5 Reasons Why Your Spreadsheet Is Misbehaving

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5 Reasons Why Your Spreadsheet Is Misbehaving

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Everything Looks Right. Why Isn't It Working?

You can do almost anything in Excel, but you still have to follow the rules.

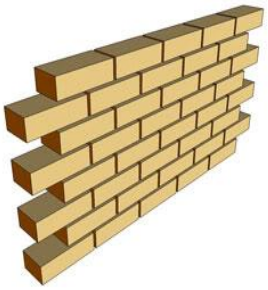
So you've spent a lot of time building a spreadsheet to make your life easier and – it doesn't work! So now, instead of spending time doing productive work, you have to spend time trying to figure out why you aren't getting the results you want or expect.

One of the best features of Excel is its flexibility. There is virtually no limit to the number of ways you can build a spreadsheet so it is customized to your particular needs. That's why Excel is such a great, powerful tool to use in managing your business, figuring out your budget or finances, or keeping track of personal items or business inventory.

You can't do whatever you want and still get the results you expect.

There are rules to follow. The good news is this: If you master a few basic, but essential concepts, you'll spend much less time working on Excel and more time working on the activities that really matter.

Let's get started!



REASON 1

Did You Normalize Your Data?

If you want your spreadsheet to work correctly, you must build it correctly.

Have you ever taken time to look at a brick wall? Structures made of brick are very sturdy and are able to stand for many, many years – if they are properly constructed. Each brick wall must be perfectly vertical and each row of bricks must follow a specific pattern. Otherwise the structure will not stand for very long.

Excel spreadsheets, to function properly, must also be constructed properly. The first thing to remember is that there is a reason Excel is organized in rows and columns. The reason is that the row and column structure, called a flat database, is an excellent format for organizing and analyzing data.

What You Need to Know

A database is a collection of Fields and Records.
A Field is a column in an Excel spreadsheet.
A Record is a row in an Excel spreadsheet.

A field contains one unit of information in a record. For example, in a record of a customer's information, there will likely be fields for such items as first name, last name, address, city, state, zip code.

A record contains all relevant information for one unique item in the database. Examples include sales transactions, customer information, and inventory specifications.

Picture 1 shows a flat database with 6 fields and 5 records. All of the information is fictional.

Picture 1: Example of a flat database

	The field named "First Name"	The field named "Last Name"	The field named "Address"	The field named "City"	The field named "State"	The field named "Zip"
Field Name	**First Name**	**Last Name**	**Address**	**City**	**State**	**Zip**
	Gia	Hodge	8936 Bay Street	Anaheim	CA	92806
	Shea	Wilson	6864 Harrison Street	Acworth	GA	30101
Records	Maribel	Tate	8662 Lafayette Avenue	Greer	SC	29560
	Cohen	Bishop	5476 Cardinal Drive	Hackensack	NJ	18234
	Karlie	Carroll	7165 Edgewood Drive	Yorktown	VA	23693

Notice how there is no duplication of data. Each field contains only one item of information. Every record is related to only one person.

What You Need to Know

Your data is not normalized if you have duplicate data.

Each record must be unique.

Let's look at some examples!

A good example is the use of dates. If you want to have a record of sales for each month, most people set up one column for each month. The thinking is that each month is a separate field, so it needs its own column. So they end up with something like what you see in Picture 2 on the next page.

This format is incorrect. The data is not normalized correctly because we only have one record that shows sales for all months.

Picture 2: Data not normalized correctly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales	1,234	1,564	1,377	855	1,183	1,328	8,976	216	2,168	3,217	3,264	8,156

What we actually want is 12 separate records. We need one record for each month. Each record should show only the total sales for that month.

Where is the error? In the field name. The field name should be "Month", not the name of each individual month.

What is the correct way to organize our data? Well, in our example, we have two pieces of information: the month of the sale and the total of sales for the month. So we only need two fields (columns) to record our data – Month and Sales. The proper way to normalize the data is shown below in Picture 3.

Picture 3: Data normalized correctly

Month	Sales
Jan	1,234
Feb	1,564
Mar	1,377
Apr	855
May	1,183
Jun	1,328
Jul	8,976
Aug	216
Sep	2,168
Oct	3,217
Nov	3,264
Dec	8,156

Now the data is normalized correctly. We have what we need, which is a list of 12 unique records, one for each month, with total sales for the month.

Always make sure you normalize your data correctly. When you do, you will find that creating and updating reports is faster and consistently more accurate.

REASON 2

Did You Use the Correct Cell Reference?

Make sure Excel is looking in the right place for the information it needs.

One of Excel's best productivity features is the ability to copy data from one cell and paste it to other cells in the spreadsheet. This feature can save you hours of time, because you do not have to manually enter the same data in one cell after another.

However, you have to know the difference between a relative and an absolute cell reference. If you don't, you will have errors in your spreadsheet.

What You Need to Know

Relative cell reference – changes if you copy or move a formula to another cell.
Absolute cell reference – does not change if you copy or move a formula to another cell.
The dollar sign ($) is used to denote an absolute cell reference.

Here are examples of a relative and absolute cell reference:

- Relative cell reference: A1
- Absolute cell reference: $A$1

Relative and absolute cell references is one of the most difficult Excel concepts. So don't get frustrated if you don't understand it right away. Once you get it, though, you'll be in the upper percentile of skilled Excel users.

The first step is to understand what we mean by a "cell reference". Simply put, a cell reference is the cell to which a cell or formula refers. In Picture 4 below, the cell reference is in cell D4 (shaded green) and it refers to cell E5 (shaded yellow).

Picture 4: Example of a cell reference

	A	B	C	D	E	F	G
1							
2							
3							
4				=E5			
5							
6							
7							

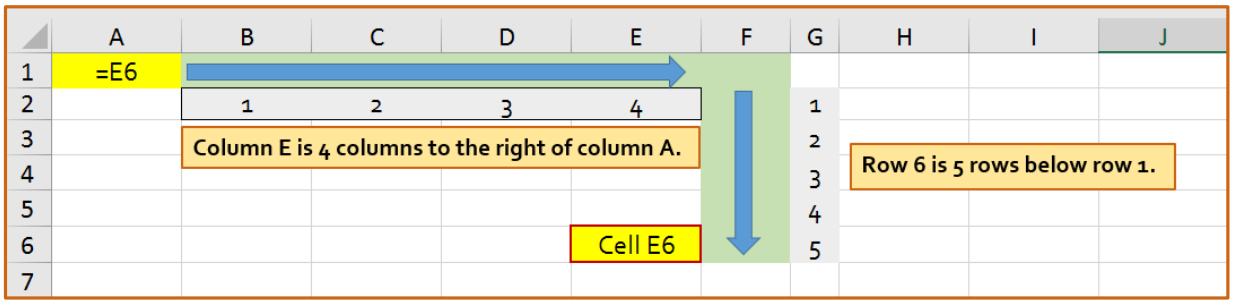
Understand that Excel views this picture differently than you do. You, the user, see the cell reference in cell D4 as an arrow, pointing you to cell E5. But Excel sees cell D4 as a map, with directions on how Excel gets to cell E5 from cell D4. Put another way:

Users see a cell reference as a location.
Excel sees a cell reference as the path to a location.

Let's look at some examples!

Here's how it works. Refer to Picture 5 below as you review each step. In cell A1, you enter the cell reference "=E6." (Cell A1 is the active cell.) Excel sees it takes two steps to move to cell E6. First, Excel must move right 4 columns relative to cell A1. Second, Excel must move down 5 rows, relative to cell A1. So, to Excel, "=E6" means "move right 4 columns, then move down 5 rows".

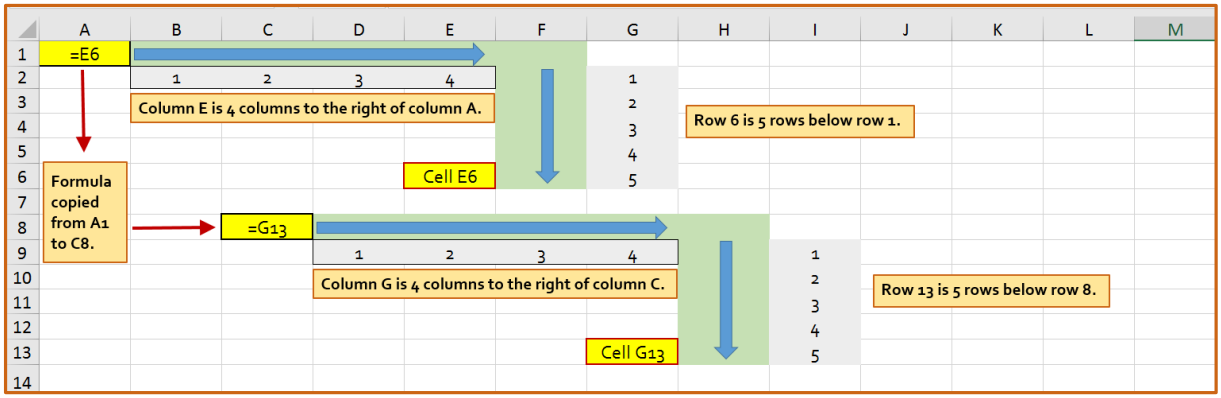
Picture 5: How Excel sees a cell reference as the path to a location in the spreadsheet



Make sure you understand what is happening in Picture 5 before you continue! Once you master this concept, everything that follows will be much easier to understand.

So what happens if we copy the formula in the active cell, A1, to another cell? What will Excel show as the cell reference in the new location? The answer is in Picture 6.

Picture 6: Results from copying formula in cell A1 to cell C8



Remember that Excel sees the cell reference as a set of directions. In our example, Excel interpreted the formula in the active cell, A1, to mean "move right 4 columns, then move down 5 rows".

So it doesn't matter where you copy the formula from the active cell, A1. Excel will always remember it as a set of directions to move right 4 columns, then down 5 rows. So if you copy the formula from A1 to C8, Excel will look right 4 columns, relative to cell C8, then down 5 rows relative to cell C8, and end up at cell G13.

Do you see how it is the same??

Cell E6 is 4 rows right, 5 rows down relative to cell A1.

Cell G13 is 4 rows right, 5 rows down relative to cell G13.

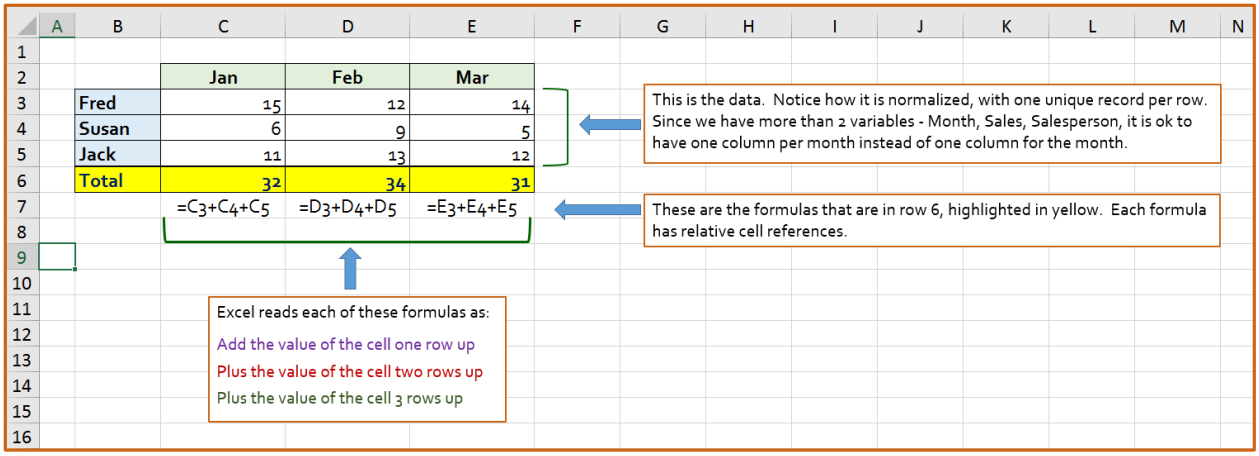
This is an example of a relative cell reference. This is because all of Excel's moves from one cell to another are relative to the active cell.

Remember that a relative cell reference changes when you copy or move a formula from one cell to another. So if the cell reference is different after you copy it, you know you have a relative cell reference.

Another way to tell you have a relative cell reference is the absence of dollar signs in the cell reference. The dollar sign is the symbol uses to indicate an absolute cell reference.

Let's take a look at how you might use relative cell addresses in a real spreadsheet. Look at the picture below.

Picture 7: Real world example of relative cell addresses

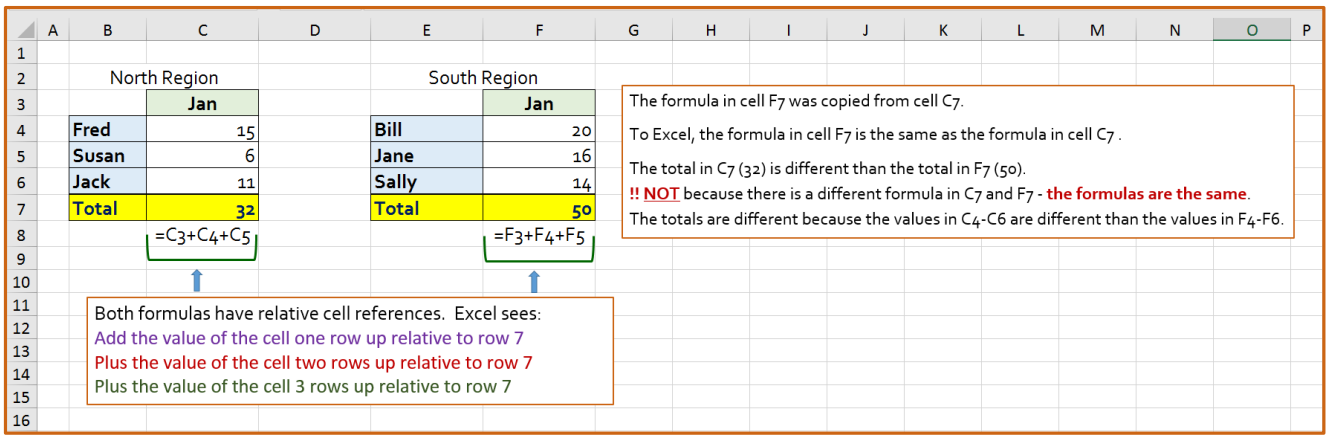


How does Excel read the formulas in row 6 (highlighted in yellow)? Add the following:

1. The value one row up relative to row 6 **Plus**
2. The value two rows up relative to row 6 **Plus**
3. The value three rows up relative to row 6.

It doesn't matter what column the formula is in. Excel will always read it the same way. Now take a look at Picture 8.

Picture 8: What happens when a formula with relative cell references is copied

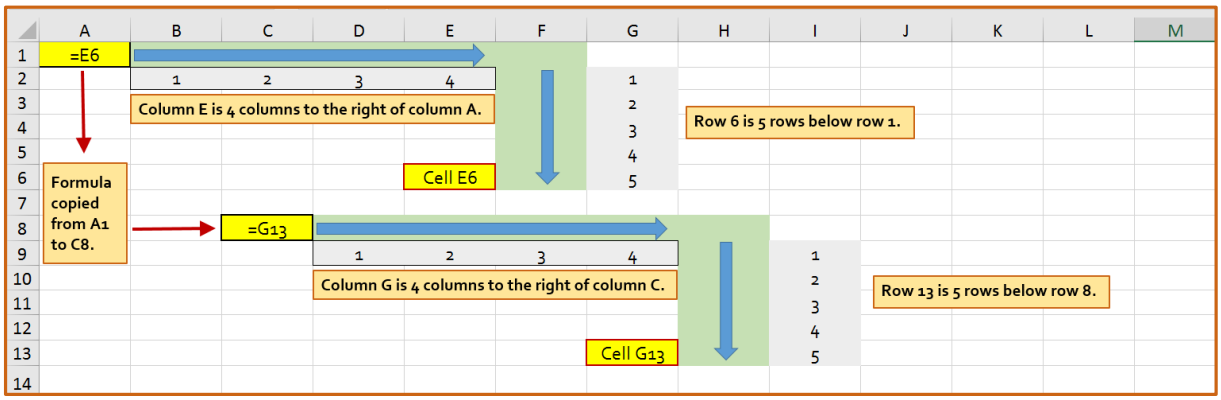


If you've understood everything so far, you're ready to learn about absolute cell references. You'll find that, having mastered the concept of relative cell addresses, absolute cell addresses will be easy to learn.

The most important thing to remember about absolute cell references is that they do NOT change when you move or copy a formula from one cell to another. Recall that relative cell references **DO** change when you move or copy a formula from one cell to another.

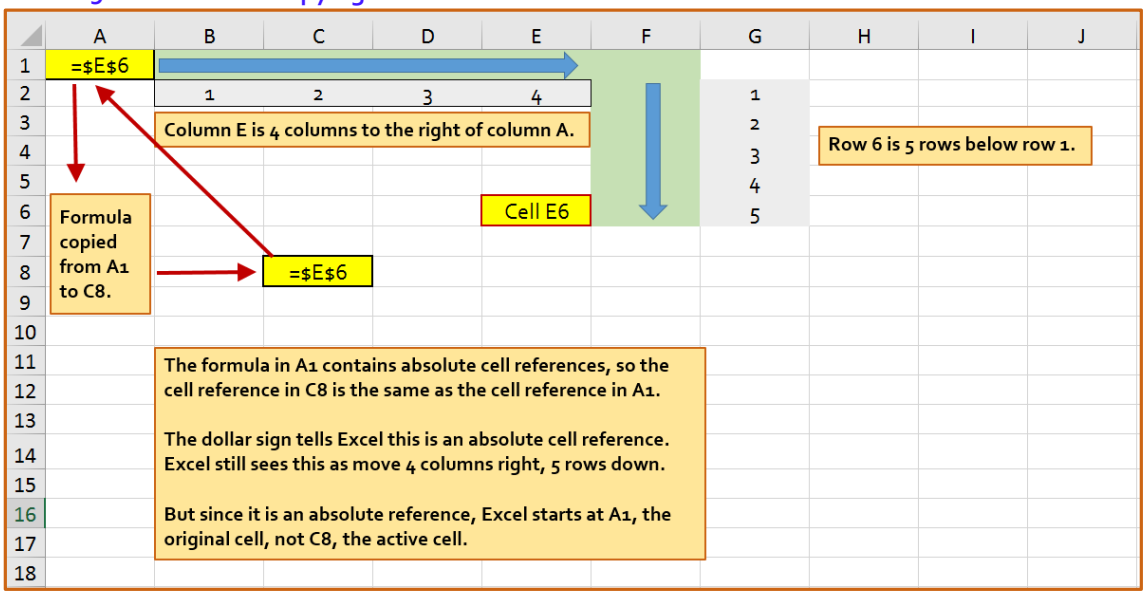
So let's look at some examples to demonstrate the concept. Here's Picture 6, which you last saw on page 8:

Picture 6: Results from copying a formula with a relative cell reference in cell A1 to cell C8



Here's what happens if we change the cell reference in cell A1 from a relative to an absolute cell reference:

Picture 9: Results from copying a formula with an absolute cell reference in cell A1 to cell C8

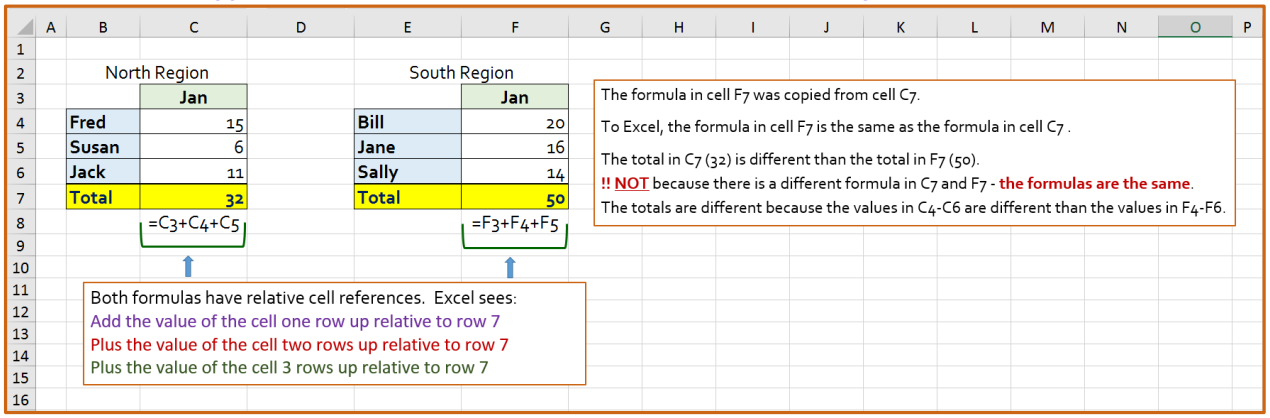


You see in Picture 9 how an absolute cell reference does not change when you copy or move the formula from one cell to another. To better understand why, let's see how Excel thinks about it.

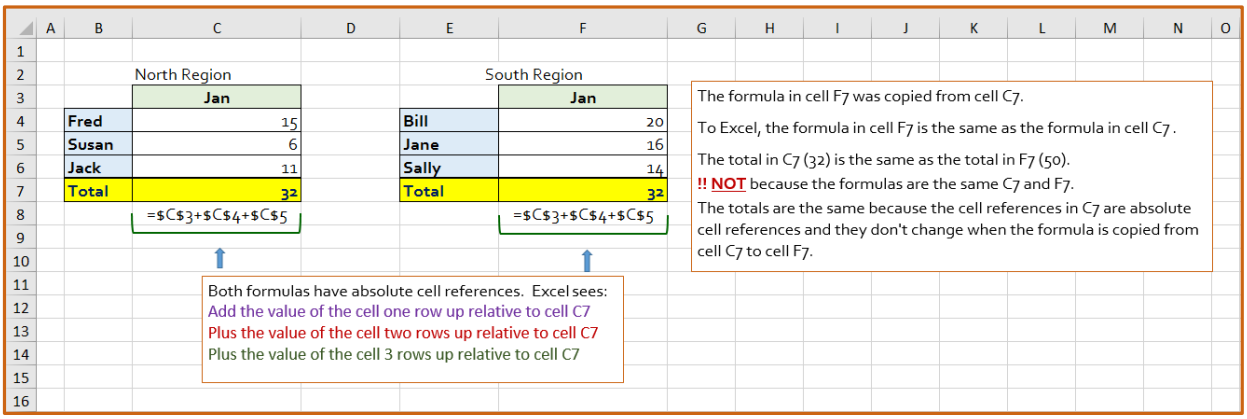
With both the absolute and relative cell reference, Excel knows the path from one cell to another – 4 columns right, 5 rows down. When there is a relative cell reference, Excel thinks "the path starts in the cell to which the formula is copied." When there is an absolute cell reference, Excel thinks "the path starts in the cell from which I copy the formula."

Let's look at one more example. Here's Picture 8 from page 9 which was a relative cell reference example:

Picture 8: What happens when a formula with a relative cell references is copied from one cell to another cell



Picture 10: What happens when a formula with an absolute cell references is copied from one cell to another cell



So check your spreadsheet to make sure you are using the correct cell reference – relative or absolute. When you use the proper type of cell reference, you will avoid multiple errors in your spreadsheets.

REASON 3

Did You Hardcode Your Formulas?

Use cell references, not numbers in your formulas.

There are basically two ways to enter data into a cell on a worksheet. One way is to enter the data manually. In other words, you type a number or text into a cell. The second way is to use a formula containing (relative or absolute) cell references to pull data from another cell.

Whenever you type a number or text into a cell, this is called hardcoding. Hardcoding also occurs when you create a formula that has text or a number instead of a cell reference. Refer to Picture 11 below.

Picture 11: Examples of Hardcoded cells

This is what the User entered	This is what Excel displays	Hardcoded?		Explanation
15	15	Yes		User typed the number 15 into B3
25	25	Yes		User typed the number 25 into B4
Fifteen	Fifteen	Yes		User typed the text "Fifteen" into B5
=B3+25	40	Yes		User typed the relative cell reference B3 and the number 25 into cell B6
=B3+B4	40		No	The formula only contains cell references - no numerical or text values.

In Picture 11, cells B3, B4 and B5 are hardcoded because the user manually entered a numerical or text value. Cell B6 is also considered to be hardcoded, even though the formula contains a relative cell reference, because the user included a specific numerical value.

What You Need to Know

When you hardcode a cell, the result will not change when you copy or move data to another cell.
This is true even if you change the values in the cells referred to by the hardcoded cell.
If your cell is partially hardcoded, your result will be wrong when you copy or move data to another cell.

Let's look at some examples!

Here's what happens when you copy a hardcoded cell.

Picture 12: Error results when the value of a hardcoded cell is copied

	A	B	C	D	E	F	G	H
1								
2			This is what the User entered	This is what Excel displays		This is what the User entered	This is what Excel displays	
3		North	15	15		5	5	
4		South	25	25		25	25	
5		TOTAL	40	40		40	40	
6								
7			Copy from cell C5 to cell F5					
8								
9			The value in cell C5 is hardcoded.					
10			The user copies cell C5 to cell F5.					
11			The user enters the number 5 in cell F3.					
12			The user enters the number 25 in cell F4.					
13			The value in cell F5 is hardcoded so the Total (40) is incorrect.					
14								
15								

Here's what happens when you copy a cell that is not hardcoded.

Picture 13: Error results when the value of a hardcoded cell is copied

	This is what the User entered	This is what Excel displays		This is what the User entered	This is what Excel displays
North	15	15		5	5
South	25	25		25	25
TOTAL	**=C3+C4**	**40**		**=F3+F4**	**30**

Copy from cell C5 to cell F5

The value in cell C5 is not hardcoded.
The user copies cell C5 to cell F5.

The user enters the number 5 in cell F3.
The user enters the number 25 in cell F4.

The value in cell F5 is not hardcoded.
The user copied a formula with relative cell addresses, so the Total (30) is correct.

The problem gets much worse if you have a large spreadsheet with many formulas. What happens if you want to change your assumptions?

If you hardcode your cells, you will have to change all the cells that contain the same value or formula. Can you imagine how much time that would take?

Here's a simple example.

Region	Year 1	Year 2	Year 3	Year 4	Year 5
Sales	10,000	11,000	12,100	13,310	14,641
Growth Rate	10%	10%	10%	10%	10%
Formula in Row 3	**10,000**	**=C3*(1.1)**	**=D3*(1.1)**	**=E3*(1.1)**	**=F3*(1.1)**

Notice that the formulas in this row all contain relative cell references.

The growth rate is 10%. To show a 10% increase each year, the previous year is multiplied by (1 + 10%), or 1.1.

Using a number like 1.1 is called **hardcoding**. This means you put in a number instead of an absolute or relative cell reference.

If you want to change the growth rate to be anything other than 10%, all 5 formulas will have to be changed manually.

Changing formulas manually is time consuming, inefficient, and very prone to error, especially if you have a large spreadsheet with many formulas.

The bigger your spreadsheet, the more cells you have to edit. With more cells to edit, it is more likely it is that you won't modify all cells that need to be changed. The result? You'll have two types of errors. First, you'll have cells with the wrong value because you copied a hardcoded cell. Second, you'll have cells with the wrong value because you missed these cells and did not even change the value.

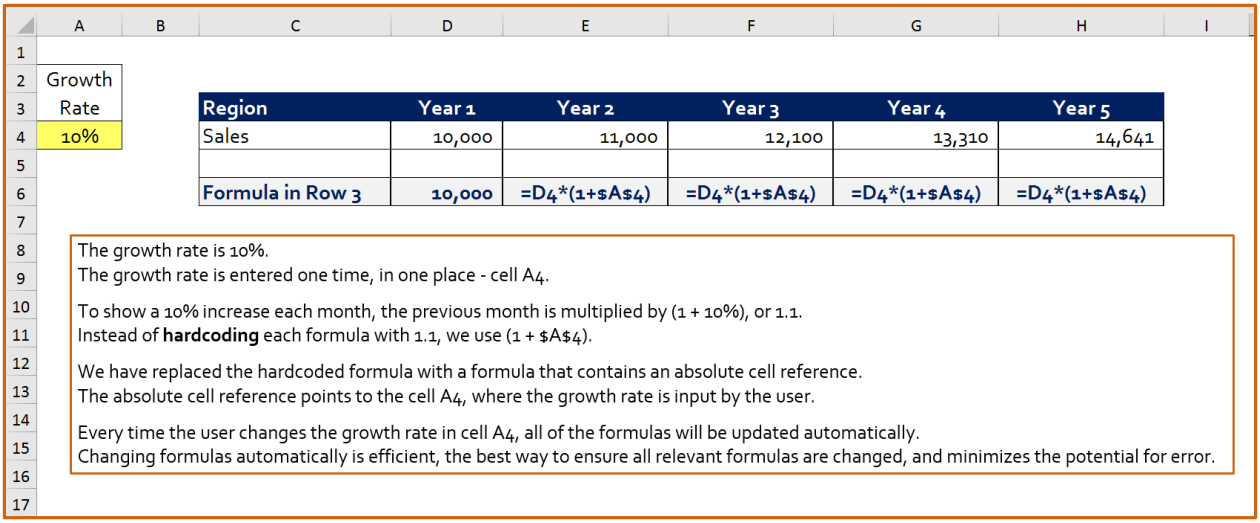
Best Practice: Enter data 1 time in 1 cell.

Related cells use formulas to point to the input cell.

It's always better to put your assumptions in one place in your spreadsheet and to label that section as your assumptions. This way, you know that it's an assumption. More importantly, you will only have to change your assumption once, and in only one place, whenever you want to use a different variable.

Picture 15 shows a better way to format your spreadsheet using a special section for assumptions.

Picture 15: Example of how to use formulas with cell references and a special Assumptions section



	A	B	C	D	E	F	G	H	I
1									
2	Growth								
3	Rate								
4	10%								
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									

Region	Year 1	Year 2	Year 3	Year 4	Year 5
Sales	10,000	11,000	12,100	13,310	14,641
Formula in Row 3	10,000	=D4*(1+$A$4)	=D4*(1+$A$4)	=D4*(1+$A$4)	=D4*(1+$A$4)

The growth rate is 10%.
The growth rate is entered one time, in one place - cell A4.

To show a 10% increase each month, the previous month is multiplied by (1 + 10%), or 1.1.
Instead of **hardcoding** each formula with 1.1, we use (1 + $A$4).

We have replaced the hardcoded formula with a formula that contains an absolute cell reference.
The absolute cell reference points to the cell A4, where the growth rate is input by the user.

Every time the user changes the growth rate in cell A4, all of the formulas will be updated automatically.
Changing formulas automatically is efficient, the best way to ensure all relevant formulas are changed, and minimizes the potential for error.

Some final comments:

- **Avoid hardcoding even if you are certain that the value in a cell will never change.** Best practice recommends that you still use a formula with a cell reference instead of hardcoding a text or numeric value.

- **Hardcoding only seems to be quicker and easier than using a formula when entering data.** If you are only doing a small, one time, simple spreadsheet and don't have much time to complete it, hardcoding may be a better option. But always assume this is the exception, not the rule.

- **Hardcoding makes your spreadsheet less flexible.** Why make your spreadsheet less flexible, when one of Excel's best features is its versatility, which enables you to build a spreadsheet that meets your needs?

- **With large, complex spreadsheets, hardcoding will always be less efficient and more time consuming whenever you change assumptions.** In addition, there is a greater risk that you will not change all of the cells that are affected.

REASON 4

Did You Copy and Paste Your Data?

Be sure you capture every cell you need to copy. Learn how to use Paste / Special.

Copy and paste is one of Excel's best and most used features. It's an incredible time saver, allowing you to replicate text, numbers and formulas to multiple cells with one click of the mouse. Thanks to copy and paste, Excel enables you to be faster, more efficient and productive in creating spreadsheets.

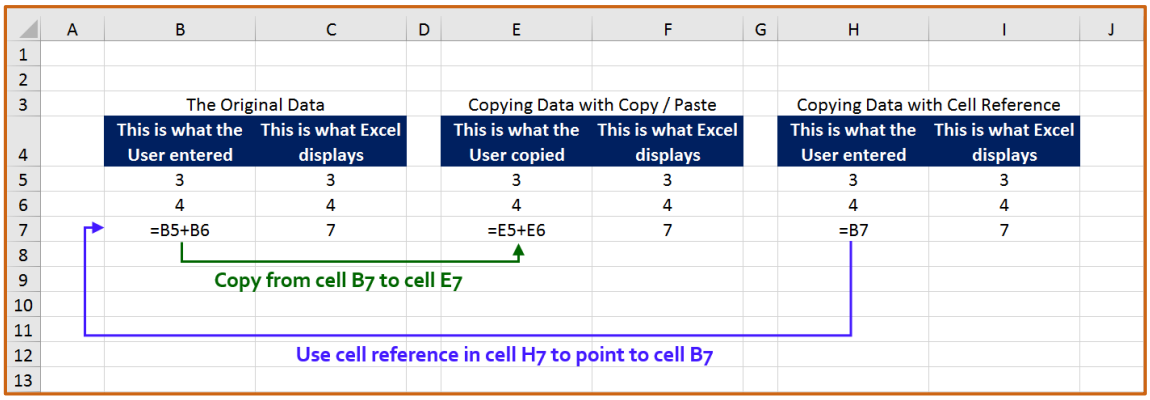
However, if you don't use copy and paste correctly, you will quickly fill your spreadsheet with all kinds of errors. Each mistake will have to be located and corrected, with the result you will be slower, less efficient and productive in creating spreadsheets.

We have already seen how copy and paste can lead to errors if you don't understand absolute and relative cell addresses. Incorrect use of copy and paste can also cause you to place the wrong text and numbers in cells. Here's the rule of thumb for copy and paste:

Rule #1: Whenever possible, use a cell reference instead of copy and paste.

Using a cell reference instead of copy and paste can significantly reduce the chance of error in your spreadsheet. Why? First, you have a much simpler formula in the cell with the cell reference. Second, you don't have to worry if the original formula is properly set with absolute or relative cell addresses. This is because you are pointing to a cell, not copying a formula. Picture 16 illustrates how this works.

Picture 16: Difference between using Copy / Paste and a cell reference to copy data



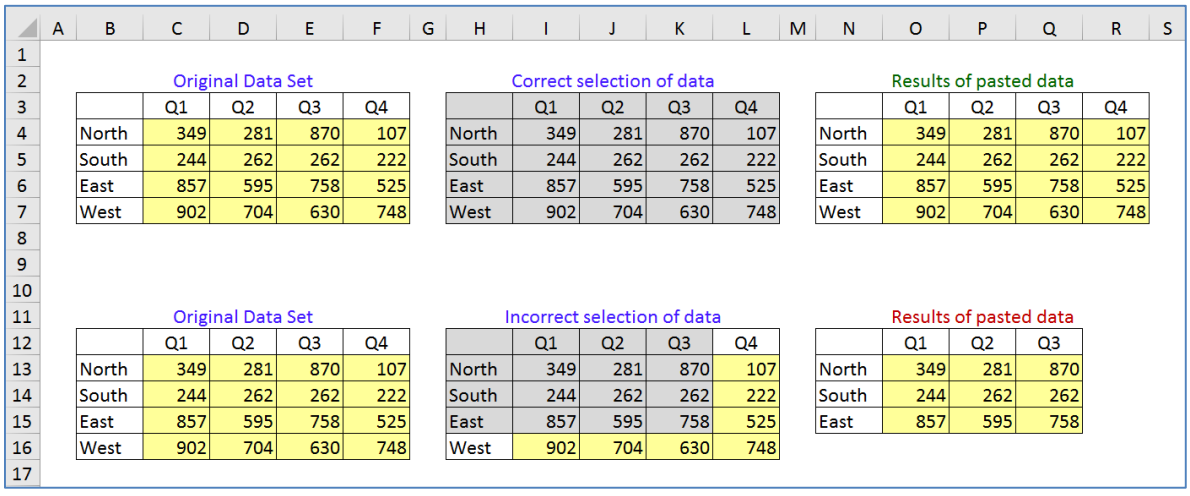
	The Original Data		Copying Data with Copy / Paste		Copying Data with Cell Reference	
	This is what the User entered	This is what Excel displays	This is what the User copied	This is what Excel displays	This is what the User entered	This is what Excel displays
5	3	3	3	3	3	3
6	4	4	4	4	4	4
7	=B5+B6	7	=E5+E6	7	=B7	7

See how much easier it is to use a cell reference instead of copy and paste? Using a cell reference means you only have to look at the referenced cell (B7). By contrast, with copy and paste you have to confirm that the correct cells are being added, and that the cell references are absolute or relative. Imagine if your formula involved more than just adding two numbers!

Rule #2: Select all of the cells you need before you copy, and paste your data to the correct location.

Picture 17 shows what happens when you don't select all of the cells you need to copy. When you paste the incomplete selection to another section of your worksheet, you do not transfer all of the data you need. Without the required data in the proper space, any calculations based on this data will be wrong.

Picture 17: Results of failing to select all cells needed before you copy



Original Data Set

	Q1	Q2	Q3	Q4
North	349	281	870	107
South	244	262	262	222
East	857	595	758	525
West	902	704	630	748

Correct selection of data

	Q1	Q2	Q3	Q4
North	349	281	870	107
South	244	262	262	222
East	857	595	758	525
West	902	704	630	748

Results of pasted data

	Q1	Q2	Q3	Q4
North	349	281	870	107
South	244	262	262	222
East	857	595	758	525
West	902	704	630	748

Original Data Set

	Q1	Q2	Q3	Q4
North	349	281	870	107
South	244	262	262	222
East	857	595	758	525
West	902	704	630	748

Incorrect selection of data

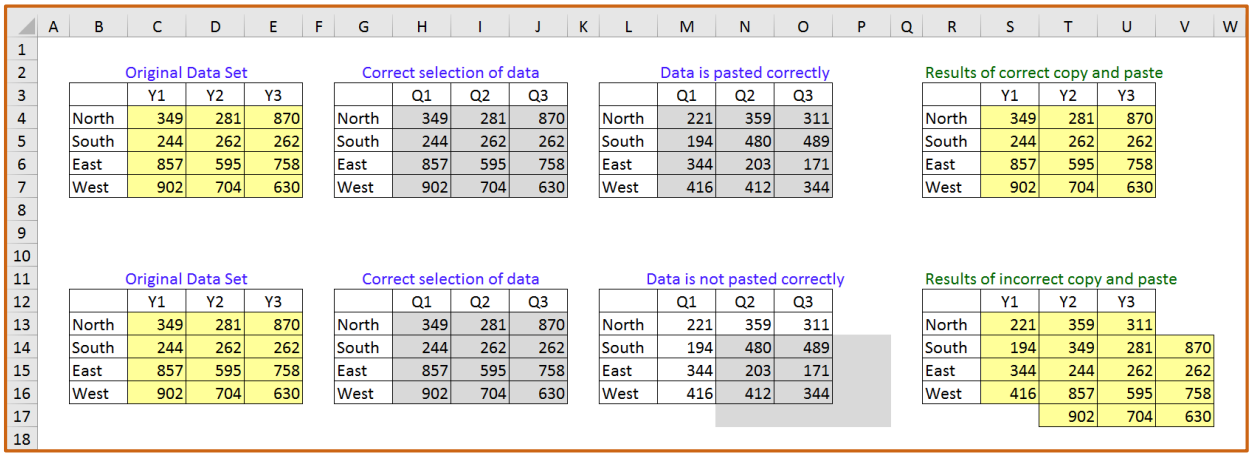
	Q1	Q2	Q3	Q4
North	349	281	870	107
South	244	262	262	222
East	857	595	758	525
West	902	704	630	748

Results of pasted data

	Q1	Q2	Q3
North	349	281	870
South	244	262	262
East	857	595	758

Picture 18 shows what happens when you paste your data to the wrong location on the worksheet.

Picture 18: Results of pasting data to the wrong location on the spreadsheet



Original Data Set

	Y1	Y2	Y3
North	349	281	870
South	244	262	262
East	857	595	758
West	902	704	630

Correct selection of data

	Q1	Q2	Q3
North	349	281	870
South	244	262	262
East	857	595	758
West	902	704	630

Data is pasted correctly

	Q1	Q2	Q3
North	221	359	311
South	194	480	489
East	344	203	171
West	416	412	344

Results of correct copy and paste

	Y1	Y2	Y3
North	349	281	870
South	244	262	262
East	857	595	758
West	902	704	630

Original Data Set

	Y1	Y2	Y3
North	349	281	870
South	244	262	262
East	857	595	758
West	902	704	630

Correct selection of data

	Q1	Q2	Q3
North	349	281	870
South	244	262	262
East	857	595	758
West	902	704	630

Data is not pasted correctly

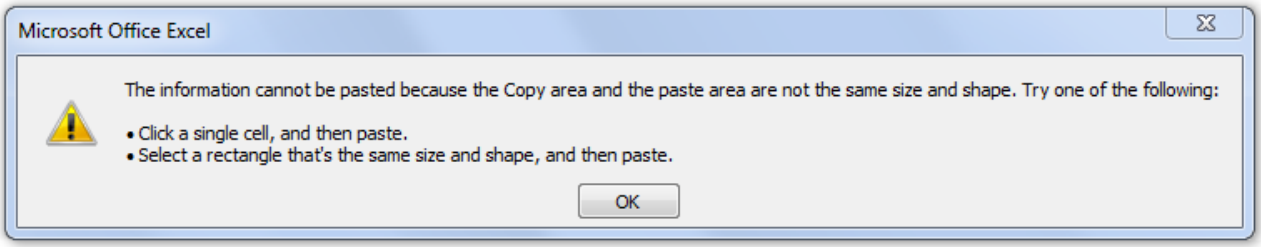
	Q1	Q2	Q3
North	221	359	311
South	194	480	489
East	344	203	171
West	416	412	344

Results of incorrect copy and paste

	Y1	Y2	Y3	
North	221	359	311	
South	194	349	281	870
East	344	244	262	262
West	416	857	595	758
		902	704	630

Rule #3: Do Not Merge Cells. Instead, use Center Across Selection.

Another common copy and paste problem occurs when you work with merged cells. Excel won't let you copy from an unmerged cell to a merged cell. If you try to do so, Excel displays a message box that looks like this:



To correct this error can be a tedious process. You have to find the cells that are merged, then unmerge them. You can probably imagine what a chore this would be if you had to change not one cell, but an entire column.

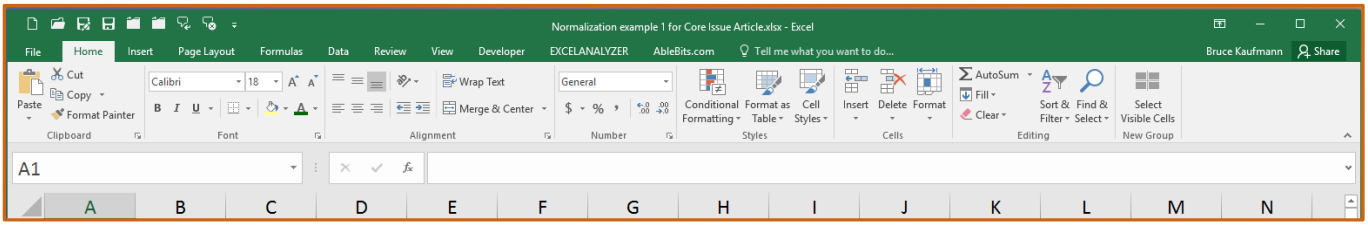
What You Need to Know

If you have to spread text over several cells do not use Merge Across.
Instead use Center Across Selection and you will never have copy and paste problems.

Center Across Selection looks exactly the same as Merge Across, but Center Across Selection is much more flexible, and is better for preserving the structure of your worksheet.

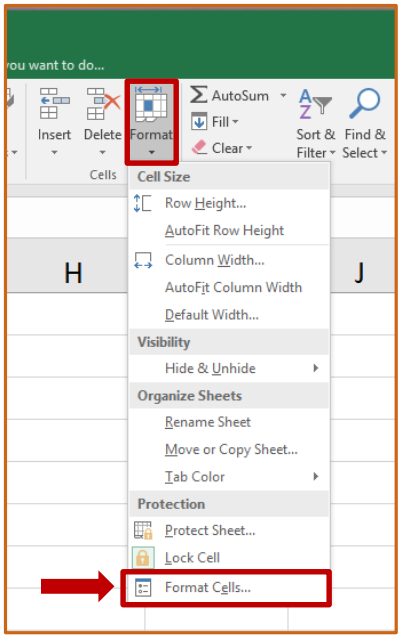
Center Across Selection is found on Format Cells dialog box, which you call up from the Format section of the Home Ribbon. First, select Format from the Cells section of the Home ribbon.

Picture 20: Location of the Format option in the Cells section of the Home ribbon



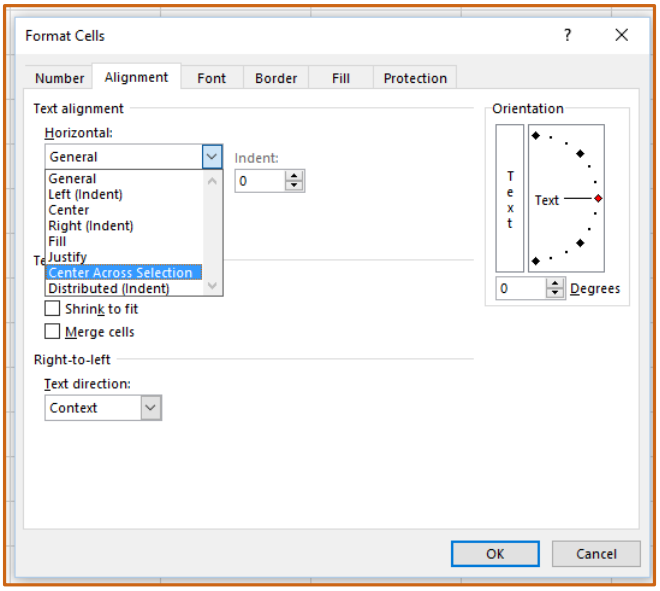
Choose the Format Cells option.

Picture 20: Location of the Format option in the Cells section of the Home ribbon



You will now see the Format Cells dialog box. Choose the Alignment tab. Under Text Alignment, click the arrow under the Horizontal option. Choose Center Across Selection from the dropdown list.

Picture 22: Center Across Selection option on the Format Cells dialog box



Rule #4: Use Paste Special.

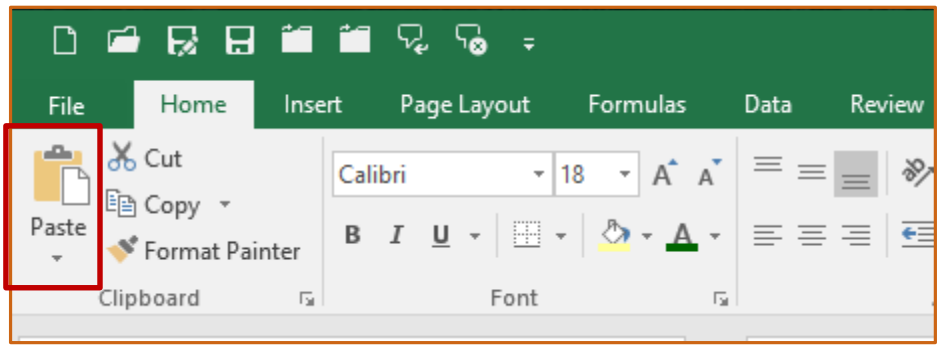
Sometimes your copy and paste error occurs because you copy everything in a cell. Even though a cell appears to have only a number, text or formula, in fact there are many elements present in a cell: formulas, values, formats, comments, data validation, and borders.

At times you may only want to copy one element from one cell to another cell. Here are some examples:

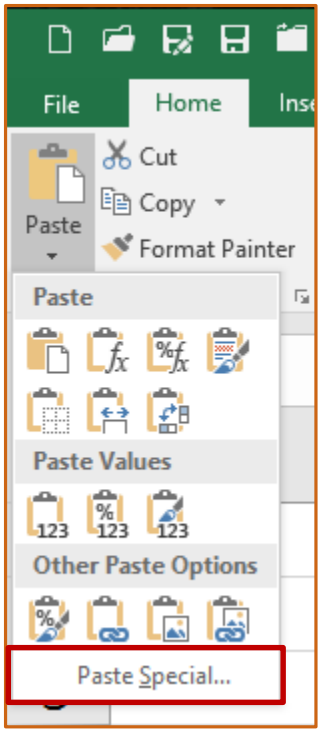
- Your cell contains a formula, but you only want to copy the results of the formula.
- Your cell has bold type and yellow shading and you only want to copy the format.
- Your cell has comments and you want to copy the comments, not the contents.
- Your cell contains a formula and you want to copy the formula, not the format.
- You have a row of data and you want to copy it elsewhere as a column.

Excel has a nifty feature that enables you to do all of these things and more. It is called Paste Special. You find this option on the Paste option in the Clipboard section of the Home ribbon. Take a look at Picture 23.

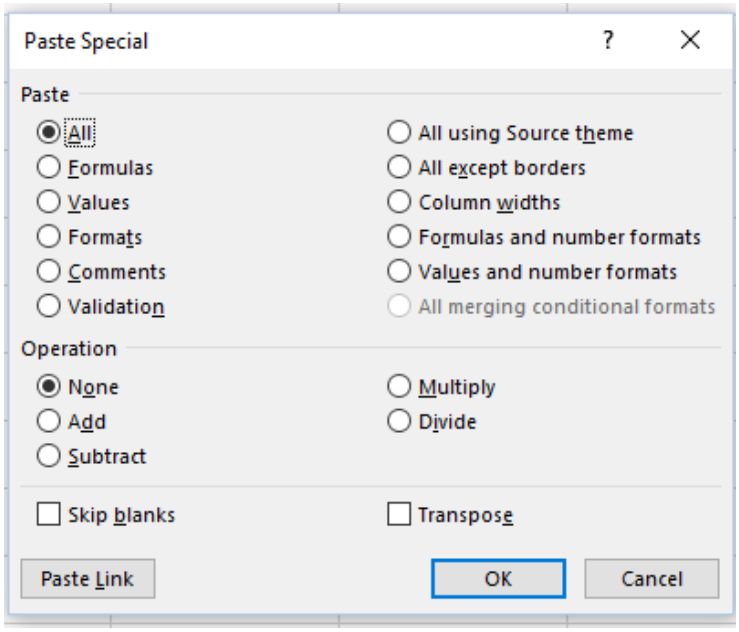
Picture 23: Location of Paste option in Clipboard section of the Home ribbon



Select Paste Special



The Paste Special Dialog box appears



Here's a list describing the most commonly used Paste Special options. I'd encourage you to experiment with the others as well, so you'll be able to use it should the need arise.

- **Formulas** - Pastes only the formulas.
  - Use this when your target cells are already properly formatted.

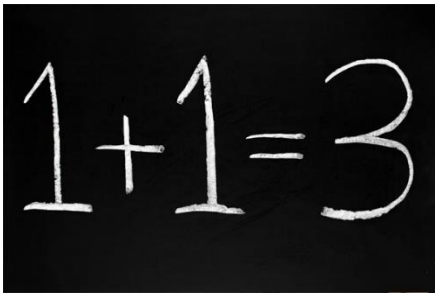
- **Values** – Pastes only the values from the copied cells. If your original cell has a formula, the target cell will have a value.
    - Use this when you want your numbers to stay the same, even if you change the original formula.

- **Formats** – Pastes only the formats from the source cell to the target cell.
    - This is the best option if you want one range of cells to look the same as another range of cells you have formatted. It is much easier and quicker to use Paste Special | Formats than to highlight each cell in the new range to manually change the formats.

- **Operation** – This allows you to apply an arithmetic operation to the copied cells, using the target cell.
    - This is most useful when you want to do a calculation using data in two columns of numbers. This is an alternative to using a formula.
    - A formula requires you to have a third column containing the formulas.
    - Paste Special | Operation enables you to have only two columns, each of which only has values.

- **Transpose** – Flips the data, from a row to column, or from column to row.
    - You can use Transpose by itself or in combination with other Paste Special options.

In summary, copy and paste is one of Excel's best features. Just be sure you have used it properly to avoid errors in your spreadsheet.



REASON 5

Do Your Formulas Have Errors?

No overly complex formulas.
Choose the right function for the job.

If you make a mistake in your formula, Excel lets you know right away. Most people are familiar with Excel's error messages that pop up when you don't enter the formula correctly. These errors, typically the result of incorrect syntax, are very common.

However, there are other common formula mistakes that people make all the time without realizing it. This includes not following the Order of Precedence, writing formulas that are needlessly complex, and choosing the wrong function.

Syntax Errors

#DIV/0! – You are trying to divide by zero. Dividing by zero is mathematically impossible, so Excel displays an error message.

#N/A – You told Excel to look for data but either the data does not exist, or you told Excel to look for the data in the wrong place. **Take Note:** Unlike other syntax errors, with the #N/A error, your formula is probably written correctly.

#NAME? – There are several reasons this can occur:

- You misspelled something in your formula, typically the function name or a named range if you have used one.
- You forgot to use double quotes when using text in the formula.
- You forgot to include the range operator – you put A1C1 instead of A1:C1.

#NUM! - Your formula produces a result – positive or negative – that is too large for Excel to show.

#REF! – Your formula points to a cell that does not exist. This typically occurs when you write a formula that refers to a cell in a row or column, then delete that row or column.

#VALUE! – Your text or numerical values are incorrect. You may have entered or pointed to text values in a formula that only accepts numerical values.

What You Need to Know

Most Excel functions have both required and optional arguments.
All optional arguments have a default value.
NEVER assume the default value is the correct choice for your situation.
ALWAYS explicitly specify the optional argument to avoid errors.

Order of Precedence

Excel follows a very specific set of rules when it calculates your formula. Excel does not just start at the beginning and go from left to right, calculating as it goes. Instead, Excel looks for certain symbols to determine the order in which Excel performs its calculations.

This is the Order of Precedence:

Picture 24: Order of Precedence

Operator	Operation	Order
:	Range	1st
<space>	Intersection	2nd
,	Union	3rd
-	Negation	4th
%	Percentage	5th
^	Exponentiation	6th
* and /	Multiplication and Division	7th
+ and -	Addition and Subtraction	8th
&	Concatenation	9th
=, <, >, <=, >=, <>	Comparison	10th

You can manipulate the Order of Precedence by using parentheses in your formula.

Let's look at some examples!

Picture 25: Formula calculation controlled by Order of Precedence vs. Controlled by Parentheses

	A	B	C	D	E	F	G
1							
2		Order of Precedence Controls Calculation			Parentheses Control Calculation		
3		Original Formula	=4-2^3*2+30/6		Original Formula	=(4-2)^(3*2)+30/6	
4							
5		Exponentiation	=4-2^3*2+30/6		Subtraction	=(4-2)^(3*2)+30/6	
6							
7		Multiplication	=4-8*2+30/6		Multiplication	=2^(3*2)+30/6	
8							
9		Subtraction	=4-16+30/6		Exponentiation	=2^6+30/6	
10							
11		Division	=-12+30/6		Division	=64+30/6	
12							
13		Addition	=-12+5		Addition	=64+5	
14							
15		Final Answer	-7		Final Answer	69	
16							

You can see how using parentheses gives a completely different answer than the Order of Precedence. So, if you want to ensure you always get the right answer, you must either:

1. Be certain that you understand the Order of Precedence OR
2. Use parentheses to ensure that your formula calculates the way you want.

Complex Formulas

All too often users write formulas that are too long and complex. Such formulas are hard to understand and even harder to troubleshoot if you get a wrong answer or an error message.

What You Need to Know

Simple. Simple. Simple.

Your formula should not be so complex that the user cannot understand it at first glance.

Resist the urge to put multiple calculations into one formula.

Break up your formula into small parts into separate columns.

Keep in mind that other people may need to look at your spreadsheet. You want to make it as easy as possible for other users to understand what you did. That is why using small formulas with helper columns is better than having one long, complex formula.

What is a helper column? It is a column that you use in a spreadsheet to store intermediate steps in your calculation. Helper columns, with short formulas, help the user understand the thought process behind your calculations.

Picture 26 shows a table that uses a needlessly complex formula in one cell. Any user who tries to understand or trouble shoot this file will get frustrated very quickly. It is hard to glance at this formula and understand what each part is doing, why it is included, and what is being referenced.

Picture 26: Sales calculation table with one, overly complex formula

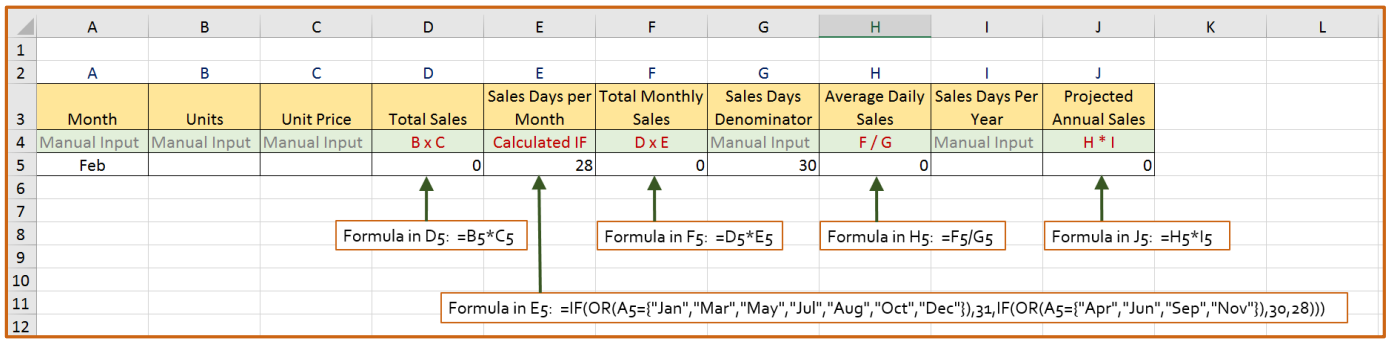
	A	B	C	D	E	F	G	H	I
1									
2	Month	Units	Unit Price	Sales Days Denominator	Sales Day Per Year	Projected Annualized Sales			
3	Feb	10	$ 1.50	30	365	5,110			
4									
5									
6	The only cell with a formula is G3. This is the formula:								
7									
8	=((B3*C3*IF(OR(A3="Jan",A3="Mar",A3="May",A3="Jul",A3="Aug",A3="Oct",A3="Dec"),31,IF(OR(A3="Apr",A3="Jun",A3="Sep",A3="Nov"),30,28)))/E3)*F3								
9									
10									

By contrast, take a look at Picture 27 on the next page. In this table, the user added several helper columns:

- Column D – Total Sales
- Column E – Sales Days per Month
- Column H – Average Daily Sales
- Column I – Sales Days per Year

With the inclusion of the helper column, it is easy to understand the process by which the final answer – annual sales – is calculated. The formula in the last column is much shorter and easier to understand. Each helper column has a short formula. The only long formula, in E5, is easier to grasp because it is a standalone IF function, and not nested in a larger formula.

Picture 27: Sales calculation table with help columns and short formulas



Choose the Correct Function

You must be careful when typing the function name in Excel. There are many functions that have similar names but perform very different functions. Here are some examples:

- AVERAGE
  - Returns the average of a list of numbers.
- AVERAGEA
  - Returns the average of a list of numbers. Counts cells with the logical values of TRUE as the number 1 and cells with the logical value of FALSE as zero.
- AVERAGEIF
  - Calculates the average of a range of cells that meet a specific criterion.
- AVERAGEIFS
  - Calculates the average of a range of cells that meet multiple criteria.

- COUNT
  - Returns the number of numerical values in a range of cells.
- COUNTA
  - Returns the number of non-blank cells in a range of cells.
- COUNTBLANK
  - Returns the number of blank cells in a range of cells.
- COUNTIF
  - Counts the number of cells in a range that meet a specific criterion.
- COUNTIFS
  - Counts the number of cells in a range that meet multiple criteria.

All Done!

We've covered a lot of reasons why your spreadsheet isn't behaving. Remember the basic steps:

1. Normalize your data.
2. Remember the difference between absolute and relative cell references.
3. Avoid hardcoding in your formulas.
4. Be careful with paste and copy. Consider using cell references or Paste Special.
5. Use the correct formula, specify all arguments, use helper columns and short formulas.

Now, there is good news and bad news. The good news is that we've covered the most common problems users encounter when they are having trouble with their spreadsheets.

The bad news we've only scratched the surface of what could go wrong. Excel is a wonderful, complex and flexible tool. The same features that make it a valuable resource also can cause many of the problems.

So if you run into a problem you can't understand or solve, don't hesitate to contact me so we can discuss your issue and determine the best solution.

I enjoy working with Excel and helping people solve their problems. I hope this has been helpful to you. Please contact me with questions or suggestions. If you think this article will be useful to someone you know, I encourage you to pass it along. Thank you.

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