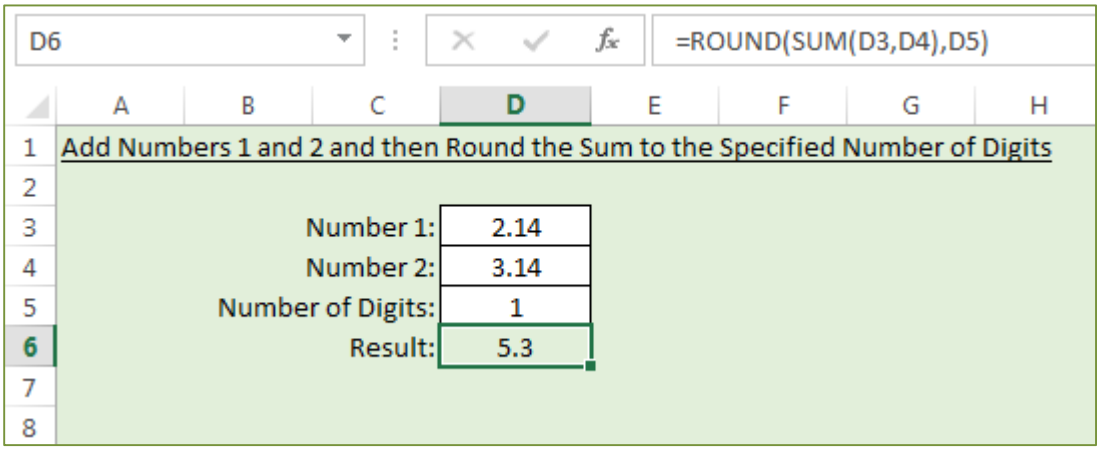


6. More on Function Arguments

Using a Cell Reference as an Argument – use ROUND



Using a Function as an Argument (Nesting)



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7. Cell References and Ranges

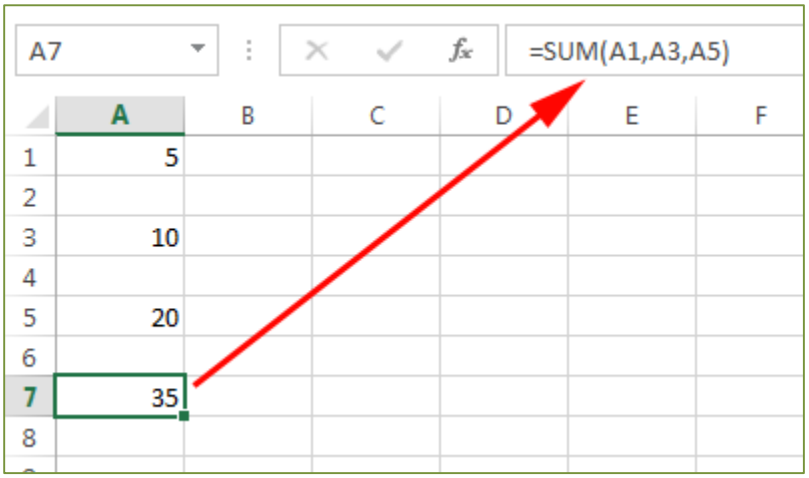
Terminology

A cell reference is that cell's address (the reference refers to that cell's address)

A range is a reference to one or more (contiguous or non-contiguous) cells

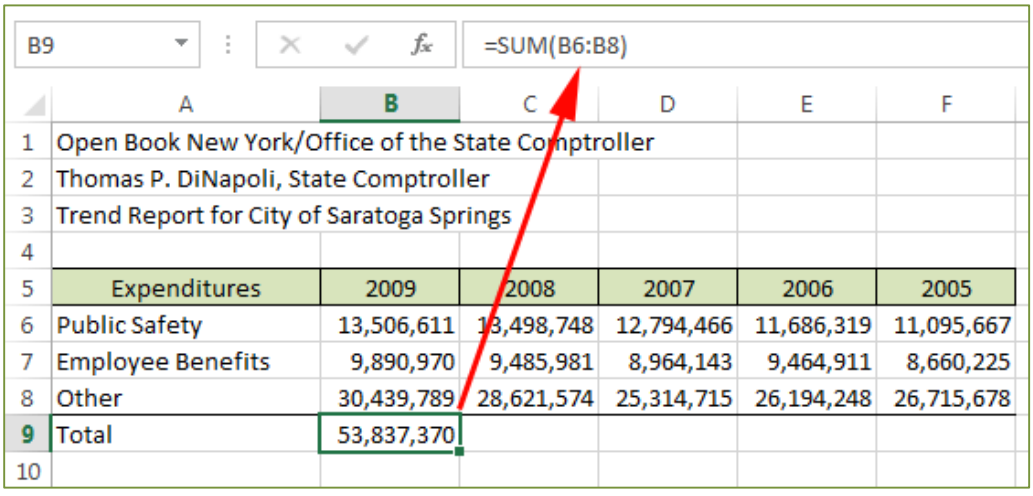
Punctuation

Comma – use a comma to refer to separate non-contiguous (or contiguous) cells



Colon – use a colon to refer to a range of contiguous cells

Create the row 9 formulas – manually and by pointing, clicking, and dragging



Combination of Comma(s) and Colon(s)

Calculate the total of the Public Safety and Other expenses from 2009 and 2007

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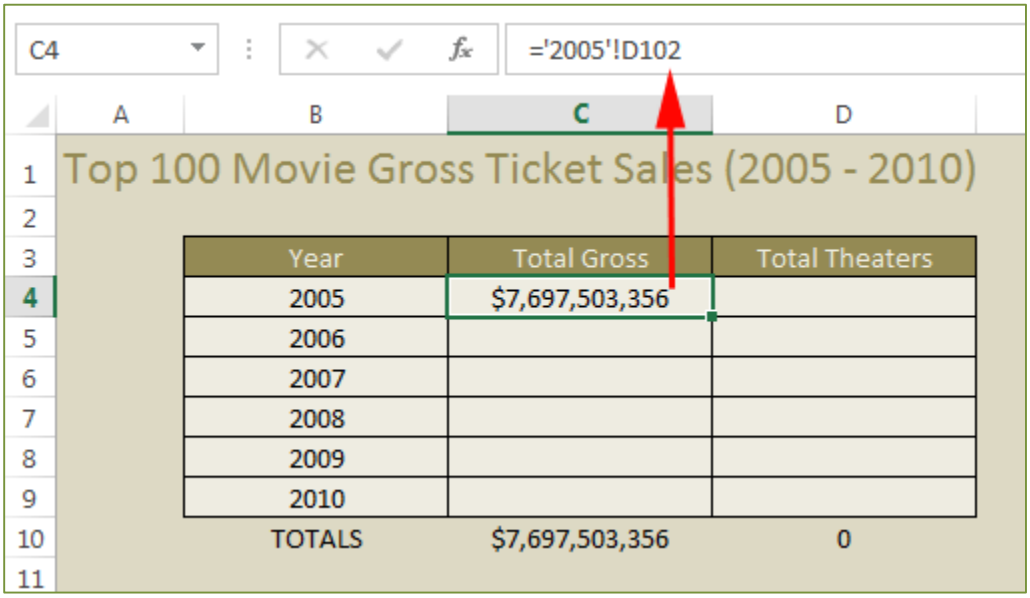
Cell Addresses from Multiple Worksheets

(movie_ranks_summary.xlsx)

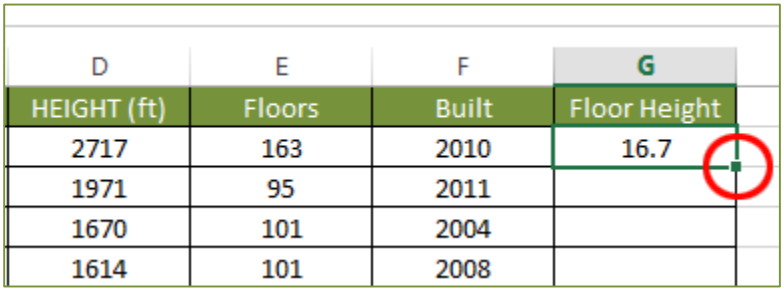
Syntax – 'SHEETNAME'!CELLADDRESS



8. AutoFill, Part II

Using Autofill with Cells That Have Formulas

Calculate the average Floor Height of all the skyscrapers and use the AutoFill handle



In this example I formatted the borders, top row colors, and the decimal places showing in column G

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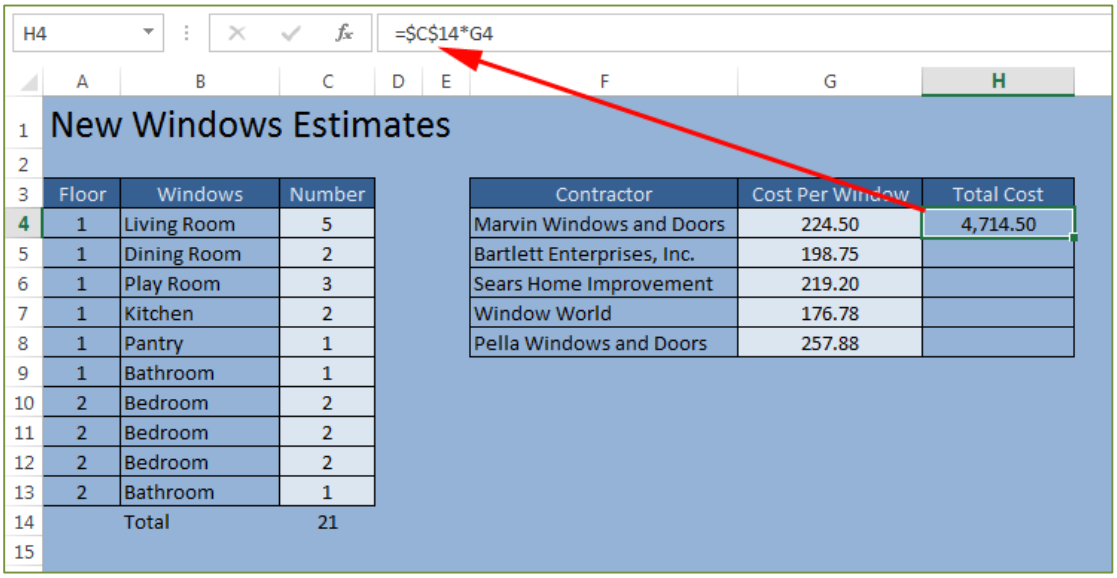
9. Absolute versus Relative References

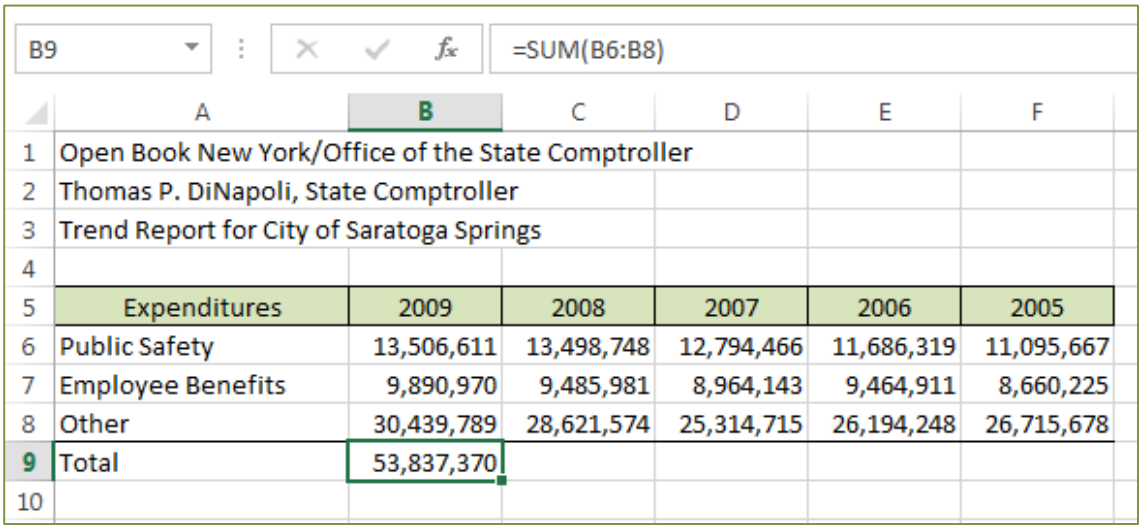
Using the $ character to keep the reference to cell C14 absolute



Copying and Pasting Formulas

Instead of dragging a formula, you can copy and paste it

Complete the row 9 total formulas by copying and pasting



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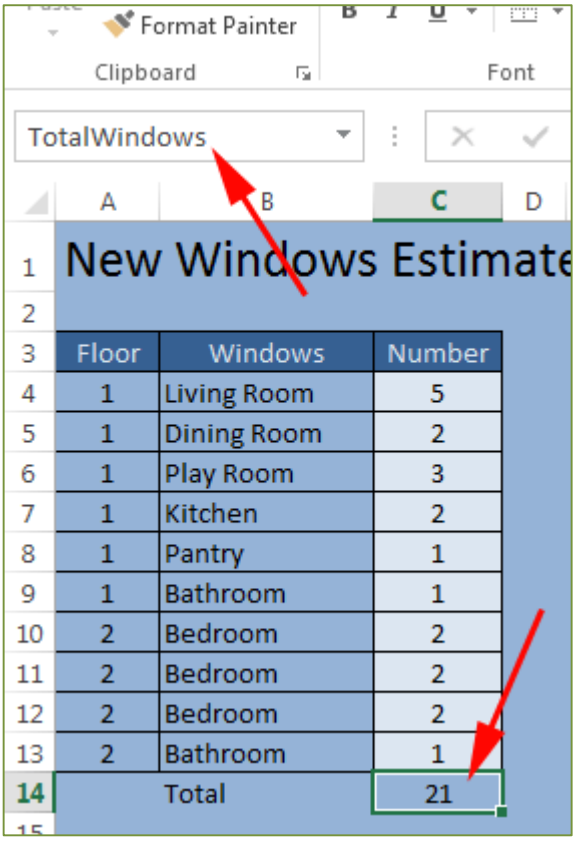
10. Using Names

Creating a Named Range

Using a Named Range in Calculations

Viewing and Editing Named Ranges
- Formulas tab
- Defined Names group
- Name Manager



Advantages of using named ranges
- Makes formulas easier to understand and maintain
- No absolute/relative reference problems
- Names display in formula auto complete dropdown (don't have to type entire name)

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11. Statistical Functions

Statistical Functions – SUM(), AVERAGE(), MEDIAN(), MODE(), MAX(), MIN()

	A	B	C	D	E
1	Grammy Award Ceremony Locations, televised era (1971 - 2014)				
2	Venue	Number			
3	Felt Forum	1		Sum	44
4	Hollywood Palladium	4		Average	5.5
5	Madison Square Garden	2		Median	3
6	Radio City Music Hall	5		Mode	1
7	Shrine Auditorium	16		Max	16
8	Staples Center	14		Min	1
9	Tennessee Theatre	1			
10	Uris Theater	1			
11					

The syntax for all these statistical formulas is the same.

In the example above, the formula for cell E4 could be either of these:

=AVERAGE(B3, B4, B5, B6, B7, B8, B9, B10)

=AVERAGE(B3:B10)

Using Statistical Functions with Named Ranges

Using named ranges can make it easier to work with statistical functions

Apply named ranges to Superbowl data, for example create named ranges and then compute:

Average winning score

Maximum winning margin

Using AVERAGE, Blank Cells versus Zeros

	A	B
1	1	1
2		0
3	2	2
4		0
5	3	3
6	2	1.2
7	Average	

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12. Date Functions

Formatting a Date

How Excel Interprets a Date (number of days from 1/1/1900 – which is day number 1)

Custom Date Formatting Shorthand (Format Cells/Number tab/Custom)

Characters you can use for a custom date format: [space], [comma], /, m, d, y

Example: mmm yy would display the date 3/12/2014 as Mar 14

For m, d, y – can use (for example): m, mm, mmm, mmmm

See date_shorthand.xlsx

Date Math

Add or Subtract Dates (example - project start date and end date)

The NOW() Function

Write a formula to calculate your age, in years

Time Math

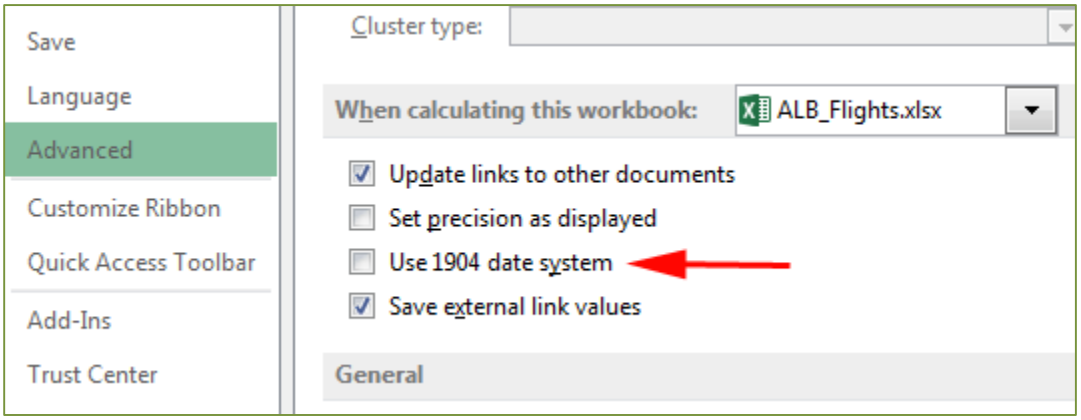
(ALB_Flights.xlsx)

The 1900 Date System cannot handle negative time values.

	A	B	C	D	E	F	G	H
1	Carrier Code	Date	Flight Number	Tail Number	Destination Airport	Scheduled Departure Time	Actual Departure Time	Difference
2	US	1/1/2009	1411	N529AU	CLT	8:30	8:26	0:04
3	US	1/1/2009	1439	N516AU	CLT	14:40	14:46	##########
4	US	1/1/2009	1611	N963UW	CLT	18:55	19:02	##########
5	US	1/1/2009	1853	N962UW	PHL	18:33	18:20	0:13
6	US	1/2/2009	1411	N444US	CLT	8:30	8:30	0:00
7	US	1/2/2009	1439	N533AU	CLT	14:40	15:53	##########

Date Systems (1/1/1900 vs. 1/1/1904)

Options/Advanced/When calculating this workbook:



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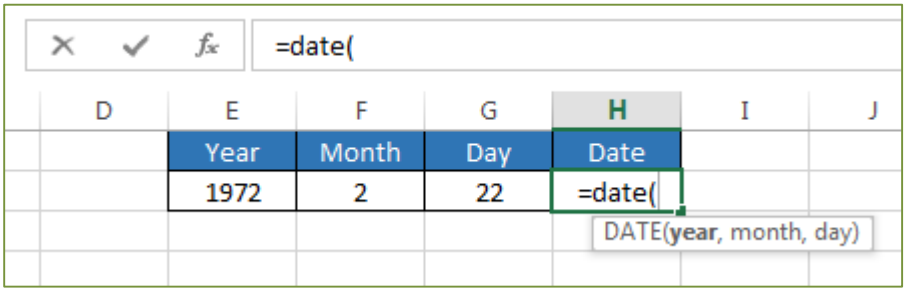
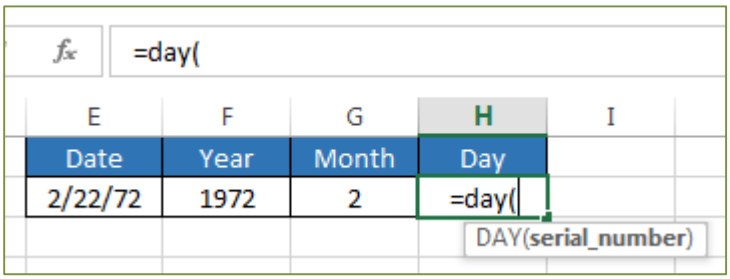
Other Date Functions

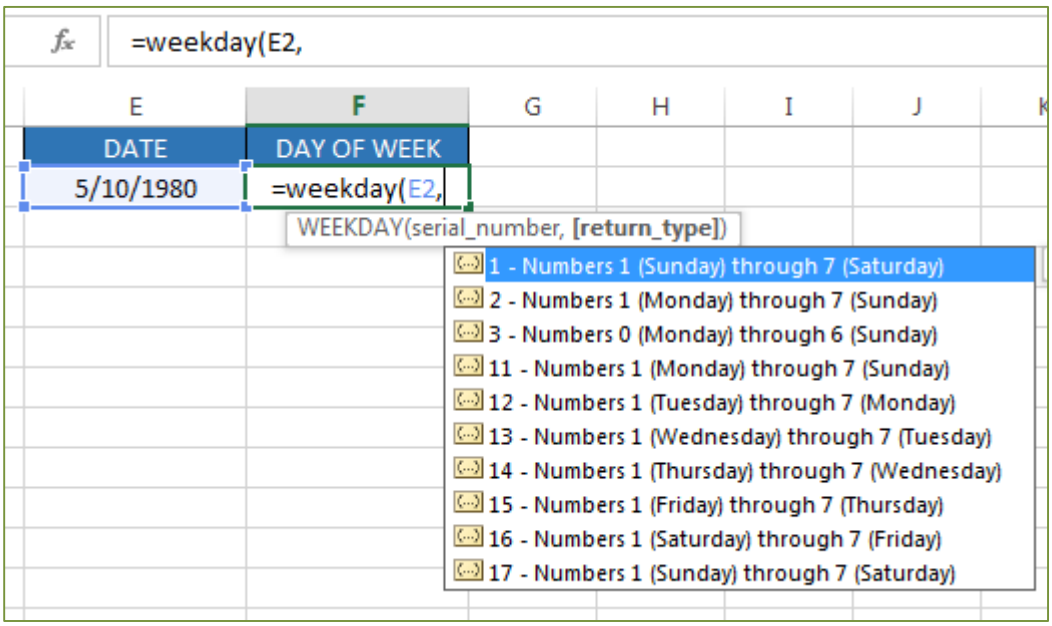
DATE



DAY, MONTH, YEAR



WEEKDAY (note – includes an optional argument)



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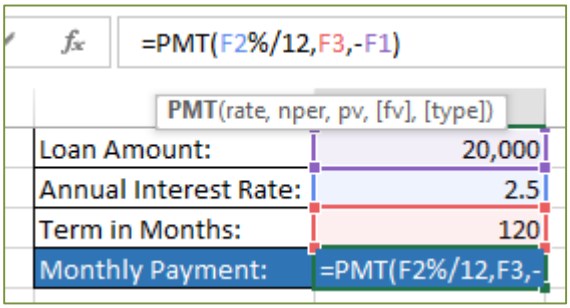
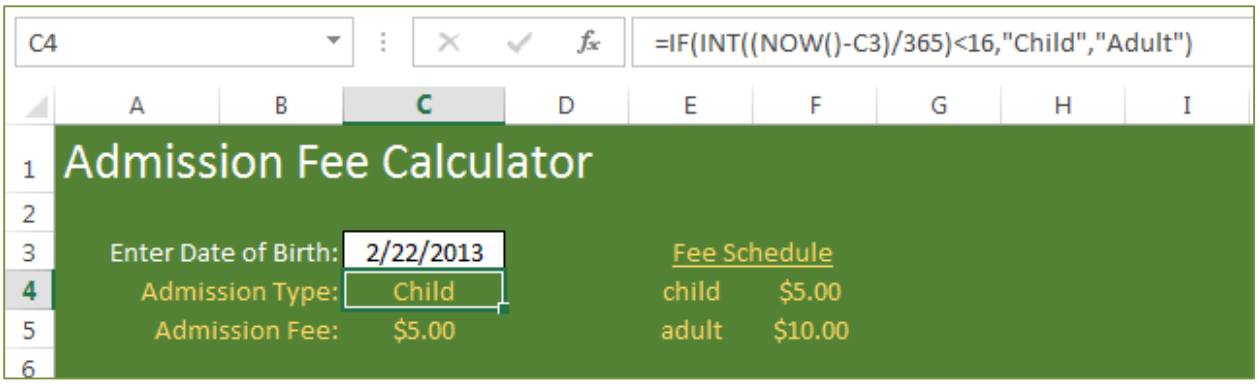
13. PMT – a Financial Function

Using the PMT Function

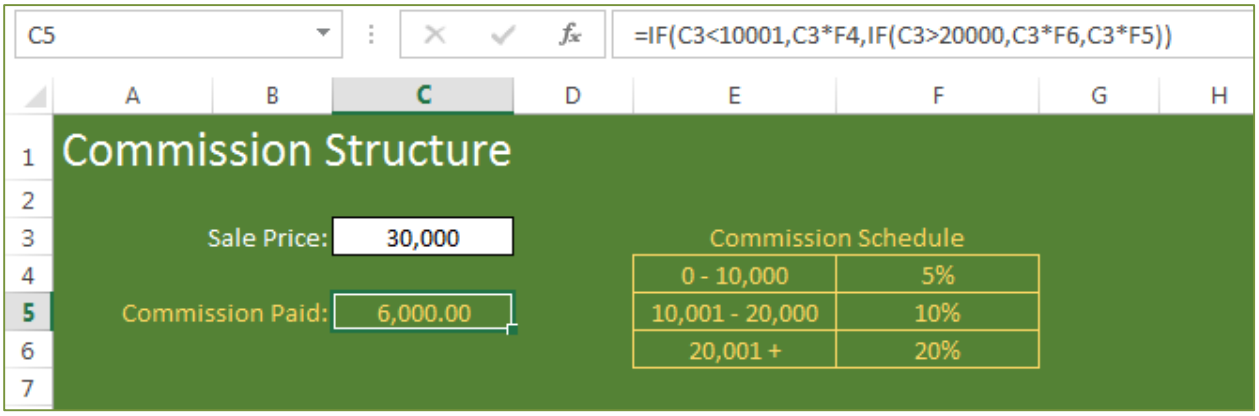


14. IF

Using IF to Evaluate a Condition



Nested IF



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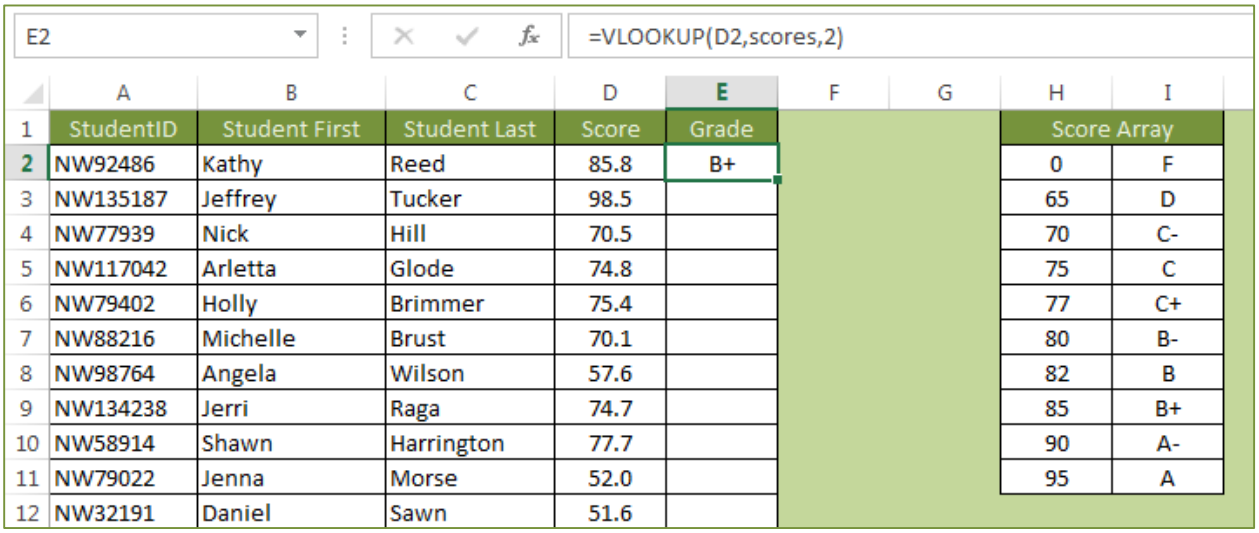
15. VLOOKUP

Using VLOOKUP to Evaluate Many Conditions

(grade_array.xlsx)



E2 | =VLOOKUP(D2,scores,2)

	A	B	C	D	E	F	G	H	I
1	StudentID	Student First	Student Last	Score	Grade			Score Array	
2	NW92486	Kathy	Reed	85.8	B+			0	F
3	NW135187	Jeffrey	Tucker	98.5				65	D
4	NW77939	Nick	Hill	70.5				70	C-
5	NW117042	Arletta	Glode	74.8				75	C
6	NW79402	Holly	Brimmer	75.4				77	C+
7	NW88216	Michelle	Brust	70.1				80	B-
8	NW98764	Angela	Wilson	57.6				82	B
9	NW134238	Jerri	Raga	74.7				85	B+
10	NW58914	Shawn	Harrington	77.7				90	A-
11	NW79022	Jenna	Morse	52.0				95	A
12	NW32191	Daniel	Sawn	51.6					

16. Text Functions

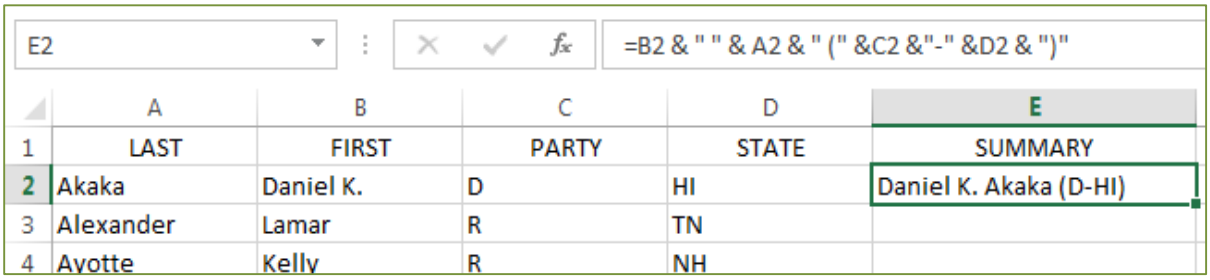
Case

UPPER(), LOWER(), PROPER()

Concatenate

CONCATENATE, &

(senators.xlsx)



E2 | =B2 & " " & A2 & " (" &C2 &"-" &D2 & ")"

	A	B	C	D	E
1	LAST	FIRST	PARTY	STATE	SUMMARY
2	Akaka	Daniel K.	D	HI	Daniel K. Akaka (D-HI)
3	Alexander	Lamar	R	TN	
4	Ayotte	Kelly	R	NH	

Extract

RIGHT(), LEFT()

SEARCH(), LEN()

MID()

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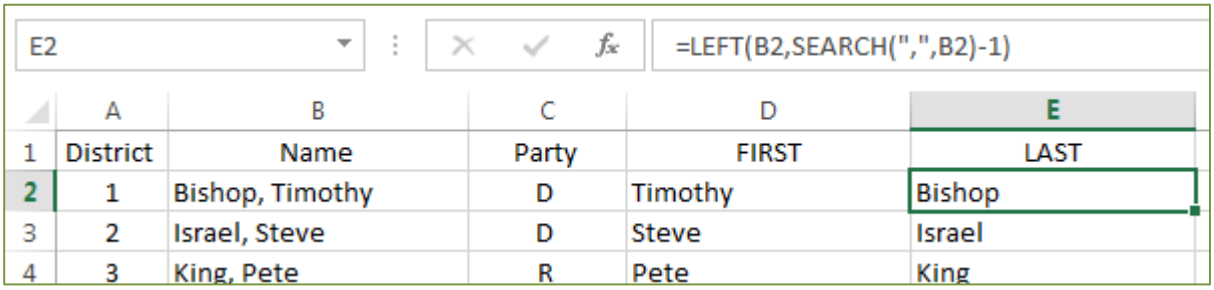
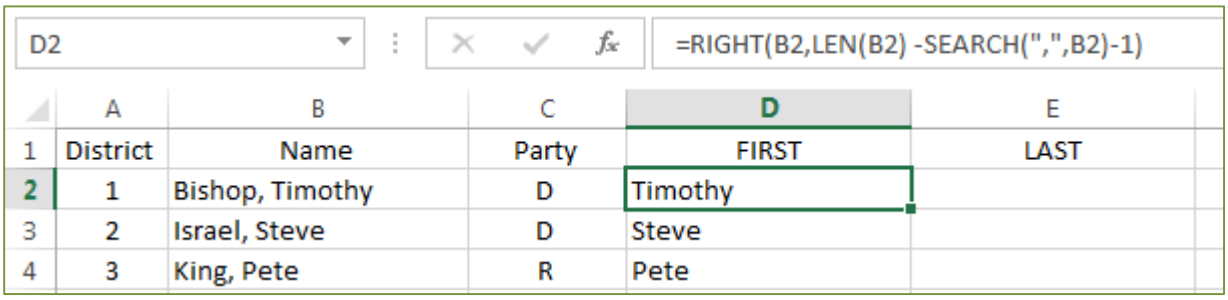
(nys_reps.xlsx)

Sample 1



	A	B	C	D	E
1	District	Name	Party	FIRST	LAST
2	1	Bishop, Timothy	D	Timothy	Bishop
3	2	Israel, Steve	D	Steve	Israel
4	3	King, Pete	R	Pete	King

Sample 2

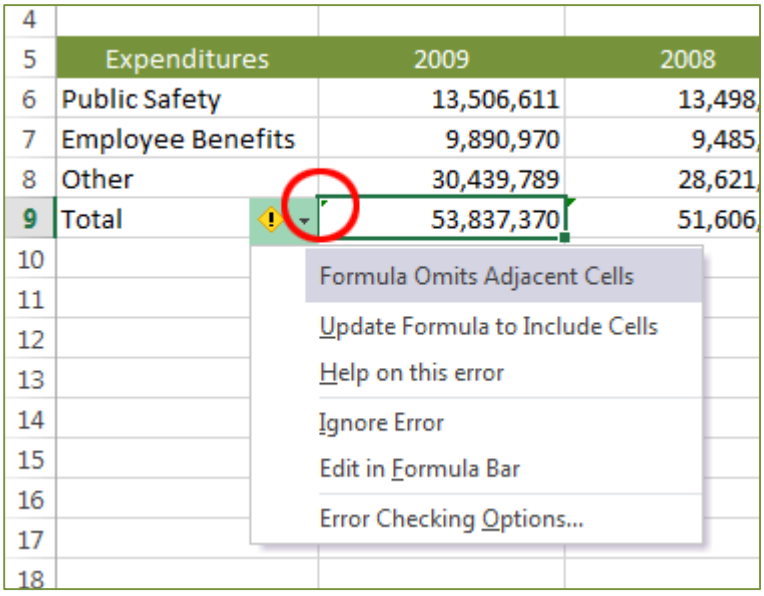


	A	B	C	D	E
1	District	Name	Party	FIRST	LAST
2	1	Bishop, Timothy	D	Timothy	
3	2	Israel, Steve	D	Steve	
4	3	King, Pete	R	Pete	

17. Errors

Warnings - Possible errors (green triangle)

Saratoga expenditures – message about not including all cells with numbers



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Common Error Warnings

Number formatted as text

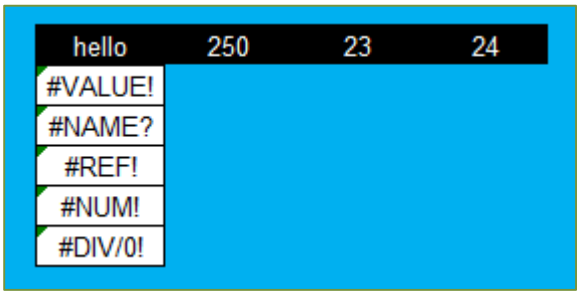
Formula omits adjacent cells

Ignoring warnings

Select, right-click, choose Ignore Error

Error Message - Definite errors –

see errors.xlsx spreadsheet



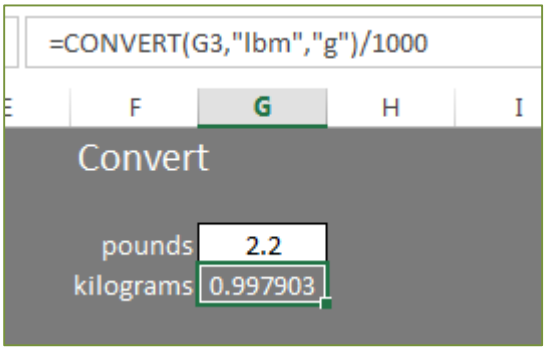
Handling Errors

IFERROR(value, value_if_error)

18. – CONVERT – a Conversion Function

Using Excel's CONVERT Function - CONVERT(number,from_unit,to_unit)

Note – when you type the formula a popup menu will display with unit choices



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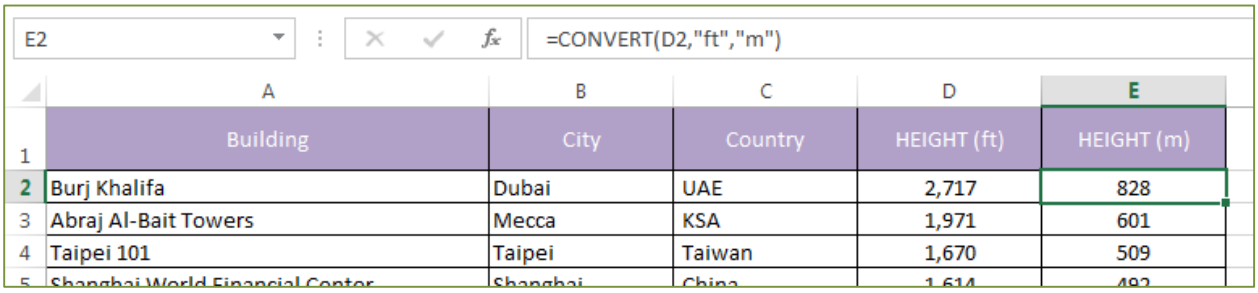
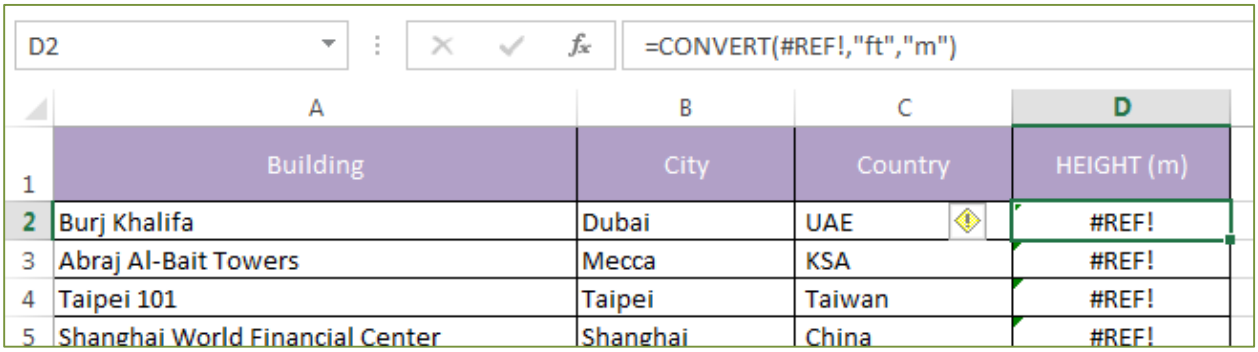
19. Other Formula Topics

Paste Values



E2 =CONVERT(D2,"ft","m")

	A	B	C	D	E
1	Building	City	Country	HEIGHT (ft)	HEIGHT (m)
2	Burj Khalifa	Dubai	UAE	2,717	828
3	Abraj Al-Bait Towers	Mecca	KSA	1,971	601
4	Taipei 101	Taipei	Taiwan	1,670	509
5	Shanghai World Financial Center	Shanghai	China	1,614	492



D2 =CONVERT(#REF!,"ft","m")

	A	B	C	D
1	Building	City	Country	HEIGHT (m)
2	Burj Khalifa	Dubai	UAE	#REF!
3	Abraj Al-Bait Towers	Mecca	KSA	#REF!
4	Taipei 101	Taipei	Taiwan	#REF!
5	Shanghai World Financial Center	Shanghai	China	#REF!

Transposing

	A	B	C
1	Year	Total Gross	Total Theaters
2	2005	7,697,503,356	288,191
3	2006	7,886,480,093	294,117
4	2007	8,509,635,974	285,635
5	2008	8,522,863,503	295,807
6	2009	9,856,086,040	294,998
7	2010	9,292,840,746	311,071

	A	B	C	D	E	F	G
1	Year	2005	2006	2007	2008	2009	2010
2	Total Gross	7,697,503,356	7,886,480,093	8,509,635,974	8,522,863,503	9,856,086,040	9,292,840,746
3	Total Theaters	288,191	294,117	285,635	295,807	294,998	311,071

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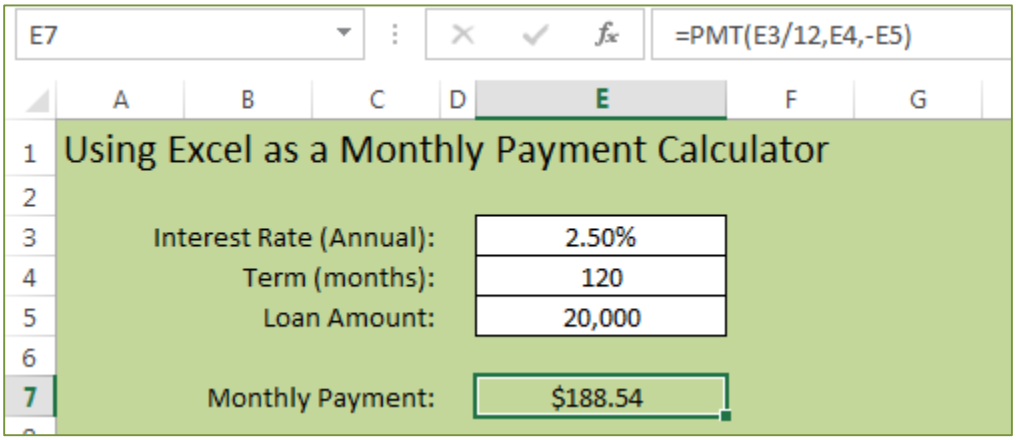
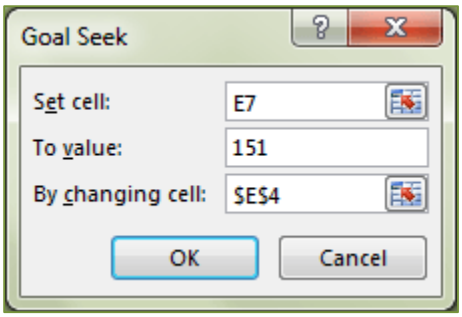
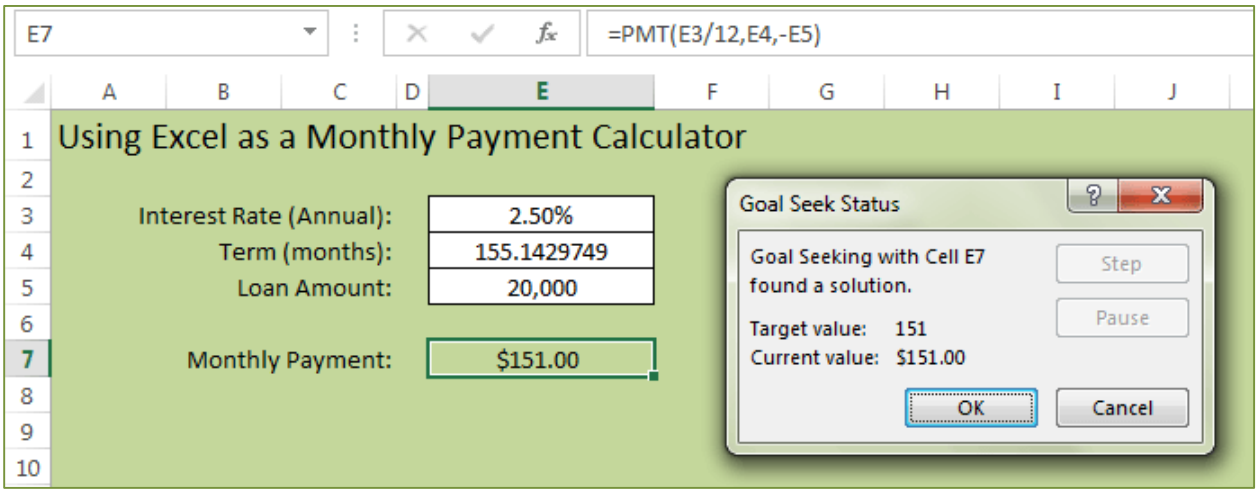
Using Goal Seeker



Data tab/Data Tools group/What-If Analysis drop down/Goal Seek





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Calculate the Entire Time of an Album

E16

	A	B	C	D	E
1	U2, The Joshua Tree				
2					
3		Track_Number	Track_Name	Track_Minutes	Track_Seconds
4		1	Where the Streets Have No Name	5	38
5		2	I Still Haven't Found What I'm Looking For	4	38
6		3	With or Without You	4	56
7		4	Bullet the Blue Sky	4	32
8		5	Running to Stand Still	4	18
9		6	Red Hill Mining Town	4	54
10		7	In God's Country	2	57
11		8	Trip Through Your Wires	3	33
12		9	One Tree Hill	5	23
13		10	Exit	4	13
14		11	Mothers of the Disappeared	5	12
15					
16				Total Time:	

Total Time:	50:14

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