G476/576 Hydrology Lab Exercise
Introduction to Microsoft Excel Spreadsheets and Data Manipulation
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INTRODUCTION

The study of hydrology is based primarily on the observation, analysis, and modelling of water-related processes at or near the Earth's surface. The observation of hydrologic phenomena is accomplished by data collection over varying spatial and temporal scales. Examples of hydrologic data include yearly rainfall magnitudes for the state of Oregon, monthly stream discharge rates for the United States, or reconstruction of global ice budgets for the past 500,000 years. The steps in hydrologic analysis include: (1) conceptual observation, (2) hypothesis building (deriving relationships), (3) time-averaged data collection, (4) data analysis, (5) hypothesis testing and reformulation, (6) continued data collection and analysis, (7) model building and validation, and (8) application of hydrologic models to real-world problems (e.g. water resource planning for a city). Microsoft Excel is a spreadsheet software program that is very useful in basic data manipulation and analysis. The objective of this lab is to introduce students to Excel techniques, that will be later applied to hydrologic problems.

HYDROLOGY CLASS COMPUTER ACCOUNTS

Lab Task 1 - Testing Your Hydrology Student Account

1. Find a network computer station in the lab and log-on at the Windows NT prompt with your username and password.

2. After you log-on to the server, perform the following mouse-click functions on the pull-down menus:

Start-Programs-Windows Explorer or use “My Computer” to check your H:\ folder

3. Check your log-on folders, you should see the following folders available:

- H:username this is your personal folder space for storing files.

4. Using windows explorer or My Computer, create a new folder on your H:\ drive entitled “Hydro”

Other notes / things to think about:

- All computers in the student labs have the local hard drives (e.g. C:\ drive) "locked" so that you cannot save or install software to the computers. You can only save to the network account, to the floppy drive (a:\ drive), a flash memory stick, or to a CD.

- Students are encouraged to work in teams, but remember that each of you will have to turn in your own work for grading. Some of this work will be electronically submitted. If you work in groups or with partners, make sure you know how to do the exercises and save your own data files. You will be tested on your ability to work with the computer as a tool!

SPREADSHEET SOFTWARE

Microsoft Excel (part of MS Office suite of software) is a spreadsheet software package that facilitates data collection, data organization, and data analysis. This software is widely used at Universities, businesses, and government facilities. This is a good tool to know how to use. Excel is widely available on campus. An overview of Excel includes:

- Excel is software that organizes information into a series of rows and columns (e.g. a "table" of data)

    - Information may either be numeric (i.e. numbers) or alphanumeric (words, letters, and numbers combined)

-Excel files are referred to as "Workbook" files, and are given a *.xls extension. Within each workbook, you may have multiple "worksheets" with different types of data.

Examples of a workbook might include river discharge data for the Willamette River (e.g. a file named *WillamQ.xls*). Within the *WillamQ.xls* file, there may be 12 worksheets with average monthly data for each month respectively.

-Excel data is organized in columns and rows ("spreadsheet" or "table" format).

- columns are identified by letter ID: A,B,C....AA, AB, AC...etc.
- rows are identified by number ID: 1, 2, ...80,000

- individual "cells" are identified by a unique column-row identifier: e.g. A1 = first cell, B25, etc.

- The column-row structure of Excel worksheets allows quick and easy analysis of data, mathematical calculations, graphing, etc. Think of Excel worksheets as "calculator" software, but you only have to enter the data once and can perform different types of mathematical and statistical functions. Example data functions include:

adding, subtracting, multiplying, dividing, means, standard deviations, frequency distributions, histogram plots, x-y scatter graphs, graph-line fitting, data sorting, trig calculations (sin, cos, tan, etc.), evaluation of algebraic / trigonometric equations... plus much more... sorting in increasing order, sorting in decreasing order, sorting in increasing alphabetical order... plus other stuff.

-Types of data/information that can be analyzed include:

numbers, angles (degrees, radians), names (e.g. sorting alphabetically)

-Math functions are performed on the "cells", regardless of the specific data that is contained in the cells. "Cell equations" are used to manipulate and analyze the data that are contained in the cells. We will refer to this methodology as "Cell Algebra".

Lab Task 2 - Basic Data Entry, Formatting and Analysis in Excel

1. Log-on to campus computer.

2. Start microsoft Excel software

Start-Programs-Microsoft Excel

3. Once in Excel, note the column-row "cell" structure. Move the mouse around and note the "+" pointer. Move the mouse / pointer, and click on Cell D5. Note that the cell becomes outlined as "active". Type your first name in cell D5. Now click on Cell B 9, type in your last name.

4. Click back on Cell D5 and change the font size to "22" (the font style and size are located on the tool bar to the top of the spread sheet).

Note that your name does not "fit" in cell D5 anymore. Change the width of cell D5 with the follow menu clicks:

Format-Column-Width-20

Now center your name in cell D5 with the following clicks:

Format-Cells-Alignment-Horizontal-Center

Save this file to your H:\Hydro folder, let's call it "temp.xls"

File-Save-H: folder-temp.xls

Check and see what this file will look like if you print it:

File-Print Preview

While in Print Preview, click on "margins", you will now see the page margins as they will be printed, drag the inner top line down to the middle of the page. Drag the left line to a third of the distance across the page. Now hit "print" to send it the page to the printer. "Close" print preview to return to "worksheet" mode.

Double Click on the "sheet 1" tab at the bottom tool bar, rename this worksheet " My Name". Click any where on the worksheet to get out of sheet name edit mode. Save / update the "temp.xls" file.

File-Save

5. Let's try an example data entry and analysis exercise now. Click on the "Sheet 2" tab at the bottom toolbar. You are now on a fresh worksheet, but note that the "my name" sheet is still in the workbook, you're just on a different worksheet now.

NOTE: If at any time you perform a task and find that it is a mistake, just go to the Edit menu at the top tool bar, and click on "undo", this will undo your last action.

Double-click on the "sheet 2" tab, and rename it "Example Data", perform the following tasks.

(A) At cell A1, type in "Table 1. Example data entry and analysis"

(B) Click on cell A1 and the the "Bold" icon on the toolbar (the "B" next to the font size")
Change the font of cell A1 to Times New Roman, 16 point

(C) Enter the following data and information with the cell structure as shown, start with cell A3:

	A	B	C	D
1	Table 1. Example Data Entry and Analysis			
2				
3	Location	Date	Rainfall (in)	Temperature(F)
4	Miami	05/23/90	1.1	72
5	Pittsburgh	06/24/90	0.2	85
6	Portland	12/22/90	2.3	35
7	Miami	06/24/90	1.3	120
8	Pittsburgh	12/22/90	0.8	68
9	Portland	05/23/90	3.8	45
10	Seattle	05/23/90	106.0	63

Note: Cell A1 is being used for the table title, Row 3 is used for column titles, cells A4 to D10 are the actual tabulated data.

(D) Using the mouse/icon, starting at cell A3, click and drag to highlight all of the data you just entered (highlight cells A3 to D10).

(E) Change the font of all data cells to "Arial" "14 pt"

(F) Click and drag to highlight cells A3 to D3 (the column titles).

(G) Once highlighted, change the column widths to 20 character wide Format-Column-Width-20

(H) Highlight all data in cells A3 to D3, center the data in columns:
Format-Cells-Alignment-Horizontal-Center

(I) Save your updated files periodically File-Save

(J) Now let's sort the data by location and date:

-highlight the data cells only (Cells A4 to D10), not the column titles in row 3
- from the top menu bar:

Data-Sort-Sort By-Location-Ascending-Then By-Date-Descending-OK

Your data should now be sorted by location (in increasing alphabetical order), then by dates (in decreasing order of time)

(K) Let's try your hand at some basic data anlaysis with Excel:

-Add the following titles to your table
Cell B12 "Total Sum"
Cell B13 "Average"

- Let's write a basic cell equation in Cell C12 =sum(C4.C10)
- now another cell equation in Cell C13 =average(C4.C10)

what you have done is added the total of all rainfall from Cells C4 to C10, and averaged all of the rainfalls from cell C4.C10

-whoops, you discovered you've made a mistake, the rainfall for Seattle on 05/23/90 is 1.06 inches, NOT 106 inches, click on cell C10 and change the number from 106 to 1.06

Check you what happened to your total sum and average at the bottom, they changed accordingly to reflect your change in data... that is the power of cell equations!!! The cell algebra keeps track of the cells, so if the data changes, the equations also are updated to provide the right answers.

- make sure you save your changes once in a while, otherwise you might lose your work if the power goes out!!!

-For cells C12 and C13, let's assume that we want the numbers in a format with 1 decimal place to the right of the decimal point, try this:
- highlight cells C12 and C13 format-cells-number-number-1 decimal place
-highlight cells C12 and C13 format-cells-alignment-horizontal-center

Next, perform a total sum and average calculation for the temperature column... since we've already written an equation, we can just copy the cell equations to the new column, so we don't have to re-write the equations.

-highlight cells C12 and C13 click on the "copy" (2 pages icon) icon just to the right of the sizzors on the top tool bar, note that the two cells are highlighted with blinking lines

-place the pointer in cell D12 click on the "paste" (clipboard icon) icon just to the

right of the "copy" icon on the top tool bar

Place the pointer in cell D12 and check out what happened: Excel copied the equation from the cell column, but automatically changed it the the "D" cell addresses when the equations were pasted. You have quickly calculated the total sum and average temperature data, without having to re-write the equations.

(L) Adding additional data in rows and columns

New data has just been received from Newport. We need to add this data into the table, and your job is to keep the locations and dates in their proper sort order. Here's how to insert new rows of data

- highlight cells A6 and A7 Insert-Rows

Type in the following Newport Data in the appropriate cells:

Location	Date	Rainfall	Temperature
Newport	05/23/90	2.3	53
Newport	06/24/90	3.3	59

***Note that the Total Sum and Average data calculations in Cells C14 to D15 have been changed automatically to reflect the new rows of data... this is very convenient!! Couldn't keep track of data like this with a calculator!*

- Now, Let's create a new data column. You decide that a good way to analyze rainfall and temperature data is to create a hypothetical quantitative parameter known as the "R/T Ratio", with the following formula:

$$\text{R/T Ratio} = \frac{\text{Rainfall (in)}}{\text{Temperature (F)}} \times 100\% \quad (\text{units} = \%\text{in/F})$$

- click/highlight on cell C3 Insert-Columns (this should insert a new column between the Date and Rainfall columns)

Note: the rainfall and temperature dated have been shifted over one column each, to columns D and E, respectively. Check out your "Total Sum" and "Average" cell equations, they have also been changed automatically.

- Label the inserted cell C3 as"R/T Ratio (%in/F)"

-highlight cells C4 to C12 Format-Cells-Number-Number-Decimal Places-3

this will set the R/T calculations to a numeric format of 3 decimal places to the right of the decimal point

- now let's calculate the R/T ratio by using some cell equations:

- in cell C4 write the following equation =(D4/E4)*100

The answer should be "1.083" which is the rainfall divided by the temperature times 100% for the Miami station on 06/24/90.

-highlight cell C4 (with the equation) hit the "copy" icon

-now, click and highlight cells C5 to C12 hit the "paste" icon

Highlight and double check the contents of each cell to make sure the the R/T ratio was properly calculated, note that copying and pasting equations results in automatic change of the cell addresses! Wow, that makes it easy.
WARNING / NOTE: If you ever find yourself writing the same cell equations over and over manually, you are doing something wrong. All you need to do is write the cell equation once, and then copy-paste to the appropriate cell destination!!!!

- Use the cell equation copy/paste method to now calculate the "Total Sum" and Average for the "R/T Ratio" column.

- Save / update your file (-file-save-temp.xls)

(M) Graphing Data

Excel also creates graphs so that you can visualize data relationships. Data graphing is a very effective tool for indentifying relationships between data. In this last part of the introductory exercise, we will create a graph of our rainfall-temperature data. Let's create a simple X-Y graph of the data, a "scatter plot".

- click/highlight on cell A20, so that the graph will be placed below the data table

- click on the "chart wizard" icon (the one that looks like a graph) on the top tool bar

- select the "X-Y Scatter" Chart Type

-Systematically highlight each X-Y chart sub-type and read the description of what each one does, then select the "Scatter, with no lines" option (double-click it).

-Data Range = D4:E12 this will graph the rainfall and temp. data

- select the "Series in Columns" radio button

-click on the "Series" folder tab to view your graph (the rainfall data is on the x-axis, and the temp data is on the y-axis).

-click on the "Next" button

-At the "Titles" tab, enter the following

Chart Title	Graph of Rainfall vs. Temperature
Value (X) Axis	Rainfall (inches)
Value (Y) Axis	Temperature (F)

- At the "Axes" tab, make sure the X and Y Axes are checked

-At the "Grid Lines" tab, Check all of the grid lines for X and Y (major and minor)

-At the "Legend" tab, click on various boxes to see where the legend will be placed on the graph. When finished exploring, place the legend on the right of the graph.

-At the "Data Labels" tab, click the various options to see what happens, but leave the final setting to "None"

-click the "Next" button, click on the "As Object In" radio button, this will place the chart on your active worksheet (Example Data)... the other option will place the graph on a new, separate worksheet by itself.

- Click "Finish", the graph should now appear on your worksheet.

- Click and drag the chart to place it below the data... we don't want the chart on top of the data... that's messy!

-Click on the chart and highlight it, right click the mouse, click on chart options... use this technique if you want to change any of the chart formatting.

-click and drag the chart, place the upper left hand corner in Cell A20

-grab the lower right corner of the chart, and stretch the size so that the corner is somewhere on Cell D40 (this is how to resize the chart for better visual effects).

- Now you can play with the chart to get it in better shape... experiment with the following:

-Place the pointer over the X-axis and double click

-at the "scale" tab, set the axis minimum = 0, maximum = 10, major tick unit = 1, minor tick unit = 0.2, value of y-axis crosses at 0

-Place the pointer over the Y-axis and double click

-at the "scale" tab, set the axis minimum = 0, maximum = 200, major tick unit = 50, minor tick unit = 10, value of x-axis crosses at 0

- Experiment by editing any part of the graph, all you have to do to edit any part of the graph (titles, grid lines, etc.), just point and double-click! You will then be able to change the formatting, font style, etc.

(N) Formatting Excel Work for Printing

-Place boxes and lines around the data table to better organize it.

highlight all data table cells	A3:E15	format-cell-border-outline
highlight the title row 3	A3:E3	format-cell-border-bottom line
highlight row 12	A12:E12	format-cell-border-bottom line
highlight cells A3:D12		format-cell-border- center /right lines
highlight cells B13:D15		format-cell-border-center/right lines

Prepare your page for printing.

-highlight all cells in the table from A1:E42 (this includes the chart area)
-click on... -File-Print Area-Set Print Area (this sets the print space)
-click on any single cell to undo the highlight, or hit the "Esc" key
-click on... -File-Page Setup-Page-Portrait
-File-Page Setup-Margins-Top = 1inch, Left / Right = 0.5 inch
-File-Print Preview

**Note: that the last column of the chart is off the page. The Columns are too wide to print, let's re-set the columns so that the table fits on the paper, close the print preview function

- Click on the date column (click on cell B3) Format-Column Width-15
-Click on the rainfall column (click on cell D3) Format-Column Width-15

**Now the table should fit on the page with 0.5 inch Left/Right Margins

- File-Print Preview check to see if everthing fits on 1 page, incl. the chart!

-hit "Print" and send to the printer

- Save and update your work

Lab Task 3 - Practice Writing and Evaluating Cell Equations in Microsoft Excel

-Use Netscape or Internet Explorer to visit the class web site (www.wou.edu/taylor follow links to G476/576 Hydrology).

- Go down the web page to the "Lab Data" section, click on the "Intro to Excel Data Set"

-When you click on the link, MS Excel should automatically start and open the file. If not, the web browser will ask you to save the file. In either case, save the file to your H\hydro folder on the campus network (the file name is "introexcel.xls").

-Click on the "Cell Equation Practice" worksheet. The other worksheets are examples of the results from completing Lab Tasks 1 and 2. You will be using the "Cell Equation Practice" worksheet for Lab Task 3 (this last task...).

-The worksheet contains two columns of generic data, we will call "Data1" and "Data2". Your job is to use cell algebra to calculate equations, as listed on the spreadsheet. The following is a summary of the table columns that you are to evaluate and complete - remember to use your cell algebra, and cut-and-paste techniques. You should not have to write an equation more than once (just copy it from cell to cell).

Refer to Appendix 1 for a summary of information on cell algebra. Also refer to the "Help" facility of Excel if you need more information. Spot check your cell equations with a calculator to make sure you have the hang of it.

Step 1 - Cell Algebra Tasks to Complete

Column D - For each row, add data1 and data2 together.	=*cell address1 + cell address 2*
Column E - For each row, subtract Data 2 from Data 1.	=*cell address1 - cell address 2*
Column F- For each row, multiple Data1 times Data 2.	=*cell1*cell2*
Column G - For each row, Divide Data1 by Data 2.	=*cell1*/*cell2*
Column H- For each row, cube Data 2	=*cell*^3
Column I- For each row, determine the Log to the base 10 for Data1	=LOG10(*cell address*)
Column J- For each row, calculate the Cosine for Data 2	=COS(*cell address*)
Column K- For each row, divide Data1 by Data2, and multiply the result by 230	=(*cell1 / cell 2*)*230
Column L-For each row, tak the square root of Data1	=SQRT(*cell address*)

Step 2 - Calculate summary statistics for all data

In the appropriate cells below the data set you've just created, use the statistical functions of excel to calculate the following numbers:

FOR EACH DATA COLUMN (columns B through L), calculate the following

The minimum value in the data set	=MIN(*cell range*)
The maximmum value in the data set	=MAX(*cell range*)
The sum of all data in the set	=SUM(*cell range*)
The average of all data in the set	=AVERAGE(*cell range*)
The median of all data in the set	=MEDIAN(*cell range*)
The Standard Deviation of all data in the set	=STDEV(*cell range*)
The number of obsevations in the data set	=COUNT(*cell range)*

When you have completed the data table, save your work, print, and include your print out as part of you lab exercise.

There you have it, a crash course in the use of Excel to analyze data!!!

If you feel confused at this point, go back to the beginning of the lab and work through it again... practice makes perfect.

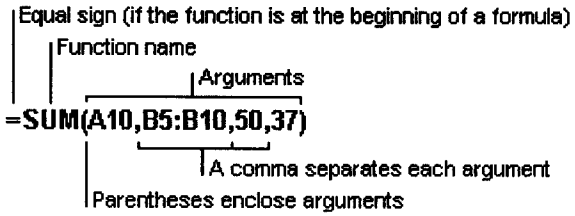
Appendix 1 - Overview of Excel Worksheet Functions

About using functions to calculate values

Functions are predefined formulas that perform calculations by using specific values, called arguments, in a particular order, called the syntax. For example, the SUM function adds values or ranges of cells, and the PMT function calculates the loan payments based on an interest rate, the length of the loan, and the principal amount of the loan.

Arguments can be numbers, text, logical values such as TRUE or FALSE, arrays, error values such as #N/A, or cell references. The argument you designate must produce a valid value for that argument. Arguments can also be constants, formulas, or other functions. For more information about using a function as an argument for another function, also known as nesting functions, click »|.

The syntax of a function begins with the function name, followed by an opening parenthesis, the arguments for the function separated by commas, and a closing parenthesis. If the function starts a formula, type an equal sign (=) before the function name. As you create a formula that contains a function, the Formula Palette will assist you .For more information about using the Formula Palette, click »|. For more information about how to enter a formula that contains a function, click »|.



About formula syntax

Formula syntax is the structure or order of the elements in a formula. Formulas in Microsoft Excel follow a specific syntax that includes an equal sign (=) followed by the elements to be calculated (the operands) and the calculation operators. Each operand can be a value that does not change (a constant value), a cell or range reference, a label, a name, or a worksheet function.

By default, Microsoft Excel calculates a formula from left to right, starting with the equal sign (=). You can control how calculation is performed by changing the syntax of the formula. For example, the following formula gives a result of 11 because Microsoft Excel calculates multiplication before addition: The formula multiplies 2 by 3 (resulting in 6) and then adds 5.

=5+2*3

In contrast, if you use parentheses to change the syntax, you can first add 5 and 2 together and then multiply that result by 3 for a result of 21.

=(5+2)*3

For more information about the order in which Microsoft Excel uses operators in formulas, click »|. For information about operators, click »|.

About cell and range references

A reference identifies a cell or a range of cells on a worksheet and tells Microsoft Excel where to look for the values or data you want to use in a formula. With references, you can use data contained in different parts of a worksheet in one formula or use the value from one cell in several formulas. You can also refer to cells on other sheets in the same workbook, to other workbooks, and to data in other programs. References to cells in other workbooks are called external references. References to data in other programs are called remote references.

By default, Microsoft Excel uses the A1 reference style, which labels columns with letters (A through IV, for a total of 256 columns) and labels rows with numbers (1 through 65536). To refer to a cell, enter the column letter followed by the row number. For example, D50 refers to the cell at the intersection of column D and row 50. To refer to a range of cells, enter the reference for the cell in the upper-left corner of the range, a colon (:), and then the reference to the cell in the lower-right corner of the range. The following are examples of references.

To refer to	Use
The cell in column A and row 10	A10
The range of cells in column A and rows 10 through 20	A10:A20
The range of cells in row 15 and columns B through E	B15:E15
All cells in row 5	5:5
All cells in rows 5 through 10	5:10
All cells in column H	H:H
All cells in columns H through J	H:J

You can also use a reference style where both the rows and the columns on the worksheet are numbered. R1C1 style is useful for computing row and column positions in macros and can be useful for showing relative cell references. In R1C1 style, Microsoft Excel indicates the location of a cell with an "R" followed by a row number and a "C" followed by a column number. For more information about R1C1 references, click »|.

Notes

- Depending on the task you want to perform in Microsoft Excel, you can use either relative cell references, which are references to cells relative to the position of the formula, or absolute references, which are cell references that always refer to cells in a specific location. For more information about relative and absolute references, click »|.
- You can use the labels of columns and rows on a worksheet to refer to the cells within those columns and rows, or you can create descriptive names to represent cells, ranges of cells, formulas, or constant values. For more information about using labels or names in formulas, click »|.
- If you want to analyze data in the same cell or range of cells on multiple worksheets within the workbook, use a 3-D reference. A 3-D reference includes the cell or range reference, preceded by a range of worksheet names. Microsoft Excel uses any worksheets stored between the starting and ending names of the reference. For more information about creating a 3-D reference, click »|.

Calculation operators in formulas

Operators specify the type of calculation that you want to perform on the elements of a formula. Microsoft Excel includes four different types of calculation operators: arithmetic, comparison, text, and reference.

- Arithmetic operators perform basic mathematical operations such as addition, subtraction, or multiplication; combine numbers; and produce numeric results.

Arithmetic operator	Meaning	Example
+ (plus sign)	Addition	3+3
– (minus sign)	Subtraction Negation	3–1 –1
* (asterisk)	Multiplication	3*3
/ (forward slash)	Division	3/3
% (percent sign)	Percent	20%
^ (caret)	Exponentiation	3^2 (the same as 3*3)

- Comparison operators compare two values and then produce the logical value TRUE or FALSE.

Comparison operator	Meaning	Example
= (equal sign)	Equal to	A1=B1
> (greater than sign)	Greater than	A1>B1
< (less than sign)	Less than	A1<B1
>= (greater than or equal to sign)	Greater than or equal to	A1>=B1
<= (less than or equal to sign)	Less than or equal to	A1<=B1
<> (not equal to sign)	Not equal to	A1<>B1

- The text operator "&" combines one or more text values to produce a single piece of text.

Text operator	Meaning	Example
& (ampersand)	Connects, or concatenates, two values to produce one continuous text value	"North" & "wind" produce "Northwind"

- Reference operators combine ranges of cells for calculations.

Reference operator	Meaning	Example
: (colon)	Range operator, which produces one reference to all the cells between two references, including the two references	B5:B15
, (comma)	Union operator, which combines	SUM(B5:B15,D5:D15)

	multiple references into one reference	
(single space)	Intersection operator, which produces one reference to cells common to two references	SUM(B5:B15 A7:D7) In this example, cell B7 is common to both ranges.

Summary functions for data analysis

Function	Summarizes
Sum	The sum of the values. This is the default function for numeric source data.
Count	The number of items. The Count summary function works the same as the COUNTA worksheet function. Count is the default function for source data other than numbers.
Average	The average of the values.
Max	The largest value.
Min	The smallest value.
Product	The product of the values.
Count Nums	The number of rows that contain numeric data. The Count Nums summary function works the same as the COUNT worksheet function.
StdDev	An estimate of the standard deviation of a population, where the sample is all of the data to be summarized.
StdDevp	The standard deviation of a population, where the population is all of the data to be summarized.
Var	An estimate of the variance of a population, where the sample is all of the data to be summarized.
Varp	The variance of a population, where the population is all of the data to be summarized.

Tips on entering dates and times

- Microsoft Excel treats dates and times as numbers. The way that a time or date is displayed on a worksheet depends on the number format applied to the cell. When you type a date or time that Microsoft Excel recognizes, the cell's format changes from the General number format to a built-in date or time format. By default, dates and times are right-aligned in a cell. If Microsoft Excel cannot recognize the date or time format, the date or time is entered as text, which is left-aligned in the cell.
- Options you select in the Regional Settings of Control Panel determine the default format for the current date and time and the characters recognized as date and time separators — for example, the colon (:) and slash (/) on United States-based systems.
- To type a date and time in the same cell, separate the date and time with a space.
- To type a time based on the 12-hour clock, type a space followed by **AM** or **PM** (or **A** or **P**) after the time. Otherwise, Microsoft Excel bases the time on the 24-hour clock. For example, if you type **3:00** instead of **3:00 PM,** the time is stored as **3:00 AM.**
- Regardless of the format used to display a date or time, Microsoft Excel stores all dates as serial numbers and stores all times as decimal fractions. To display a date as a serial number or display a time as a fraction, select the cells that contain the date or time. On the **Format** menu, click **Cells,** click the **Number** tab, and then click **General** in the **Category** box.
- Times and dates can be added, subtracted, and included in other calculations. To use a date or time in a formula, enter the date or time as text enclosed in quotation marks. For example, the following formula would display a difference of 68:

  ="5/12/94"-"3/5/94"
- In Microsoft Excel for Windows (and Lotus 1-2-3), days are numbered from the beginning of the century; the date serial number 1 corresponds to the date January 1, 1900. Microsoft Excel for the Macintosh uses the 1904 date system; the date serial number 1 corresponds to January 2, 1904. To change the date system for use in calculations, click **Options** on the **Tools** menu, and then click the **Calculation** tab. Under **Workbook options,** select the **1904 date system** check box. Use the 1904 date system for a workbook if you use that workbook with other workbooks that use the 1904 date system.

  If you open in Microsoft Excel for Windows a file created in Microsoft Excel version 2.0 or later for the Macintosh, Microsoft Excel recognizes the file format and automatically changes dates to the 1900 date system. Similarly, if you open a Microsoft Excel for Windows file on a Macintosh, Microsoft Excel changes dates to the 1904 date system.

LN

See Also

Returns the natural logarithm of a number. Natural logarithms are based on the constant e (2.71828182845904).

Syntax

LN(number)

Number is the positive real number for which you want the natural logarithm.

Remarks

LN is the inverse of the EXP function.

Examples

`LN(86)` equals 4.454347

`LN(2.7182818)` equals 1

`LN(EXP(3))` equals 3

`EXP(LN(4))` equals 4

LOG

See Also

Returns the logarithm of a number to the base you specify.

Syntax

LOG(number,base)

Number is the positive real number for which you want the logarithm.
Base is the base of the logarithm. If base is omitted, it is assumed to be 10.

Examples

`LOG(10)` equals 1

`LOG(8, 2)` equals 3

`LOG(86, 2.7182818)` equals 4.454347

LOG10

See Also

Returns the base-10 logarithm of a number.

Syntax

LOG10(number)

Number is the positive real number for which you want the base-10 logarithm.

Examples

`LOG10(86)` equals 1.934498451

`LOG10(10)` equals 1

`LOG10(1E5)` equals 5

`LOG10(10^5)` equals 5

PI

See Also

Returns the number 3.14159265358979, the mathematical constant π, accurate to 15 digits.

Syntax

PI( )

Examples

`PI()/2` equals 1.57079...

`SIN(PI()/2)` equals 1

If the radius of a circle is stored in a cell named Radius, the following formula calculates the area of the circle:

```
PI()*(Radius^2)
```

RADIANS

See Also

Converts degrees to radians.

Syntax

RADIANS(angle)

Angle is an angle in degrees that you want to convert.

Example

`RADIANS(270)` equals 4.712389 ($3\pi/2$ radians)

SIN

See Also

Returns the sine of the given angle.

Syntax

SIN(number)

Number is the angle in radians for which you want the sine. If your argument is in degrees, multiply it by PI()/180 to convert it to radians.

Examples

`SIN(PI())` equals 1.22E-16, which is approximately 0 (zero). The sine of π is zero.

`SIN(PI()/2)` equals 1

`SIN(30*PI()/180)` equals 0.5, the sine of 30 degrees

COS

See Also

Returns the cosine of the given angle.

Syntax

COS(number)

Number is the angle in radians for which you want the cosine. If the angle is in degrees, multiply it by PI()/180 to convert it to radians.

Examples

`COS(1.047)` equals 0.500171

`COS(60*PI()/180)` equals 0.5, the cosine of 60 degrees

TAN

See Also

Returns the tangent of the given angle.

Syntax

TAN(number)

Number is the angle in radians for which you want the tangent. If your argument is in degrees, multiply it by PI()/180 to convert it to radians.

Examples

`TAN(0.785)` equals 0.99920

`TAN(45*PI()/180)` equals 1

POWER

See Also

Returns the result of a number raised to a power.

Syntax

POWER(number,power)

Number is the base number. It can be any real number.
Power is the exponent to which the base number is raised.

Remark

The "^" operator can be used instead of POWER to indicate to what power the base number is to be raised, such as in 5^2.

Examples

`POWER(5,2)` equals 25

`POWER(98.6,3.2)` equals 2401077

`POWER(4,5/4)` equals 5.656854

SQRT

See Also

Returns a positive square root.

Syntax

SQRT(number)

Number is the number for which you want the square root. If number is negative, SQRT returns the #NUM! error value.

Examples

`SQRT(16)` equals 4

`SQRT(-16)` equals #NUM!

`SQRT(ABS(-16))` equals 4