Excel's Top 15 All Time Hints and Tips

Take your Excel productivity and efficiency to a new level by learning about fifteen of Excel's greatest features and functions. In this session, you will learn how to turbo charge your Excel workbooks with features such as Fuzzy Lookups and Inquire, along with tips for solving rounding issues and reducing spreadsheet errors. After you implement the tips you learn in this session, your Excel productivity will be at levels you may have never thought possible.

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Introduction

Even in the newest versions of Excel, many time tested, tried and true tips and tricks continue to provide great value to Excel users. Couple that with new features and functionality such as Inquire and Tables, and Excel maintains its role as the "king of productivity" among applications used by accountants and other business professionals. This session will cover some of the top Excel tips and tricks of all time plus new productivity-enhancing features and functions of the latest versions. Among them are tips for enabling global rounding to avoid the "one-cent" rounding error in Excel, using the Camera to create dynamic reports from multiple ranges, overcoming the limitations of VLOOKUP with the Fuzzy Lookup add-in, building sum-through formulas with the SUM function and many, many more. Whether you are a new or experienced Excel user, don't miss this opportunity to improve your worksheet skills.

Learning Objectives

Upon completion of this course, participants should be able to:

- Describe how to use global rounding to eliminate rounding errors in Excel and eliminate positive and negative zeroes in worksheet reports
- Explain the impact of the accounting format on underlines and cell alignment
- List ways to select, copy, and paste data in a range without copying data in hidden rows or columns
- Use the Camera to create dynamic reports from worksheet snippets and for pasting Excel data into Word documents
- Identify multiple ways of summarizing data without using the SUM function
- Build sum-through formulas more effectively using the SUM function rather than using an arithmetic formula
- Work more efficiently in Excel while reducing the potential for errors

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Use the Camera to Create Composite Reports

1 Quite often, users would like to print several print areas on the same page. Their desired report is composed of multiple small snippets of a workbook or workbooks arranged on a single page. We refer to the resulting printable sheet as a *composite report*. Those faced with the task of building reports in this fashion understand the difficulty of achieving this result. Cutting and pasting doesn't work because the column widths of the individual snippets vary, so the report doesn't line up properly. Further, cutting and pasting static reports requires the process to be repeated when the underlying data changes. Building formulas to enable flow-through reporting is a better solution, but the process is time-consuming and cumbersome, and there is no guarantee that the data will line up any better than with cutting and pasting.

Enter the **Camera** tool. The **Camera** allows users to cut and paste *dynamic pictures* of data ranges that can then be arranged in any layout for display or printing. To use the **Camera**, first add the tool to the Quick Access Toolbar (QAT), as shown in **Figure 1**. Just click on the drop-down arrow at the far right end of the QAT and select **More Commands**. In the **Excel Options** dialog box, select **All Commands**. Place the cursor in the commands list and type "**C**" to reposition the cursor to commands that start with the letter "C." Then, scroll down in the list to select the **Camera** tool. Click **Add** and then **OK** to close the dialog box.

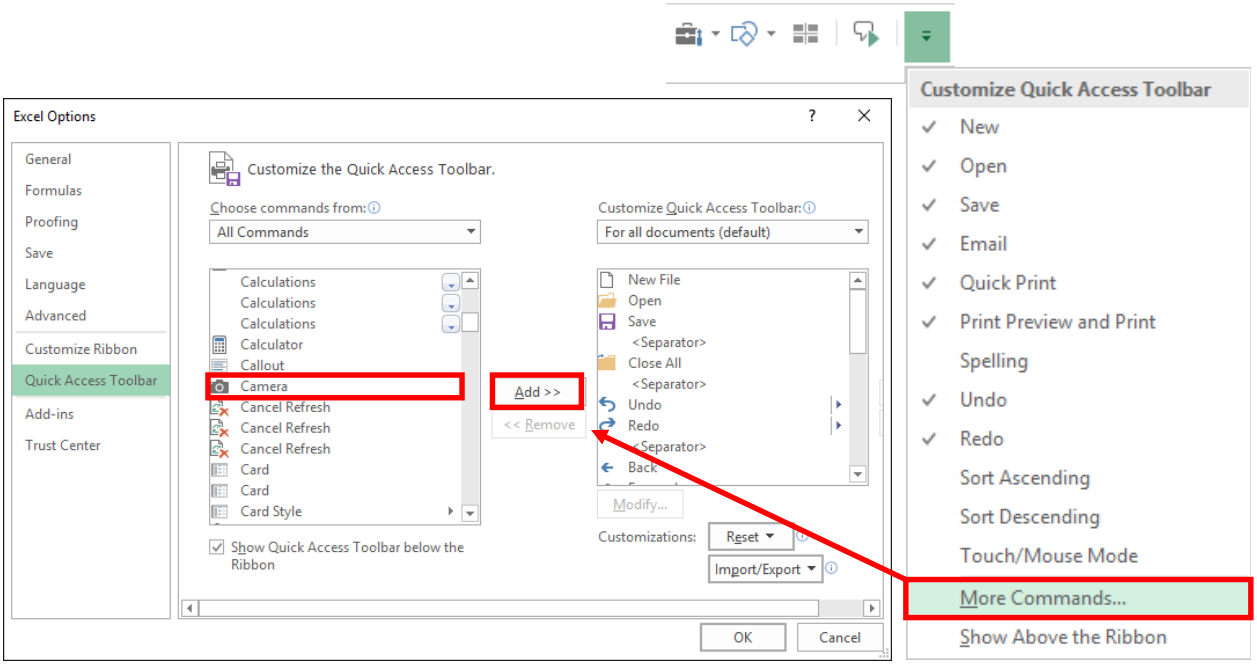

Figure 1 – Customizing the QAT to Add the Camera

The use of the **Camera** is very similar in operation to cut and paste. Highlight the range to copy and click the **Camera** toolbar button. Then, navigate to the worksheet that will serve as your composite report and click on the sheet with your mouse. A *picture* of your data snippet will be pasted on the worksheet. First, click-and-drag the picture to its proper location. Then, right-click on the picture and choose **Format Picture** in the context-sensitive menu. In the **Format Picture** task pane, click the **Paint Bucket** icon, expand the **Line** list, and then select **No line** to remove the border. Next, click the **Picture** icon, expand the **Picture Corrections** list, and select a picture correction in the **Presets** drop-down list that removes the gridlines

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(**Brightness: 0% (Normal) Contrast: +40%**). Repeat the process with other data snippets to build your composite report as shown in **Figure 2**.

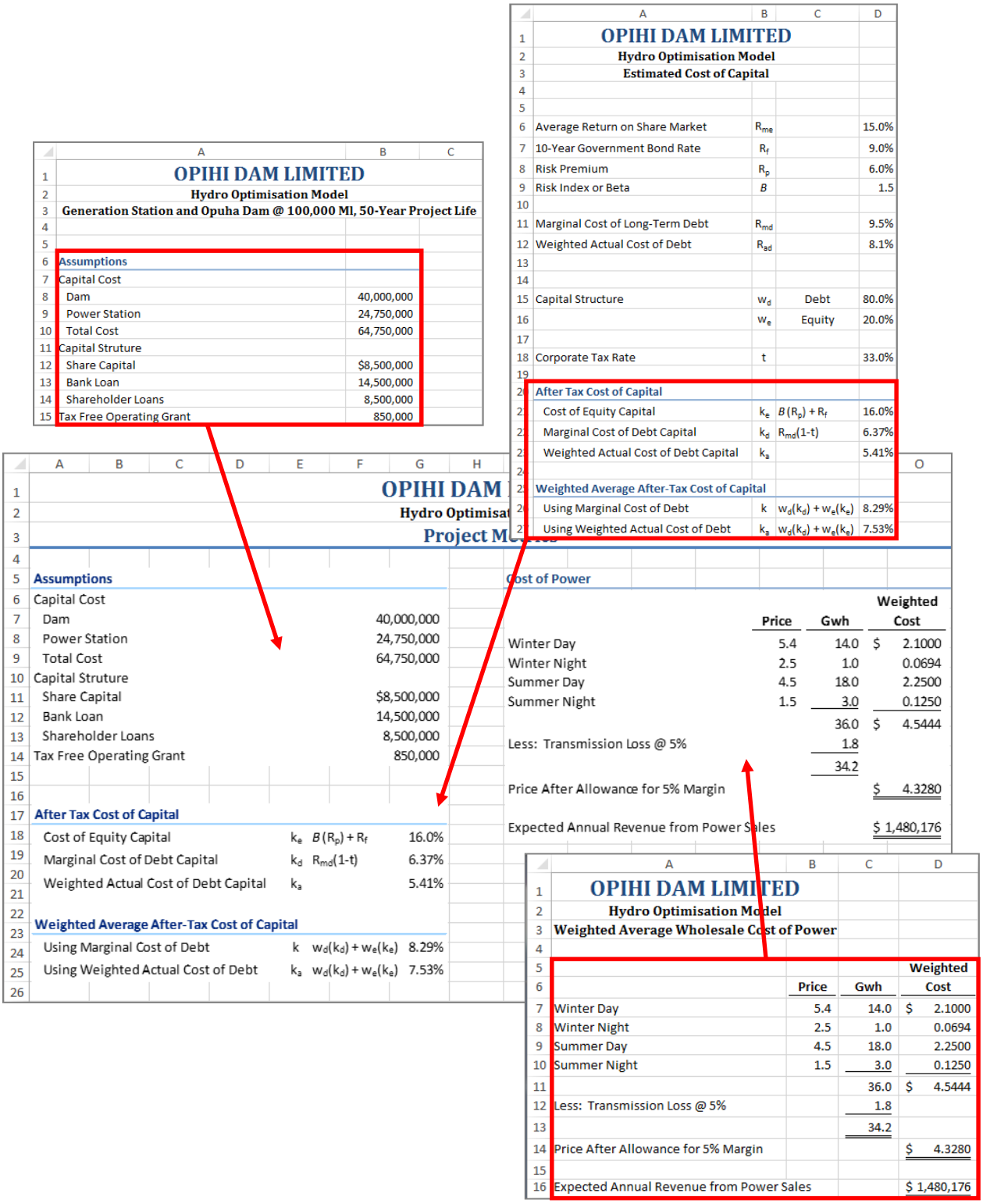

Figure 2 – Assembling a Composite Report Using the Camera

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2 Enhance Navigation, Filtering, and Printing with Custom Views

One of the little known but powerful features of Excel is the ability to create views of a workbook for use on demand. The feature, referred to as **Custom Views**, can be used to navigate or arrange a workbook for a specific purpose, or for capturing print or filter settings. Using Custom Views allows a *single* worksheet to have *multiple* print settings such as page orientation, margins, or headers and footers, etc. Most accounting professionals set up a worksheet to print an area, only to have to re-set the same worksheet to print another area, perhaps several times over. Furthermore, they may do this many times each month in multiple workbooks to create the reports they need. Custom Views can automate the process of creating multiple print areas and modifying the print settings without writing any macros. This has the potential to improve staff productivity dramatically. Similarly, Custom Views can be used to capture *multiple* complex filter settings in a worksheet to reduce the time spent setting and resetting filters during data analysis. Don't overlook the productivity gains to be made by using Custom Views for its most basic function, as a means of navigating and rearranging large workbooks.

To create a Custom View, do the following.

1. Rearrange the worksheet on the screen just as you want to use it. Make sure to reposition the cursor to the likely point of use.

2. From the **View** tab, select **Custom Views**. In the Custom Views dialog box, click **Add**. In the **Name** box of the **Add View** dialog, type in a name for your view and click **OK**.

To use this view, simply select **Custom Views** from the **View** tab. Then, highlight the view in the dialog box and click **Show** as shown in **Figure 3**. Your worksheet will be rearranged to show the view as it was originally created. Adding the Custom Views selection box to the QAT allows users to change views quickly within a workbook without using the dialog box.

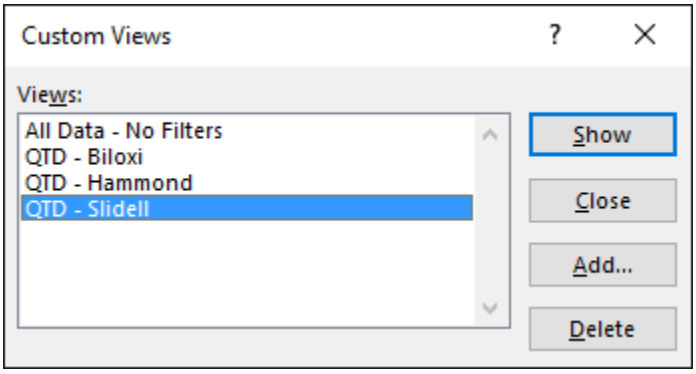

Figure 3 - Selecting a Custom View

Views can include settings for hidden rows and columns, frozen panes, window splits, data filters, and printing. A view cannot be edited directly. However, to work around this limitation, display the view that needs to be changed. Make the changes to the view as required and choose to add a new Custom View as described previously, making sure to save the view with the *same name*. Confirm the change by clicking **Yes** to overwrite the existing view.

Custom Views can contain print settings such as defined Print Areas, but they can also contain all other print settings that are defined in the **Page Setup** dialog box. For example, a view can contain settings for

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margins, shrink to fit, page orientation, headers and footers, rows or columns to be repeated, whether gridlines are to be printed, and even the printer from which the view is to be printed. Any print setting that is defined in the **Page Setup** dialog box can be captured in a view. Just make sure to set all relevant print settings *before* creating the Custom View.

Each workbook has its own set of Custom Views, so they must be created in each workbook or be included in user-defined templates. Since Custom Views are defined *within* workbooks, a view to another workbook cannot be produced directly. An effective workaround is to bring the desired data into the workbook where it is to be viewed or printed using formulas or Camera objects linked to the source workbook and then to create a Custom View of the linked data.

Use Inquire to Document and Compare Workbooks

Inquire is a Microsoft add-in for Excel 2013/2016 Professional Plus that allows users to compare versions of a workbook, check workbooks for problems and inconsistencies, and identify links between workbooks or worksheets. Office Professional Plus is available on Open License or in several Office 365 subscriptions (ProPlus, E3, or E5). In a nutshell, Inquire allows users to analyze, review, audit, and document their workbooks. By using Inquire, users will better understand the design and function of their workbooks as well as potential errors, data dependencies, and security issues.

If the **INQUIRE** tab does not appear in the ribbon, enable the add-in in Excel. Click **File, Options, Add-ins,** select **COM Add-ins** in the **Manage** box in the pane on the right, and then click **Go**. Check **Inquire** in the COM Add-ins dialog box and click **OK** to enable the add-in, which will now appear in the ribbon as shown in **Figure 4**.

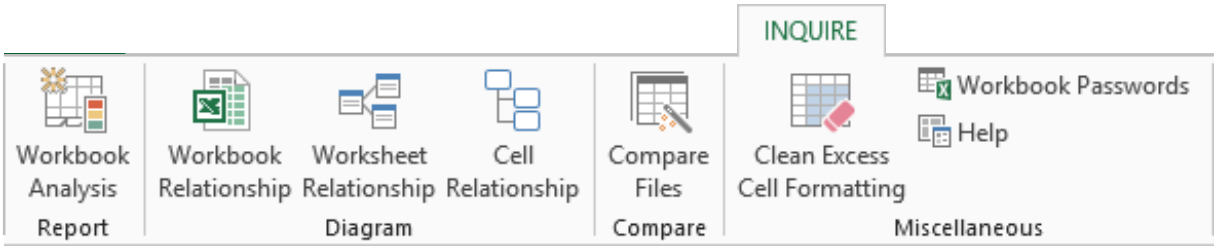

Figure 4 – Inquire Functionality Available from the Ribbon

The primary means of analyses available in Inquire are 1) a tool to analyze workbooks and provide textual summary reports;, 2) tools to identify and provide a graphical map of relationships among cells, worksheets, and workbooks, 3) a link to Spreadsheet Compare (a separate application that is included with Office 2013/2016 Professional Plus) for comparing workbook files, 4) a tool to remove excess formatting from empty cells in worksheets or workbooks, and 5) a password manager to ease the burden of analyzing password-protected files. The Inquire tools can be used in conjunction with or as a supplement to the formula auditing and evaluation tools available in all versions of Excel.

Workbook Analysis produces a comprehensive analysis of the workbook, sheet by sheet and cell by cell. The **Summary** section identifies any linked workbooks or data connections used by the workbook, provides a history of the file (author, creation date, last modification date), and identifies the number of hidden and unhidden sheets. Other sections comprehensively document formulas, cells, ranges, and warnings. Check any areas for which additional scrutiny is desired (such as formulas with errors or the

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workbook summary) and then click the **Excel Export** button to export the details to a separate analysis workbook. Click **Load Export File** to open the analysis workbook, which contains the selected details and a column for reviewer comments as shown in **Figure 5**. For complete and comprehensive documentation of a workbook, check **Items** in the Workbook Analysis Report before exporting it to Excel.

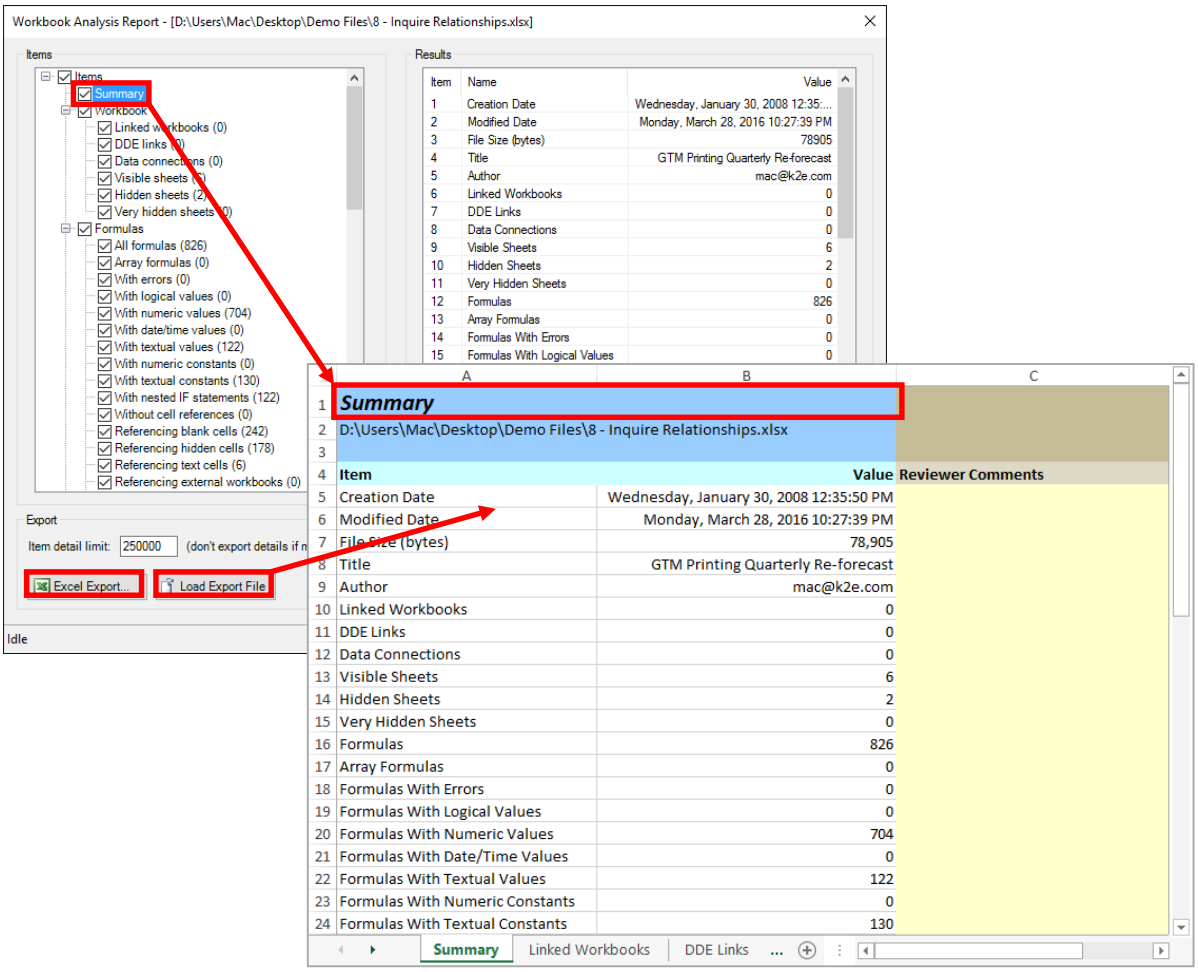

Figure 5 – Producing the Workbooks Analysis Report

Workbook Relationship produces a graphical map of all other workbooks to which the current workbook links. Likewise, **Worksheet Relationship** provides a graphical map of all other worksheets to which the currently active worksheet links. As shown in **Figure 6**, **Cell Relationship** allows users to visualize how other cells and ranges link to the currently selected cell. All of these tools are similar in the way they portray relationships and interact with a user. Any node on the map – workbook, worksheet, cell, or range of cells – can be repositioned on the map by clicking and dragging the node to another position. The arrows indicate the direction of the relationship between the nodes. To identify dependents or precedents better, right-click on a node and select **Highlight Dependents** or **Highlight Precedents** from the context-sensitive menu. Dependents will be highlighted in red, and precedents will be highlighted in blue. Selecting **Layout Children** will display the nodes in a pre-defined pattern.

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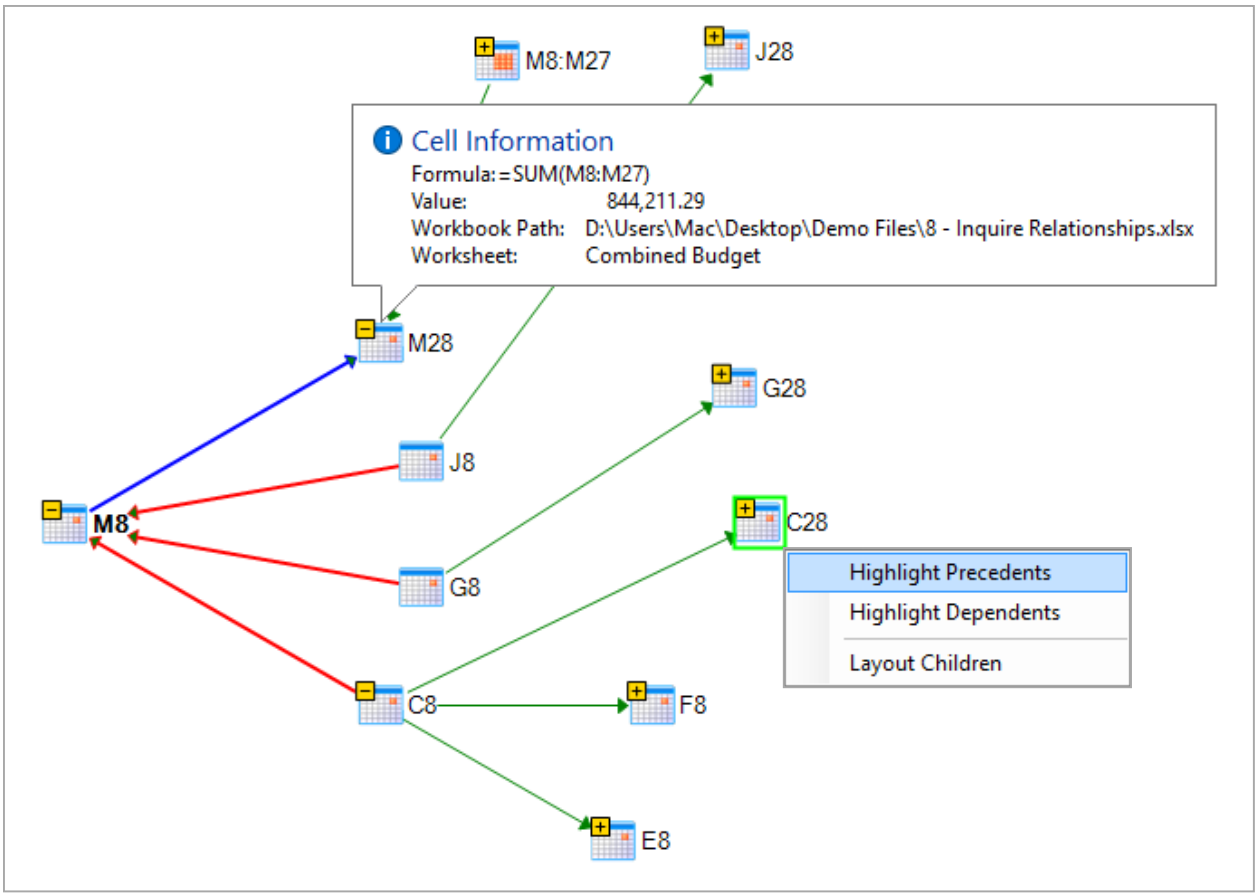

Figure 6 – Cell Relationship Map

Right-clicking the diagram's background allows users to zoom in or out on the map, adjust the layout to a pre-defined pattern, or remove highlights from the diagram. Hovering over a node activates a balloon popup that displays more detail about the node. Point to a node and click the plus sign (**+**) or minus sign (**–**) to expand or collapse the map from that node.

Compare Files evaluates two Excel workbooks and identifies cells that are different. First, open the files to be compared and click **Compare Files** on the **Inquire** tab. In the **Select Files to Compare** dialog box, select the open files to be compared. Click **Compare** to produce the analysis shown in **Figure 7**. The first file is displayed in the upper left panel and the second file in the upper right. Cells are color-coded to indicate the types of differences between the files. For example, dark green indicates differences in entered values, light green indicates differences in calculated values, and purple indicates differences in formulas. A tabular list of all differences is displayed in the lower left panel. A chart on the right displays the relative incidence of the differences by type.

Two other features round out the Inquire functionality. **Clean Excess Cell Formatting** provides users with a tool to clean unwanted formatting from blank cells, a common cause of bloated files and poor performance. Lastly, the **Workbook Passwords** feature is used to save workbook passwords. This relieves users of having to log in to password-encrypted linked files when running an analysis or file comparison in Inquire.

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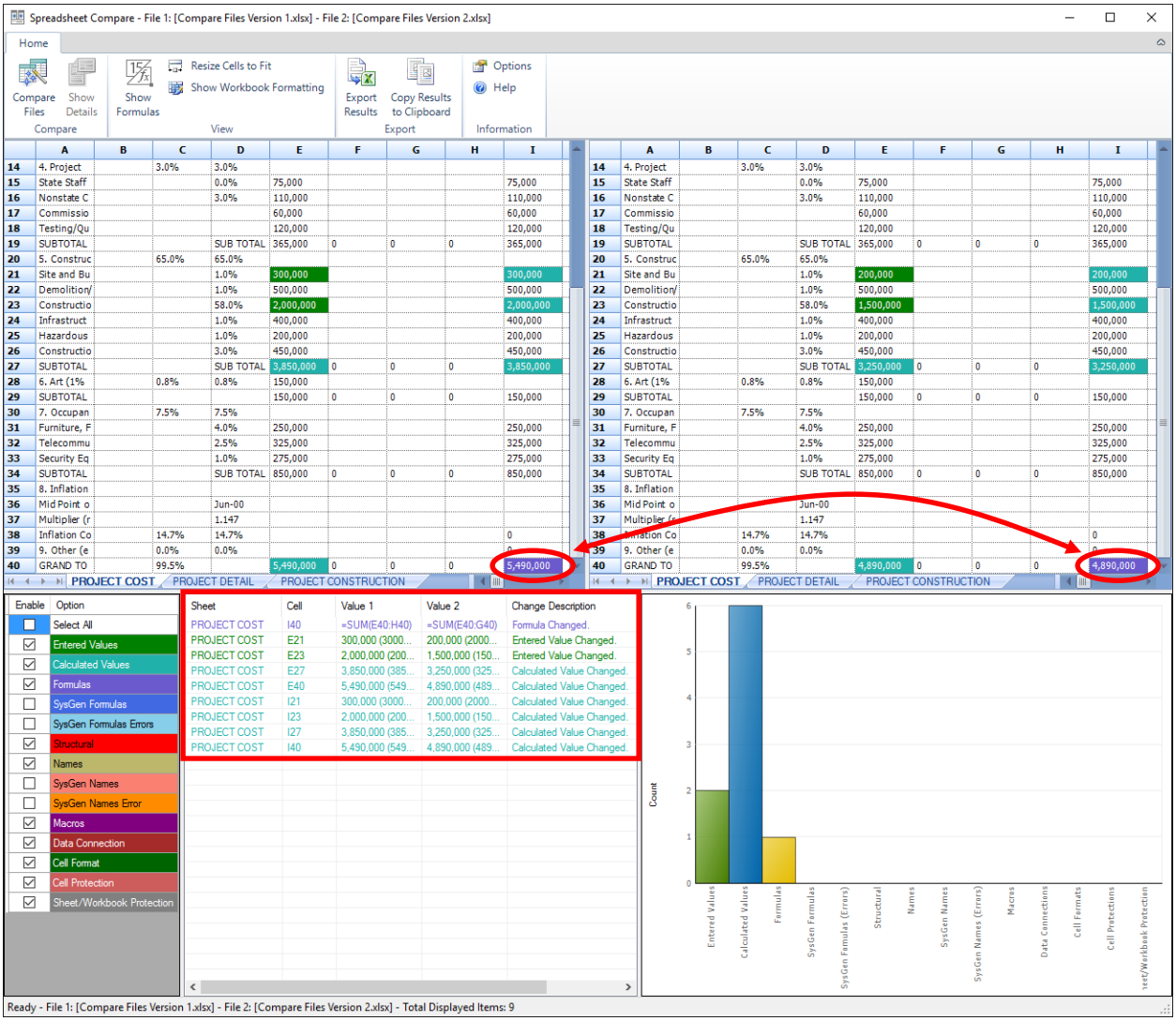

Figure 7 – Comparing Files to Identify Differences

Match Inexact Data with Fuzzy Lookup

When using Excel's VLOOKUP function, users sometimes don't get the results they were seeking because the data they are trying to match is not an exact match. For example, if you are using VLOOKUP to find *123 Main Street*, Excel will not match that to *123 Main St*. To match inexact records, Microsoft offers the **Fuzzy Lookup Add-in for Excel**. To use fuzzy lookup, you must first download and install the add-in from the Microsoft website. Note that the latest add-in works with all versions of Excel 2007 through 2016.

The Fuzzy Lookup Add-in matches inexact textual data stored in tables and allows users to join data from multiple Excel tables into one. **Figure 8** presents two tables that will be used to demonstrate fuzzy lookup. ***SSN*** is the name of the table on the left, and ***Compensation*** is the name of the table on the right. We would like to match the *Name* field in SSN to the *Name* field in Compensation and create a results list that shows employee names, Social Security numbers, and compensation. Note that all of the names are not spelled or arranged in the same manner. If we attempt to use an ordinary VLOOKUP function to complete

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this task, we will not be successful. For example, consider the name *Jan Kotas* on row 4 of the SSN table. In looking at row 8 of Compensation, we see that what should be the matching name is arranged as *Kotas, Jan*. Thus, a VLOOKUP function would not match the two names together. Likewise, *Robert Zare* on row 8 and *Thomas Axen* on row 13 of SSN are not exact matches to *Robert Zare, III* on row 11 and *T G Axen* on row 17 of Compensation, again presenting problems if we try to match the records using traditional methods.

	A	B	C	D	E
1	Name	SSN		Name	Compensation
2	Nancy Freehafer	111-11-1111		Jean Philippe Bagel	132,294
3	Andrew Cencini	111-11-1112		Ming-Yang Xie	131,754
4	Jan Kotas	111-11-1113		Anne Hellung-Larsen	131,622
5	Mariya Sergienko	111-11-1114		O'Donnell, Martin	131,306
6	Steven Thorpe	111-11-1115		Carlos Grilo	128,691
7	Michael Neipper	111-11-1116		Catherine Autier Miconi	127,624
8	Robert Zare	111-11-1117		Kotas, Jan	124,021
9	Laura Giussani	111-11-1118		Mikael Sandberg	118,776
10	Anne Hellung-Larsen	111-11-1119		Cornelia Weiler	118,388
11	Anna Bedecs	111-11-1120		Robert Zare, III	117,838
12	Antonio Gratacos Sols	111-11-1121		Johnathan Edwards	115,046
13	Thomas Axen	111-11-1122		Francisco Pérez-Olaeta	114,247
14	Christina Lee	111-11-1123		L T Sousa	113,109
15	Martin O'Donnell	111-11-1124		Ludick, Jr., Andre	112,387
16	Francisco Pérez-Olaeta	111-11-1125		Run Liu	112,022
17	Ming-Yang Xie	111-11-1126		T G Axen	108,507

Figure 8 - Tables for Fuzzy Lookup

However, we can match the data in these two tables using the Fuzzy Lookup Add-in. Simply click **Fuzzy Lookup** on the **Fuzzy Lookup** tab to start the process. Excel automatically senses and inserts the names of the tables into the Fuzzy Lookup task pane. Excel also automatically analyzes the columns in the tables and joins the tables if a column in one table has the same name as a column in the other table. In any case, users can edit both the table and column selections, if necessary.

In the **Output Columns** section, check the box next to each field to be included in your results list. In this example, we want the Name and SSN fields from the SSN table and the Compensation field from the Compensation table to be included in the output. We also want the system-generated *Similarity* score to be included. The Similarity score provides a measure of how "confident" Excel is in its matching of inexact data. With these processes complete, click **Go** to create the results listed in **Figure 9**.

A close inspection of the data in Figure 9 reveals that the tool worked well, though not flawlessly. It did not find matches for Mariya Sergienko or Thomas Axen. Return to the **Fuzzy Lookup** task pane and reduce the **Similarity Threshold** setting to **0.4** as shown in **Figure 10**. A threshold setting of 1.0 requires an *exact match*, just like VLOOKUP. As the similarity threshold is reduced, less similar items are matched, hence the name "fuzzy lookup."

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Employee	SSN	Compensation	Similarity
Nancy Freehafer	111-11-1111	73,977	0.9455
Andrew Cencini	111-11-1112	70,353	0.9455
Jan Kotas	111-11-1113	124,021	1.0000
Mariya Sergienko	111-11-1114		0.0000
Steven Thorpe	111-11-1115	79,014	0.9455
Michael Neipper	111-11-1116	78,288	1.0000
Robert Zare	111-11-1117	117,838	0.9333
Laura Giussani	111-11-1118	93,669	1.0000
Anne Hellung-Larsen	111-11-1119	131,622	1.0000
Anna Bedecs	111-11-1120	80,582	1.0000
Antonio Gratacos Solsona	111-11-1121	66,270	1.0000
Thomas Axen	111-11-1122		0.0000

Figure 9 - Sample Fuzzy Lookup Results

After modifying the Similarity Threshold, click **Go** to generate a new set of results. The Fuzzy Lookup Add-in matches all of the data in the tables without error.

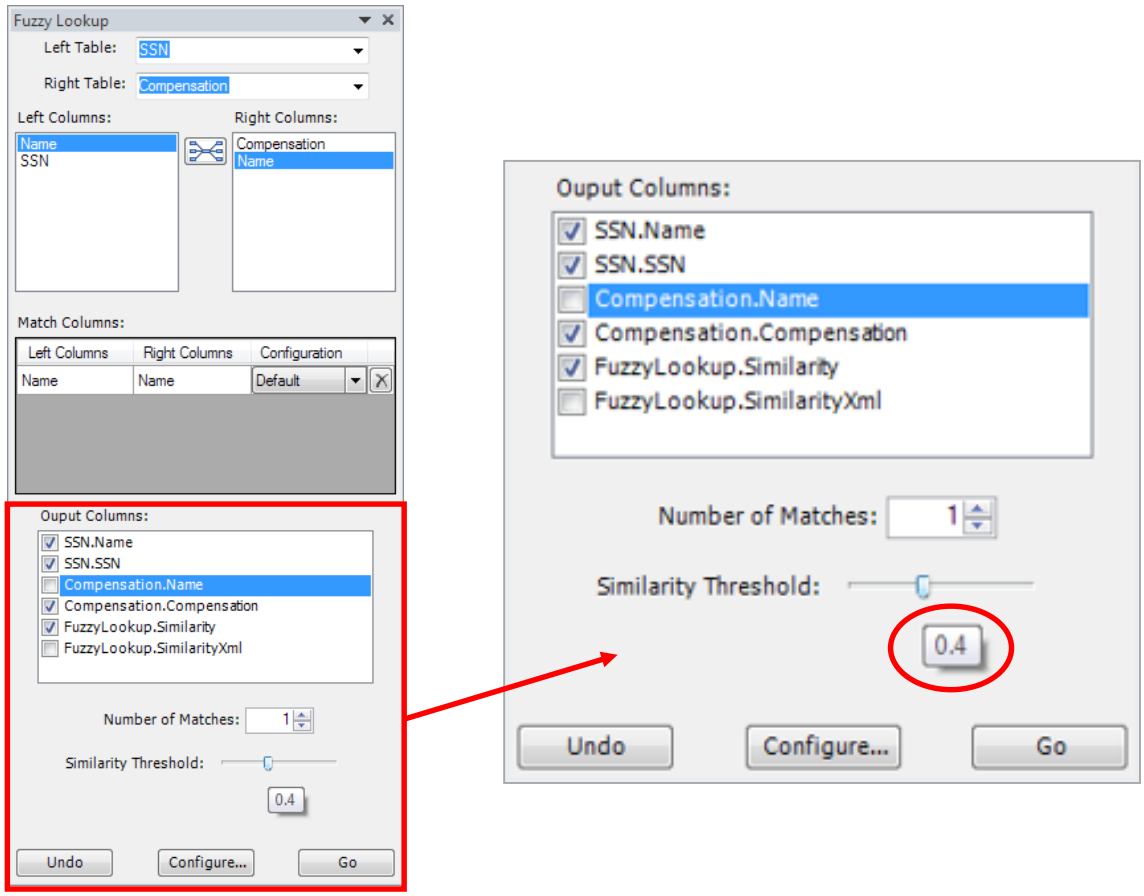

Figure 10 - Modifying the Similarity Threshold for a Fuzzy Lookup

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When faced with the task of matching inexact data, including names and addresses, many Excel users expend vast amounts of time cleaning up the data before using traditional techniques such as VLOOKUP. With the Fuzzy Lookup Add-in for Excel, that need not be the case. This free tool from Microsoft provides an extremely powerful and efficient means for matching data when perfect matches do not exist.

Take Advantage of the Accounting Format

5 When asked if they use the accounting format, many accounting professionals respond that they don't use it. In reality, the accounting format is probably the most frequently used number format within the profession. That's because the accounting format can be applied directly from the **Home** tab of the Ribbon or from the **Mini-Toolbar** as shown in **Figure 11**. The Mini-Toolbar appears whenever a user right-clicks on the worksheet grid.

Figure 11 – Accounting Format Buttons on the Ribbon and Mini-Toolbar

The dollar sign (**$**) button applies the accounting format with the dollar sign and two decimal places, while the comma (**,**) button applies the accounting format without the dollar sign. The accounting format displays negative numbers within parentheses and ensures that decimal points align – perfect for financial reports.

The most significant impact of the accounting format is its effect on the way single and double underlines are applied to numbers and labels. When using the accounting format, single and double underlines for subtotals, totals, and column headings do not span the entire column as do cell borders. The accounting format indents single and double underlines one character from the left and right cell margins. This provides the necessary break in underlines across adjacent columns without resorting to the common practice of inserting narrow *faux* columns to accomplish the same effect.

Figure 12 displays single and double underlines applied to labels and numbers in cells formatted with the accounting format. Notice how the single and double underlines do not quite span the width of the cells, thereby allowing for breaks in the underlines between adjacent columns. For single and double underlines to display and print properly for cells containing text rather than values, the single or double underline formats must be applied after applying the accounting format. For cells that are already underlined when the accounting format is applied, simply remove and then reapply the desired underline format.

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DNM Marketing Inc				
Annual Sales Performance Report for the Year Ending 2017				
In Millions of Dollars				
	Sales			
Region	Budgeted	Adjusted Budgeted	Actual	Variance from Adjusted Budget
Southern	$ 2.80	$ 2.70	$ 2.72	$ 0.02
Eastern	4.60	4.70	4.69	(0.01)
Midwestern	3.90	3.50	3.30	(0.20)
Mountain	1.70	1.70	1.65	(0.05)
Far West	4.70	4.80	4.82	0.02
	$ 17.70	$ 17.40	$ 17.18	$ (0.22)

Figure 12 – Single and Double Underlines Using the Accounting Format

Report in Thousands, Millions, or Billions with Custom Number Formats

6 Custom number formats can used to format numbers and text easily for financial reporting. For example, financial statements may need to be restated and reported in thousands, millions, or billions. While many accounting practitioners accomplish this task by dividing their actual data by an appropriate divisor, the same result can be accomplished by merely using a custom format to display the financial data in thousands, millions, or billions as shown in **Figure 13**.

To create a custom format to report in thousands, millions, or billions, first format your cells with the desired accounting formats – with or without decimals and dollar signs. Next, access the **Format Cells** dialog box with the dialog launcher in the **Font** group on the **Home** tab of the Ribbon or from the context-sensitive menu. In the **Format Cells** dialog box, select the **Number** tab and then **Custom** in the **Category** box. Modify the format code in the **Type** box to append commas to the positive and negative formats appropriate for your needs. To format the numbers in thousands, append one comma; for millions, append two commas; and for billions, append three commas. To display and print negative numbers in red, modify any number format to include the tag **[Red]** immediately preceding the negative number format code. Note that the buttons for increasing or decreasing the number of displayed decimal points work with these custom format codes.

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	YTD
Net Sales	$ 243,585,573.23
Cost of Goods Sold	156,498,219.84
Gross Margin	87,087,353.39
Operating Expenses	62,792,138.76
Income from Operations	24,295,214.63
Income Taxes	5,587,899.36
Net Income	$ 18,707,315.27

Thousands with Dollar Signs:

_($* #,##0.00,_);_($* (#,##0.00,);_($* "-"??_);_(@_)

Thousands without Dollar Signs:

_(* #,##0.00,_);_(* (#,##0.00,);_(* "-"??_);_(@_)

	YTD Thousands
Net Sales	$ 243,585.57
Cost of Goods Sold	156,498.22
Gross Margin	87,087.35
Operating Expenses	62,792.14
Income from Operations	24,295.21
Income Taxes	5,587.90
Net Income	$ 18,707.31

Millions with Dollar Signs:

_($* #,##0.00,,_);_($* (#,##0.00,,);_($* "-"??_);_(@_)

Millions without Dollar Signs:

_(* #,##0.00,,_);_(* (#,##0.00,,);_(* "-"??_);_(@_)

	YTD Millions
Net Sales	$ 243.59
Cost of Goods Sold	156.50
Gross Margin	87.09
Operating Expenses	62.79
Income from Operations	24.30
Income Taxes	5.59
Net Income	$ 18.71

Figure 13 - Using Custom Formats to Report in Thousands or Millions

Eliminate Rounding Errors with Precision as Displayed

7 Have you ever experienced the "one cent" rounding error in Excel? This is caused by the way Excel displays numbers and makes calculations. In default, Excel rounds off numbers for display but uses the underlying data to make calculations as did its predecessor, Lotus 1-2-3. This is especially problematical when summing floating-point calculations as shown in **Figure 14**. The conventional solution is to round off all of the intermediary calculations and then sum the rounded numbers.

An alternative solution is to turn on "global rounding," referred to in Excel as **Precision as Displayed**. Precision as displayed alters the way that Excel evaluates formulas. With precision as displayed enabled, Excel ignores the underlying data and uses the data displayed on the face of the worksheet to make calculations. Hence, when Precision as Displayed is enabled, all calculations will foot and cross-foot accurately without using the ROUND function. The example in Figure 14 will help in explaining Precision as Displayed.

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Units Rec'd	Product Code	PO	Total	Average Unit Cost
4	G217-9	06-1838	247.11	61.78
15	H77-9	06-1838	494.22	32.95
13	H83-3	06-1799	741.33	57.03
7	K562-3	06-1803	988.44	141.21
Total Received				292.96

Average Unit Cost
61.777500000000
32.948000000000
57.025384615385
141.205714285714
292.956598901099

With Precision as Displayed Disabled

Units Rec'd	Product Code	PO	Total	Average Unit Cost
4	G217-9	06-1838	247.11	61.78
15	H77-9	06-1838	494.22	32.95
13	H83-3	06-1799	741.33	57.03
7	K562-3	06-1803	988.44	141.21
Total Received				292.97

With Precision as Displayed Enabled

Figure 14 - Rounding Error Corrected by Enabling Precision as Displayed

Note the one-cent (least significant digit) rounding error in the table at the top of Figure 14. The total displayed is $292.96 but should read $292.97. The error occurs because Excel is using the underlying data shown in the column displayed on the right to make the calculation. In the bottom table, Precision as Displayed has been enabled. In this case, Excel is using the data displayed on the face of the worksheet to make the calculation, and the rounding error disappears.

To enable Precision as Displayed, select **File, Options, Advanced** and then check **Set precision as displayed** in the section titled **When calculating this workbook**. When enabling Precision as Displayed, users will get the warning message displayed in **Figure 15**. In most cases, users can ignore the warning.

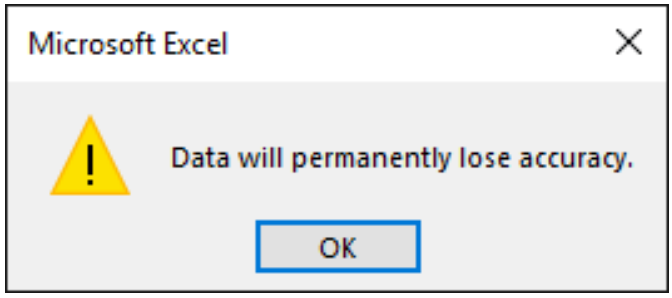

Figure 15 – Warning Message when Precision as Displayed is Enabled

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The warning message refers to a problem that can arise when users enter or import constants (raw numbers) into a worksheet but do not display all of the decimals entered. In this circumstance, any decimals not displayed will be truncated. For example, if a user entered **2.2385** in a cell and displayed only two decimal places, the contents of the cell would be truncated to **2.24** if Precision as Displayed was enabled. Furthermore, if a user tried to undo the change, she would find that this change cannot be undone – it is a *permanent* change. Under these circumstances, it would be wise to save workbooks before enabling Precision as Displayed.

Note that this issue does not arise when cells contain *formulas*. In other words, Precision as Displayed can be enabled or disabled at will without any impact on the accuracy of the underlying data when the data results from formulas. Since most, if not all, of our rounding issues result from floating point calculations, and since most practitioners are not likely to type in constants with more decimal places than are displayed, Precision as Displayed is not likely to pose a problem in day-to-day practice. The one common circumstance where this may be a problem is when detailed financial statements are exported to Excel from an accounting solution and then are reported in thousands, millions, or billions. If Precision as Displayed is enabled, users will lose the underlying detail in the exported report. To work around this issue, use formulas to bring the data to another worksheet. Apply formatting to the new worksheet to report the financial data at the desired level (thousands, millions, or billions) while maintaining full detail on the worksheet containing the exported data. In this way, enabling Precision as Displayed will not cause report detail to be lost.

8 Eliminate Positive or Negative Zeros with ROUND

One of the most puzzling problems of using any of the financial number formats (accounting, currency, and number) is the display of zeros. Recall that the third part of any number format code is the code to display zeros. However, that format code only applies when the value in a cell is equal to zero, not when the value in a cell *appears* to be zero, such as when a small value rounds off to zero for display. This is especially problematic when using the accounting format because cells can be displayed as zeros, positive zeros, or negative zeros as shown in **Figure 16**.

			Zero	Positive Zero	Negative Zero
Accounting Format Display	**$**		$ -	$ 0.00	$ (0.00)
	w/o $		-	0.00	(0.00)
Actual Number in Cell			0	0.001	-0.001

Figure 16 - Zero Display Using the Accounting Format

Some practitioners have become so frustrated with this problem that they enter hard-coded zeros over formulas when this occurs so that zeros display consistently throughout their reports. In the process of overwriting their formulas, however, they potentially corrupt their worksheets so that they do not recalculate properly in the future.

There are two easily applied solutions to this problem. The most common solution is to round calculations to the number of displayed decimals. In other words, values **0.001** or **-0.001** rounded to two decimals will

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result in a value of zero, which would be displayed properly when using the accounting format. When a positive or negative zero is encountered, simply round the contents of the cell to the appropriate number of decimal places using the **ROUND** function. The second solution to this problem is to enable **Precision as Displayed**, covered earlier, in the affected workbook. When enabled, all values are rounded to their cell formats. In other words, the values **0.001** or -**0.001** displayed with two decimals will automatically be rounded to a value of zero, which would be displayed properly when using the accounting format.

Use Tables for List Data

9 Excel Tables embody database technology similar to that found in Microsoft Access. They are designed to overcome the difficulties of working with large data sets in Excel. A table is nothing more than a list of data in which each column has a heading or field name, and each row represents a record. Think of tables as two-dimensional Excel databases with special functionality. Many worksheets are used to manipulate lists – two-dimensional data sets of employees, customers, vendors, or products, etc. The table features in Excel are designed to ease and enhance the way users sort, filter, format, and analyze list information. Among the many advantages of working with tables are 1) auto expansion (tables automatically resize themselves as new data is entered), 2) formula replication (formulas are copied down automatically to the extent of the data), 3) structured referencing (reference by table name and column or item rather than by cell references) to make formula building easier and less error prone, and 4) the ability to relate multiple tables (in Excel 2013 and 2016 only) to create PivotTables and Pivot Charts from multiple tables. Tables can be dynamically linked to external data sources such as your accounting solutions, serve as dynamic data sources for PivotTables and Pivot Charts, and make building formulas on large datasets easier and less error prone.

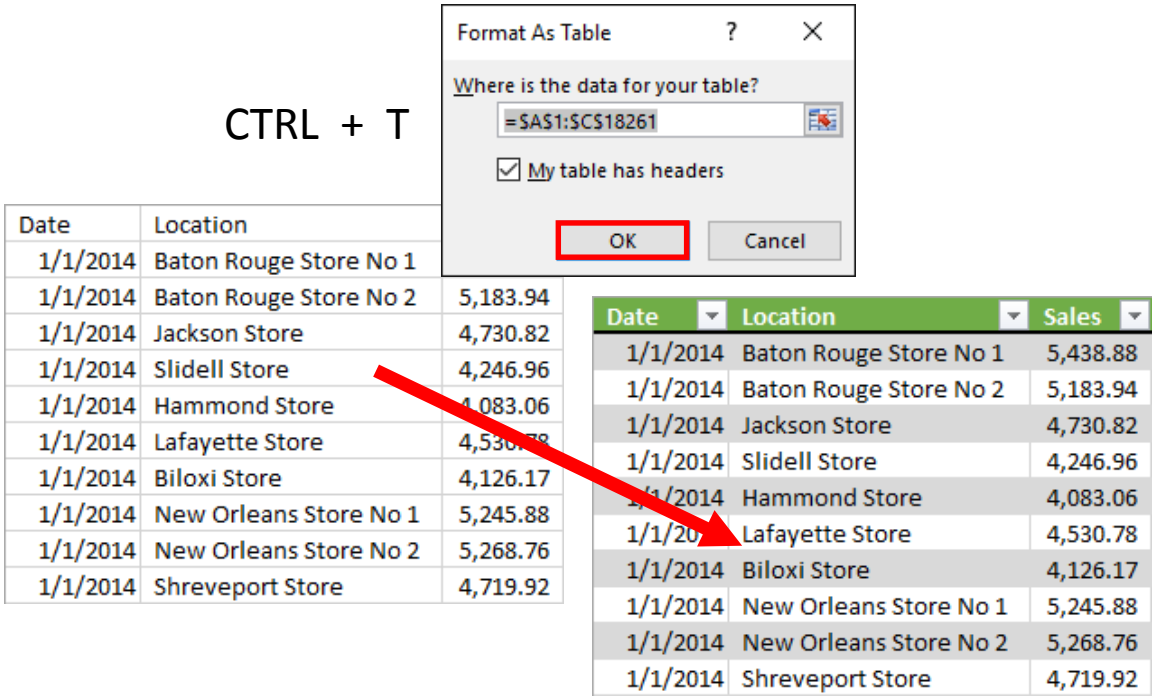

Figure 17 - Creating a Table from the Keyboard with CTRL+T

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To create a Table in Excel using the default style, place the cursor inside of the data range and press **CTRL + T**. In the **Create Table** dialog box, confirm the Table range and check **My Table has headers**. Click **OK** to create the Table as shown in **Figure 17**. In this case, the default style shades every other row for readability. Drop-down filter arrows are visible at the top of each column. Click on the arrows to filter or sort the columns. Don't overlook **Search** filters available beginning with Excel 2010. Note that the arrows do not print on reports. Any columns that do not have a name in the header row at the top of the data set will be named ***Column1***, ***Column2***, ***Column3,*** etc. These fields can be renamed by typing over the inserted labels.

Alternatively, the table could have been created from the ribbon. Again, position the cursor inside the data range. Then, select **Format as Table** from the **Home** tab. Select the desired style from the gallery and then confirm the table range in the **Create Table** dialog box. Click **OK** to create the table.

Tables can be referred to by name. In default, Excel gives each table a generic name – ***Table1***, ***Table2***, ***Table3***, etc. – based on the order in which the table was created in the workbook. Tables can be renamed with a descriptive name, such as Sales or Invoices, to make building formulas easier and more intuitive, especially when multiple tables are present in a single workbook. To rename a table, click in the **Table Name** box on the **Table Tools, Design** contextual tab and type in the desired name. The naming rules and conventions that apply to Defined Names also apply to table names.

New records can be added to a table by entering new records into the first blank row immediately below the table. Press **TAB** to advance the cursor to the next field as you are typing. Alternatively, you can paste new data to the first blank row below the table. In either case, the table will automatically be expanded to include the rows typed or pasted. A new row can also be added by dragging the resize handle in the lower right-hand corner of the table to expand its size.

Adding a column to a table is just as easy. For example, to add a new column to the table containing a formula to total weekly sales by store, position the cursor in cell **J1**, type in the column label **EOW Totals**, and then press **ENTER**. The table immediately expands to include the new column. Position the cursor in cell **J2** and perform the following steps to create the formula.

1. Type in "**=SUM(**" and move left one cell to cell **I2**.

2. Then, hold down the **SHIFT** key while using the **LEFT ARROW** to expand the range to include cells **I2** through **C2**.

3. Type in "**)**" to complete the formula and press **ENTER**.

The formula will be copied down the column automatically to the extent of the data. Note the contents and format of the formula.

=SUM(WeeklySales[@,[Sun]:[Sat]])

The format of these formulas is known as *structured referencing*, which allows users to refer to columns, rows, or specific ranges within a table using tags. Building formulas outside of a table that references table data is just as easy. Position your cursor in any cell *outside* of the table and then enter the formula below.

=SUM(WeeklySales[Wed])

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The created formula totals sales for Wednesday – and it doesn't matter if the table contains 100 records or 500,000! Add another record, and the total will be updated to include whatever sales amount was entered for Wednesday.

At first glance, auto-expansion of tables may appear to be just another ho-hum feature, but beneath this facade lurks great power because any formula, chart, or PivotTable that references the table will automatically incorporate any new data added to the table. Have you heard of dynamic defined names? Tables in Excel can perform the same function but without the need for creating defined names based on complex formulas that average users have little chance of understanding or applying.

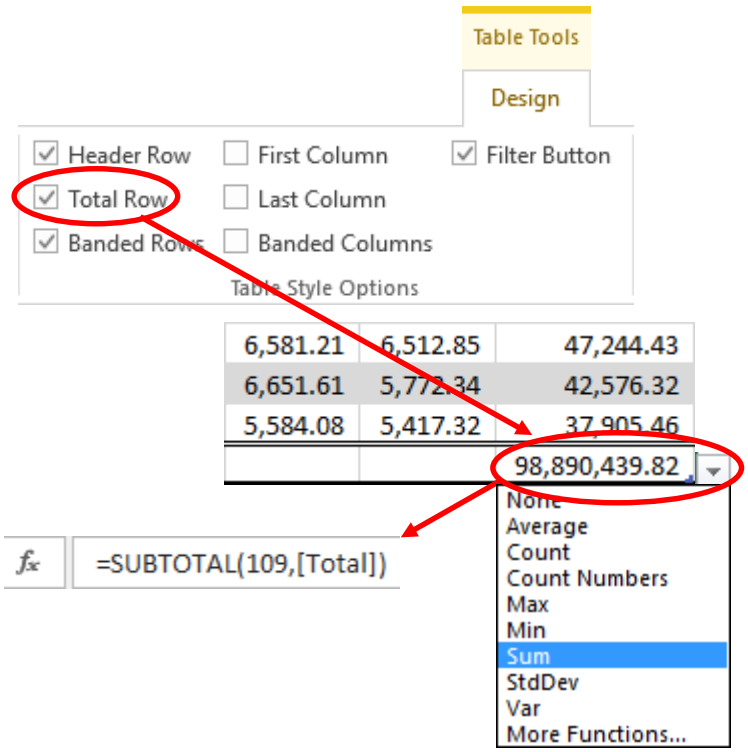

Figure 18 - Adding a Total Row to a Table

Adding totals to a table is as easy as checking a box. First, position the cursor inside the table and select the **Table Tools, Design** tab on the ribbon. Then, check **Total Row** in the **Table Style Options** group as shown in **Figure 18**. A grand total will be appended to the bottom of the table in the EOW Total column. Click on the cell containing the total and then click the drop-down arrow on the right to select the desired summarizing function. Select **SUM**, which is the default, to sum the column. Notice the formula in the Formula Bar. Excel entered the **SUBTOTAL** function instead of SUM so that the total will not include hidden rows when the table is filtered.

10 Sum with SUMIFS, SUBTOTAL, and AGGREGATE

Many clients think that accountants are mathematicians, but most of our reports and analysis require little more than simple arithmetic. We add and subtract, and sometimes use multiplication or division! We use the SUM function most often, but other functions may be better choices in some circumstances. For example, SUMIFS is useful when adding amounts that meet some specified criteria, SUBTOTAL is useful for adding amounts while ignoring amounts on hidden rows,

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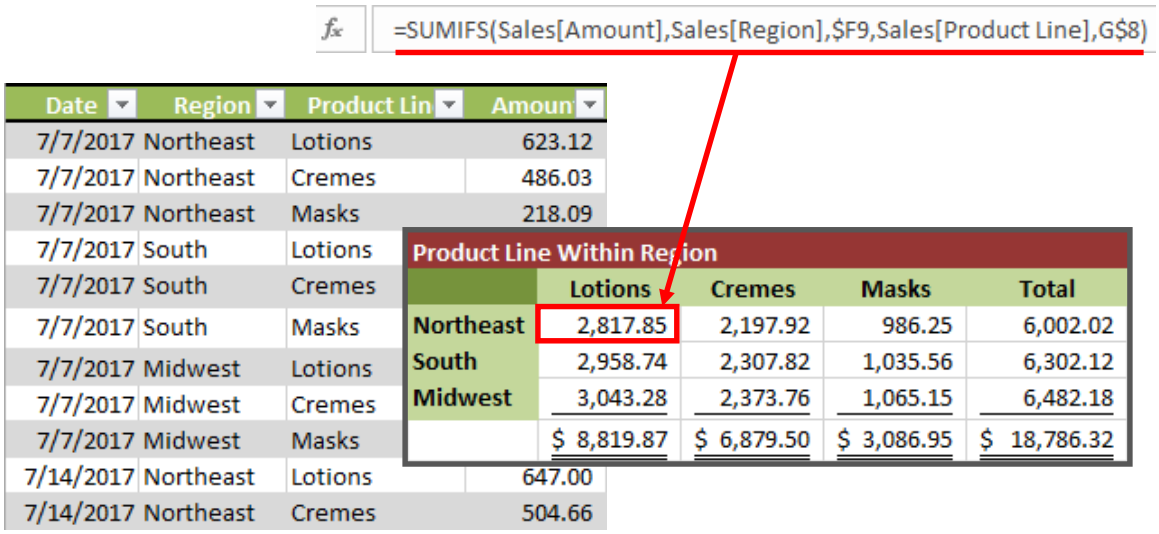
and AGGREGATE (available beginning with Excel 2010) can ignore errors and hidden data in the sum range. AGGREGATE also provides more sub functions than SUBTOTAL, which provides much greater flexibility.

SUMIFS

SUMIFS became available in Excel 2007. Accountants and business professionals can put SUMIFS to use in many contexts. For example, SUMIFS can be used to summarize sales data by product within region as shown in **Figure 19**.

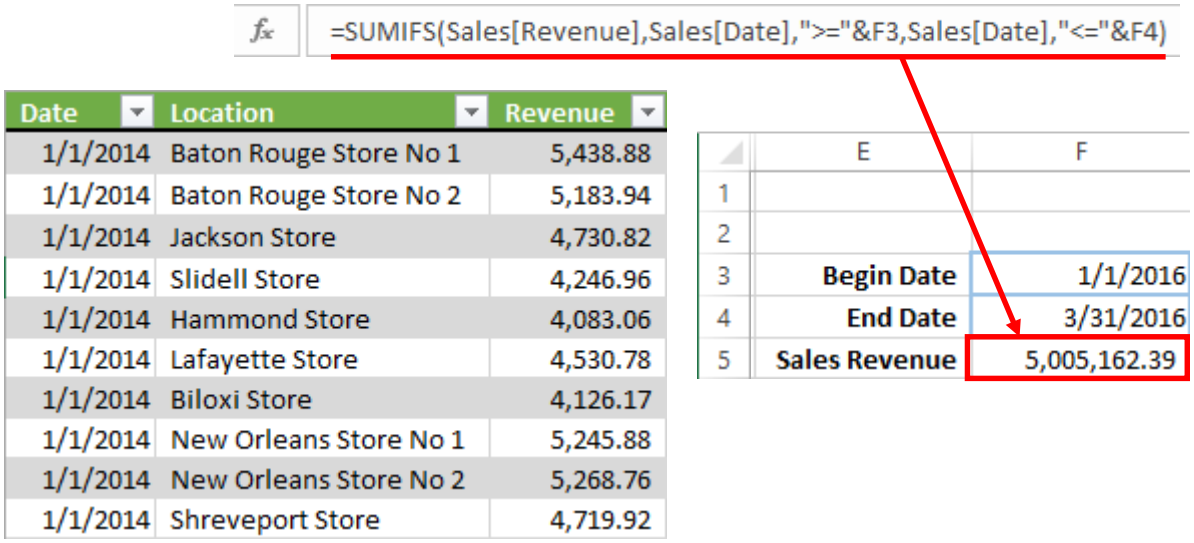


Date	Region	Product Lin	Amoun
7/7/2017	Northeast	Lotions	623.12
7/7/2017	Northeast	Cremes	486.03
7/7/2017	Northeast	Masks	218.09
7/7/2017	South	Lotions	
7/7/2017	South	Cremes	
7/7/2017	South	Masks	
7/7/2017	Midwest	Lotions	
7/7/2017	Midwest	Cremes	
7/7/2017	Midwest	Masks	
7/14/2017	Northeast	Lotions	647.00
7/14/2017	Northeast	Cremes	504.66

	Lotions	Cremes	Masks	Total
Northeast	2,817.85	2,197.92	986.25	6,002.02
South	2,958.74	2,307.82	1,035.56	6,302.12
Midwest	3,043.28	2,373.76	1,065.15	6,482.18
	$ 8,819.87	$ 6,879.50	$ 3,086.95	$ 18,786.32

Figure 19 – Using SUMIFS to Sum Sales by Product within Region

The SUMIFS function can also be used to sum data that falls within a user-defined date range. To illustrate, consider the data and analysis in **Figure 20.** SUMIFS is being used to sum data within begin and end dates specified in cells **F3** and **F4**. Note how the operators are appended to the contents of the cells containing the dates. The operators are enclosed in quotation marks and are appended to the cells containing the dates with the ampersand (**&**).



Date	Location	Revenue
1/1/2014	Baton Rouge Store No 1	5,438.88
1/1/2014	Baton Rouge Store No 2	5,183.94
1/1/2014	Jackson Store	4,730.82
1/1/2014	Slidell Store	4,246.96
1/1/2014	Hammond Store	4,083.06
1/1/2014	Lafayette Store	4,530.78
1/1/2014	Biloxi Store	4,126.17
1/1/2014	New Orleans Store No 1	5,245.88
1/1/2014	New Orleans Store No 2	5,268.76
1/1/2014	Shreveport Store	4,719.92

	E	F
1		
2		
3	Begin Date	1/1/2016
4	End Date	3/31/2016
5	Sales Revenue	5,005,162.39

Figure 20 - Sample Dataset Used in SUMIFS Formula

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SUBTOTAL

Many accounting workbooks have multiple levels of subtotals that are ultimately summarized into a grand total. The SUBTOTAL function makes this process easier and less prone to error, especially when using big datasets with many subtotals. Nested subtotals (subtotals within subtotals) are ignored to avoid double counting. Grand totals are always calculated on the detail data, not on any included intermediate (nested) subtotals. The SUBTOTAL function can summarize columns of data using any of twenty-two sub-functions identified in the following table. The sub-functions in the first column include values on hidden rows within the subtotal range in the calculation. The sub-functions in the second column ignore values on hidden rows.

	Sub-Function Number	
Sub-Function	**Includes Hidden Values**	**Ignores Hidden Values**
AVERAGE	1	101
COUNT	2	102
COUNTA	3	103
MAX	4	104
MIN	5	105
PRODUCT	6	106
STDEV.S	7	107
STDEV.P	8	108
SUM	9	109
VAR.S	10	110
VAR.P	11	111

Data Filters alter the rules of the SUBTOTAL function. Summarizations calculated on filtered data always exclude values on hidden rows regardless of the function used. In other words, functions 1 and 101 do not include values on hidden rows in the calculation of subtotals. Furthermore, operation of the **AutoSum** button accessible on the **Home** tab of the ribbon is altered when a *filter is active* so that SUBTOTAL functions are entered rather than simple summarization functions such as SUM, AVERAGE, or COUNT, etc.

The example in **Figure 21** uses the SUBTOTAL function to produce subtotals on rows 11 and 19 and a grand total on row 20. The formulas in the left column use sub-function 9 in the SUBTOTAL function. These formulas include hidden values in the subtotals. The formulas in the right column use sub-function 109 in the SUBTOTAL function. These formulas do not include hidden values in the subtotals. If function 109 is used, it is a simple task to create a report that excludes miscellaneous expenses. Just hide the two miscellaneous expense rows, and the calculations of the subtotals and grand total will immediately reflect their absence.

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5	**Tax Department**			
6	8000	Meals and Entertainment	$ 865.35	$ 865.35
7	8020	Airfares	7,864.36	7,864.36
8	8030	Hotels	2,899.36	2,899.36
9	8040	Local Transportation	648.65	648.65
10	8050	Miscellaneous	483.21	483.21
11	Total for the Tax Department		$12,760.93	$12,760.93
12				
13	**Audit Department**			
14	8100	Meals and Entertainment	$ 579.78	$ 579.78
15	8120	Airfares	5,269.12	5,269.12
16	8130	Hotels	1,942.57	1,942.57
17	8140	Local Transportation	434.60	434.60
18	8150	Miscellaneous	323.75	323.75
19	Total for the Audit Department		$ 8,549.82	$ 8,549.82
20		Total for All Departments	$21,310.75	$21,310.75

fx =SUBTOTAL(9,C5:C19)

fx =SUBTOTAL(109,D5:D19)

5	**Tax Department**			
6	8000	Meals and Entertainment	$ 865.35	$ 865.35
7	8020	Airfares	7,864.36	7,864.36
8	8030	Hotels	2,899.36	2,899.36
9	8040	Local Transportation	648.65	648.65
11	Total for the Tax Department		$12,760.93	$12,277.72
12				
13	**Audit Department**			
14	8100	Meals and Entertainment	$ 579.78	$ 579.78
15	8120	Airfares	5,269.12	5,269.12
16	8130	Hotels	1,942.57	1,942.57
17	8140	Local Transportation	434.60	434.60
19	Total for the Audit Department		$ 8,549.82	$ 8,226.07
20		Total for All Departments	$21,310.75	$20,503.79

Figure 21 - Using SUBTOTAL to Automate the Totaling Process

AGGREGATE

The AGGREGATE function is similar to SUBTOTAL, but it includes a greater number of sub-functions and can ignore nested SUBTOTAL and AGGREGATE functions, hidden rows, or *errors*. A user must specify the types of values to be ignored. Some of the sub-functions operate on cell references, and some operate on arrays, as identified in the following table.

Reference Sub-Functions	Sub-Function Number	Array sub-Functions	Sub-Function Number
AVERAGE	1	MEDIAN	12
COUNT	2	MODE.SNGL	13
COUNTA	3	LARGE	14
MAX	4	SMALL	15
MIN	5	PERCENTILE.INC	16
PRODUCT	6	QUARTILE.INC	17
STDEV.S	7	PERCENTILE.EXC	18
STDEV.P	8	QUARTILE.EXC	19
SUM	9		
VAR.S	10		
VARP.P	11		

The array sub-functions require the specification of the "**k**" element to be returned. For example, if a user wanted the third largest value returned from a referenced range, the sub-function would be **14** (LARGE) and **k** would be **3**. The options to ignore nested SUBTOTAL and AGGREGATE functions, hidden rows, error values, or some combination of these options is identified in the option table below. In default, nested SUBTOTAL and AGGREGATE functions in the referenced range are ignored.

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Option Number	Option Behavior
0 or Omitted	Ignore nested SUBTOTAL and AGGREGATE functions
1	Ignore hidden rows, nested SUBTOTAL and AGGREGATE functions
2	Ignore error values, nested SUBTOTAL and AGGREGATE functions
3	Ignore hidden rows, error values, nested SUBTOTAL and AGGREGATE functions
4	Ignore nothing
5	Ignore hidden rows
6	Ignore error values
7	Ignore hidden rows and error values

The worksheet displayed in **Figure 22** uses AGGREGATE and SUMIFS together to sum the top five weekly sales results. AGGREGATE is used to identify the fifth largest sales result, which is then used as the criteria in SUMIFS to sum all sales values greater than or equal to the identified result. Similarly, users could sum the top or bottom ten or twenty results or all weekly sales in an identified quartile or percentile. AGGREGATE is also very useful in analyses that generate errors because of its ability to ignore errors in the process of summarizing data.

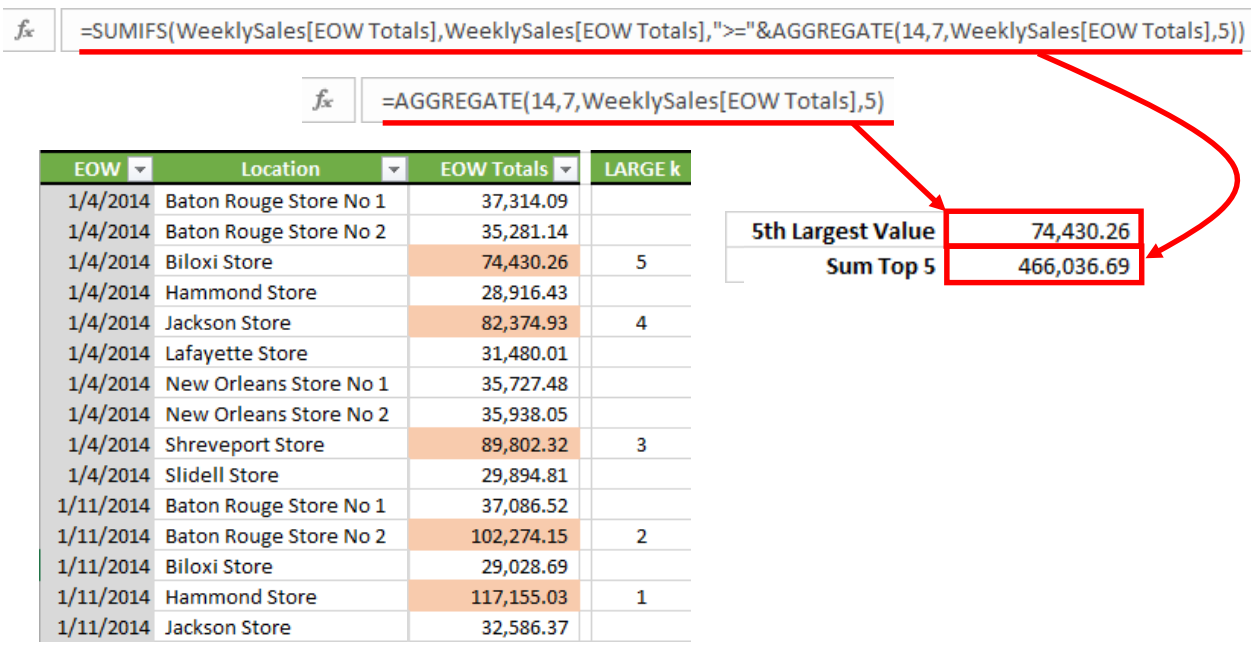

Figure 22 – Using AGGREGATE with SUMIFS to SUM the TOP 5 Sales Results

11 Highlight Exceptional Values with Conditional Formatting

Conditional formatting makes data easier to interpret because the data's appearance is based on its value. These formats are called conditional formats because their application is dependent on whether the data meets user-defined conditions. Conditional formats make analyzing data – spotting unusual observations, tracking trends, checking status, and finding top values – easier and more effective. To apply conditional formats to a cell or range of cells, highlight the cells and

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then select **Conditional Formatting** on the **Home** tab. Select the conditional formatting type desired and fill out any additional dialogs to complete the process.

The multi-column exception report displayed in **Figure 23** was built using **SUMIFS** on data stored in a table connected to an external data source. Conditional formats were applied to highlight monthly sales greater than $130,000 or less than $25,000. Two **Highlight Cells** rules were used to produce the formatting. To add end-user interaction, cell **D4** uses **List** validation with **EOMDates** (a defined name) as the source of the list values. The formulas in cells **B6** to **G6** use the **EOMONTH** function to head the columns with the appropriate month ending dates, which are formatted with a custom date format, "**mmm yyyy**". Considering that the report is built with formulas connected to a dynamic Table, the conditional formats will reflect changes in the data as the data is updated.

Two conditional formatting rules have been applied to identify monthly sales that exceed $130,000 or those below $25,000.

	A						G	H
1	DNM Marketing LLC							
2	Product Sales Performance							
3	For the six months ended March 31, 2016							
4								3/31/2016
5								
6		Oct 2015	Nov 2015	Dec 2015	Jan 2016	Feb 2016	Mar 2016	Total
7	Astringent, Organic, 16 oz	$ 49,484.17	$ 43,906.34	$ 42,542.72	$ 39,380.12	$ 41,922.31	$ 36,989.43	$ 254,225.09
8	Astringent, Organic, 24 oz	93,371.40	84,856.59	80,258.19	74,586.43	80,496.52	69,722.65	483,291.78
9	Astringent, Organic, 32 oz	139,284.27	124,495.79	120,392.38	110,537.24	118,032.41	104,534.38	717,276.47
10	Astringent, Organic, 48 oz	45,638.88	41,105.92	40,409.70	36,194.47	38,957.18	35,156.37	237,462.52
11	Cream, Aloe Vera Hand, 9 oz	50,650.19	45,694.80	44,941.69	40,143.25	43,380.90	39,334.88	264,145.71
12	Cream, Extra Moisturizing Hand, 9 oz	53,939.34	50,007.97	47,701.16	42,843.83	47,775.96	41,485.86	283,754.12
13	Cream, Hand and Body, 16 oz	93,090.94	85,133.00	82,132.24	74,431.29	80,783.67	71,482.56	487,053.70
14	Lotion, Extra Moisturizing Body, 9 oz	50,763.19	45,762.41	44,729.10	40,299.82	43,467.34	38,888.35	263,910.21
15	Lotion, Organic Body, 16 oz	111,434.61	101,154.03	97,867.72	88,554.87	96,006.89	85,132.00	580,150.12
16	Lotion, Organic Body, 24 oz	158,572.47	144,447.88	138,435.78	125,882.51	137,122.58	120,762.29	825,223.51
17	Lotion, Organic Body, 9 oz	58,592.62	53,436.38	49,654.01	46,530.91	50,860.93	43,263.09	302,337.94
18	Lotion, Organic Hand and Body, 16 oz	115,096.50	103,266.74	98,808.81	91,655.75	98,168.20	85,687.15	592,683.15
19	Lotion, Organic Hand and Body, 9 oz	63,313.28	55,903.00	54,579.32	50,351.79	52,901.04	47,538.38	324,586.81
20	Mask, Organic Facial, 9 oz	101,768.81	89,834.10	91,021.14	80,581.92	85,398.30	79,449.55	528,053.82
21	Mask, Wrinkle Reducing Facial, 16 oz	25,422.63	23,620.20	22,917.15	25,273.89	22,500.62	20,007.10	139,741.59
22	Mask, Wrinkle Reducing Facial, 24 oz	38,182.65	36,004.97	34,726.27	38,034.47	34,319.27	30,132.96	211,400.59
23	Mask, Wrinkle Reducing Facial, 9 oz	138,808.40	127,940.05	120,148.27	110,641.10	121,205.71	104,258.62	723,002.15
24	Scrub, Hypo-Allergenic, 16 oz	49,553.80	44,092.41	42,441.37	39,260.06	41,760.62	37,003.49	254,111.75
25	Scrub, Hypo-Allergenic, 24 oz	86,515.30	77,364.24	74,633.38	68,515.15	73,578.35	65,288.61	445,895.03
26	Scrub, Hypo-Allergenic, 9 oz	43,539.34	39,106.34	37,346.08	34,644.09	37,345.79	32,465.52	224,447.16
27								
28	Total Sales	$1,567,022.79	$1,417,133.16	$1,365,686.48	$1,258,342.96	$1,345,984.59	$1,188,583.24	$ 8,142,753.22

Figure 23 - Conditional Formatting Using Multiple Highlight Cells Rules

Multiple rules can be applied to the same range of cells. However, when a cell meets the criteria of more than one rule, the rule highest in the **Conditional Formatting Rules Manager** will prevail. As new conditional formatting rules are created, they are added to the top of the Rules Manager list. The Rules Manager provides a single place to manage all rules for a selected range, the active worksheet, or another sheet in the active workbook. To access the Rules Manager, select **Conditional Formatting, Manage Rules** from the **Home** tab.

Our second example uses conventional formulas to build a product sales performance report, shown in **Figure 24**, based on a table connected to an external data source. The **Total Sales** column uses the **SUMIFS**

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function to retrieve data from the table based on the product name and the date entered in cell **D4**, which uses **Data Validation** to provide user interaction. Cell **D4** uses **List** validation with **EOMDates** (a defined name on another worksheet) as the data source. Columns **C** and **D** contain simple formulas that point to column **B**, which contains the total sales revenue per product.

Conditional formatting was applied to columns **C** and **D**. In column **C**, KPI, a three-level **Icon Set**, was applied. The **Green Check** was set to format sales values that are greater than or equal to **50%** of the total, and the **Yellow Exclamation** was set to format values that are greater than or equal to **20%**. **Red X**'s identify values that are less than **20%** of total sales, and **Show Icon Only** was checked.

In column **D**, Chart, **Blue Data Bars** with **Gradient** fill were applied, and **Show Bar Only** was checked. Since the report is linked to a table connected to an external data source, the report will reflect changes in the data as the data is updated.

The KPI column is conditionally formatted with an Icon Set, and the Chart column is conditionally formatted with Data Bars.

		C	D
1	DNM Marketing LLC		
2	Product Sales Performance		
3	For the month ended April 30, 2016		
4			4/30/2016
5			
6	Total Sales	KPI	Chart
7	Astringent, Organic, 16 oz	$ 38,342.18	
8	Astringent, Organic, 24 oz	73,849.97	
9	Astringent, Organic, 32 oz	112,155.07	
10	Astringent, Organic, 48 oz	36,302.46	
11	Cream, Aloe Vera Hand, 9 oz	40,852.03	
12	Cream, Extra Moisturizing Hand, 9 oz	43,377.77	
13	Cream, Hand and Body, 16 oz	75,974.98	
14	Lotion, Extra Moisturizing Body, 9 oz	39,755.14	
15	Lotion, Organic Body, 16 oz	86,486.01	
16	Lotion, Organic Body, 24 oz	123,183.28	
17	Lotion, Organic Body, 9 oz	46,269.94	
18	Lotion, Organic Hand and Body, 16 oz	92,794.46	
19	Lotion, Organic Hand and Body, 9 oz	50,224.28	
20	Mask, Organic Facial, 9 oz	82,484.02	
21	Mask, Wrinkle Reducing Facial, 16 oz	20,380.09	
22	Mask, Wrinkle Reducing Facial, 24 oz	31,142.52	
23	Mask, Wrinkle Reducing Facial, 9 oz	108,941.12	
24	Scrub, Hypo-Allergenic, 16 oz	38,602.30	
25	Scrub, Hypo-Allergenic, 24 oz	67,076.17	
26	Scrub, Hypo-Allergenic, 9 oz	34,453.90	
27			
28	Total Sales	$ 1,242,647.69	

Figure 24 – Conditional Formats Provide Up-to-Date Analysis

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Find or Select Cells with Special Characteristics

12

The Find and Select commands can be used to find or select cells with special characteristics. Click **Find & Select** on the **Home** tab to select cells that contain formulas, comments, conditional formatting, constants, or data validation. Users can also do a custom search (**Find**) or replace values that meet specified characteristics (**Replace**). The full range of find and select options is available by clicking on **Find & Select, Go To Special**. Among the additional characteristics that can be selected are blank cells (useful in cleaning up exported reports to produce a data source for PivotTables or Pivot Charts) and visible cells (useful in copying data ranges that include hidden columns or rows without copying the hidden data).

FIND FORMULAS

To find all of the cells in a worksheet that contain formulas, click **Find & Select, Formulas** on the **Home** tab. Alternatively, press **F5**, click the **Special** button, and then select **Formulas** in the **Go To Special** dialog box. Click **OK** to highlight the cells as shown in **Figure 25**. Once all cells containing formulas are highlighted, click **Fill Color** on the **Home** tab to apply distinctive formatting to the cells or apply a predefined style from the **Styles Gallery**. This technique is very useful in reviewing worksheets. When the review is complete, repeat the process but this time remove the special color or style from the cells containing formulas to return the sheet to its original state.

Loan Amortization Schedule

	Enter values
Loan amount	$ 50,000.00
Annual interest rate	4.00 %
Loan period in years	8
Number of payments per year	12
Start date of loan	6/1/2016
Optional extra payments	$ -

	Loan summary
Scheduled payment	$ 609.46
Scheduled number of payments	96
Actual number of payments	96
Total early payments	$ -
Total interest	$ 8,508.52

Lender name:

Pmt No.	Payment Date	Beginning Balance	Scheduled Payment	Extra Payment	Total Payment	Principal	Interest	Ending Balance	Cumulative Interest
1	7/1/2016	$ 50,000.00	$ 609.46	$ -	$ 609.46	$ 442.80	$ 166.67	$ 49,557.20	$ 166.67
2	8/1/2016	49,557.20	609.46	-	609.46	444.27	165.19	49,112.93	331.86
3	9/1/2016	49,112.93	609.46	-	609.46	445.75	163.71	48,667.18	495.57
4	10/1/2016	48,667.18	609.46	-	609.46	447.24	162.22	48,219.94	657.79
5	11/1/2016	48,219.94	609.46	-	609.46	448.73	160.73	47,771.21	818.52

Figure 25 – Finding Formulas in a Workbook

SELECT VISIBLE CELLS

When copying cells, users can copy just the cells that are displayed on the face of a worksheet. For example, users may hide columns or rows to produce a dataset for other users in order to meet their particular needs. However, when copying the data to a new workbook, the hidden rows and columns are copied as well. Similarly, business professionals who use Data Subtotals for analysis often want to copy the data summaries to another worksheet for distribution to other users. Unfortunately, a simple copy-and-paste process copies all data, not just the summary data displayed on the face of the worksheet. To copy just the visible cells, first highlight the range of visible cells prior to using the copy command. Next, select **Find & Select, Go To Special, Visible cells only** as shown in **Figure 26**. Then, perform the copy-and-paste process to copy just the visible cells. Selecting visible cells is available directly from the keyboard by

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pressing **ALT + ;** (semi-colon). Visible cells may also be selected by pressing **F5**, and then **Special, Visible cells only** or by adding the **Select Visible Cells** command to the QAT. Note that when copying *filtered* data, Excel copies visible cells only in default.

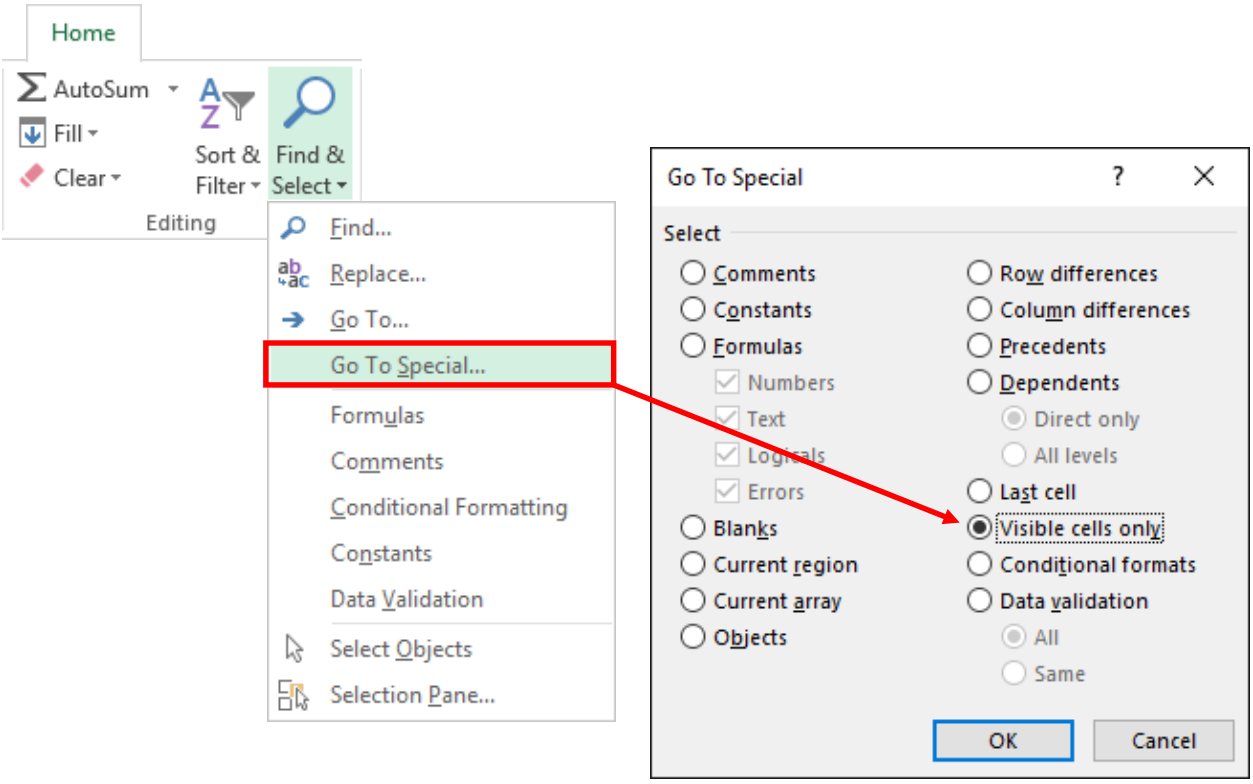

Figure 26 – Selecting Visible Cells Only

13 Use Array Formulas for Complex Calculations

An *array* is a collection or range of two or more items. An *array formula* is a formula that acts on an array – a range of cells instead of individual cells – or a formula that delivers results to more than one cell. In a nutshell, array formulas can perform multiple discrete calculations in a single cell and return the results to a single cell or to multiple cells. Note that the results of an array formula can be imbedded within other formulas. Since array formulas work on a group of cells in a single operation, array formulas can perform calculations that are not possible with conventional formulas.

Array formulas can be created using ordinary functions that take individual cells as their values. This type of array formula must be entered using CTRL + SHIFT + ENTER. Excel also includes functions that operate on arrays natively, such as SUMPRODUCT, AGGREGATE, LOOKUP, INDEX and SUMIF(S), COUNTIF(S), and AVERAGEIF(S). These functions produce array formulas without entering CTRL + SHIFT + ENTER. Another set of functions produce resultant arrays. Among them are TRANSPOSE, TREND, FREQUENCY, LINEST, and LOGEST.

SIMPLE ARRAY FORMULAS

In this first example, three methods – conventional analysis using a helper column, an array formula using the SUM function, and an array formula using SUMPRODUCT – will be used to calculate the total wages paid to a project team for the week.

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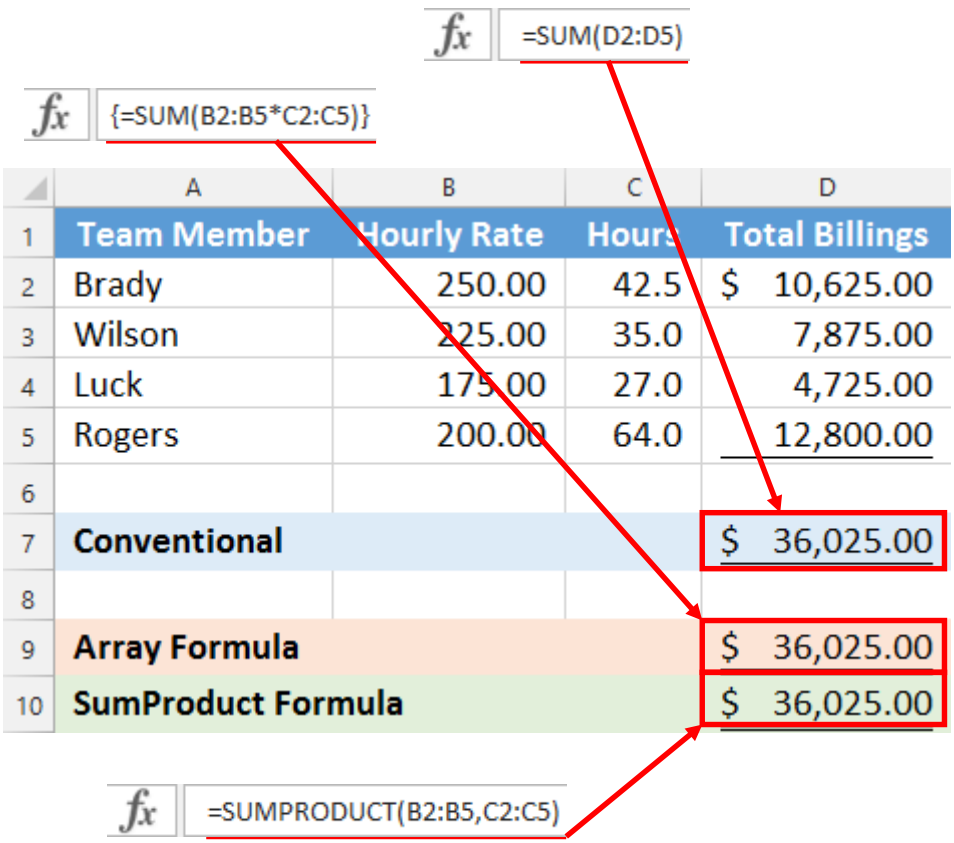
1. In column **D**, create individual formulas to calculate the wages for each team member. Copy the formula down and then sum the results in cell **D7**.

2. Build an ordinary array formula. Enter the formula **=SUM(B2:B5*C2:C5)** in cell **D9**. Make sure to press **CTRL + SHIFT + ENTER** to enter the formula. Otherwise, the formula will evaluate to **#VALUE!**. Note the braces **{ }** surrounding the formula in the formula bar.

3. Use the SUMPRODUCT function to build the formula. Enter **=SUMPRODUCT(B2:B5,C2:C5)** into cell **D10** and press **ENTER**. The formula need not be entered with CTRL + SHIFT + ENTER, nor do braces **{ }** surround the formula in the formula bar. The SUMPRODUCT function produces an array formula without all of the complexities of an ordinary array formula. It can handle up to 255 arrays of data.



	A	B	C	D
1	Team Member	Hourly Rate	Hours	Total Billings
2	Brady	250.00	42.5	$ 10,625.00
3	Wilson	225.00	35.0	7,875.00
4	Luck	175.00	27.0	4,725.00
5	Rogers	200.00	64.0	12,800.00
6				
7	**Conventional**			$ 36,025.00
8				
9	**Array Formula**			$ 36,025.00
10	**SumProduct Formula**			$ 36,025.00

Figure 27 – Conventional vs. Array Formulas

Note that each of the three methods returned the same result, but the array formulas used a single cell to make the calculation. In the simple context presented, the most commonly used method with a helper column works as well as the array formulas, but in situations involving thousands of transactions, calculating the extended price or cost of goods just to calculate total revenue or total cost of goods sold would be cumbersome and time-consuming. In those situations, a single cell array formula would be a better alternative. Further, using SUMPRODUCT in situations like these is a better solution because it

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calculates faster and is easier for average Excel users to understand than ordinary array formulas entered using CTRL + SHIFT + ENTER.

Before leaving this example, let's use an advanced technique to examine or troubleshoot array formulas. Position the cursor in cell **D9**, the cell containing the ordinary array formula. Press **F2** to edit the formula and then click ***number 1*** in the **Screen Tip** that appears to select the array reference. Press **F9** to see the underlying array as shown in **Figure 28**. Do *not* press Enter without first pressing **CTRL + Z** to undo the change. Otherwise, the cell references will be replaced with the *array constant* so that the formula will no longer calculate by reference to the values in the cells but by reference to the values inside the SUM function, thereby breaking the formula envisaged.

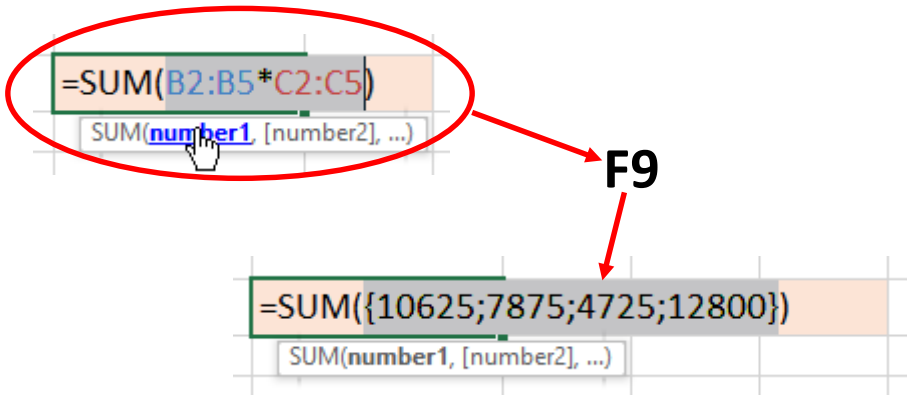

Figure 28 – Troubleshooting an Array Formula

Similarly, the formula built using SUMPRODUCT can be examined. Note that the individual items of the arrays can be examined rather than the results of the array calculations displayed in the ordinary array formula.

ROUND IN A TOTAL

This example uses an array formula to round off in a total. Many accounting professionals have been faced with the need to sum a large number of amounts that result from floating point calculations. The amounts may be the result of formulas or may be imbedded in data imported from other systems. A problem arises when the amounts are not rounded off because Excel uses the underlying values rather than the displayed values in calculating formulas, including summary totals. Conventional practice requires the use of the ROUND function to round off all of the calculated amounts prior to summing their values, but that solution is cumbersome and time-consuming when a large number of values are present. A better alternative would be to build a formula that can round and sum the amounts in a single calculation. A simple array formula like the one displayed below can perform this task quickly and easily.

{=SUM(ROUND(E5:E8,2))}

Note the braces that surround the array formula. The braces are not typed in but are added by Excel when an array formula is entered. To enter an ordinary array formula, type in the formula and then press **CTRL + SHIFT + ENTER**.

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		No Rounding	Conventional Rounding	Array Formula
Total	Units	Average Unit Cost	Average Unit Cost	Average Unit Cost
247.11	4.00	61.78	61.78	61.78
494.22	5.00	98.84	98.84	98.84
741.33	6.00	123.56	123.56	123.56
988.44	7.00	141.21	141.21	141.21
		425.38	425.39	425.39

{=SUM(ROUND(E5:E8,2))}

Figure 29 - Using an Array Formula to Round and Sum Data in a Total

Again, let's use the technique discussed earlier to examine the array formula. Position the cursor in cell **E10** and press **F2**. Then, click inside the **ROUND** function, click ***number*** in the **Screen Tip**, and press **F9** to see the *unrounded* values. Press **CTRL + Z** to undo the changes. Then, click inside the **SUM** function but before the **ROUND** function, click ***number 1*** in the **Screen Tip,** and press **F9** to see the *rounded* array values. This examination helps us understand just how the array formula is making the calculation. It's not rounding the sum; it's summing the rounds!

Use Defined Names for Easier Formula Building

14 Defined names, referred to as named ranges in Lotus 1-2-3, can be used in place of cell references when building formulas. Defined names are more easily remembered than corresponding cell references, constants, or formulas when building worksheet models. In default, defined names are specific to the workbook in which they are created, although worksheet-specific names can also be created.

Defined names in Excel can be created in several ways. One method is to highlight the cells that you desire to name and then enter an appropriate name in the **Range Box** on the **Formula Bar**. A second method is to highlight the cell or range of cells to be named and then click **Defined Name** on the **Formulas** tab. Type in the desired **Name**, select the **Scope**, enter a **Comment**, and modify the **Refers to** information as required. Click **OK** to create the defined name.

Excel has naming conventions or rules for defined names:

- Names must begin with a letter, backslash, or underscore
- No spaces are allowed in a defined name
- Names that resemble cell references cannot be used

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- Single letters cannot be used for names except for R, r, C, c
- Names can contain up to 255 characters and are *not* case-sensitive

Defined names can also be created from adjacent labels. Just highlight the range, including the labels, and, from the **Formulas** tab, select **Create from Selection** as shown in **Figure 30**. In the **Create Names from Selection** dialog box, check the boxes that correspond with the position of the labels in the selected range and click **OK** to create the names automatically. Any spaces or special characters in the labels will be replaced with underscores in the defined names. Defined names created from labels that begin with a number, such as 1Q2017, will be preceded with an underscore.

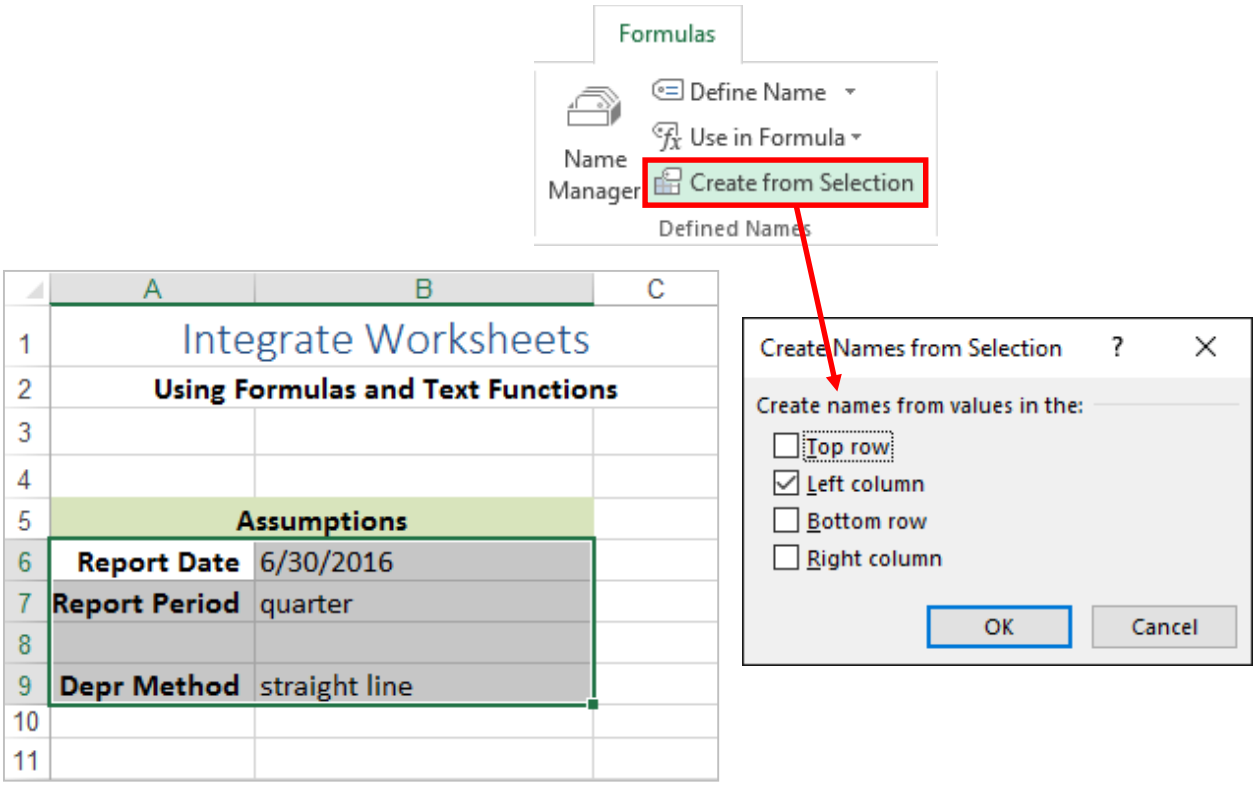

Figure 30 - Creating Defined Names from Adjacent Labels

Use SUM with End Points for Sum-through Formulas

15 Most accounting professionals routinely face the task of combining or consolidating financial data from several worksheets. The task may require consolidating the results of multiple periods, multiple departments, multiple divisions, or multiple related businesses. In almost every case, practitioners choose to insert a new worksheet to hold the combined or consolidated information and then sum through the existing worksheets to produce consolidated totals.

Generally, a single formula is created and then copied down and across the consolidating worksheet. Extraneous totals, such as where blank lines exist in the layout of the individual data worksheets, are then deleted, and formatting is applied to complete the report. This method is easily understood, can be applied by most moderately experienced users, and is very well suited for those situations where the worksheets being summed have identical layouts – column by column, row by row, and cell by cell. If the

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worksheets do not have identical layouts, the common workaround is to add rows and/or columns to one or more of the worksheets until the cells align properly.

While some users create simple arithmetic formulas (**=Jan!B15 + Feb!B15 + Mar!B15**) to sum through sheets, a more efficient method is to use the SUM function if the cells are properly aligned. Such a formula would be similar to this one: **=SUM(Jan:Mar!B15)**. Note the range colon between the sheet names. While the process is quicker and easier, if anyone rearranges the sheets for any reason, the sum-through totals will be corrupted.

A simple solution to this problem is to create dummy worksheets that have no purpose other than to function as end points for the sum-through formulas. In other words, create two new sheets, one named **Begin** and the other **End,** that serve as the end points for the sum-through formulas as shown in **Figure 31**.

	A	B	C
1	GTM Distributors Inc		
2	Comparative Results of Operations		
3	Year-to-Date 2017		
4			
5			
6		**2017**	**2016**
7			
8	Sales	$ 39,974,969	$ 38,071,400
9	Cost of Goods Sold	15,774,633	15,023,461
10	Gross Profit	24,200,336	23,047,938
11	Selling, General and Administrative Expenses	22,231,846	21,173,185
12	Operating Income	1,968,490	1,874,753
13	Other Income and Expenses:		
14	Interest Income	250,493	238,565
15	Interest Expense	(2,077,834)	(1,978,890)
16	Other	293,905	279,908
17	Total Other Income and Expenses	(1,533,436)	(1,460,416)
18	Income Before Income Taxes	435,053	414,337
19	Income Taxes (Benefits):		
20	Deferred:		
21	Federal	207,027	197,169
22	State	(5,753)	(5,479)
23	Total Income Taxes (Benefits)	201,274	191,690
24	Net Income	$ 233,779	$ 222,647
25			

Begin | Jan | Feb | Mar | End | Consolidated

Figure 31 - Using Dummy Worksheets as End Points for Sum-through Formulas

Once the end-point worksheets are in place, and the sum-through formulas are created, users can protect themselves and others against corruption of the consolidated totals by protecting the workbook structure. Users may hide the end-point worksheets before protecting the workbook, but merely hiding the worksheets does not protect the integrity of the formulas because worksheets can be inserted, deleted, or moved inside or outside of the end points inadvertently, thereby corrupting the consolidated totals.

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Using dummy sheets as end points can be very useful in situations where users want to report year-to-date or rolling twelve-monthly or rolling quarterly results. The report column where the rolling totals are reported would use sum-through formulas employing dummy end-point sheets. As the financial results from a new month are copied into the workbook, the new sheet is moved between the end points and/or the oldest sheet is moved outside of the end points, thereby creating year-to-date reports or easily rolling up the results for the previous twelve-months without creating a new formula as shown in **Figure 32**.

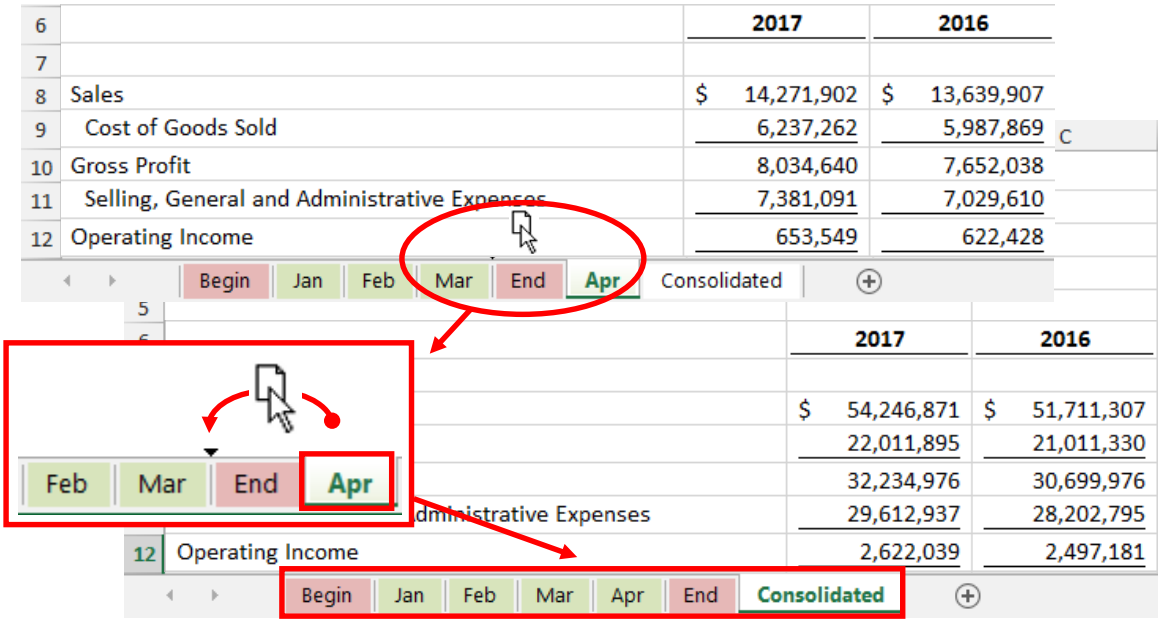

Figure 32 - Drag-and-Drop Consolidation with End-Point Worksheets

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