Data Analysis & Business Intelligence Made Easy with Excel Power Tools
Excel Data Analysis Basics = E-DAB
Notes for Video:
E-DAB-03: Summary Reports with Excel Spreadsheet Formulas

Objectives of Video:

1. Excel Spreadsheet Formulas Uses in Data Analysis

Objective #1: Excel Spreadsheet Formulas Uses in Data Analysis

Excel Spreadsheet Formulas are the only feature in Excel that update instantly when source data changes.
When you want a Data Analysis Excel Solution to respond instantly to changes in the source data, use formulas.
Other Data Analysis Excel Solution such as PivotTables and Power Query respond to changes in the source data only after using the refresh command.

Date	Sales Rep	Autos	Sales
2/11/2019	Alma	Chevy	$38,016
2/11/2019	Tyrone	Chevy	$71,182
2/11/2019	Jaeyoung	Honda	$70,720
2/11/2019	Alma	Chevy	$69,598
2/11/2019	Tyrone	Honda	$55,299
2/11/2019	Jaeyoung	Toyota	$63,882
2/12/2019	Alma	Toyota	$47,352
2/12/2019	Tyrone	Ford	$53,105
2/12/2019	Jaeyoung	Toyota	$32,058
2/12/2019	Alma	Honda	$33,415
2/12/2019	Tyrone	Honda	$71,880
2/13/2019	Jaeyoung	Ford	$63,092
2/13/2019	Alma	Ford	$37,432
2/13/2019	Tyrone	Ford	$45,376
2/13/2019	Jaeyoung	Chevy	$57,034
2/13/2019	Tyrone	Honda	$45,881
2/13/2019	Tyrone	Honda	$39,950
1/14/2019	Alma	Ford	31980
1/14/2019	Tyrone	Toyota	45789
1/14/2019	Jaeyoung	Honda	55299
1/14/2019	Alma	Toyota	63882
1/14/2019	Tyrone	Toyota	47352
1/14/2019	Jaeyoung	Chevy	29870
1/14/2019	Alma	Honda	31852

Total Sales ($)				
Autos/ Sales Rep	Alma	Jaeyoung	Tyrone	**Total**
Chevy	107,614	57,034	71,182	235,830
Ford	37,432	63,092	98,481	199,005
Honda	33,415	70,720	213,010	317,145
Toyota	47,352	95,940	0	143,292
Total	225,813	286,786	382,673	895,272

Reports built with **Excel Spreadsheet Formulas** update instantly when source data changes.

Sum of Sales ($)	Sales Rep			
Autos	**Alma**	**Jaeyoung**	**Tyrone**	**Grand Total**
Chevy	107,614	57,034	71,182	235,830
Ford	37,432	63,092	98,481	199,005
Honda	33,415	70,720	213,010	317,145
Toyota	47,352	95,940		143,292
Grand Total	**225,813**	**286,786**	**382,673**	**895,272**

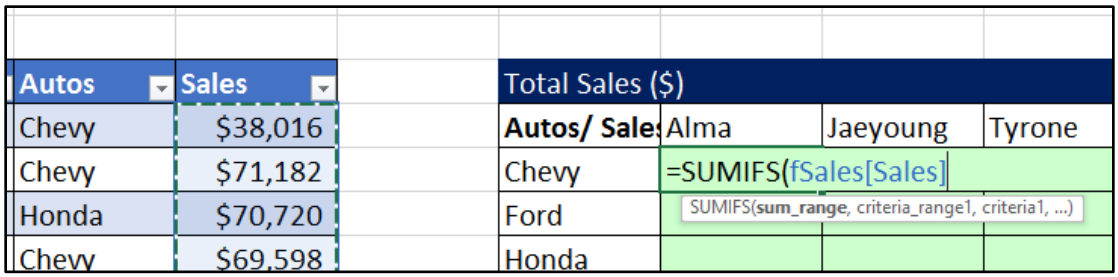
Reports built with **Excel PivotTables** require you to refresh the Report when source data changes.

As seen in the video, when this new data is added to the Excel Table, the **formula report will respond instantly.**

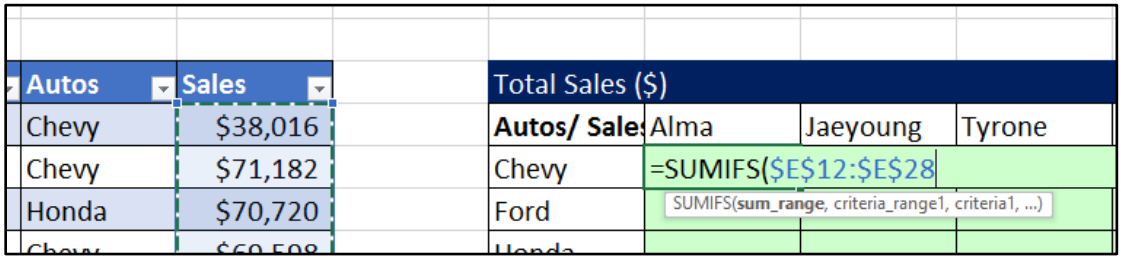
2. <u>Change Default Settings for Table Formula Nomenclature (Structured References).</u>

When we refer to a Field or Column in an Excel Table, we can choose one of two options:

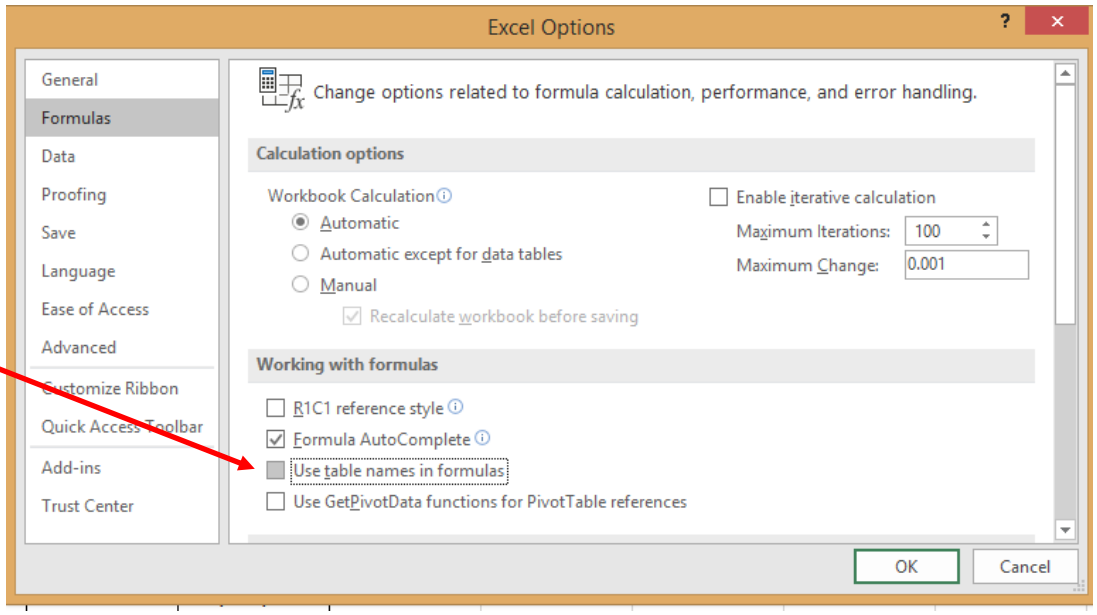
1. Table Name and then field name in square brackets, called Table Formula Nomenclature (or Structured References), as seen here:



2. We can use the actual cell references as seen here:



3. To change the default setting for referring to a File or Column in an Excel Table, Go to the File Ribbon Tab, Then to Options, then on the left click on the Formula tab, then check or uncheck the option "", as seen here:



3. Cell References in Formulas.

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: $A$1
        - 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 $A$1, 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.

4. Excel Functions to Make Calculations Based on one Condition, four examples:

5. SUMIFS Function with One Condition shown on next page in cell H13

6. SUMIFS Function with One Condition & Dynamic Array shown on next page in cell K13

7. COUNTIFS Function with One Condition shown on next page in cell H24

8. COUNTIFS Function with One Condition & Dynamic Array shown on next page in cell K24

Date	Sales Rep	Autos	Sales
2/11/19	Alma	Chevy	$43,000
2/11/19	Tyrone	Chevy	$71,182
2/11/19	Jaeyoung	Honda	$70,720
2/11/19	Alma	Chevy	$69,598
2/11/19	Tyrone	Honda	$55,299
2/11/19	Jaeyoung	Toyota	$63,882
2/12/19	Alma	Toyota	$47,352
2/12/19	Tyrone	Ford	$53,105
2/12/19	Jaeyoung	Toyota	$32,058
2/12/19	Alma	Honda	$33,415
2/12/19	Tyrone	Honda	$71,880
2/13/19	Jaeyoung	Ford	$63,092
2/13/19	Alma	Ford	$37,432
2/13/19	Tyrone	Ford	$45,376
2/13/19	Jaeyoung	Chevy	$57,034
2/13/19	Tyrone	Honda	$45,881
2/13/19	Tyrone	Honda	$39,950
1/14/19	Tyrone	Subaru	$39,500
1/14/19	Alma	Ford	$31,980
1/14/19	Tyrone	Toyota	$45,789
1/14/19	Jaeyoung	Honda	$55,299
1/14/19	Alma	Toyota	$63,882
1/14/19	Tyrone	Toyota	$47,352
1/14/19	Jaeyoung	Chevy	$29,870
1/14/19	Alma	Honda	$31,852

Summary Report - Adding with 1 Condition

Spreadsheet Formulas:

Autos	Total Sales
Chevy	$270,684
Ford	$230,985
Honda	$404,296
Subaru	$39,500
Toyota	$300,315

Office 365 Dynamic Array Formulas:

Autos	Total Sales
Chevy	$270,684.00
Ford	$230,985.00
Honda	$404,296.00
Subaru	$39,500.00
Toyota	$300,315.00

Summary Report - Counting with 1 Condition

Spreadsheet Formulas:

Autos	Count Sales
Chevy	5
Ford	5
Honda	8
Subaru	1
Toyota	6

Office 365 Dynamic Array Formulas:

Autos	Count Sales
Chevy	5
Ford	5
Honda	8
Subaru	1
Toyota	6

Formula in cell H13: =SUMIFS($E$9:$E$33,$D$9:$D$33,G13)

Formula in cell K13: =SUMIFS(E9:E33,D9:D33,J13#)

Formula in cell H24: =COUNTIFS($D$9:$D$33,G24)

Formula in cell K24: =COUNTIFS(D9:D33,J24#)

9. Excel Functions to Make Calculations Based on an AND Logical Text.

i. Functions that can perform AND Logical Tests:
    1. SUMIFS: Adds numbers with one or more conditions or criteria
    2. COUNTIFS: Counts with one or more conditions or criteria
    3. AVERAGEIFS: Averages numbers with one or more conditions or criteria
    4. MAXIFS: Finds Maximum number with one or more conditions or criteria
    5. MINIFS: Finds Minimum number with one or more conditions or criteria

ii. Each function has arguments that you must enter to make the AND Logical Test Calculation.

iii. Examples of arguments for SUMIFS and COUNTIFS:

SUMIFS(**sum_range, criteria_range1, criteria1, criteria_range2, criteria2…)**

- The SUMIFS function adds with 1 or more conditions/criteria.
- **sum_range** argument will contain the range with the numbers.
- **criteria_range1** argument will contain the range with all the items being considered.
- **criteria1** argument contains the specific condition or criteria that tells the function what to consider.
- You can up to 127 pairs of criteria_rangeN and criteriaN argumnets

COUNTIFS(**criteria_range1, criteria1, criteria_range2, criteria2…)**

- The COUNTIFS function counts with 1 or more conditions/criteria.
- **criteria_range1** argument will contain the range with all the items being considered.
- **criteria1** argument contains the condition or criteria that tells the function what to count.
- You can up to 127 pairs of criteria_rangeN and criteriaN argumnets

iv. Examples on Next Page:

10. SUMIFS for Summary Report Based on Adding, Old School Cell References and Dynamic Arrays.

11. COUNTIFS for Summary Report Based on Counting, Old School Cell References and Dynamic Arrays.

12. AVERAGEIFS for Summary Report Based on Averaging, Old School Cell References and Dynamic Arrays.

Goals:

1. We want a Cross Tabulated Report showing Total Sales by Auto and Sales Rep.
2. We want a Cross Tabulated Report showing Average Sales by Auto and Sales Rep.
3. We want a Cross Tabulated Report showing the Count of Transactions by Auto and Sales Rep.
4. We are entering data each day and we want reporting solution to update instantly when we add new sales data.

Date	Sales Rep	Autos	Sales
2/11/19	Alma	Chevy	$38,016
2/11/19	Tyrone	Chevy	$71,182
2/11/19	Jaeyoung	Honda	$70,720
2/11/19	Alma	Chevy	$69,598
2/11/19	Tyrone	Honda	$55,299
2/11/19	Jaeyoung	Toyota	$63,882
2/12/19	Alma	Toyota	$47,352
2/12/19	Tyrone	Ford	$53,105
2/12/19	Jaeyoung	Toyota	$32,058
2/12/19	Alma	Honda	$33,415
2/12/19	Tyrone	Honda	$71,880
2/13/19	Jaeyoung	Ford	$63,092
2/13/19	Alma	Ford	$37,432
2/13/19	Tyrone	Ford	$45,376
2/13/19	Jaeyoung	Chevy	$57,034
2/13/19	Tyrone	Honda	$45,881
2/13/19	Tyrone	Honda	$39,950

Cross Tabulated Report for Total Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	107,614	57,034	71,182
Ford	37,432	63,092	98,481
Honda	33,415	70,720	213,010
Toyota	47,352	95,940	0

Cross Tabulated Report for Average Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	53,807	57,034	71,182
Ford	37,432	63,092	49,241
Honda	33,415	70,720	53,253
Toyota	47,352	47,970	0

Cross Tabulated Report for Count of Transactions

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	2	1	1
Ford	1	1	2
Honda	1	1	4
Toyota	1	2	0

Cross Tabulated Report for Total Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	107,614	57,034	71,182
Ford	37,432	63,092	98,481
Honda	33,415	70,720	213,010
Toyota	47,352	95,940	0

Cross Tabulated Report for Average Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	53,807	57,034	71,182
Ford	37,432	63,092	49,241
Honda	33,415	70,720	53,253
Toyota	47,352	47,970	0

Cross Tabulated Report for Count of Transactions

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone
Chevy	2	1	1
Ford	1	1	2
Honda	1	1	4
Toyota	1	2	0

Old School Cell Reference Formulas:

Formula in cell H12: =SUMIFS($E$11:$E$27,$C$11:$C$27,H$11,$D$11:$D$27,$G12)

Formula in cell H20: =IFERROR(AVERAGEIFS($E$11:$E$27,$D$11:$D$27,$G20,$C$11:$C$27,H$19),0)

Formula in cell H27: =COUNTIFS($D$11:$D$27,$G27,$C$11:$C$27,H$26)

New School Dynamic Array Formulas:

Formula in cell H13: =SUMIFS($E$11:$E$27,$C$11:$C$27,H$11,$D$11:$D$27,$G13)

Formula in cell N20: =IFERROR(AVERAGEIFS(E11:E27,D11:D27,M20#,C11:C27,N19#),0)

Formula in cell N27: =COUNTIFS(D11:D27,M27#,C11:C27,N26#)

13. Screen Shots of Old School Formulas with Totals on Worksheet Named “Old School with Totals”.

Objective #5: SUMIFS for Summary Report Based on Adding

Goals:

1 We want a Cross Tabulated Report showing Total Sales by Auto and Sales Rep.

2 We want a Cross Tabulated Report showing Average Sales by Auto and Sales Rep.

3 We want a Cross Tabulated Report showing the Count of Transactions by Auto and Sales Rep.

4 We are entering data each day and we want reporting solution to update instantly when we add new sales data.

Formula in Cell H15: =SUMIFS($E$14:$E$30,$D$14:$D$30,$G15,$C$14:$C$30,H$14) copied through range H15:J18

The SUM Function is used to calculated the Totals (Alt + = is keyboard for SUM Function).

Date	Sales Rep	Autos	Sales
2/11/19	Alma	Chevy	$38,016
2/11/19	Tyrone	Chevy	$71,182
2/11/19	Jaeyoung	Honda	$70,720
2/11/19	Alma	Chevy	$69,598
2/11/19	Tyrone	Honda	$55,299
2/11/19	Jaeyoung	Toyota	$63,882
2/12/19	Alma	Toyota	$47,352
2/12/19	Tyrone	Ford	$53,105
2/12/19	Jaeyoung	Toyota	$32,058
2/12/19	Alma	Honda	$33,415
2/12/19	Tyrone	Honda	$71,880
2/13/19	Jaeyoung	Ford	$63,092
2/13/19	Alma	Ford	$37,432
2/13/19	Tyrone	Ford	$45,376
2/13/19	Jaeyoung	Chevy	$57,034
2/13/19	Tyrone	Honda	$45,881
2/13/19	Tyrone	Honda	$39,950

Cross Tabulated Report for Total Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone	Total
Chevy	107,614	57,034	71,182	235,830
Ford	37,432	63,092	98,481	199,005
Honda	33,415	70,720	213,010	317,145
Toyota	47,352	95,940	0	143,292
Total	225,813	286,786	382,673	895,272

SUMIFS in cell H15 adds the Sales for the Sales Rep "Alma" and the Auto "Chevy". In order for a number to be included in the calculation, the record must show the Sales Rep "Alma" and the Auto "Chevy".

Each cell in the interior of this Cross Tabulated Report (Cross-Tab) runs an AND Logical Test calculation to add Sales based on Sales Rep and Auto.

Objective #6: COUNTIFS for Summary Report Based on Counting

Formula in Cell N15: =COUNTIFS($D$14:$D$30,$M15,$C$14:$C$30,N$14) copied through range N15:P18

The SUM Function is used to calculated the Totals (Alt + = is keyboard for SUM Function).

Cross Tabulated Report for Counting Transactions

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone	**Total**
Chevy	2	1	1	4
Ford	1	1	2	4
Honda	1	1	4	6
Toyota	1	2	0	3
Total	5	5	7	17

Objective #7: AVERAGEIFS for Summary Report Based on Averaging

Using the AVERAGEIFS function we calculated 4 different averaging formulas to create this report

Cross Tabulated Report for Averaging Transactional Sales ($)

Autos/ Sales Rep	Alma	Jaeyoung	Tyrone	**Total**
Chevy	53,807	57,034	71,182	58,958
Ford	37,432	63,092	49,241	49,751
Honda	33,415	70,720	53,253	52,858
Toyota	47,352	47,970		47,764
Total	45,163	57,357	54,668	52,663

Formula in Cell N28: =IF(N15=0,"",AVERAGEIFS($E$14:$E$30,$D$14:$D$30,$M28,$C$14:$C$30,N$27)) copied through range N28:P31

Formula in Cell N32: =AVERAGEIFS($E$14:$E$30,$C$14:$C$30,N27) copied through range N32:P32

Formula in Cell Q28: =AVERAGEIFS($E$14:$E$30,$D$14:$D$30,M28) copied through range Q28:Q31

Formula in Cell Q32: =AVERAGE(E14:E30)

14. Office 365 Dynamic Array Notes from Worksheet named "O365 Dynamic Arrays".

Objective #8: Office 365 Dynamic Array Functions for Summary Report

In Office 365 Insider Edition, and then at a later release date in 2019, Microsoft has introduced a new Excel Calculation Engine and a new set or special Array Functions.
Some of the new Array Functions are SORT and UNIQUE. TRANSPOSE is an old Array Function that takes a vertical range and converts it to a horizontal range, and Vice Versa.
In addition, if we make a Function Argument Array Operation (putting more than one item into a function argument with the goal of getting the Function to spill multiple answers), the new Excel Calculation Engine will automatically spill the results in the correct number of cells.
To refer to a Spilled Array, use the top cell in the Spilled Array with a pound sign #, like: H20# to refer to the Spilled Array that lives in cell H20.
For a Spilled Array, the formula lives in the first cell and the remaining cells are gray to indicate that they spilled though the cells but not actually in the cell.
The Dynamic Array Functions will spill automatically and if the source data changes, the function will automatically update.

Goals:

1. We want a Cross Tabulated Report showing Total Sales by Auto and Sales Rep.
2. We are using Office 365 Insider Addition, or later in 2019 Microsoft says that these new Dynamic Array Formulas will be available.
3. We are entering data each day and we want reporting solution to update instantly when we add new sales data.

Date	Sales Re	Autos	Sales
2/11/19	Alma	Chevy	$38,016
2/11/19	Tyrone	Chevy	$71,182
2/11/19	Jaeyoung	Honda	$70,720
2/11/19	Alma	Chevy	$69,598
2/11/19	Tyrone	Honda	$55,299
2/11/19	Jaeyoung	Toyota	$63,882
2/12/19	Alma	Toyota	$47,352
2/12/19	Tyrone	Ford	$53,105
2/12/19	Jaeyoung	Toyota	$32,058
2/12/19	Alma	Honda	$33,415
2/12/19	Tyrone	Honda	$71,880
2/13/19	Jaeyoung	Ford	$63,092
2/13/19	Alma	Ford	$37,432
2/13/19	Tyrone	Ford	$45,376
2/13/19	Jaeyoung	Chevy	$57,034
2/13/19	Tyrone	Honda	$45,881
2/13/19	Tyrone	Honda	$39,950

Cross Tabulated Sales ($)

Sales Rep / Autos	Alma	Jaeyoung	Tyrone
Chevy	$107,614.00	$57,034.00	$71,182.00
Ford	$37,432.00	$63,092.00	$98,481.00
Honda	$33,415.00	$70,720.00	$213,010.00
Toyota	$47,352.00	$95,940.00	$0.00

Formula in Cell G21: =SORT(UNIQUE(D20:D36))
Formula in Cell H20: =TRANSPOSE(SORT(UNIQUE(C20:C36)))
Formula in Cell H21: =SUMIFS(E20:E36,C20:C36,H20#,D20:D36,G21#)