M 365 Excel Class Video 03: Excel Worksheet Formulas and Models by excelisfun

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Formula Elements

Excel Worksheet Formulas:
Math, logical or data manipulation operation to create an answer.
All formulas have an equal sign (=) as first character in cell
You can use Arrow Keys to put Cell References in Formula, or the Mouse.
Number Formula: Use Math Operators or Functions to calculate a number answer. Numbers are aligned to the right by default.
Logical Formula: Use a Comparative Operators or Functions to deliver a TRUE or FALSE. TRUE & FALSE are aligned in the Center by default.
Text Formula: Use Join Operator, "Text" in quotes or Functions (like LEFT, TEXT, FIXED and more) to deliver a text answer. Text is aligned to the left by

Formulas elements (things that can go into formulas):
Equal sign as first character in cell to tell Excel you are making a formula
References: cell references, table references and spilled range reference
Math operators
Numbers (if the number won't change like 12 for months in a year)
Built-in functions (like SUM, COUNTIFS, SUMIFS, AVERAGE, NORM.DIST, RSQ)
Comparative operators (like > and <)
Join Symbol: & (Ampersand)
Text in double quotes (like "Revenue" or ", ")

Math Operators (Shown in Math Order of Operations)	
( ) represents Parentheses	Shift + 9 and Shift + 0
^ represents Exponents (powers and roots)	Shift + 6 = ^ = caret
* represents Multiplication	* on Number pad
/ represents Division	/ on Number pad
+ represents Addition	+ on Number pad
− represents Subtraction	- on Number pad

Comparative Operators
> Greater Than
>= Greater Than Or Equal To
< Less Than
<= Less Than Or Equal To
= Equal To
<> Not Equal To

Join Symbol (Ampersand)
&

Worksheet Cell References

1) Example of Cell Reference: A1
    i. Column reference = A
    ii. Row reference = 1
2) Copying formulas with Cell References:
    i. When we copy a formula that contains cell references, we need to consider whether we need: Relative, Absolute, Mixed with the Column Locked or Mixed with the Row Locked.
    ii. If you will not copy the formula, there is no need to consider what type of cell reference it will be.
3) Four Basic Types of Cell References (Relative, Absolute, Mixed Column Locked, Mixed Row Locked):
    i. Relative Cell References – Example: A1
        • No dollar signs
        • Moves relatively throughout the copy action.
        • Relatively means that if the formula is looking at a cell reference that is three cells to the left, when you copy the formula to any other cell, the cell reference will still be looking three cells to the left.
    ii. Absolute Cell References – Example: A1
        • Dollar signs before both:
            i. Column reference = A
            ii. Row reference = 1
        • Absolute means that if the formula is looking at a particular cell reference, when you copy the formula to any other cell, the cell reference will still be looking at that particular cell reference. If the absolute cell reference is A1, the formula will always look at cell A1. It is as if the formula is locked on the cell A1 throughout copy action.
    iii. Mixed Cell References with Row Locked – Example: A$1
        • Dollar sign before row reference only.
        • Remains absolute or locked when copying across the rows, vertically (up and down).
        • Moves relatively when copying across the columns, horizontally (side to side).
    iv. Mixed Cell References with Column Locked – Example: $A1
        • Dollar sign before column reference only.
        • Remains absolute or locked when copying across the columns, horizontally (side to side).
        • Moves relatively when copying across the rows, vertically (up and down).
4) Keyboard to Toggle Cell References = F4 Key.
    i. F4 key = If cursor is touching a cell reference in a formula while in edit mode, F4 toggles between the four basic types of cell references.

Excel Formula Order of Operations

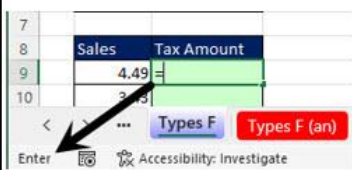| Excel Formula Order of Operations: |
| --- |
| **1) Parenthesis** ( ) |
| **2) Reference Operators**: colon, space, comma |
| Example of colon in range of cells: =SUM(A1:A4) |
| Example of intersection operator: =E12:G12 F10:F15 (retrieve what is in F12) |
| Example of comma (union): =SUM(E10:G10,E14:G14) |
| **3) Negation** (-)   (give me opposite) |
| Example: = -2^4 = 16 |
| Example: = -(2^4) = -16 |
| Example: --2+1 = 3 |
| **4) Converts %** (1% to .01) |
| **5) Exponents** (^) |
| Example: 3^2 = 9 |
| Example: 2^3 = 2*2*2 = 8 |
| Example: 4^(1/2) = 2 |
| **6) Multiplication** (*) and **Division** (/), left to right |
| **7) Adding** (+) and **Subtracting** (-), left to right |
| **8) Ampersand** (&)   (Join operator) |
| **9) Comparative operators**: =, <>, >=, <=, <, > |

Modes of Cell Editing:

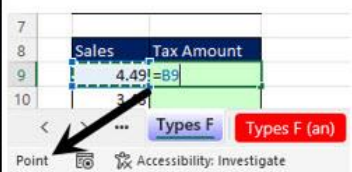**Mode of cell when you are creating or editing a Worksheet Formula:**
* The mode of a cell is listed in the lower-left corner of the status bar.
* If you want to toggle between the modes, you can press the F2 key.
* The four modes the status bar lists tell you what you can do with a formula:

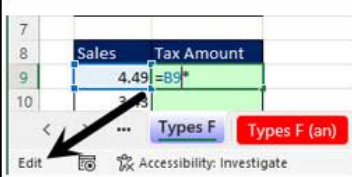|	
	1) **Ready** indicates that the cell is selected and ready for you to enter text, a number, or a formula.
	2) **Enter** indicates that you can use arrow keys or the mouse to select a range or the keyboard to enter a formula, or to type formula elements.
	3) **Point** indicates that that you are using your arrow keys or mouse to select a range. You can type formula elements in this mode also.
	4) **Edit** indicates that that the arrow keys will move the insertion point cursor from left to right in the formula.

Types of Formulas

Formulas by data type:
1) Number Formulas deliver numbers results (numbers, times, dates). Default Align to right.
2) Text Formulas deliver text results. Default Align to left.
3) Logical Formulas deliver logical values, or Boolean values. These formulas deliver either a TRUE or a FALSE. Default Align center and all CAPS.
Formulas by calculation type:
1) Aggregate Formulas operate on an array of values and deliver a single answer, like with adding, averaging or running an AND logical test.
2) Single Input-Output Formulas are formulas that operate on single inputs and deliver a single answer.
This type of formula has single values entered into a function argument, like =FORMULATEXT(B1), or has single values on either side of an operator, like =A1*B1, where the operator is a multiplication operator. These formulas require that you: 1) Consider what type of cell references (relative, absolute, mixed) are required.   2) Enter the formula into one cell, and if the formula must be copied, you must manually copy the formula to other cells.   3) If you need to edit the formula, you edit the cell and re-copy the formula to other cells if necessary.
Array Formulas are formulas that contain one or more array operations that deliver an array of answers rather than a single answer. The array operation can involve multiple values entered into a function argument, like =FORMULATEXT(B1:B4), or there can be multiple values on one or more sides of an operator, like =A1*B1:B5, or A1:A5*B1, or A1:A5*B1:B5. Array formula is the general term used to describe both types of array formulas:
3) Dynamic Spilled Array Formulas are array formulas that deliver a spilled array to the worksheet as the final answer. Dynamic Spilled Array formulas spill from the top cell and only live in the top cell. If you spill a formula from cell F9, you refer to the spilled array with the spilled range operator #, as in SUM(#F9) when you want to add the values.
4) Scalar Array Formulas are array formulas that deliver a single, scalar value as the final answer. For example: =SUM(ROUND(M9:M13*N6,2)), where the array operation M9:M13*N6 delivers an array of values to ROUND and then SUM adds the values to deliver a single scalar value (one value).
5) Excel Table Formulas are formulas that use the table formula nomenclature, rather than cell references.   Excel Tables are dynamic because if you add rows or columns, anything pointing to table will update with new data. Some of the Excel items that will update: formulas, PivotTable, Power Query, Charts and more.   Table formula nomenclature (References to Excel Table objects):   TaxTable = Excel Table Name   TaxTable[Tax Amount] = Field Name in an Excel Table   [@Tax Amount] = Relative Cell Reference   Implicit Intersection Operator (@)   Implicit Intersection Operator (@) allows you to get a corresponding item in the current row of a column or a parallel column.   **Note:** Dynamic Spilled Array Formulas are NOT allowed in an Excel Table.

Examples of Types of Formulas:

Goal: Calculate tax for each sales amount, then add

2) Single Input-Output Formulas

Tax Rate	0.0975

Sales	Tax Amount
4.49	$0.44
3.43	$0.33
4.98	$0.49
4.49	$0.44
3.44	$0.34
Total	$2.04

C9: =ROUND(B9*C6,2)
C14: =SUM(C9:C13)

SIOF: Notes:
Use if you have to send a
solution to someone
without M365 Excel.

3) Dynamic Spilled Array Formulas

Tax Rate	0.0975

Sales	Tax Amount
4.49	$0.44
3.43	$0.33
4.98	$0.49
4.49	$0.44
3.44	$0.34
Total	$2.04

F9: =ROUND(E9:E13*F6,2)
F14: =SUM(F9#)

DSAF Notes:
Advantages:
1) Did not need to Lock Cell References.
2) Did not need to manually copy the formula.
3) Editing a formula is faster and easier.

5) Excel Table Formulas

Tax Rate	0.0975

Sales	Tax Amount
4.49	0.44
3.43	0.33
4.98	0.49
4.49	0.44
3.44	0.34
Total	2.04

I9: =ROUND([@Sales]*I6,2)
I14: =SUBTOTAL(109,[Tax Amount])

ETF Notes:
Use when you will add new records to your table.
You still must lock references, but formulas
are automatically copied down column.

Goal: Calculate total tax amount

5) Excel Table Formulas

Total Tax From Excel Table

2.04

1) Aggregate Formulas

K9: =SUM(TaxTable[Tax Amount])

Tax Rate	0.098

Sales
4.49
3.43
4.98
4.49
3.44

4) Scalar Array Formulas

Total Tax calculated in single cell

2.04

Aggregate and Array Formula

O9: =SUM(ROUND(M9:M13*N6,2))

Style Formatting

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		**Style Formatting** = All formatting for cells that is not Number Format. Things like Cell Fill Color, Font Color, Borders, Indents and more.											
3													
4			Jan	Feb	Mar	Apr	Total		**Minimalism** School of Style Formatting				
5		Sales	5000	6750	7950	9285.39	30955		Bold to emphasize labels				
6		COGS	1875	2531.25	2981.25	4220.63	11608.13		Default gray lines				
7		Operation Expense	1250	1687.5	1987.5	2813.75	7738.75		Underlines to emphasize calculations				
8		Administrative Expense	625	843.75	993.75	1406.88	3869.38		Indent to group some labels				
9		Other Expense	375	506.25	596.25	844.13	2321.63						
10		Total Expenses	4125	5568.75	8000	9285.39	25537.89		**Format Painter**: copies only Formatting.				
11		Net Income	875	1181.25	-50	0	5417.11		Home tab, Clipboard group, or MiniTool bar				
12													
13													
14													
15			Jan	Feb	Mar	Apr	Total		**Accounting Number Format** uses:				
16		Sales	$ 5,000.00	$ 6,750.00	$ 7,950.00	$ 9,285.39	$ 30,955.00		Fixed $ sign on left				
17		COGS	1,875.00	2,531.25	2,981.25	4,220.63	11,608.13		( ) for negative numbers				
18		Operation Expense	1,250.00	1,687.50	1,987.50	2,813.75	7,738.75		Zeros are dashes				
19		Administrative Expense	625.00	843.75	993.75	1,406.88	3,869.38		Lines up digits and $ signs				
20		Other Expense	375.00	506.25	596.25	844.13	2,321.63						
21		Total Expenses	$ 4,125.00	$ 5,568.75	$ 8,000.00	$ 9,285.39	$ 25,537.89						
22		Net Income	$ 875.00	$ 1,181.25	$ (50.00)	$ -	$ 5,417.11						
23													
24													
25													
26			Jan	Feb	Mar	Apr	Total		**Currency Number Format** uses:				
27		Sales	$5,000.00	$6,750.00	$7,950.00	$9,285.39	$30,955.00		Floating $ sign				
28		COGS	$1,875.00	$2,531.25	$2,981.25	$4,220.63	$11,608.13		Choose how negative numbers display				
29		Operation Expense	$1,250.00	$1,687.50	$1,987.50	$2,813.75	$7,738.75		Lines up digits if you use consistent				
30		Administrative Expense	$625.00	$843.75	$993.75	$1,406.88	$3,869.38		negative number formats				
31		Other Expense	$375.00	$506.25	$596.25	$844.13	$2,321.63						
32		Total Expenses	$4,125.00	$5,568.75	$8,000.00	$9,285.39	$25,537.89						
33		Net Income	$875.00	$1,181.25	-$50.00	$0.00	$5,417.11						
34													
35													
36													
37		Amounts in $	Jan	Feb	Mar	Apr	Total		**Indicate Unit in a Label**				
38		Sales	5,000.00	6,750.00	7,950.00	9,285.39	30,955.00		Makes Report less cluttered				
39		COGS	1,875.00	2,531.25	2,981.25	4,220.63	11,608.13						
40		Operation Expense	1,250.00	1,687.50	1,987.50	2,813.75	7,738.75		**Number** Number Formatting uses				
41		Administrative Expense	625.00	843.75	993.75	1,406.88	3,869.38		No Dollar sign				
42		Other Expense	375.00	506.25	596.25	844.13	2,321.63		Shows Commas				
43		Total Expenses	4,125.00	5,568.75	8,000.00	9,285.39	25,537.89		Lines everything up without the extra spaces				
44		Net Income	875.00	1,181.25	-50.00	0.00	5,417.11		that Accounting Number Format uses				
45									to accommodate the parentheses				
46													
47													
48		Amounts in $	Jan	Feb	Mar	Apr	Total		**Non-Minimal Style Format**				
49		Sales	5,000.00	6,750.00	7,950.00	9,285.39	30,955.00		Be sure that the value difference between				
50		COGS	1,875.00	2,531.25	2,981.25	4,220.63	11,608.13		fill and font color makes it easy to read				
51		Operation Expense	1,250.00	1,687.50	1,987.50	2,813.75	7,738.75		$ sign in labels helps it to be less cluttered				
52		Administrative Expense	625.00	843.75	993.75	1,406.88	3,869.38						
53		Other Expense	375.00	506.25	596.25	844.13	2,321.63						
54		Total Expenses	4,125.00	5,568.75	8,000.00	9,285.39	25,537.89						
55		Net Income	875.00	1,181.25	-50.00	0.00	5,417.11						

Worksheet Formula Model Guidelines

Worksheet Formula Models	
1)	**Worksheet formulas** = tool to make calculations and perform data analysis.
	Equal sign as 1st character can contain built-in functions (like SUM), math operators, cell references & other formula element
2)	**Number Formatting as Façade:**
	Number formatting displays numbers in a certain way without changing the underlying number.
	Formulas do not act on Number Formatting: they act on underlying value.
	The General Number format is like an eraser that wipe away all number formatting to see the actual numbers in the cell.
	$ signs: Accounting uses ( ) for negative numbers and a fixed $ sign on left. Currency has a floating $ sign. Number Formatting with $ sign in column label is less cluttered.
	The Percentage Format displays decimals as percentages without changing the underlying number. The decimal 0.01 and the percentage 1.00% are mathematically equivalent: both mean 1 part out of 100.
	Keyboard to open Format Cells dialog box = Ctrl + 1.
3)	**Style Formatting**
	Formatting such as fill color, font color, borders indent, wrap text, alignment (Font and Alignment groups in Home tab).
	Minimal school of style formatting: bold for column headers, default gray lines and borders for totals at bottom.
	Non-minimal school of style formatting: aim for clarity & ease of understanding. Pick a way of formatting & be consistent.
	Do not use Fill and Font Colors that make it hard to read, such as Red Fill and Black Font. You can squint your eyes to gage if value difference makes it hard to read.
	Keep default alignment so that data types are visually obvious.
4)	**Excel's Golden Rule:**
	If a formula input can change, put in in a cell, label it and refer to it in formula with reference.
	If a formula input will not change, you can type it into formula, like 12 months in a year, 24 hours in a day or 1 to represent a base amount in percentage formulas.
5)	**Document formulas** with =IFNA(FORMULATEXT(Cell),""). This is not always necessary, but it can help to see what is going on with formulas in model.
6)	**Use the ROUND function when required.**
	You must use ROUND Function when: 1) You are required to round (like with $), 2) You have extraneous decimals, and 3) You will use formula result in a subsequent formula.
	In the second argument of ROUND: 2 rounds to the penny (hundredth), 0 rounds to the dollar (ones position). See picture below =>

Number	Position of the number you want to round to for num_digit argument								
52.727625	5	2	.	7	2	7	6	2	5
			Decimal						
	▲	▲		▲	▲	▲	▲	▲	▲
num_digits:	-1	0		1	2	3	4	5	6
	Dollar Position			Penny Position					

Examples 1-3 of Worksheet Formula Models

Example 1:

You are required to make a sales and expense budget. The estimated sales for Jan = $5,000, Feb = $6,750, Mar = $7,950 and Apr = $11,255. The expenses as a percentage of sales are as follows:

COGS = 37.5%, Operation Expense = 25%, Administrative Expense = 12.5% and Other Expense = 7.5%. Build an Excel Model.

Expenses as a % of Sales	%
COGS	37.50%
Operation Expense	25.00%
Administrative Expense	12.50%
Other Expense	7.50%
Total Expense as % of Sales	82.50%

Check list:
- ✓ Excel's Golden Rule: List all formula elements in cells with label?
- ✓ Style Formatting: is it easy to read and understand?
- ✓ Is Number Formatting interfering with our solution, or helping?
- ✓ Document model?
- ✓ Use ROUND function if necessary?
- ✓ Keep default alignments?

Amounts in $	Jan	Feb	Mar	Apr	Total
Sales	5,000.00	6,750.00	7,950.00	11,255.00	30,955.00
COGS	1,875.00	2,531.25	2,981.25	4,220.63	11,608.13
Operation Expense	1,250.00	1,687.50	1,987.50	2,813.75	7,738.75
Administrative Expense	625.00	843.75	993.75	1,406.88	3,869.38
Other Expense	375.00	506.25	596.25	844.13	2,321.63
Total Expenses	4,125.00	5,568.75	6,558.75	9,285.39	25,537.89
Net Income	875.00	1,181.25	1,391.25	1,969.61	5,417.11

Example 2:

Gel Boomerangs manufacturers boomerangs and calculates the price of the boomerangs by adding a 72% markup on the cost of the product (cost = how much it cost to produce the boomerang).

If the Quad boomerang cost $13.55 to manufacturer (cost), what is the price? Build an Excel Model.

Boomerang	Quad
Cost to Make ($)	13.55
% Markup on Cost	0.72

Difference between % Markup on Cost Vs. % Markup on Price:
Excel & Business Math 41: Markup On Cost or Markup On Sell P
https://www.youtube.com/watch?v=TfjZuOJBRsE&list=PLrRPv

% Markup on cost = how many pennies to add each dollar of cost to get price

Markup ($)	9.756	=D61*D62
Rounded Markup ($)	9.76	=ROUND(D64,2)
Price ($)	23.31	=D61+D65
Price ($)	23.31	=D61+ROUND(D61*D62,2)
Price ($)	23.31	=ROUND((1+D62)*D61,2)
Check: % Markup on Cost	0.72	=D64/D61

Check list:
- ✓ Excel's Golden Rule: List all formula elements in cells with label?
- ✓ Is Number Formatting interfering with our solution, or helping?
- ✓ Style Formatting: is it easy to read and understand?
- ✓ Document model?
- ✓ Use ROUND function if necessary?
- ✓ Keep default alignments?

Date and Time Number Formatting and Formulas:

1) **Format of Valid Dates & Times is set in Regional Settings:** Window Key, then type Regional.

2) **Date Number Formatting:**

Under Date Number Format, there are serial numbers, which are the number of days since Dec 31, 1899.

Dates can be entered as 1/2/2022 or 1-2-2022 or 1/2/22 and other ways also.

Difference Between Two Days formula: End Date - Start Date. **End Date formula:** Start Date + Number of Days Till End Date.

3) **Time Number Format:**

Under Time Number Format, there are serial numbers that represents the proportion of one 24-hour day.

Time serial number = number between 0 and 1, where 6 AM = 6/24 = 0.25.

Enter time as: hours, colon, minutes, colon, seconds, then a space, and AM or PM (there are other methods also).

Example: 8:15 AM, or 10:15:15 PM. Military time such as 13:00 = 1:00 PM. Not a Time Value: 8:00AM.

To **convert time values to number of hours (whole numbers) formula:** (End Time - Start Time)*24.

Date	# in cell	Time	# in cell		
1/1/1900	1	12:00:00 AM	0		Current Date Keyboard = Ctrl + ;
1/2/1900	2	6:00:00 AM	0.25		Current Time Keyboard = Ctrl + Shift ;
1/31/1999	36191	8:45:15 AM	0.364756944		
7/13/2022	44755	4:00:00 PM	0.666666667		
1/1/1800	1/1/1800	11:59:59 PM	0.999988426		

Example 3:

Calculate total number of days and total amount of time it took to complete the project if project started on 7/13/2022 and continued every day until 7/27/2022 and the team worked from 6 AM to 1:30 PM each day. Build an Excel Model.

				Check list:
Start Date	7/13/22			
End Date	7/27/22		✓	**Excel's Golden Rule:** List all formula
# of Days	14	=E97-E96	✓	**Style Formatting:** is it easy to read a
Start Time	6:00 AM		✓	Is **Number Formatting** interfering w
End Time	1:30 PM		✓	**Document** model?
# of Hours each day	7.5	=(E100-E99)*24	✓	Use **ROUND function** if necessary?
Total Hours	105	=E98*E101	✓	Keep **default alignments?**

Example 4: Lookup products biggest sale and profit

	A	B	C	D	E	F	G	H	I
1									
2		**Example 4:**							
3		Calculate the amount of the profit from the biggest sale for each product. The profit margin (% left over after all expenses paid) is 17.5%.							
4		Create dynamic worksheet formula model. Sort report A-Z by product.							
5									
6		**Date**	**Product**	**Customer**	**Sales ($)**		Profit Margin		17.50%
7		7/19/22	Carlota	Customer 20	36,368.19				
8		7/17/22	Aspen	Customer 6	32,532.89		**Product**	**Biggest Sale ($)**	**Profit ($)**
9		7/10/22	Yanaki	Customer 20	27,638.77		Aspen	71,245.42	12,467.95
10		7/17/22	Aspen	Customer 15	14,635.89		Carlota	97,008.74	16,976.53
11		7/9/22	Yanaki	Customer 14	34,372.40		Quad	71,123.28	12,446.57
12		7/7/22	Yanaki	Customer 16	37,088.49		Sunshine	54,182.63	9,481.96
13		7/3/22	Yanaki	Customer 10	24,704.79		Yanaki	52,856.78	9,249.94
14		7/13/22	Aspen	Customer 27	38,171.46				
15		7/18/22	Quad	Customer 19	28,347.85				
16		7/30/22	Quad	Customer 2	12,746.14		=SORT(UNIQUE(fSales4[Product]))		
17		7/23/22	Yanaki	Customer 12	24,177.25			=MAXIFS(fSales4[Sales ($)],fSales4[Product],G9#)	
18		7/29/22	Quad	Customer 1	16,007.05			=H9#*H6	

MAXIFS and Other IFS

- All five functions have matching pairs of criteria_range and criteria arguments that increment as criteria_range1 and criteria1, criteria_range2 and criteria2 and so on. These matching pairs expect a range of values in the criteria_range argument and then the condition for the logical test in the criteria argument.
- COUNTIFS function contains only paired criteria_range and criteria arguments because it counts how many times matches are made.

- SUMIFS, AVERAGEIFS, MINIFS and MAXIFS all contain a first argument that expect ranges of number values.

- The dimensions for the number ranges and criteria ranges must be the same, or else you get a #VALUE! error.

- Array operations are not allowed in the number ranges and criteria ranges (like sum_range, criteria_range1).
- Array operations are allowed in the criteria arguments (like criteria1, critera2 and so on).
- When you use two or more criteria arguments (critera2 or more), these functions run an AND logical test.
- You can force these functions to make an OR logical test by placing an array of values into the criteria argument.

Example 5 of Finance Excel Worksheet Model:

In Finance, this is example of an Excel Cash Flow Model to determine if a new machine provides profitable cost savings would look like this:
Goal: Determine whether project is profitable by using IRR and NPV metrics.

Cost	$850,000.00		Year	OCF	NWC	Cap Spending	Total CF
Years	5		0		$75,000.00	-$850,000.00	-$775,000.00
Depr Method	SL		1	$261,000.00			$261,000.00
Salvage for Depr	0		2	$261,000.00			$261,000.00
Annual Depr Expense	$170,000.00		3	$261,000.00			$261,000.00
Sell Price at end of life	$180,000.00		4	$261,000.00			$261,000.00
Pre-taxed COST Savings per year (Like Cash In because it is a savings)	$310,000.00		5	$261,000.00	-$75,000.00	$117,000.00	$303,000.00
Reduce NWC (positive Cash Flow at Beginning)	$75,000.00						
Tax Rate	0.35					IRR	21.28%
RRR	0.1					NPV	$240,474.04

From my Finance Class at YouTube:
https://www.youtube.com/playlist?list=PL90E1F26C7B85E78F
This example from chapter 9, video 87:
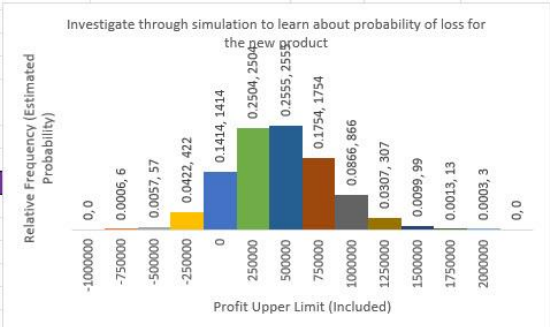https://www.youtube.com/watch?v=8pw9B9ItR4g&list=PL90E1F26C7B85E78F&index=90

Example 6 of Business Analytics Excel Worksheet Model:

	B	C	D	E	F	G	H	I	J
1									
2	In Business Analytics, this is a Monte Carlo Simulation Model to investigate the risk of loss for a new product.								
3	**Goal:** The company wants to: Investigate through simulation to learn about probability of loss for the new product.								
4									
5	Bay Air Services is a compressor manufacturer company. The company wants to: Investigate through simulation to learn about probability of loss for the new product.								
6	There are Set or Static Variables and Uncertain of Random Variables for the simulation.								
7	The Set Variables are: Selling Price per Unit = $199 and Total Administrative & Advertising Cost = $850,000.								
8	The Uncertain variables are: Direct Labor Cost Per Unit, Material Cost Per Unit and Demand.								
9	Based on historical data and current wage contracts managers believe that Direct Labor Cost Per Unit will have a Best, Base and Worst case scenario as listed below.								
10	They also believe that the discrete probability distribution for the Direct Labor Cost Per Unit variable reflects that probability of wage costs.								
11	Based on historical data and current prices for materials managers believe that Material Cost Per Unit will have a Best, Base and Worst case scenario as listed below.								
12	Based on historical data and current projections for demand managers believe that Demand will have a Best, Base and Worst case scenario as listed below.								
13	Based on past data the assumed probability distribution type for each of the uncertain variables are listed below.								
14	Create the Best, Base and Worst case scenarios								
15									
16	Formula Inputs (Parameters, Assumptions, Decision Variables, Set/Static Variables, Uncertain/Random Variables								
17	Company Name	Bay Air Services							
18	New Product	Compressor						From my Business Analytics Class at YouTube:	
19	Goal:	Investigate through simulation to learn about probability of loss for the new product					https://www.youtube.com/playlist?list=PLrRPvpgDmw0mSJCZaqQPFj0eto4qnzkCZ		
20	Set/Static Variables	Variable	Set Amount				This example from video 66:		
21	Selling Price per Unit	P	$199.00				https://www.youtube.com/watch?v=Eb4jPVdaITg&list=PLrRPvpgDmw0mSJCZaqQPFj0eto4qnzkCZ&index=70		
22	Total Administrative & Advertising Cost	TAC	$850,000.00						
23									

	Random Variables (Uncertain Values)	Variable	Assumed: Variable Type	Distribution Based on Historical Data	Mean	Standard Deviation	Best	Base	Worst
24									
25	Direct Labor Cost Per Unit	DLC	Discrete	Historical Relative Frequency Distribution			$39.00	$42.00	$45.00
26	Material Cost Per Unit	MC	Continuous	Uniform			$75.00	$90.00	$105.00
27	Demand	D	Continuous	Normal	17,500	5,000	32,500	17,500	0
28	Math formula:								
29	Profit = D*(P-DLC-MC)-TAC								
30									

	Lookup Column	Direct Labor Cost Per Unit	Probability
31			
32	0	$39	0.1
33	0.1	$40	0.15
34	0.25	$41	0.2
35	0.45	$42	0.25
36	0.7	$43	0.15
37	0.85	$44	0.1
38	0.95	$45	0.05

	B	C	D	E	F	G	H	I	J	K	L	M
40	Model:											
42		Profit	Profit	Profit								
43	Best	$1,912,500.00	$1,912,500.00	$1,912,500.00								
44	Base	$322,500.00	$322,500.00	$322,500.00								
45	Worst	-$850,000.00	-$850,000.00	-$850,000.00								

Investigate through simulation to learn about probability of loss for the new product

	Direct Labor Cost Per Unit	Material Cost Per Unit	Demand	Profit		Data Table Column Input (Empty Cell):			
Simulation #	41	$97.38	7718	-$382,134.84					
1	39	103.22	17009	115771.02					
2	41	89.24	17837	376472.12		**Analysis**			
3	40	103.45	26168	603632.4		Mean	$322,625		
4	41	101.8	10183	-277715.4		Count	10000		
5	43	98.42	17124	135999.92		Max	$1,787,327		
6	43	90.39	17448	294763.28		Min	-$822,127		
7	41	88.72	8729	-245254.88		Standard Deviation	$370,198		
8	42	86.84	19845	542325.2		Probability of Loss	0.1912		
9	40	87.05	14782	213564.9					

						Profit Upper Limit (Included)	Frequency	Relative Frequency (Estimated Probability)	Explicit Category
10	43	97.98	9265	-312444.7		-1000000	0	0	X <= -1000000
11	40	80.18	23514	1003373.48		-750000	5	0.0005	-1000000 < X <= -750000
12	44	75.17	23274	1007963.42		-500000	77	0.0077	-750000 < X <= -500000
13	42	78.94	18499	594031.94		-250000	430	0.043	-500000 < X <= -250000
14	41	98.89	13701	-40133.89		0	1400	0.14	-250000 < X <= 0
15	44	79.49	24858	1027027.58		250000	2467	0.2467	0 < X <= 250000
16	39	78.21	18862	692722.98		500000	2615	0.2615	250000 < X <= 500000
17	41	83.34	12528	85340.48		750000	1739	0.1739	500000 < X <= 750000
18	42	84.23	19848	594338.96		1000000	841	0.0841	750000 < X <= 1000000
19	41	88.6	25256	902766.4		1250000	321	0.0321	1000000 < X <= 1250000
20	44	80.83	16273	356968.41		1500000	84	0.0084	1250000 < X <= 1500000
21	42	76.94	18205	607492.3		1750000	19	0.0019	1500000 < X <= 1750000
22	40	79.21	3557	-566186.97		2000000	2	0.0002	1750000 < X <= 2000000
23	39	94.22	23423	690764.94			0	0	2000000 < X
24	42	91.3	26342	880669.4			10000	1	
25	43	84.24	11559	-20526.16					
26	40	80.93	16662	459880.41					