

<p>Excel & Business Math Video/Class Project #06 Formula Elements and Formula Tips For Business Math (17 Examples)</p>

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1) Math Operators used in Excel

Math Operators:	
()	Parentheses.
^	Raising to an exponent. ("caret", like carrot)
*	Multiplying.
/	Dividing.
+	Adding.
-	Subtracting or Negation.

Math Operators on the Standard Keyboard:	
(Shift + 9
)	Shift + 0
^	Shift + 6
*	Shift + 8, or Number Pad
/	/ Key, or Number Pad
+	Shift + =, or Number Pad
-	- Key, or Number Pad

2) Math Order of Operations

i. When using more than one math operator in a formula you must evaluate the math operators in this order:

Math order of operations	
1	First, do everything in the parentheses
2	Second, do all exponents
3	Third, do all multiplication and division, left to right
4	Fourth, do all adding and subtracting, left to right

Math order of operations	
1	()
2	^
3	* / Left to Right
4	+ - Left to Right

By Hand Examples:

Example 1:

$$8 + 2 * 2$$

$$8 + 4$$

$$12$$

Example 2:

$$(8 + 2) * 2$$

$$10 * 2$$

$$20$$

Example 3:

$$(8 + 2 - 1)^{12} * 2$$

$$(10 - 1)^{12} * 2$$

$$9^{12} * 2$$

$$9 * 9 * 2$$

$$81 * 2$$

$$162$$

Example 4:

$$8 + 2 * (100 - 25)$$

$$8 + 2 * 75$$

$$8 + 150$$

$$158$$

Example 5:

$$(100 - 50) * 10$$

$$50 * 10$$

$$500$$

Excel Examples:

	A	B	C	D
10	Ex 3	Number 1	8	
11		Number 2	2	
12		Number 3	1	
13		Number 4	2	
14		Number 5	2	
15		Math Formula:	$= (8 + 2 - 1)^{12} * 2$	
16		Excel Formula:	162	$= (C10 + C11 - C12)^{12} * C13 * C14$
17				
18	Ex 4	Number 1	8	
19		Number 2	2	
20		Number 3	100	
21		Number 4	25	
22		Math Formula:	$8 + 2 * (100 - 25)$	
23		Excel Formula:	158	$= C18 + C19 * (C20 - C21)$
24				
25	Ex 5	Goal: Calculate Cost of Goods Sold (COGS) in Accounting		
26		Product	Aspen	
27		Beginning Quantity	100	
28		End Quantity	50	
29		Value Each	\$10.00	
30		Accounting Formula:	$(\text{Beginning Quantity} - \text{End Quantity}) * \text{Value Each}$	
31		Math Formula:	$(100 - 50) * \$10$	
32		Excel Formula:	\$500.00	$= (C27 - C28) * C29$

3) Watch How Excel Calculates Your Formula with Evaluate Formula feature

- i. If we want to see how Excel evaluates or calculates our formula one step at a time, we can use the Evaluate Formula feature in Excel.
- ii. Here are the steps to evaluate your formula:
 1. Select cell with formula
 2. In the Formula Ribbon Tab, go to the Formula Auditing group, then click on the Evaluate Formula button
 3. Then use the Evaluate button or the Enter key to step through and watch Excel calculate your formula one step at a time.

2) Click Evaluate Formula

3) Click Evaluate button or hit Enter Key

1) Select Cell with Formula

1	()
2	^
3	*/ Left to Right
4	+ - Left to Right

Ex 3	Number 4	2
	Number 5	2
	Math Formula:	$=(8+2-1)^2*2$
	Excel Formula:	162

4) What to do if Arrow Keys do NOT put Cell Reference in Formula.



- i. Note about Arrow Keys for putting Cell References into formulas: : If you try to use the arrow keys to put a Cell Reference in the formula and it does not work, hit F2 key to toggle it back to "Enter" mode as seen on the left side of the Status Bar.
 1. Enter means you can use Arrow Keys to get a Cell Reference
 2. Point means that you are currently using the Arrow Keys to get a Cell Reference
 3. Edit means Arrow Keys will move Left to Right in the Formula itself.

5) Comparative Operators used in Excel

- i. When we use comparative operators, the formula (or formula element) will deliver a TRUE or FALSE and is considered a Logical Formula.
- ii. The following table show the different Comparative Operators in Excel:

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

By Hand Examples:

<u>Example 6 :</u> $448.00 = 448.01$  FALSE	<u>Example 7 :</u> $63500 >= 55000$  TRUE
---	---

Excel Examples:

	A	B	C	D	E	F
1	Comparative Operators.					
2	= Equal: are two things equal?					
3	<> Not: are two things not equal? Type less than symbol, then greater than symbol.					
4	> Greater than: is the thing on the left greater than the thing on the right?					
5	>= Greater than or equal to: is the thing on the left greater than or equal to the thing on the right?					
6	< Less than: is the thing on the left less than the thing on the right?					
7	<= Less than or equal to: is the thing on the left less than or equal to the thing on the right?					
8						
9	Ex 6	Goal: Determine If Debits = Credits				
10		Debit (DR)	Credit (CR)			
11		35.74	35.74			
12		73.61	73.61			
13		113.08	113.08			
14		100.49	100.5			
15		17.7	17.7			
16		107.38	107.38		In Balance?	
17		448.00	448.01		FALSE	=B17=C17
18						
19	Ex7	Goal: Determine If Employee Gets a Bonus				
20		Employee	Sales	Do they Get Bonus?		
21		Emma Petrov	\$63,500.00	TRUE		=C21>=\$D\$28
22		Rolando Robbins	\$55,000.00	TRUE		
23		Abdi Amari	\$74,558.65	TRUE		
24		ShelaDown Cohen	\$53,741.33	FALSE		
25		Sioux Radcoolinator	\$37,251.06	FALSE		
26		Miki Ito	\$55,000	FALSE		
27						
28			Hurdle to Get Bonus	\$55,000.00		

iii. For each Comparative Operator there are many ways to phrase the operator. This means that you can articulate a particular comparative operator in various ways. Below list a list of different phrases that may be used for each operator:

Comparative Operator:	=	>	>=	<	<=	<>
Possible Words:	equal	greater than	greater than or equal to	less than	less than or equal to	not
		more than	at least	below	at most	complement of
		above	no less than	under	no more than	
			X or more		X or less	
Examples of Words:	equals 2000	greater than 2000	greater than or equal to 2000	less than 2000	less than or equal to 2000	not 2000
		more than 2000	at least 2000	below 2000	at most 2000	complement of 2000
		above 2000	no less than 2000	under 2000	no more than 2000	
			2000 or more		2000 or less	

If Hurdle:
2000

6) Types of Formulas seen in this class:

1) **Number formulas** deliver a single number answers such as a tax deduction or a monthly insurance expense.

Example:

	B	C	D	E	F	G
59	Product	Beginning Quantity	End Quantity	Value Each	COGS	
60	Aspen	114	45	10	690	=(C60-D60)*E60
61	Quad	146	117	20	580	
62	Carlota	108	102	15	90	
63	Bellen	61	47	10	140	
64	Sunset	54	51	12	36	

2) **Logical formulas** (Boolean Formulas) deliver a TRUE or FALSE.

i. When we use comparative operators, the formula (or formula element) will deliver a TRUE or FALSE.

Example:

	B	C	D	E	F
122	Debit (DR)	Credit (CR)			
123	35.74	35.74			
124	73.61	73.61			
125	113.08	113.08			
126	100.49	100.5			
127	17.7	17.7			
128	107.38	107.38			
129	448	448	In Balance?	FALSE	=B129=C129

When we use a Comparative Operator (= in this example), the formula is a Logical Formula

3) Other Types of formulas in Excel that are not seen in this class (but are seen in other classes I teach at Highline):

- i. Text Formulas
- ii. Array Formulas
- iii. DAX Formulas
- iv. Power Query Formulas

7) How to Build Formulas for Business Math

- 1) Equal Sign as first character in cell starts all formulas.
- 2) Follow Excel's Golden Rule for formula inputs
 - i. If a formula input can change, put it into a cell and refer to it in the formula with a cell reference.
 - ii. If a formula input will not change, you can type it into a formula (like 12 months in a year or 7 days in a week). Typing a Formula Input into a formula is called "Hard Coding" Formula Input into formula.
 - iii. Always label your formula inputs so that the formula input can be clearly understood by any user of the Excel spreadsheet solution.
- 3) Formula Elements (things you can put into a formula):
 - i. Equal Sign to Start Formula
 - ii. Cell References:
 1. Relative Cell References, like: A1 or A1:A10
 2. Absolute Cell References, like: \$A\$1 or \$A\$1:\$A\$10
 - iii. Math operators: -, +, %, *, ^, and ()
 - iv. Numbers (if they won't change)
 - v. Built-in Functions, like SUM or ROUND
 - vi. Comparative operators, >, <, >=, <=, =, <>
- 4) Math Order of Operations:
 - i. When using more than one math operator, this is the order in which Excel will calculate the operations:
 1. Operations inside Parenthesis
 2. Exponents
 3. Multiplication & Division, Left To Right
 4. Adding & Subtracting, Left To Right
- 5) Use ROUND Function When Three Conditions Met:
 - i. You are required to round, like with Money.
 - ii. You have extraneous decimals, like past the penny position.
 - iii. You will use formula result in a subsequent formula.
- 6) SUM Function hints:
 - i. Use SUM Function rather than many plus symbols.
 1. It is faster.
 2. If you insert a row in between the start and end cell in the range, SUM will update.
 3. YES: =SUM(D128:D137)
 4. NO: =C128+C129+C130+C131+C132+C133+C134+C135+C136+C137
 - ii. Do not wrap SUM Function around a calculation when the SUM Function is not necessary:
 1. It is adds unnecessary complication to the formula: Formula is harder to read and internally it takes Excel longer to calculate
 2. YES: =D146/12 NO: =SUM(C146/12)

8) Examples 8 to 16 From Video

	A	B	C	D	E	F	G	H	I	J
32	Ex 8	Goal: Calculate average and maximum value for each quiz								
33		Type of Formula: Number Formula.								
34		Formula Elements: Equal Sign, Built-in Function,								
35		Relative Range of Cells								
36										
37		Student	Quiz 1	Quiz 2	Quiz 3	Quiz 4				
38		Sioux	17	13	10	23				
39		Tyrone	24	21	24	25				
40		Abdi	15	12	13	15				
41		Gigi	25	19	23	24				
42		Timmy	19	15	9	7				
43		Chin	23	17	23	9				
44		Miki	15	19	20	25				
45		Average	20	17	17	18	Formula in cell C45 is: =AVERAGE(C38:C44)			
46		Max	25	21	24	25	Formula in cell C46 is: =MAX(C38:C44)			
47										
48	Ex 9	Goal: Calculate Monthly Insurance Expense.								
49		Type of Formula: Number Formula.								
50		Formula Elements: Equal Sign, Cell Reference,								
51		Math Operator, Number.								
52										
53		Annual Insurance	\$13,500.00							
54		Monthly Allocation	\$1,125.00							
55			Formula in cell C54 is: =C53/12							
56										
57	Ex 10	Goal: Calculate Cost of Goods Sold (COGS) in Accounting								
58		Type of Formula: Number Formula.								
59		Formula Elements: Equal Sign, Parenthesis, Relative Cell Reference, Math Operator,								
60		Relative Cell Reference, Parenthesis, Math Operator, Relative Cell Reference								
61										
62		Product	Beginning Quantity	End Quantity	Value Each	COGS				
63		Aspen	100	50	10	500	Formula in cell F63 is: =(C63-D63)*E63			
64		Quad	146	117	20	580				
65		Carlota	108	102	15	90				
66		Bellen	61	47	10	140				
67		Sunset	54	51	12	36				

	A	B	C	D	E	F	G	H	I	J	
69	Ex 11	Goal: Calculate Deduction for Each Employee, then Calculate a Total for Deductions.									
70		The Tax Rate is 0.1675.									
71		Type of Formulas: Number Formulas.									
72		Formula Elements: Equal Sign, Built-In Function, Relative Cell Reference,									
73		Math Operator, Absolute Cell Reference, Number									
74											
75		Employee	Gross Pay	Deduction				Tax Rate			
76		Sioux	\$2,830.34	\$474.08	Formula in cell D76 is: =ROUND(C76*\$H\$76,2)			0.1675			
77		Chin	\$2,239.93	\$375.19							
78		Tyrone	\$2,953.98	\$494.79							
79		Gigi	\$2,926.74	\$490.23							
80			Total	\$1,834.29	Formula in cell D80 is: =SUM(D76:D79)						
81											
82	Ex 12	Goal: Calculate where each student earned an honors badge.									
83		Honors is assigned when the average quiz score is greater than 22.5									
84		Type of Formula: Logical Formula.									
85		Formula Elements: Equal Sign, Relative Cell Reference,									
86		Comparative Operator, Absolute Cell Reference						Hurdle	22.5		
87											
88		Student	Quiz 1	Quiz 2	Quiz 3	Quiz 4	Average	Honors?			
89		Sioux	17	13	10	23	16	FALSE	Formula in cell H89 is: =G89>=\$H\$86		
90		Tyrone	24	21	24	25	24	TRUE			
91		Abdi	15	12	13	15	14	FALSE			
92		Gigi	25	19	23	24	23	TRUE			
93		Timmy	19	15	9	7	13	FALSE			
94		Chin	23	17	23	9	18	FALSE			
95		Miki	15	19	20	25	20	FALSE			

	A	B	C	D	E	F	G	H	I	J
97	Ex13	Goal: Formula to determine whether we need to reorder?								
98		If End Quantity is less than 75, we must re-order.								
99		Type of Formula: Logical Formula.								
100		Formula Elements: Equal Sign, Built-in Function, Absolute Range of Cells,								
101		Relative Cell Reference								
102										
103		Product	Beginning Quantity	End Quantity	Do we need to Re-order?				Reorder Hurdle	
104		Aspen	114	45	TRUE	Formula in cell E104 is: =D104<\$I\$104			75	
105		Quad	146	121	FALSE					
106		Carlota	108	102	FALSE					
107		Bellen	61	21	TRUE					
108		Sunset	54	51	TRUE					
109										
110	Ex 14	Goal: Calculate Commission for Each Employee, then Calculate a Total for Commissions.								
111		The Commission Rate is 0.025								
112		Type of Formulas: Number Formulas.								
113		Formula Elements: Equal Sign, Built-In Function, Relative Cell Reference,								
114		Math Operator, Absolute Cell Reference, Number								
115										
116		Employee	Sales	Commission				Commission Rate		
117		Sioux	\$297,538.88	\$7,438.47	Formula in cell D117 is: =ROUND(C117*\$H\$117,2)			0.025		
118		Chin	\$378,065.76	\$9,451.64						
119		Tyrone	\$485,157.58	\$12,128.94						
120		Gigi	\$340,380.05	\$8,509.50						
121			Total	\$37,528.55	Formula in cell D121 is: =SUM(D117:D120)					

9) Condensed Formula Notes From Video:

Formula Types:

- 1) **Number formulas** that deliver a single number answers such as a tax deduction or a insurance expense.
- 2) **Logical formulas** (Boolean Formulas) deliver a TRUE or FALSE.

Excel's Golden Rule: If a formula input can change, put it in cell, label it and refer to it with a cell reference.

Formula Elements:

- 1) Equal sign, =
- 2) Cell references, like A1, \$A\$1, A1:A10, \$A\$1:\$A\$10
- 3) Math operators, -, +, /, *, ^, and ()
- 4) Numbers (if they won't change), like 12 months
- 5) Built-in Functions, like SUM and ROUND
- 6) Comparative operators, >, <, >=, <=, =, <>

Math order of operations

()

^

* / Left to Right

+ - Left to Right

When to use ROUND Function

- 1) You are required to round, like with Money.
- 2) You have extraneous decimals, like past the penny position.
- 3) You will use formula result in a subsequent formula.

SUM Function Hints:

- 1) Use SUM Function rather than many plus symbols.
- 2) Do not wrap SUM Function around a calculation when the SUM Function is not necessary:

10) Excel's Complete Formula Order of Operations, for Math, Comparative and Join Operators

1 **Parenthesis ()**

2 **Reference Operators:** colon, comma

Example of colon in range of cells: =SUM(A1:A4)

Example of comma (union): =SUM(E10:G10,E14:G14)

3 **Negation (-)**

Example: =-2^4 = 16

Example: =-(2^4) = -16

4 **Converts % (1% to .01)**

5 **Exponents (^)**

Example: 3^2 = 9

6 **Multiplication (*) and Division (/), left to right**

7 **Adding (+) and Subtracting (-), left to right**

8 **Ampersand (&)**

9 **Comparative symbols: =, <>, >=, <=, <, >**