

# Formulas and Functions

## Excel's Golden Rule (Dan Bricklin and Bob Frankston)

Excel's Golden Rule: If formula input data can change, put it in cell and refer to it with cell references. If data will not change, you can hard code it into formula. Always label the formula elements and the cells with the calculations.

## Formulas

All formulas must start with an = sign.

## Math Operators

- + Adding.
- Subtracting or Negation.
- \* Multiplying.
- / Dividing.
- ^ Raising to an exponent.
- ( ) Parentheses.

## Comparative Operators

- = Equal: are two things equal?
- <> Not: are two things not equal? (Type less than symbol, then greater than symbol)
- > Greater than: is the number on the left greater than the number on the right?
- >= Greater than or equal to: is the number on the left greater than or equal to the number on the right?
- < Less than: is the number on the left less than the number on the right?
- <= Less than or equal to: is the number on the left less than or equal to the number on the right?

## Number Formatting is a Façade

What you see on the face of the spreadsheet can be different from the underlying number in the cell.

There can be a disconnect between what you see in a cell with your eyes and what is actually stored in the cell as content. Calculations are made upon the underlying number, not the Number Format that you see on the face of the spreadsheet.

Example: You can use the Decrease Decimal button to show fewer decimals, but that does not remove the decimals for calculating purposes.

Example: Dates such as 12/1/2012 are serial numbers. Formulas calculate upon the underlying serial number 41,244, not the date 12/1/2012.

## Cell Addresses

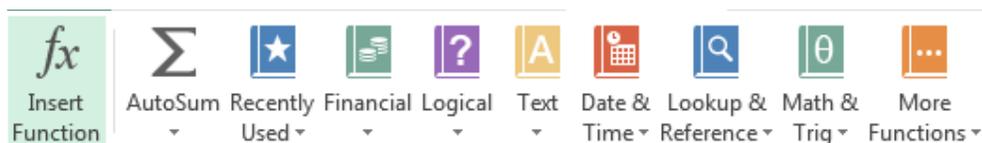
Cell addresses, when used in formulas which are to be copied or cut to a new location, are by default adjusted to reflect their new position i.e. if the original formula added the two cells just above, the formula in its new location will add the two cells just above. The formula =A1+A2 in cell A3 when copied to cell D4 becomes =D2+D3 - both the column letter and row number change. This is called **relative** addressing. Certain situations require that a copied/cut cell address be fixed and not adjusted to reflect its new position. This is called **absolute** addressing and is indicated by using \$ signs as part of a cell address e.g. \$A\$1 - The cell address will remain the same, independent of new location. In other copy/cut operations, the row may be locked or the column may be locked but not both. This is called **mixed** addressing. \$A1 - Only the row number will change; A\$1 - Only the column letter will change. The F4 function key can be used to cycle through the possible absolute addressing options.

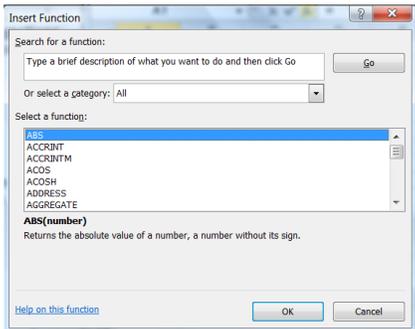
## MultiWorksheet/MultiWorkbook Operations

Any operation that can be done on a single worksheet, can be done over multiple worksheets and/or workbooks. The key is the form of the referenced cell. A cell's address changes from A1 to refer to a cell on the same worksheet, to "**sheetname!A1**" when referring to a cell on a worksheet in the same workbook e.g. **Corp\_1!A1** where "Corp\_1" is the sheet name, to "**[filename]sheetname!A1**" when referring to a cell on a worksheet in a different workbook (if the workbook is open) e.g. **[Corp\_3]sheetname!A1** where "Corp\_3" is the name of an open workbook and "Sheet1" is the name of a sheet in that workbook, to **pathname\[filename]sheetname!A1** when referring to a cell on a worksheet in a different workbook (if the workbook is closed). These cell references are best made by clicking on the desired cell rather than by typing the address.

## Functions

Functions are built-in tools Excel provides for doing many things. All functions have a name followed by a pair of parentheses. The parentheses may or may not contain arguments. Functions are found on the Formulas ribbon. Clicking the "Insert Function" icon on the "Formulas" tab, produces the Insert Function dialog box.

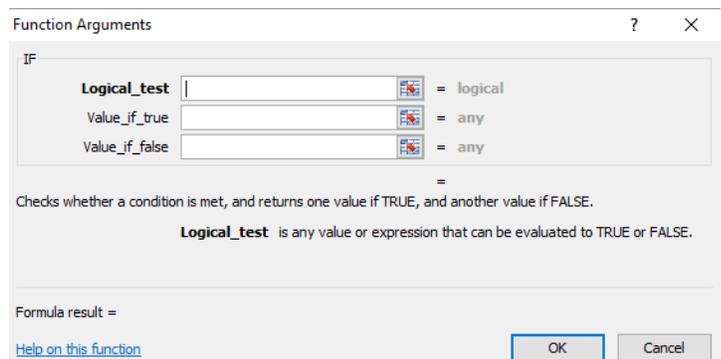




The box has three sections: 1) “Search for a function”: Example - Enter “Car payment”, click Go, possible functions are displayed in the “Select a Function” box; 2) “Select a category”: Use the drop down arrow to show the categories, select a category, possible functions are displayed in the “Select a Function” box; 3) “Select a Function”. Based on choices in the previous sections, a list of functions is displayed. Clicking on a function in the list will display a brief description of what the function does and information on its usage. Clicking OK after a function is selected will open the “Function Arguments” dialog box. The “Functional Arguments” dialog box for the IF function is shown. Help is available for the chosen function by clicking “Help on this function”.

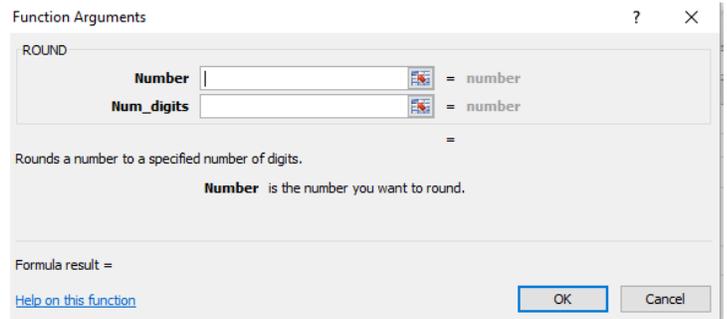
## Logical Function

The IF function is used to test values using the comparative operators and returning a result based on the outcome of the test. The IF function takes 3 arguments, a logical test i.e.  $A3 > A1$ , what to do if the test is passed, and what to do if the test fails. The arguments may be entered into the “Function Arguments” dialog box or the function may be typed directly into a cell.



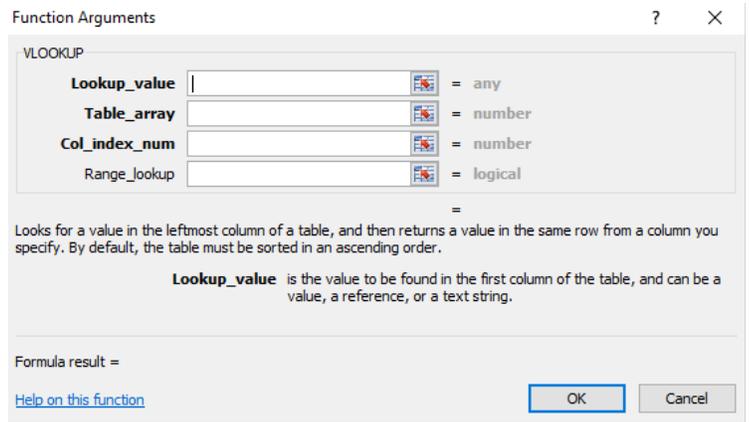
## Math and Trig Function

The ROUND function is used to set to 0 unwanted digits of a value. The ROUND function takes two arguments, the number, or the cell address of a number, to be rounded, and the number of decimal places to be shown. For currency calculations Num\_digits is 2. To round to a whole number, Num\_digits is 0. Positive Num\_digits are to the right of the decimal point, negative Num\_digits are to the left of the decimal point.



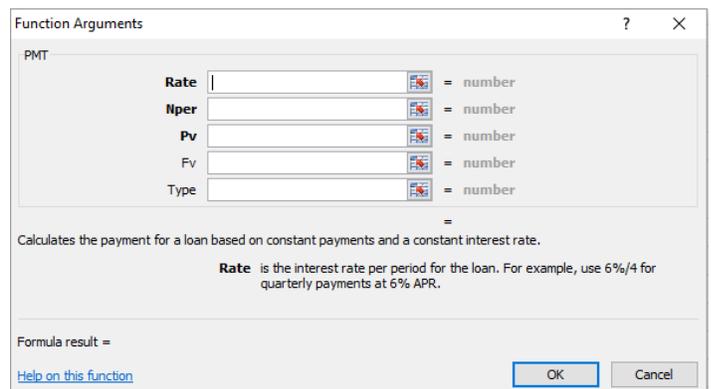
## Lookup Functions

VLOOKUP looks for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify. By default, the table must be sorted in ascending order. HLOOKUP looks for a value in the topmost row of a table, and then returns a value in the same column from a row you specify. The VLOOKUP and HLOOKUP functions take four arguments. The "Lookup\_value" is the address of the cell containing the information to be looked up, "Table\_array" is the range of cells containing the data (if the data is arranged vertically, VLOOKUP is used, if the data is arranged horizontally, HLOOKUP is used, "Col\_index\_num/Row\_index\_num" is the column or row containing the data to be returned, "Range\_lookup" is a logical value: to find the closest match in the leftmost column/top row (sorted in ascending order) = TRUE or omitted; find an exact match = FALSE.



## Financial function

The PMT function is used to calculate the payment due on a loan based on the values entered as arguments. The PMT function takes a minimum of three arguments: "Rate" is the interest rate per period; "Nper" is the number of periods (The unit for the period for both "Rate" and "Nper" must match i.e. Months or Years.), "Pv" is the amount of the loan, "Fv" is the future value, or a cash balance you want to attain after the last payment is made, 0 (zero) if



omitted, “Type” is a logical value: payment at the beginning of the period =1; payment at the end of the period = 0 or omitted. The last two arguments are optional.