Advanced Excel

Sheet protection with password

- Flash Fill option
- Database access from MS Excel
- What if Analysis-Goalseek, Solver &Scenerios
- Macros & VBA
- Cell reference-Relative, Absolute, Row Absolute & Column Absolute. Reference from other sheet
- R1C1 Notation
- Using Name for cell range
- Excel formula error codes.
- Auditing tool in Excel
- Trace precedence & dependence.
- Formula evaluator
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- Lookup formulasVlookup, Lookup, Index, Hlookup
- Excel settings in Registry
- Tips and tricks
- Pivot table and Pivot chart
- Conditional formatting
- Advanced Graphs
- Power Queries

Flash Fill option

Using Flash Fill in Excel

Flash Fill automatically fills your data when it senses a pattern. For example, you can use Flash Fill to separate first and last names from a single column, or combine first and last names from two different columns.

Note: Flash Fill is only available in Excel 2013 and later.

How to use Flash Fill in Excel

Flash Fill is one of the most amazing features of Excel. It grabs a tedious task that would take hours to be performed manually and executes it automatically in a flash (hence the name). And it does so quickly and simply without you having to do a thing, but only provide an example of what you want.

What is Flash Fill in Excel?

Excel Flash Fill is a special tool that analyses the information you are entering and automatically fills data when it identifies a pattern.

The Flash Fill feature was introduced in Excel 2013 and is available in all later versions of Excel 2016, Excel 2019, Excel 2021, and Excel for Microsoft 365.

History

Started in December 2009 as an attempt of Sumit Gulwani, a senior researcher at Microsoft, to help a businesswoman he accidentally met at the airport with her merging challenge, a few years later it has evolved into a powerful ability to automate many Excel chores.

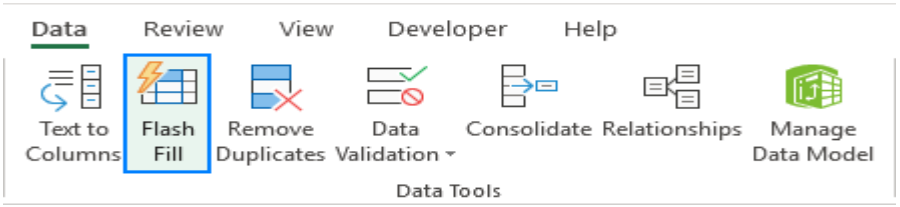
Flash Fill easily copes with dozens of different tasks that otherwise would require complex formulas or even VBA code such as splitting and combining text strings, cleaning data and correcting inconsistencies, formatting text and numbers, converting dates to the desired format, and a lot more.

Each time, Flash Fill combines millions of small programs that might accomplish the task, then sorts those code snippets using machine-learning techniques and finds the one that suits best for

the job. All this is done in milliseconds in the background, and the user sees the results almost immediately!

Where is Flash Fill in Excel?

In Excel 2013 and later, the Flash Fill tool resides on the *Data tab*, in the *Data tools* group:



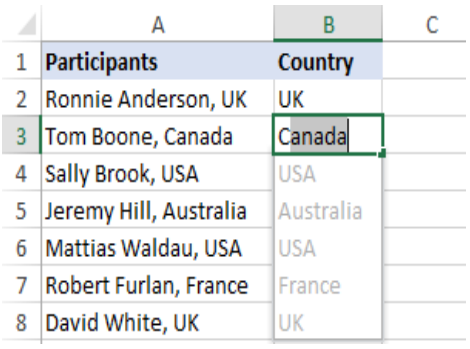
Excel Flash Fill shortcut

Those of you who prefer working from a keyboard most of the time, can run Flash Fill with this key combination: Ctrl + E

How to use Flash Fill in Excel

Usually Flash Fill starts automatically, and you only need to provide a pattern. Here's how:

1. Insert a new column adjacent to the column with your source data.
2. In the first cell of a newly added column, type the desired value.
3. Start typing in the next cell, and if Excel senses a pattern, it will show a preview of data to be auto-filled in the below cells.
4. Press the Enter key to accept the preview. Done!
5.



	A	B	C
1	Participants	Country	
2	Ronnie Anderson, UK	UK	
3	Tom Boone, Canada	Canada	
4	Sally Brook, USA	USA	
5	Jeremy Hill, Australia	Australia	
6	Mattias Waldau, USA	USA	
7	Robert Furlan, France	France	
8	David White, UK	UK	

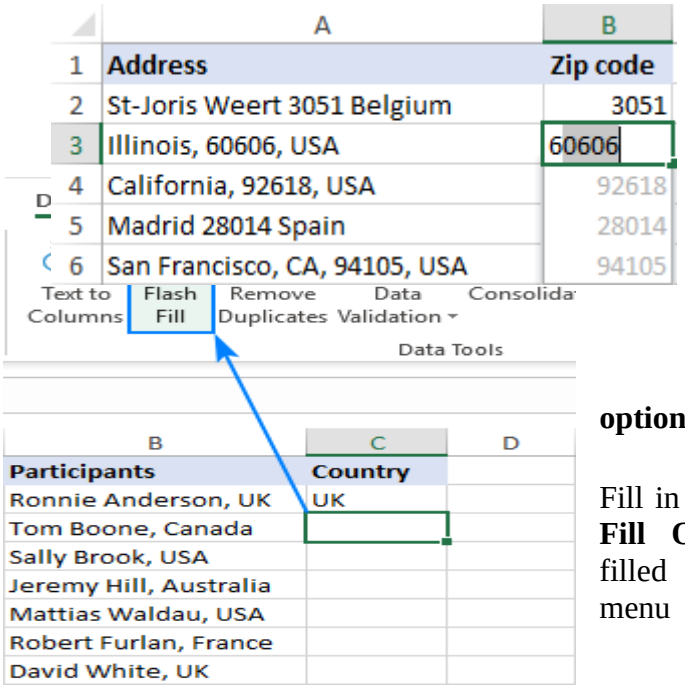
Tips:

- If you are unhappy with the Flash Fill results, you can undo them by pressing Ctrl + Z or via the Flash Fill options menu.
- If Flash Fill does not start automatically, try these simple troubleshooting techniques.
- To find the number of the Flash Fill changed cells, just look at the Excel status bar.

F shortcut

In most situations, Flash Fill kicks in automatically as soon as Excel establishes a pattern in the data you are entering. If a preview does not show up, you can activate Flash Fill manually in this way:

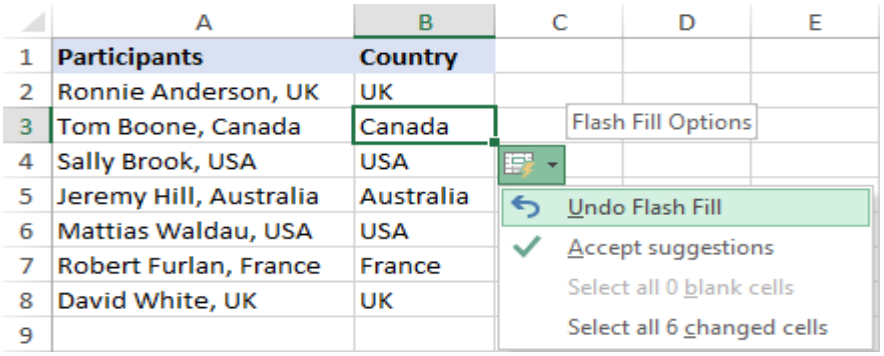
1. Fill in the first cell and press Enter.
2. Click the **Flash Fill** button on the *Data* tab or press the Ctrl + E shortcut.



Excel Flash Fill options

When using Flash Fill in Excel to automate data entry, the **Flash Fill Options** button appears near the auto-filled cells. Clicking this button opens the following menu that lets you do the following:

- Undo the Flash Fill results.
- Select blank cells that Excel has failed to populate.
- Select the changed cells, for example, to format them all at once.



Excel Flash Fill examples

As already mentioned, Flash Fill is a very versatile tool. The below examples demonstrate some of its capabilities, but there is much more to it!

Extract text from cell (split columns)

Before Flash Fill came into existence, splitting the contents of one cell into several cells required the use of the Text to Columns feature or Excel Text functions. With Flash Fill, you can get the results instantly without intricate text manipulations.

Supposing you have a column of addresses and you want to extract zip codes into a separate column. Indicate your goal by typing the zip code in the first cell. As soon as Excel understands what you are trying to do, it fills in all the rows below the example with the extracted zip codes. You only need to hit Enter to accept them all.

Formulas to split cells and extract text:

- Extract substring - formulas to extract text of a specific length or get a substring before or after a given character.
- Extract number from string - formulas to extract numbers from alphanumeric strings.
- Split names in Excel - formulas to extract first, last and middle names.

Extracting and splitting tools:

- Split Text - a versatile tool to divide cell content into multiple columns or rows. Easily split string by any character, string, or mask.
- Split Names tool - fast and easy way to separate names in Excel.

Combine data from several cells (merge columns)

If you have an opposite task to perform, no problem, Flash Fill can concatenate cells too. Moreover, it can separate the combined values with a space, comma, semicolon or any other character - you just need to show Excel the required punctuation in the first cell:

	A	B	C	D
1	**City**	**Country**	**Zip code**	**Address**
2	Alden	USA	60001	Alden, USA, 60001
3	Los Angeles	USA	900001	Los Angeles, USA, 900001
4	Madrid	Spain	28014	Madrid, Spain, 28014
5	San Francisco	USA	94105	San Francisco, USA, 94105
6	St-Joris Weert	Belgium	3051	St-Joris Weert, Belgium, 305

Formulas to join cell values:

- CONCATENATE function in Excel - formulas to combine text strings, cells and columns.

Merging tools:

- Merge Tables Wizard - quick way to combine two tables by common columns.
- Merge Duplicates Wizard - Combine similar rows into one by key columns.

Clean data

If some data entries in your worksheet begin with a leading space, Flash Fill can get rid of them in a blink. Type the first value without a preceding space, and all extra spaces in other cells are gone too:

	A	B
1	**Source data**	**Cleaned data**
2	Alden	Alden
3	Los Angeles	Los Angeles
4	Madrid	Madrid
5	San Francisco	San Francisco
6	St-Joris Weert	St-Joris Weert

Formulas to clean data:

- Excel TRIM function - formulas to remove excess spaces in Excel.

Data cleaning tools:

- Trim Spaces - trim all leading, trailing and in-between spaces but a single space character between words.

Format text, numbers and dates

Quite often the data in your spread sheets is formatted in one way while you want it in another. Just start typing the values exactly as you want them to appear, and Flash Fill will do the rest.

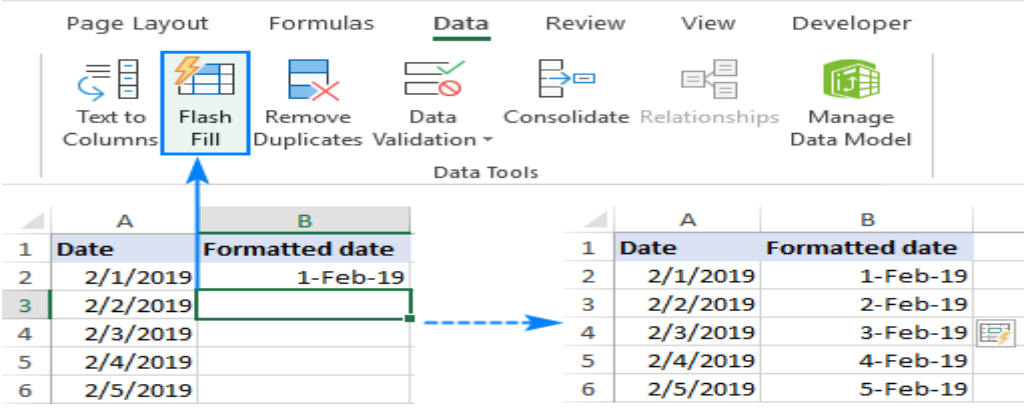
Perhaps you have a column of first and last names in lowercase. You wish the last and first names to be in proper case, separated with a comma. A piece of cake for Flash Fill :

	A	B
1	**Name**	**Properly formatted name**
2	ronnie anderson	Anderson, Ronnie
3	tom boone	Boone, Tom
4	sally brook	Brook, Sally
5	jeremy hill	Hill, Jeremy
6	mattias waldau	Waldau, Mattias
7	robert furlan	Furlan, Robert
8	david white	White, David

Maybe you are working with a column of numbers that need to be formatted as phone numbers. The task can be accomplished by using a predefined Special format or creating a custom number format. Or you can do it an easy way with Flash Fill:

	A	B
1	**Number**	**Phone number**
2	1234567891	123-456-7891
3	2345678912	234-567-8912
4	3456789123	345-678-9123
5	4567891234	456-789-1234
6	5678912345	567-891-2345

To re-format the dates to your liking, you can apply the corresponding Date format or type a properly formatted date into the first cell. Oops, no suggestions have appeared… What if we press the Flash Fill shortcut (Ctrl + E) or click its button on the ribbon? Yep, it works beautifully!



	A	B
1	**Date**	**Formatted date**
2	2/1/2019	1-Feb-19
3	2/2/2019	
4	2/3/2019	
5	2/4/2019	
6	2/5/2019	

	A	B
1	**Date**	**Formatted date**
2	2/1/2019	1-Feb-19
3	2/2/2019	2-Feb-19
4	2/3/2019	3-Feb-19
5	2/4/2019	4-Feb-19
6	2/5/2019	5-Feb-19

Replace part of cell contents

Replacing part of a string with some other text is a very common operation in Excel, which Flash Fill can also automate.

Let's say, you have a column of social security numbers and you want to censor this sensitive information by replacing the last 4 digits with XXXX.

To have it done, either use the REPLACE function or type the desired value in the first cell and let Flash Fill auto fill the remaining cells:

	A	B
1	**Social Security Number**	**Censored data**
2	123-45-6789	123-45-XXXX
3	012-34-6789	012-34-XXXX
4	234-56-7891	234-56-XXXX
5	234-56-7890	234-56-XXXX
6	456-78-9012	456-78-XXXX

Advanced combinations

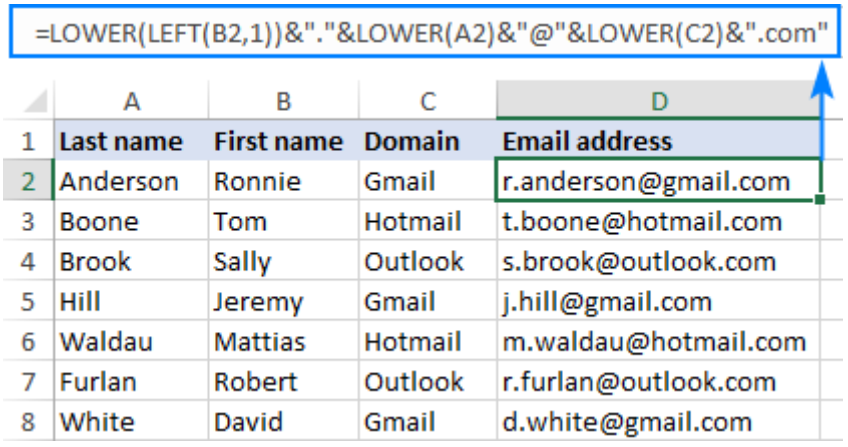
Flash Fill in Excel can accomplish not only straightforward tasks like demonstrated in the above examples but also perform more sophisticated data re-arrangements.

As an example, let's combine different pieces of information from 3 columns and add a few custom characters to the result.

Supposing, you have first names in column A, last names in column B, and domain names in column C. Based on this information, you want to generate email addresses in this format: *initial.surname@domain.com*.

For experienced Excel users, there is no problem to extract the initial with the LEFT function, convert all the characters to lowercase with the LOWER function and concatenate all the pieces by using the concatenation operator:

=LOWER(LEFT(B2,1))&"."&LOWER(A2)&"@"&LOWER(C2)&".com"



	A	B	C	D
1	**Last name**	**First name**	**Domain**	**Email address**
2	Anderson	Ronnie	Gmail	r.anderson@gmail.com
3	Boone	Tom	Hotmail	t.boone@hotmail.com
4	Brook	Sally	Outlook	s.brook@outlook.com
5	Hill	Jeremy	Gmail	j.hill@gmail.com
6	Waldau	Mattias	Hotmail	m.waldau@hotmail.com
7	Furlan	Robert	Outlook	r.furlan@outlook.com
8	White	David	Gmail	d.white@gmail.com

But can Excel Flash Fill create these email addresses for us automatically? Sure thing!

	A	B	C	D
1	Last name	First name	Domain	Email address
2	Anderson	Ronnie	Gmail	r.anderson@gmail.com
3	Boone	Tom	Hotmail	t.boone@hotmail.com
4	Brook	Sally	Outlook	s.brook@outlook.com
5	Hill	Jeremy	Gmail	j.hill@gmail.com
6	Waldau	Mattias	Hotmail	m.waldau@hotmail.com
7	Furlan	Robert	Outlook	r.furlan@outlook.com
8	White	David	Gmail	d.white@gmail.com

Excel Flash Fill limitations and caveats

Flash Fill is an awesome tool, but it does have a couple of limitations that you should be aware of before you start using this feature on your real data sets.

1. Flash Fill results do not update automatically

Unlike formulas, the results of Flash Fill are static. If you make any changes to the original data, they won't be reflected in the Flash Fill results.

2. May fail to identify a pattern

In some situations, especially when your original data are arranged or formatted differently, Flash Fill may stumble and produce incorrect results.

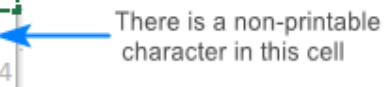
For example, if you use Flash Fill to extract middle names from the list where some entries contain only the First and Last names, the results for those cells will be wrong. So, it is wise to always review the Flash Fill output.

	A	B
1	Fll name	Middle Name
2	Ronnie D. Anderson	D.
3	Tom Andrew Boone	Andrew
4	Sally Ann Brook	Ann
5	Jeremy Hill	Jeremy Hi
6	Robert M. Furlan	M.

3. Ignores cells with non-printable characters

If some of the cells to be auto-filled contain spaces or other non-printable characters, Flash Fill will skip such cells.

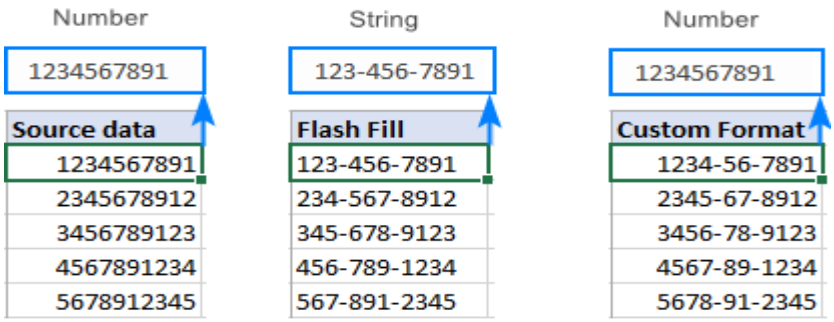
	A	B
1	Address	Zip code
2	St-Joris Weert 3051 Belgium	3051
3	Illinois, 60606, USA	60606
4	California, 92618, USA	
5	Madrid 28014 Spain	28014
6	San Francisco, CA, 94105, USA	94105



So, if any of the resulting cells are blank, clear those cells (*Home* tab >*Formats* group > *Clear* > *Clear All*) and run Flash Fill again.

4. May convert numbers to strings

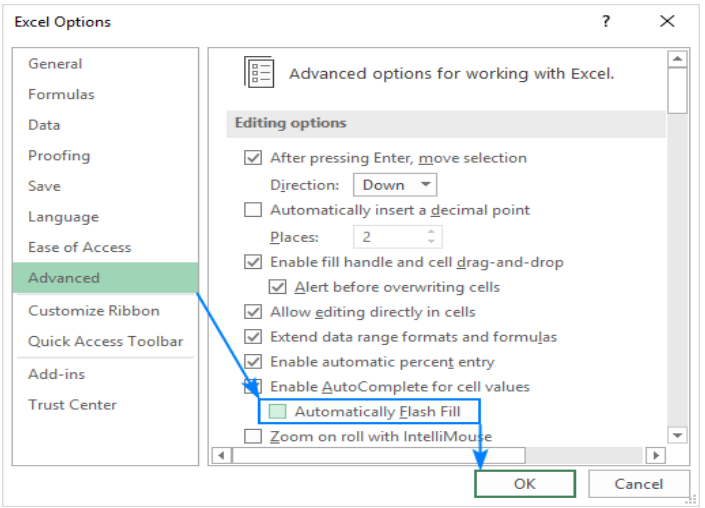
When using Flash Fill for reformatting numbers, please be aware that it may convert your numbers to alphanumeric strings. If you prefer to keep the numbers, use the capabilities of Excel format that changes only the visual representation, but not the underlying values.



How to turn Flash Fill on and off

Flash Fill in Excel is turned on by default. If you do not want any suggestions or automatic changes in your worksheets, you can **disable Flash Fill** in this way:

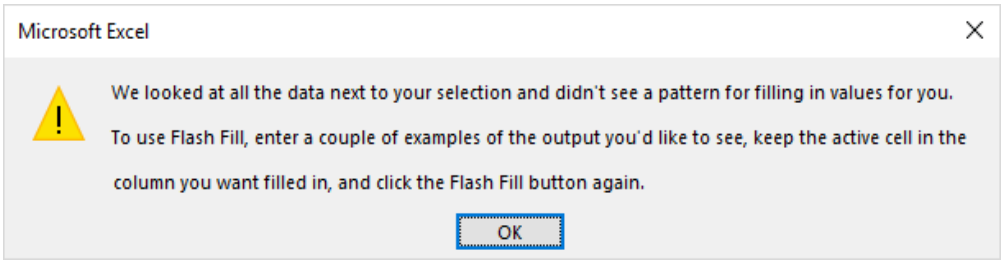
1. In your Excel, go to *File*> *Options*.
2. On the left panel, click *Advanced*.
3. Under *Editing options*, clear the **Automatically Flash Fill** box.
4. Click OK to save the changes.



To **re-enable** Flash Fill, simply select this box again.

Excel Flash Fill not working

In most cases, Flash Fill works without a hitch. When it falters, the below error may show up, and the following tips will help you get it fixed.



1. Provide more examples

Flash Fill learns by example. If it is unable to recognize a pattern in your data, fill in a couple more cells manually, so that Excel could try out different patterns and find the one best suited for your needs.

2. Force it to run

If Flash Fill suggestions do not appear automatically as you type, try to run it manually.

3. Make sure Flash Fill is enabled

If it does not start either automatically or manually, check if the Flash Fill functionality is turned on in your Excel.

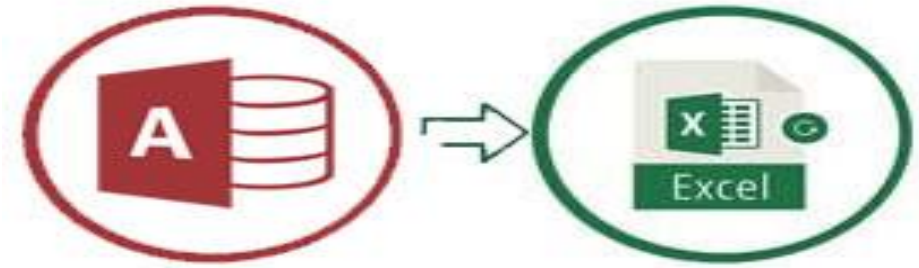
4. Flash Fill error persists

If none of the above suggestions has worked and Excel Flash Fill still throws an error, there is nothing else you can do but enter the data manually or with formulas.

That's how you use Flash Fill in Excel. I thank you for reading and hope to see you on our blog next week!

--x---x---x--

Database access from MS Excel



"Microsoft Access is an excellent general-purpose database management system whereas Excel is a spread sheet package, with lots of extra features thrown in."

MS Excel vs Access Comparison

MS Excel and Access are both Microsoft Office products. Microsoft Access, from the Office suite, is an excellent general-purpose database management system made for storing and analysing data.

Excel on the other hand is a spread sheet package, with lots of extra features thrown in which allow you to do things like creating pivot tables for summarising data. Using Excel as a database is great for small businesses and database beginners.

What Is MS Excel Used For?

Many people use Excel in business for a range of tasks from simple admin to full-scale automation. Thanks to its easy to use features Excel is very flexible and allows you to summarise data quickly without having to do anything too complicated.

Some of the uses for Excel include:

- Tabulating and analysing complex numerical data
- Creating tables and forms
- Writing and running macros to automate tasks
- General day-to-day data management (e.g., creating reports, charts, etc.)
- Store and manipulate audio and video files

Excel is very intuitive and easy to use, which allows most people to learn it quickly. If you're job hunting, including Excel skills on your CV can help you out a lot!

What Is An MS Access Database Used For?

MS Access is a database management system that gives you the ability to store your data in a relational database. This means that you can have multiple tables, linked together to form a relationship, which is all stored in one file.

The advantage of this is that if you update data in one table, it automatically updates all related records. This eliminates a lot of time-consuming admin and manual errors.

Access is great for

- Storing and managing large amounts of data
- Running reports that allow for grouping and sorting data
- Managing relational databases (e.g., adding and deleting tables, etc.)

The main disadvantage of Access is that it can be quite confusing to set up a database the first time. This means you should work with an MS Access Expert to help set it up and ensure everything is running smoothly.

"Excel and Access share some traits but are ultimately different tools. Comparing them is a useful way to highlight the key differences and understand where the strengths and weaknesses are."

Key Differences between Excel vs. Access

Excel and Access share some traits but are ultimately different tools. Comparing Excel vs. Access is a useful way to highlight the key differences between them and understand where the strengths and weaknesses are for both products.

Excel Do's and Don'ts: How to Make Your Spread sheets shine!

Excel vs. Access – Data Visualisation

Excel allows you to add graphics such as charts, pictures, etc. to your worksheets. You can also link these pictures or graphics to your data so they automatically update when the data updates. This is great if you have a report that requires data to be displayed in the form of a chart.

Access allows you to add custom forms when creating a database. These forms can take multiple pieces of information from a user and display them in an organised fashion, so they are easy to read and navigate.

You can also add buttons or links on these forms so your users can navigate to the information they require. This is useful if you need your users to provide data on a form or screen that they must print and sign, etc.

Excel vs. Access – Automation

Excel allows you to add macros so you can automate Excel tasks such as deleting reports once they have been printed and saving files on a regular basis. These are useful if your company requires the same routine tasks to be performed on various data files on a regular basis.

On the other hand, Microsoft Access allows you to create modules in which you can write VBA (Visual Basic for Applications) code. This allows you to automate certain tasks, such as inserting new records into a table or deleting old records. This is great if your company needs a certain set of tasks to be completed on a regular basis.

Excel vs. Access – Data Security

Excel does not allow you to add security measures to your files, so anyone with access will be able to view or edit the data. You can lock or protect individual worksheets with user-level security features, which might be useful if you need to restrict access to certain worksheets.

Access allows you to control who has access to your database files and what they can do with them. You can create usernames for multiple users so different people have different levels of access, depending on which username they use.

This is great if you want some users (e.g. managers) to update data, while others (e.g. MS Access consultants) are only allowed to view the data and access data when needed.

Excel vs. Access – Data Analysis

Excel allows you to perform basic data analysis by adding formulas and performing certain functions on written values.

Access has specific tools that are designed for analysing and summarising your data. These include PivotTables, which allow you to create tables that summarise the data in various ways (e.g., number of sales per region, etc.). This is great if you want to quickly analyse large amounts of data.

"Because Access is a professional database programme, it has some significant benefits over Microsoft Excel when building and using databases. Here are five reasons to use Access vs. Excel."

5 Reasons to Use Microsoft Access vs. Excel

Because Access is a professional database programme, it has some significant benefits over Microsoft Excel when building and using databases. Here are five reasons to use Access vs. Excel.

1. User Security Model

Access provides all the tools needed to set access permissions on objects such as tables and queries. The security model allows you to grant or deny certain users (e.g., managers) rights to edit or update data while restricting other users (e.g., consultants) so they are only allowed to view data in pre-defined ways.

2. Data Storage Capacity

Access is superior to Excel when it comes to the amount of data you can store in a database. This is because Access is specifically designed for storing large amounts of data, whereas Excel was not.

3. Maintaining Data Integrity

Access allows you to define field types and limits, which enforces appropriate data entry and prevents users from unintentionally inserting invalid values into fields.

For example, if your database requires a specific data format, Access can enforce this by defining the field as a Date type and setting an appropriate limit (e.g., only valid dates). The same applies to numerical values, currency types or text containing specific characters.

4. Data Analysis

Access provides various tools that are specifically designed for performing data analysis on large data sets. Use Pivot Tables to create tables summarising the data in multiple ways quickly (e.g., number of sales per region). This way, you don't have to enter all the data manually to find the information you need.

5. Summarising Data

Visual Basic for Applications (VBA) allows you to write code to execute specific tasks regularly. This makes it very easy to bring your database up-to-date by adding new records or deleting old ones. The VBA capability allows you access to the tables and fields within your database, which means that you can automate tasks like importing new records and exporting data to other applications.

"While Access is better suited to being used as a database, Excel can still be helpful too."

5 Examples Where an Excel Database Is Useful

While Access is better suited to being used as a database, Excel can still be helpful too. Here are three examples where an Excel database might be a good idea:

1. Phone Book

If you have a small phone book, using Microsoft Excel may be sufficient to store contact details. However, if you have a larger phone book, you could create a copy of the contacts in Excel and convert this into a database to make it easier to sort, update and retrieve information. In this case, you can utilise the standard functionality in Excel to create and manage your contacts.

2. Product Information Management (PIM)

Microsoft Excel's ability to create and update records makes it very useful for storing PIM data. The spread sheet can be set up with one column per product and another column for the price.

One of the most important fields is probablystock, which specifies how many products you have in stock. You can then quickly update this when you receive new products from suppliers or sell existing ones to customers.

3. Budget Planning

You may want to use a spread sheet in your budget planning because it makes it easy for you to create and manage several budgets.

Simply enter the budget items for each month, the beginning balance, create a formula to calculate the year-to-date totals and then sum up all of these values at the end.

4. Inventory Management

One of Excel's strengths is its ability to insert large amounts of data quickly. This can be useful if you need to keep track of thousands or even millions of products.

For instance, you could create a spread sheet where one row is created per product and include the price in these rows. This way, if you add new products, update prices or remove items from stock, you can simply enter the new values into Excel and then write a macro to update your inventory system automatically.

5. Sales & Order Tracking

Another way to use Excel as a database is by setting up one sheet per order. This allows you to create and update records easily and quickly view information such as the customer name and address, the list of items ordered their prices, and quantities.

"Excel and Access have their advantages and disadvantages. It really depends on what you want to do with them and how much knowledge you have on the product before deciding which is right for you."

Choosing Microsoft Access vs. Excel for Your Business

Both of these software packages have their advantages and disadvantages. It really depends on what you want to do with them and how much knowledge you have on the product before deciding which is right for you.

If you need to use a database regularly and need to automate tasks, Microsoft Access may be a better choice as it allows you to write VBA code. If you only need the software occasionally or want a simple solution for managing data, then Excel is probably more suited for your needs.

If you need help with databases in Excel or Microsoft Access contact our database experts today. We've worked with businesses across multiple industries to create professional databases solutions for millions of data records.

History

Ben Heron-Grimes

Ben is the founder and Director/ Head of Data Visualisation at The Excel Experts, a data consultancy creating spread sheet-based solutions for a range of B2B and B2C businesses. With over 15 years in the industry, Ben has extensive knowledge and skills ranging from data organisation and analysis to advanced 3D visualisation. He's also a WUMA-qualified Tai Chi instructor.

Need Help With Excel?

The Excel Experts are here to help with your Excel tasks big or small, including spread sheet help, consulting, reporting, VBA, automation, and Power Bi. Let us help you take your Excel skills to the next level with our experience in delivering solutions.

What if Analysis-Goalseek, solver & Scenerios

Introduction to What-If Analysis

By using What-If Analysis tools in Excel, you can use several different sets of values in one or more formulas to explore all the various results.

For example, you can do what-If Analysis to build two budgets that each assumes a certain level of revenue. Or, you can specify a result that you want a formula to produce, and then determine what sets of values will produce that result. Excel provides several different tools to help you perform the type of analysis that fits your needs.

How to use Goal Seek in Excel for What-If analysis

What-If Analysis is one of the most powerful Excel features and one of the least understood. In most general terms, What-If Analysis allows you to test out various scenarios and determine a range of possible outcomes. In other words, it enables you to see the impact of making a certain change without changing the real data. In this particular tutorial, we will focus on one of Excel's What-If Analysis tools **- Goal Seek.**

What is Goal Seek in Excel?

Goal Seek is Excel's built-in What-If Analysis tool that shows how one value in a formula impacts another. More precisely, it determines what value you should enter in an input cell to get the desired result in a formula cell.

The best thing about Excel Goal Seek is that it performs all calculations behind the scenes, and you are only asked to specify these three parameters:

- Formula cell
- Target/desired value
- The cell to change in order to achieve the target

The Goal Seek tool is especially useful for doing sensitivity analysis in financial modelling and is widely used by management majors and business owner. But there are many other uses that may prove helpful to you.

For instance, Goal Seek can tell you how much sales you have to make in a certain period to reach $100,000 annual net profit (example 1). Or, what score you must achieve for your last exam to receive an overall passing score of 70% (example 2). Or, how many votes you need to get in order to win the election (example 3).

On the whole, whenever you want a formula to return a specific result but are not sure what input value within the formula to adjust to get that result, stop guessing and use the Excel Goal Seek function!

Note. Goal Seek can process only **one input value** at a time. If you are working on an advanced business model with multiple input values, use the Solver add-in to find the optimal solution.

How to use Goal Seek in Excel

The purpose of this section is to walk you through how to use the Goal Seek function. So, we'll be working with a very simple data set:

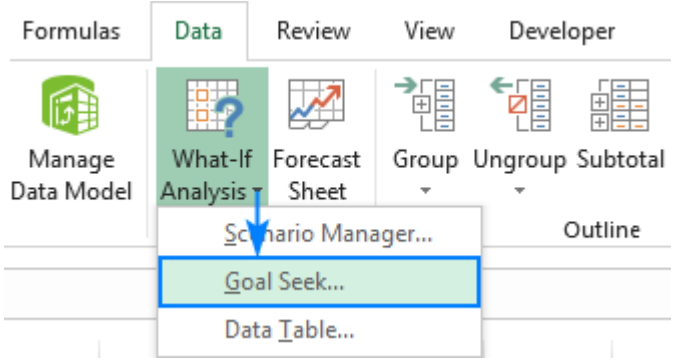
Data set:

	A	B	C
1		**Goal Seek**	
2	**Item price**	$5	
3	**Qty.**	100	Variable
4	**Commission**	10%	
5	**Revenue**	$450	=B2*B3*(1-B4)

The above table indicates that if you sell 100 items at $5 each, minus the 10% commission, you will make $450. The question is: How many items do you have to sell to make $1,000?

Let's see how to find the answer with Goal Seek:

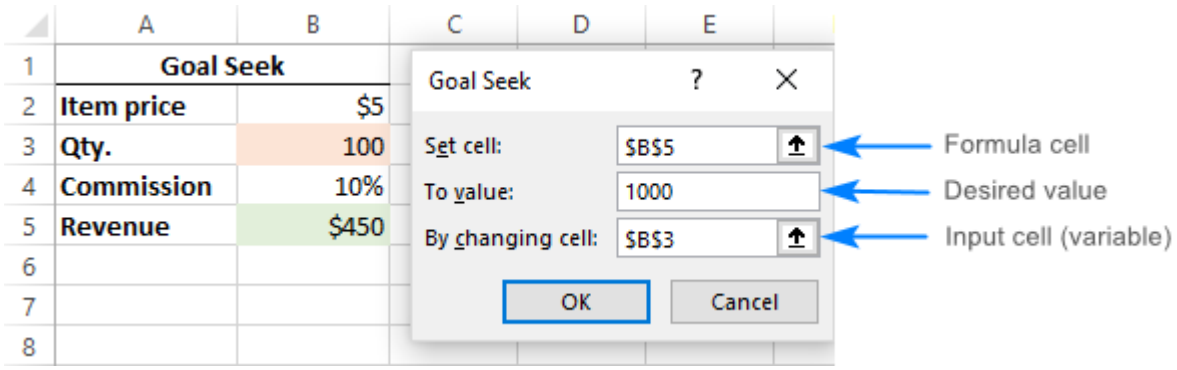
1. Set up your data so that you have a *formula cell* and a *changing cell* dependent on the formula cell.
2. Go to the *Data* tab > *Forecast* group, click the **what if Analysis** button, and select **Goal Seek…**



3. In the *Goal Seek* dialog box, define the cells/values to test and click *OK*:

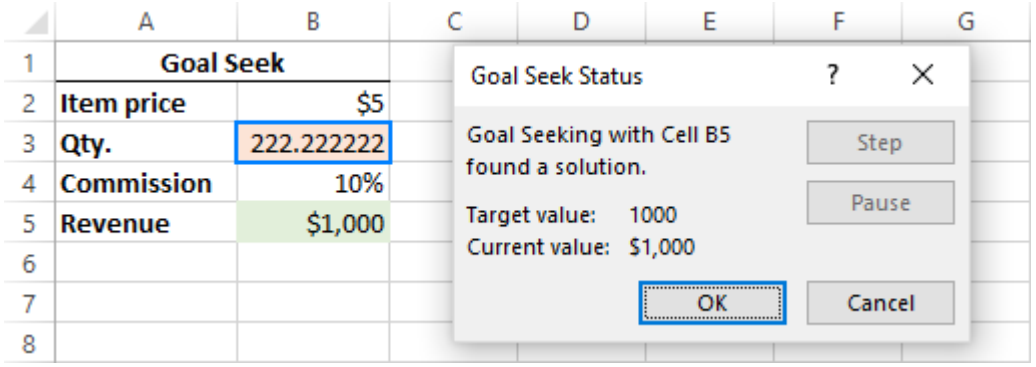
- **Set cell** - the reference to the cell containing the formula (B5).

- **To value** - the formula result you are trying to achieve (1000).
- **By changing cell** - the reference for the input cell that you want to adjust (B3).

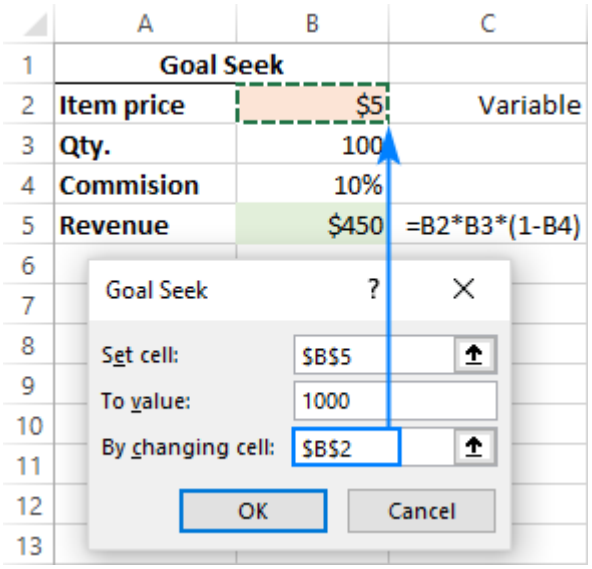


4. The *Goal Seek Status* dialog box will appear and let you know if a solution has been found. If it succeeded, the value in the "changing cell" will be replaced with a new one. Click *OK* to keep the new value or *Cancel* to restore the original one.

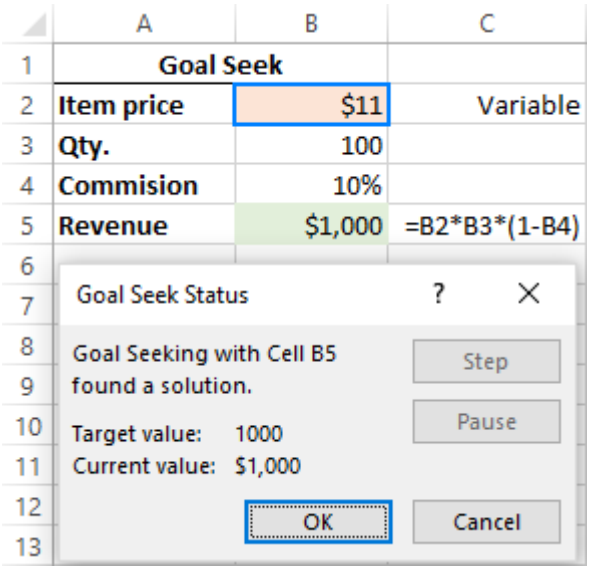
   In this example, Goal Seek has found that 223 items (rounded up to the next integer) need to be sold to achieve revenue of $1,000.



If you are not sure you will be able to sell that many items, then maybe you can reach the target revenue by changing the item price? To test this scenario, do Goal Seek analysis exactly as described above except that you specify different *Changing cell (B2):*



As the result, you will find out that if you increase the unit price to $11, you can reach $1,000 revenue by selling only 100 items



Tips and notes:

- Excel Goal Seek does not change the formula, it only **changes the input value** that you supply to the *By changing cell* box.
- If Goal Seek is not able to find the solution, it displays the **closest value** it has come up with.
- You can **restore** the original input value by clicking the *Undo* button or pressing the Undo shortcut (Ctrl + Z).

Examples of using Goal Seek in Excel

Below you will find a few more examples of using the Goal Seek function in Excel. The complexity of your business model does not really matter as long as your formula in the *Set cell* depends on the value in the *Changing cell*, directly or through intermediate formulas in other cells.

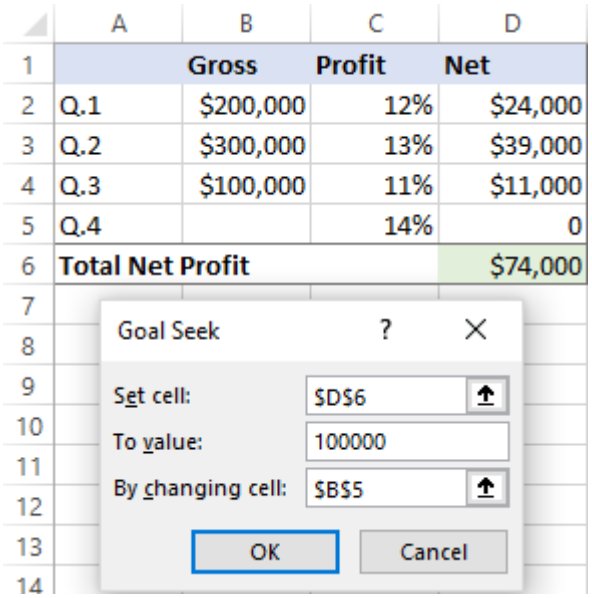
Example 1: Reach the profit goal

Problem: It is a typical business situation - you have the sales figures for the first 3 quarters and you want to know how much sales you have to make in the last quarter to achieve the target net profit for the year, say, $100,000.

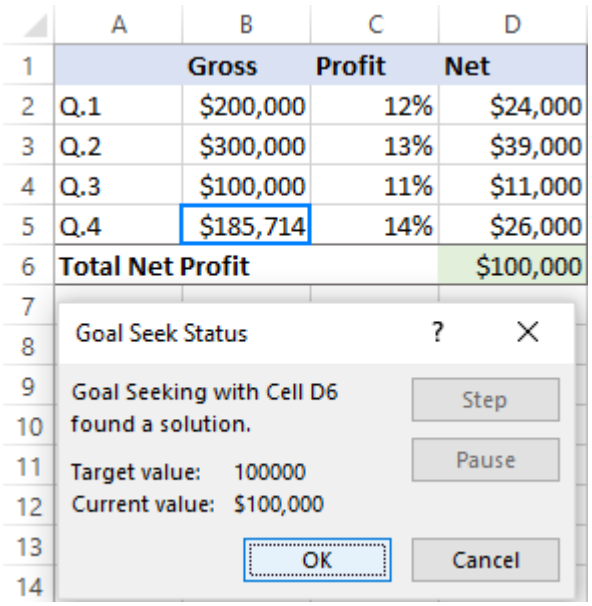
	A	B	C	D	E
1		Gross	Profit	Net	
2	Q.1	$200,000	12%	$24,000	=B2*C2
3	Q.2	$300,000	13%	$39,000	=B3*C3
4	Q.3	$100,000	11%	$11,000	=B4*C4
5	Q.4		14%	0	=B5*C5
6	Total Net Profit			$74,000	=SUM(D2:D5)

Solution: With the source data organized like shown in the screenshot above, set up the following parameters for the Goal Seek function:

- *Set cell* - the formula that calculates the total net profit (D6).
- *To value* - the formula result you are looking for ($100,000).
- *By changing cell* - the cell to contain the gross revenue for quarter 4 (B5).



Result: The Goal Seek analysis shows that in order to obtain $100,000 annual net profit, your fourth-quarter revenue must be $185,714.



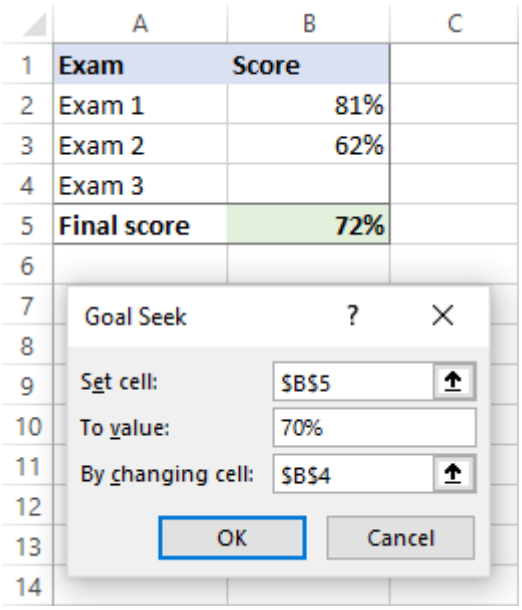
Example 2: Determine the exam passing score

Problem: At the end of the course, a student takes 3 exams. The passing score is 70%. All the exams have the same weight, so the overall score is calculated by averaging the 3 scores. The student has already taken 2 out of 3 exams. The question is: What score does the student need to get for the third exam to pass the entire course?

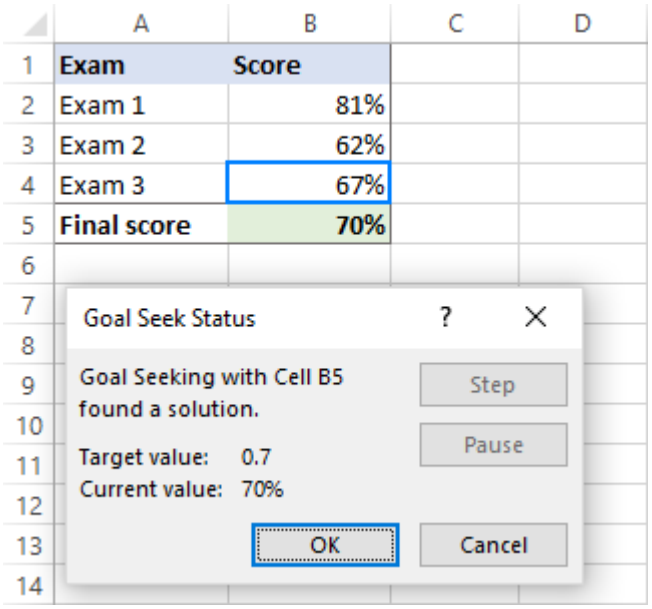
	A	B	C	D
1	**Exam**	**Score**		
2	Exam 1	81%		
3	Exam 2	62%		
4	Exam 3			
5	**Final score**	**72%**	=AVERAGE(B2:B4)	

Solution: Let's do Goal Seek to determine the minimum score on exam 3:

- *Cell* - the formula that averages the scores of the 3 exams (B5).
- *To value* - the passing score (70%).
- *By changing cell* - the 3rd *Set* exam score (B4).



Result: In order get the desired overall score; the student must achieve a minimum of 67% on the last exam:



Example 3: What-If analysis of the election

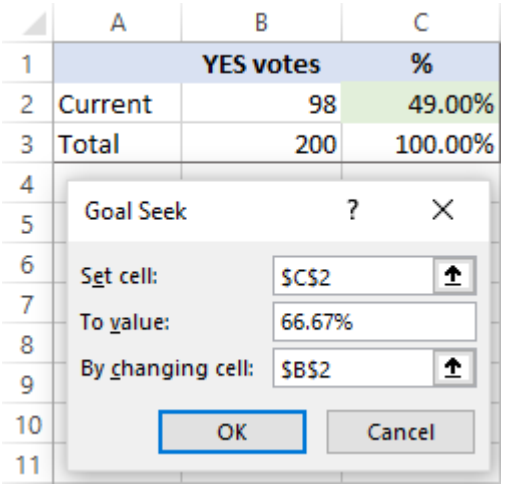
Problem: You are running for some elected position where a two-thirds majority (66.67% of votes) is required to win the election. Assuming there are 200 total voting members, how many votes do you have to secure?

Currently, you have 98 votes, which is quite good but not sufficient because it only makes 49% of the total voters:

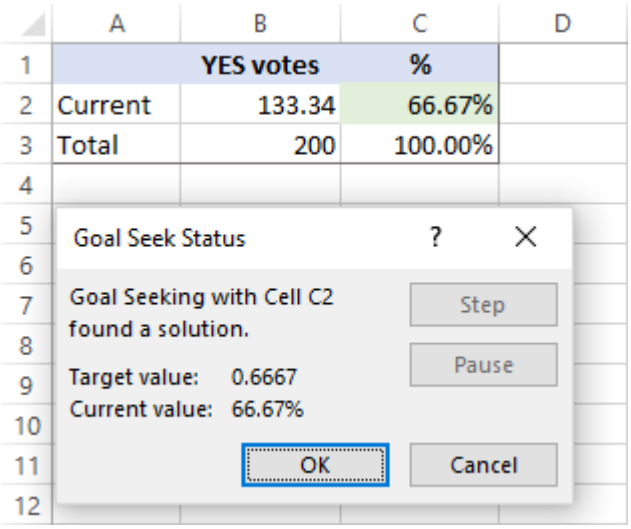
	A	B	C	D
1		YES votes	%	
2	Current	98	49.00%	=B2/B3
3	Total	200	100.00%	

Solution: Use Goal Seek to find out the minimum number of "Yes" votes you need to get:

- *Set cell* - the formula that calculates the percentage of the current "Yes" votes (C2).
- *To value* - the required percentage of "Yes" votes (66.67%).
- *By changing cell* - the number of "Yes" votes (B2).

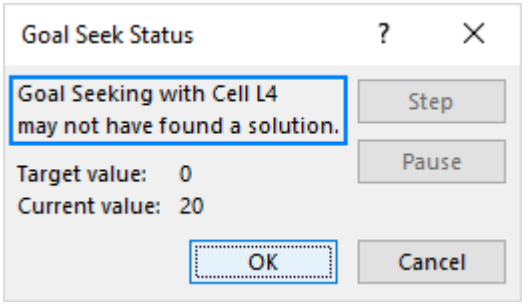


Result: What-If analysis with Goal Seek shows that to achieve the two-thirds mark or 66.67%, you need 133 “yes” votes:



Excel Goal Seek not working

Sometimes Goal Seek is not able to find a solution simply because it does not exist. In such situations, Excel will get the closest value and inform you that Goal Seeking may not have found a solution:



If you are certain that a solution to the formula you are trying to resolve does exist, check out the following troubleshooting tips.

1. Double check Goal Seek parameters

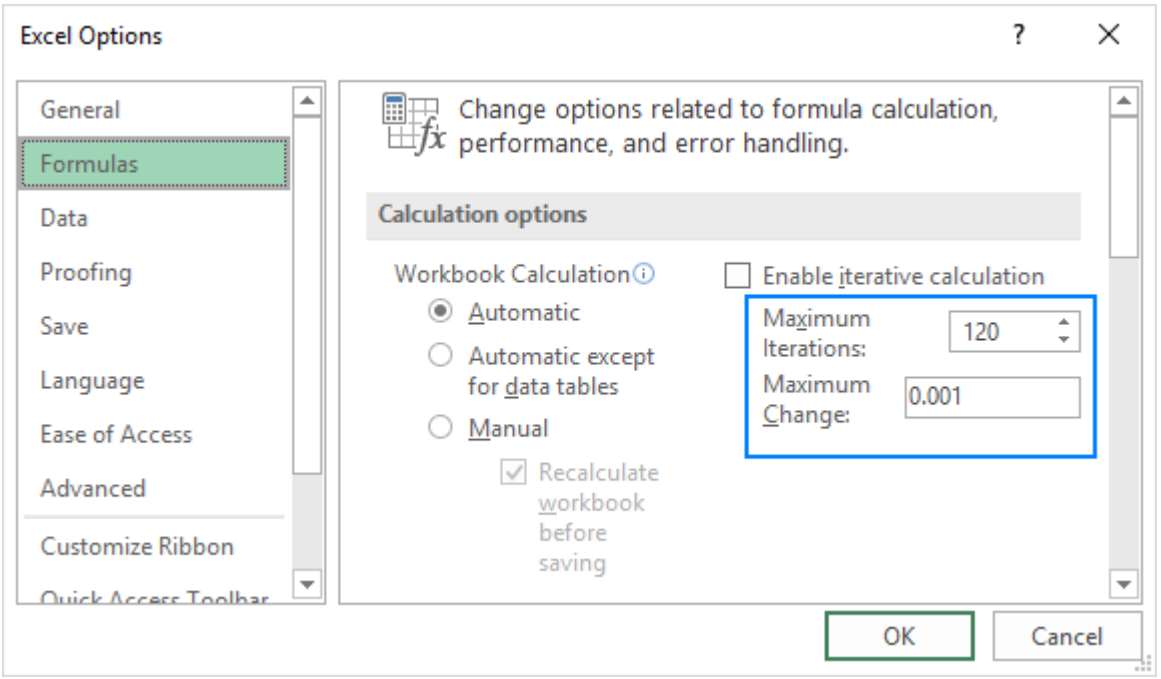
First off, make sure the *Set cell* refers to the cell containing a formula, and then, check if the formula cell depends, directly or indirectly, on the changing cell.

2. Adjust iteration settings

In your Excel, click *File* > *Options* > *Formulas* and change these options:

- *Maximum Iterations* - increase this number if you want Excel to test more possible solutions.
- *Maximum Change* - decrease this number if your formula requires more accuracy. For example, if you are testing a formula with an input cell equal to 0 but Goal Seek stops at 0.001, setting *Maximum Change* to 0.0001 should fix the issue.

The below screenshot shows the default iteration settings:



3. No circular references

For Goal Seek (or any Excel formula) to work properly, the involved formulas should not be co-dependent on each other, i.e. there should be no circular references.

That's how you perform What-If analysis in Excel with the Goal Seek tool. I thank you for reading and hope to see you on our blog next week!

Macros & VBA

How to create, change, copy and delete macros

This tutorial will set you on your way to learning Excel macros. You will find how to record a macro and insert VBA code in Excel, copy macros from one workbook to another, enable and disable them, view the code, make changes, and a lot more.

For Excel newbies, the concept of macros often looks insurmountable. Indeed, it may take months or even years of training to master VBA. However, this does not mean you cannot take advantage of the automation power of Excel macros right away. Even if you are a complete novice in VBA programming, you can easily record a macro to automate some of your repetitive tasks.

This article your entry point to the fascinating world of Excel macros. It covers the essential basics that you need to know to get started and provides links to the related in-depth tutorials.

What are macros in Excel?

Excel macro is a set of commands or instructions stored in a workbook in the form of VBA code. You can think of it as a small program to perform a predefined sequence of actions. Once created, macros can be re-used anytime. Running a macro executes the commands it contains.

Typically, macros are used to automate repetitive tasks and daily routines. Skilled VBA developers can write really sophisticated macros that go well beyond reducing the number of keystrokes.

Quite often, you may hear people referring to a "macro" as "VBA". Technically, there is a distinction: a macro is a piece of code while Visual Basic for Applications (VBA) is the programming language created by Microsoft to write macros.

Why use Excel macros?

The main purpose of macros is to have more work done in less time. Like you use formulas to crunch numbers and manipulate text strings, you can use macros to perform frequent tasks automatically.

Let's say, you are to create a weekly report for your supervisor. For this, you import various analytics data from a couple or more external resources. The problem is that those data are

messy, superfluous, or not in the format that Excel can understand. That means you need to reformat dates and numbers, trim extra spaces and delete blanks, copy and paste information into appropriate columns, build charts to visualize trends, and do a lot more different things to make your report clear and user-friendly. Now, imaging that all these operations can be performed for you instantly in a mouse click!

Of course, building a complex macro takes time. Sometimes, it can take even more time than performing the same manipulations manually. But creating a macro is a onetime set-up. Once written, debugged and tested, VBA code will do the job quickly and flawlessly, minimizing human errors and costly mistakes.

How to create a macro in Excel

There are two ways to create macros in Excel - by using the Macro Recorder and Visual Basic Editor.

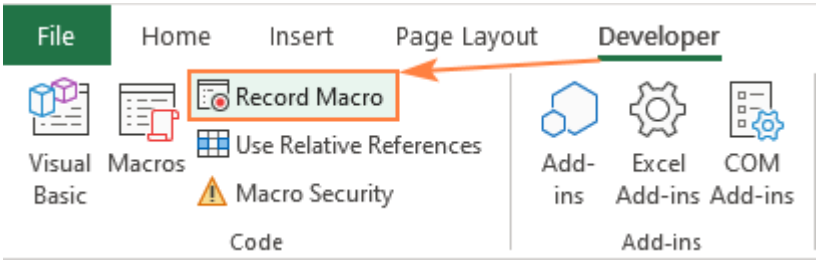
Tip. Within Excel, most operations with macros are done via the *Developer* tab, so be sure to add Developer tab to your Excel ribbon.

Recording a macro

Even if you don't know anything about programing in general and VBA in particular, you can easily automate some of your work just by letting Excel record your actions as a macro. While you are performing the steps, Excel closely watches and writes down your mouse clicks and keystrokes in the VBA language.

The Macro Recorder captures nearly everything that you do and produces a very detailed (often redundant) code. After you've stopped the recording and saved the macro, you can view its code in the Visual Basic Editor and make small changes. When you run the macro, Excel goes back to the recorded VBA code and executes the exact same moves.

To start recording, click the **Record Macro** button on either the *Developer* tab or the *Status* bar.



Writing a macro in Visual Basic Editor

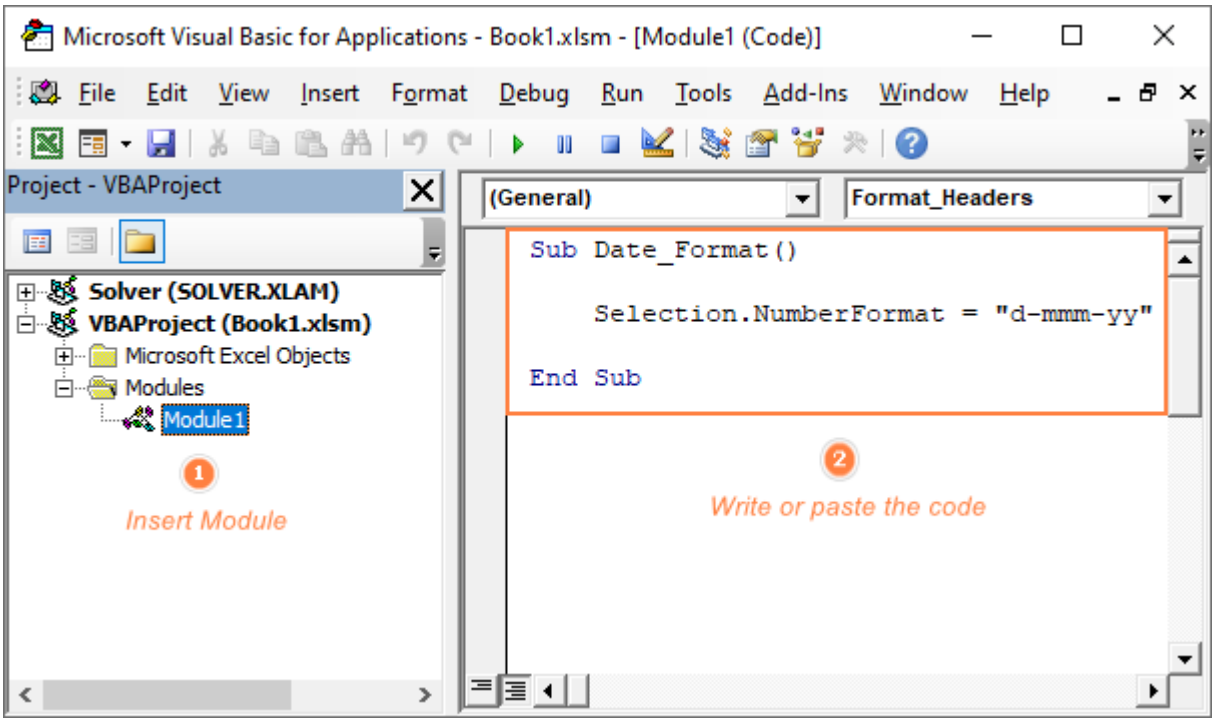
The Visual Basic for Applications (VBA) Editor is the place where Microsoft Excel keeps the code of all macros, both recorded and written manually.

In the VBA Editor, you can not only program a sequence of actions, but also create custom functions, display your own dialog boxes, evaluate various conditions, and most importantly code the logic! Naturally, creating your own macro requires some knowledge of the structure and syntax of the VBA language, which is beyond the scope of this tutorial for beginners. But there is nothing that would prevent you from reusing someone else's code (say, the one you've found on our blog :) and even a complete novice in Excel VBA should have no difficulties with that!

First, press Alt + F11 to open the Visual Basic Editor. And then, insert the code in these two quick steps:

1. In the Project Explorer on the left, right-click the target workbook, and then click *Insert* > *Module*.
2. In the Code window on the right, paste the VBA code.

When done, press F5 to run the macro.



How to run macros in Excel

There are several ways to start a macro in Excel:

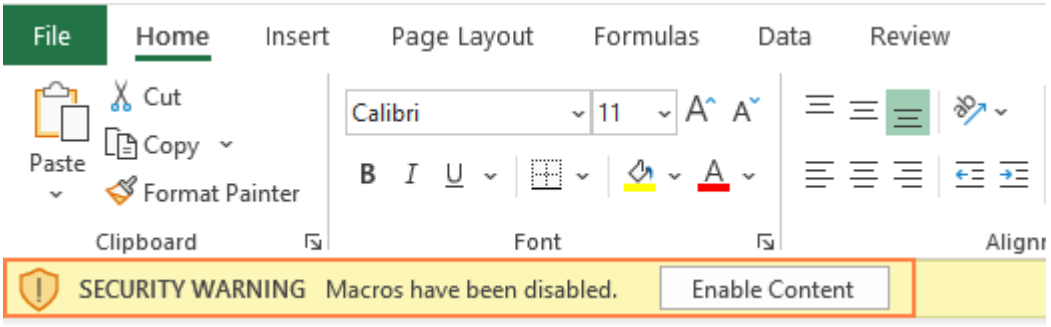
- To run a macro from a worksheet, click the *Macros* button on the *Developer* tab or press the Alt + F8 shortcut.
- To run a macro from the VBA Editor, press either:
  - F5 to run the entire code.
  - F8 to go through the code line-by-line. This is very useful for testing and troubleshooting.

Additionally, you can launch a macro by clicking a custom button or pressing the assigned shortcut.

How to enable macros in Excel

Because of security reasons, all macros in Excel are disabled by default. So, to use the magic of VBA codes to your advantage, you need to know how to enable them.

The easiest way to turn on macros for a specific workbook is to click the **Enable Content** button in the yellow security warning bar that appears at the top of the sheet when you first open a workbook with macros.



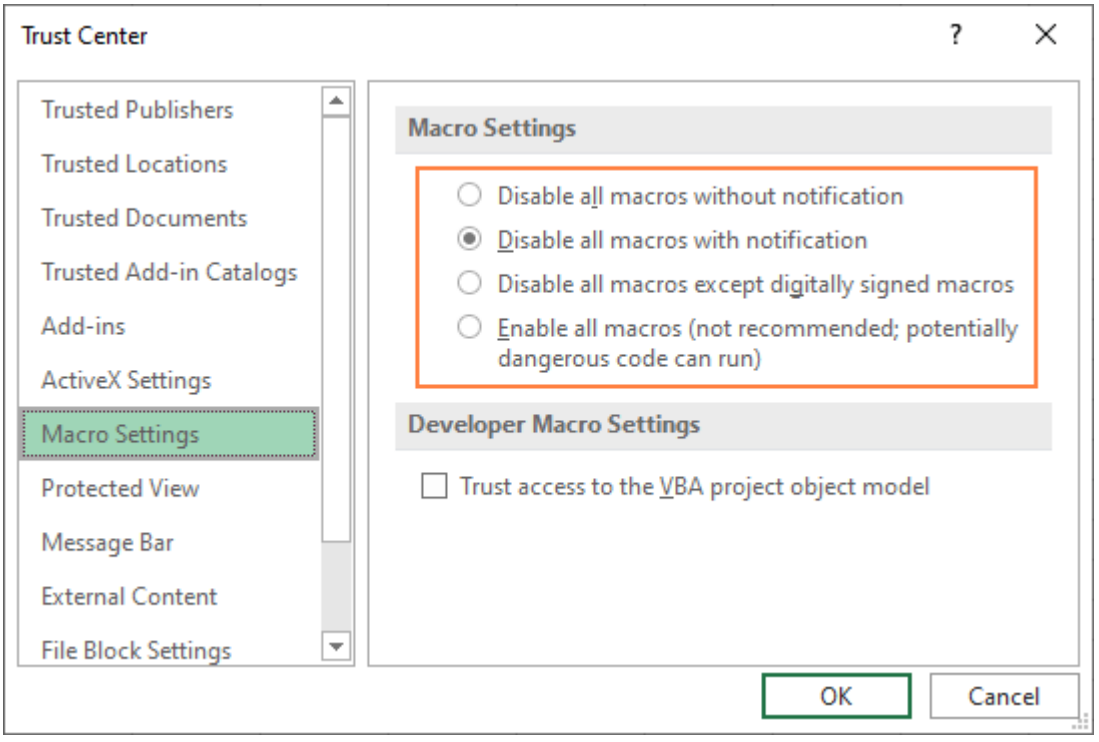
How to change macro settings

Microsoft Excel determines whether to allow or disallow VBA codes to be executed in your workbooks based on the macro setting selected in the *Trust Center*.

Here are the steps to access the Excel macro settings and change them if needed:

1. Go to the *File* tab and select *Options*.
2. On the left-side pane, select *Trust Center*, and then click *Trust Center Settings…* .
3. In the *Trust Center* dialog box, click *Macro Settings* on the left, select the desired option, and click *OK*.

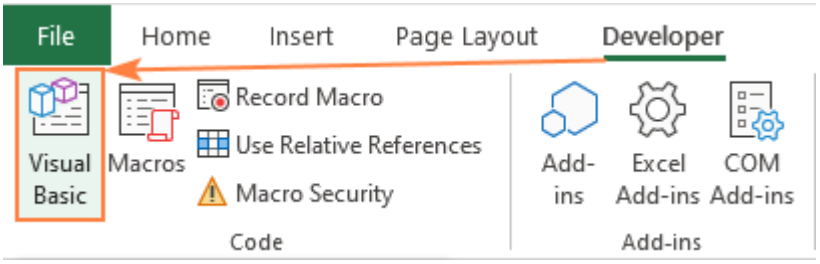
In the screenshot below, the default macro setting is selected:



How to view, edit and debug VBA codes in Excel

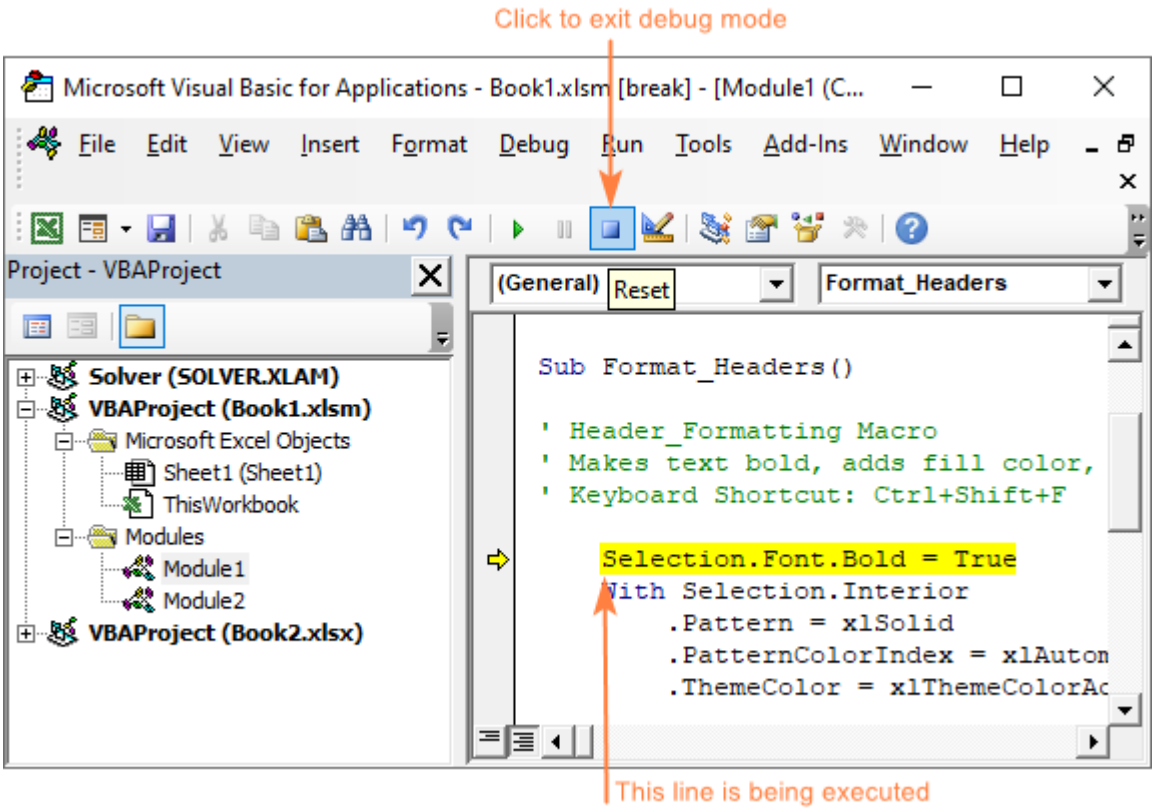
Any changes to the code of a macro, whether it's generated automatically by the Excel macro recorder or written by you, are made in the Visual Basic Editor.

To open the VB Editor, either press Alt + F11 or click the *Visual Basic* button on the *Developer* tab.



To **view and edit** the code of a specific macro, in the *Project Explorer* on the left, double-click the module that contains it, or right-click the module and pick *View Code*. This opens the Code window where you can edit the code.

To **test and debug** a macro, use the F8 key. This will take you through the macro code line-by-line letting you see the effect that each line has on your worksheet. The line currently being executed is highlighted in yellow. To exit debug mode, click the *Reset* button on the toolbar (blue square).



How to copy a macro to another workbook

You created a macro in one workbook and now want to reuse it in other files too? There are two ways to copy a macro in Excel:

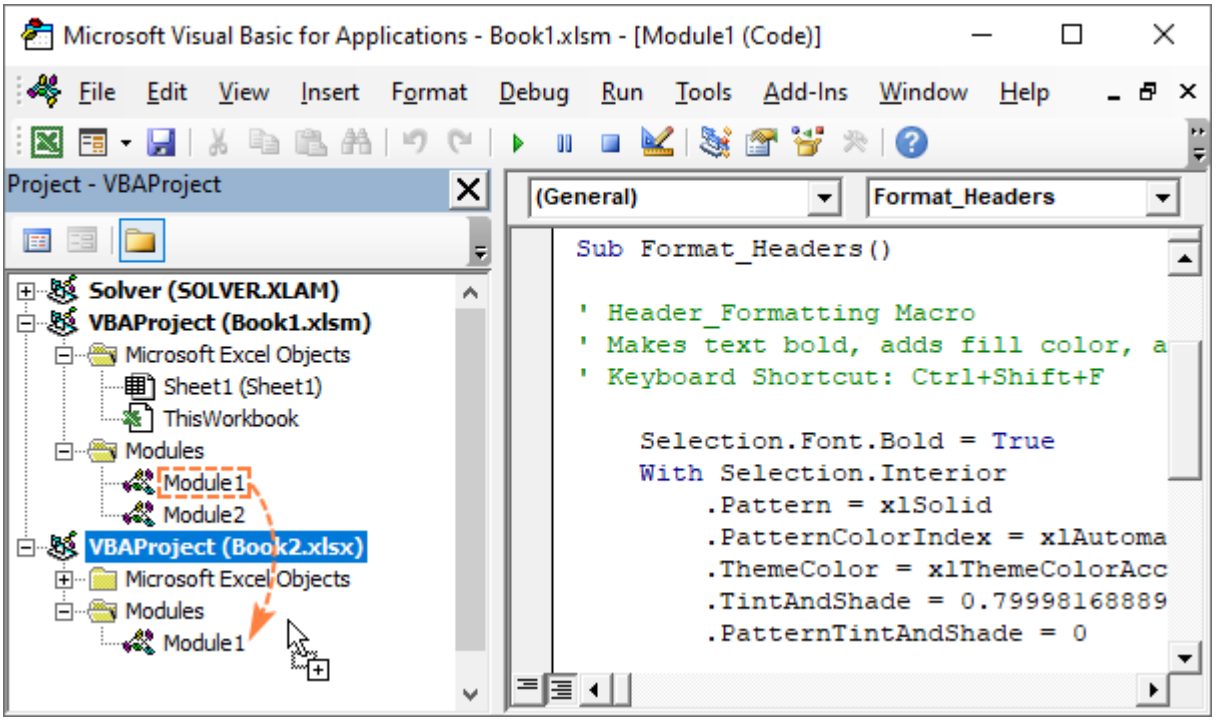
Copy the module containing a macro

In case the target macro resides in a separate module or all the macros in the module are useful for you, then it makes sense to copy the whole module from one workbook to another:

1. Open both workbooks - the one that contains the macro and the one where you wish to copy it.
2. Open the Visual Basic Editor.

3. In the Project Explorer pane, find the module containing the macro and drag it to the destination workbook.

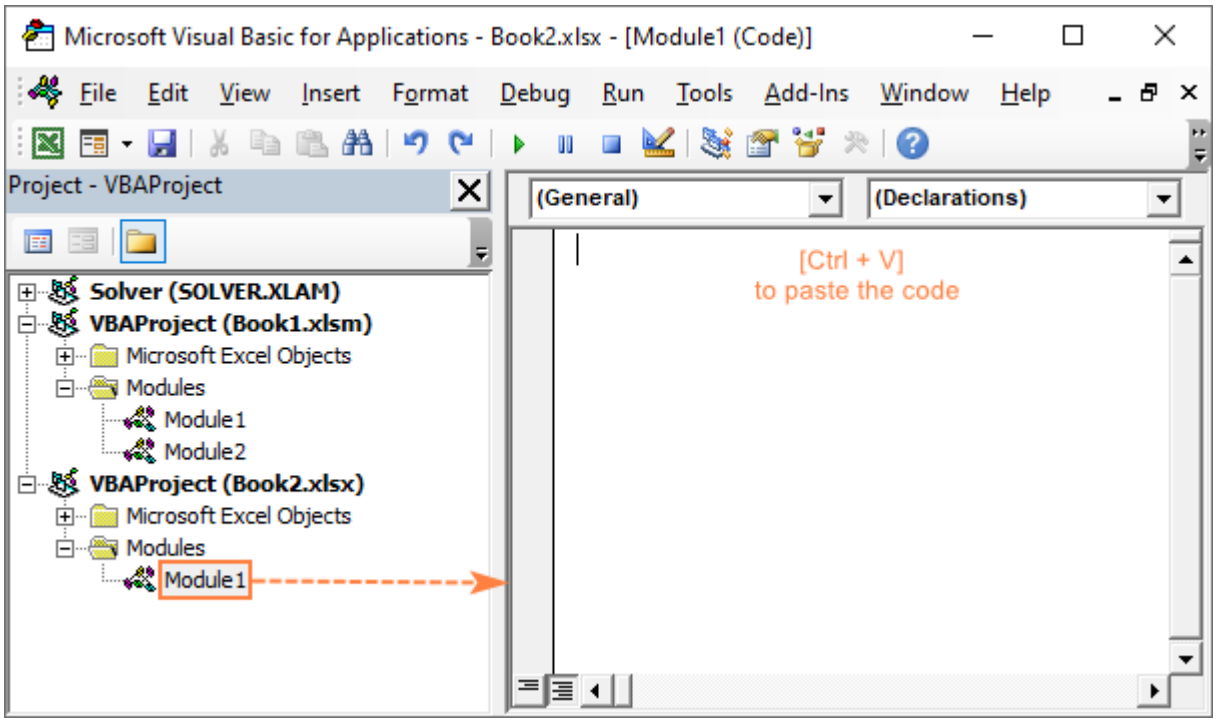
In the screenshot below, we are copying *Module1* from *Book1* to *Book2*:



Copy the source code of a macro

If the module contains many different macros while you need just one, then copy only the code of that specific macro. Here's how:

1. Open both workbooks.
2. Open the Visual Basic Editor.
3. In the Project Explorer pane, double-click the module containing the macro that you'd like to copy to open its Code window.
4. In the Code window, find the target macro, select its code (beginning with *Sub* and ending with *End Sub*) and press Ctrl + C to copy it.
5. In the Project Explorer, find the destination workbook, and then either insert a new module into it (right-click the workbook and click *Insert* > *Module*) or double-click an existing module to open its Code window.
6. In the Code window of the destination module, press Ctrl + V to paste the code. If the module already contains some code, scroll down to the last code line, and then paste the copied macro.



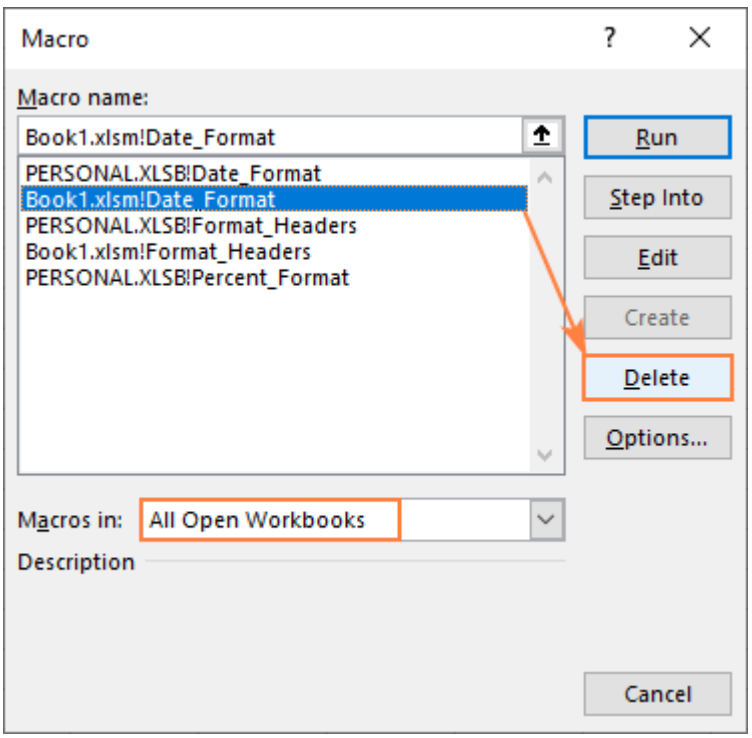
How to delete macros in Excel

If you no longer need a certain VBA code, you can delete it by using the *Macro* dialog box or the Visual Basic Editor.

Deleting a macro from a workbook

To delete a macro directly from your Excel workbook, carry out these steps:

1. On the *Developer* tab, in the *Code* group, click the **Macros** button or press the Alt + F8 shortcut.
2. In the *Macro* dialog box, select the macro you want to remove and click **Delete**.



Tips:

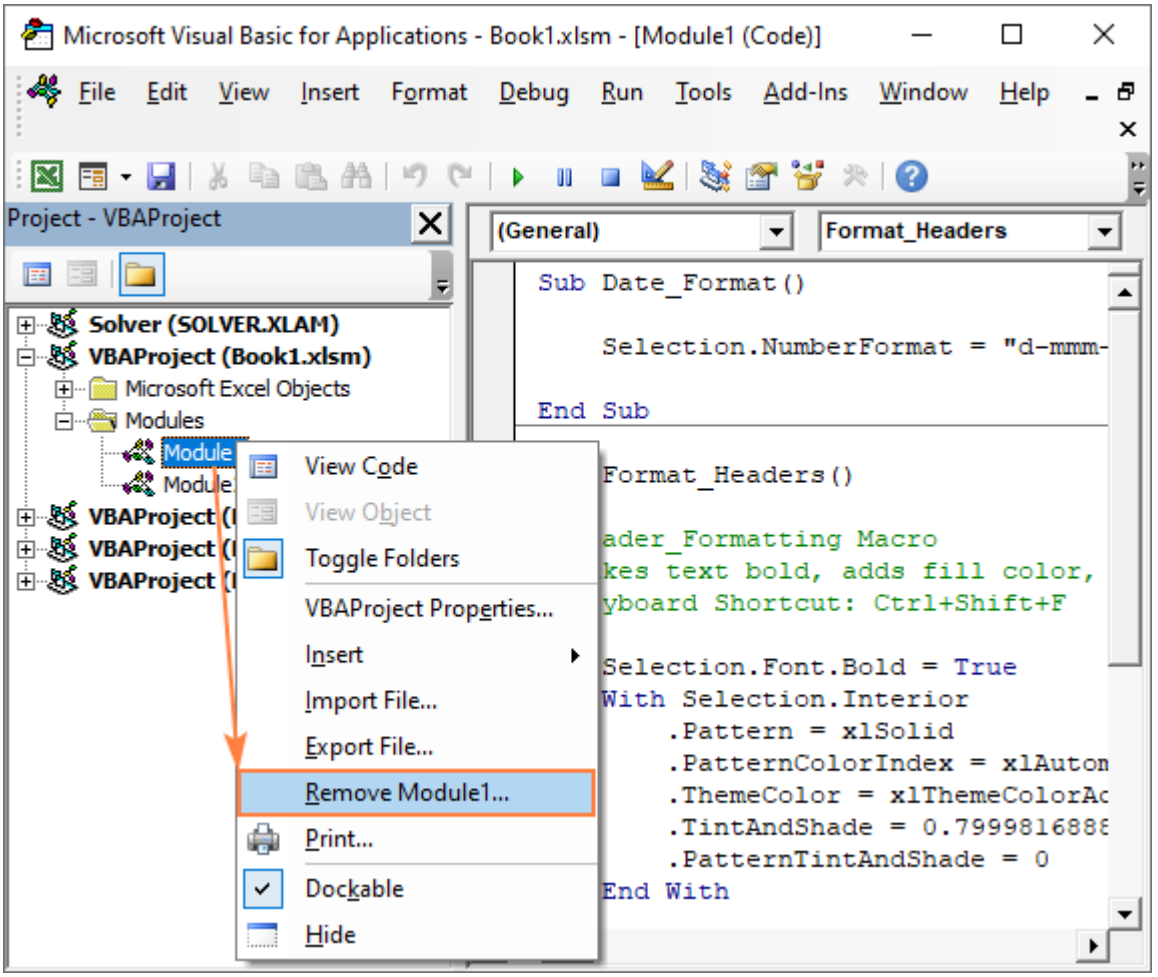
- To view all the macros in all open files, select **All Open Workbooks** from the *Macros in* drop-down list.
- To be able delete a macro in the Personal Macro Workbook, you need to unhide Personal.xlsb first.

Deleting a macro via Visual Basic Editor

A benefit of using the VBA Editor is that it enables you to delete an entire module with all the macros it contains in one go. Also, the VBA Editor allows deleting macros in the Personal Macro Workbook without unhiding it.

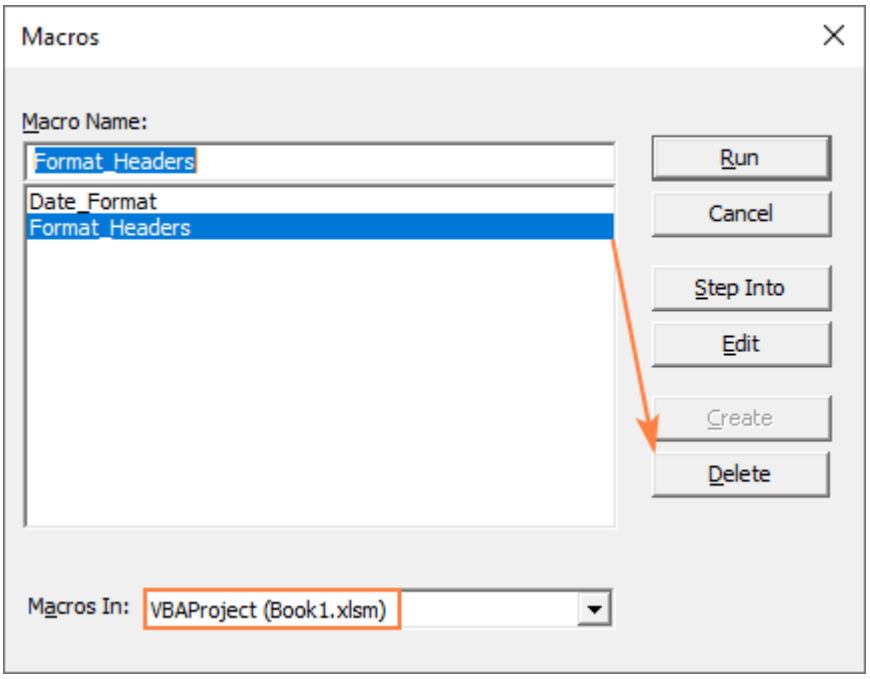
To permanently **delete a module**, perform these steps:

1. In the *Project Explorer*, right-click on the module and choose **Remove** from the context menu.
2. When asked whether you want to export the module before removing it, click *No*.



To **remove a specific macro**, simply delete its source code directly in the Code window. Or, you can delete a macro by using the *Tools* menu of the VBA Editor:

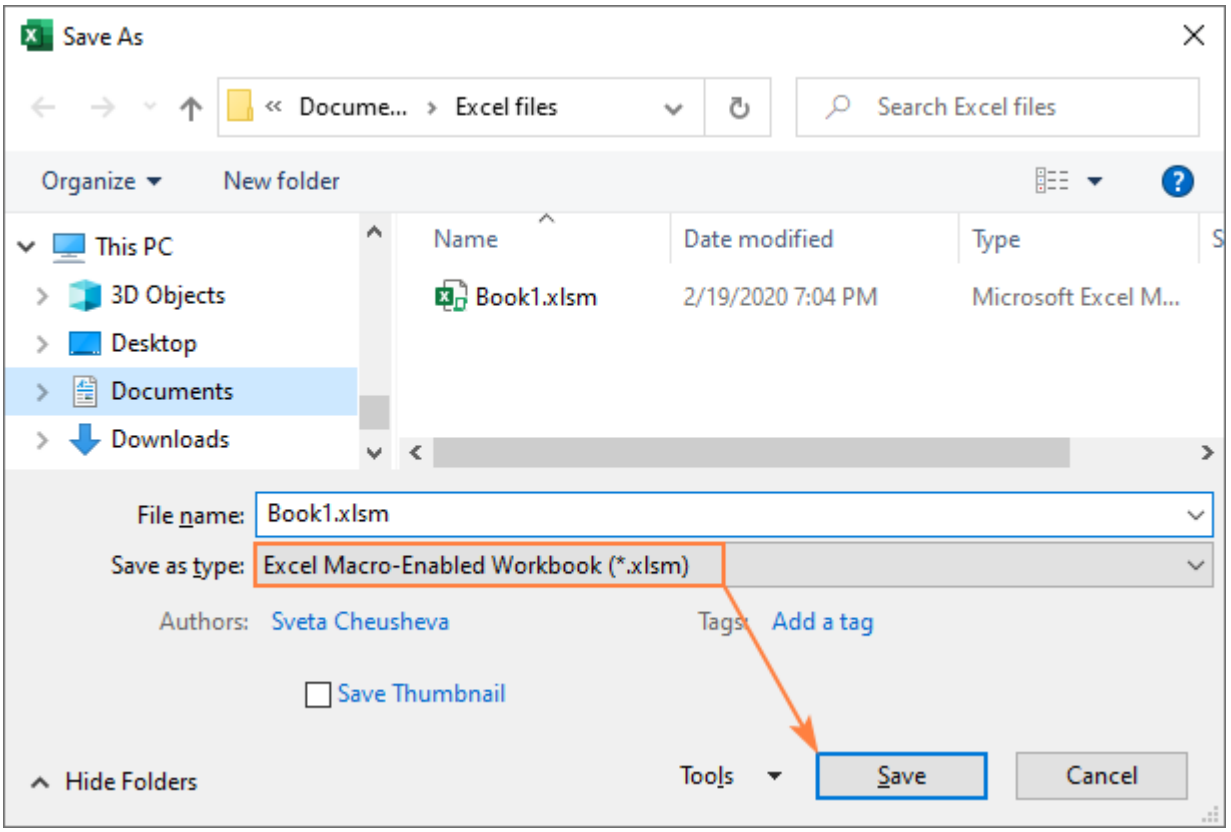
1. From the *Tools* menu, choose **Macros**. The *Macros* dialog box will appear.
2. In the *Macros In* drop-down list, select the project containing the unwanted macro.
3. In the *Macro Name* box, select the macro.
4. Click the **Delete** button.



How to save macros in Excel

To save a macro in Excel, either recorded or written manually, just save the workbook as macro enabled (*.xlms). Here's how:

1. In the file containing the macro, click the *Save* button or press Ctrl + S.
2. The *Save As* dialog box will appear. Choose **Excel Macro-Enabled Workbook (*.xlsm)** from the *Save as type* drop-down list and click *Save*:



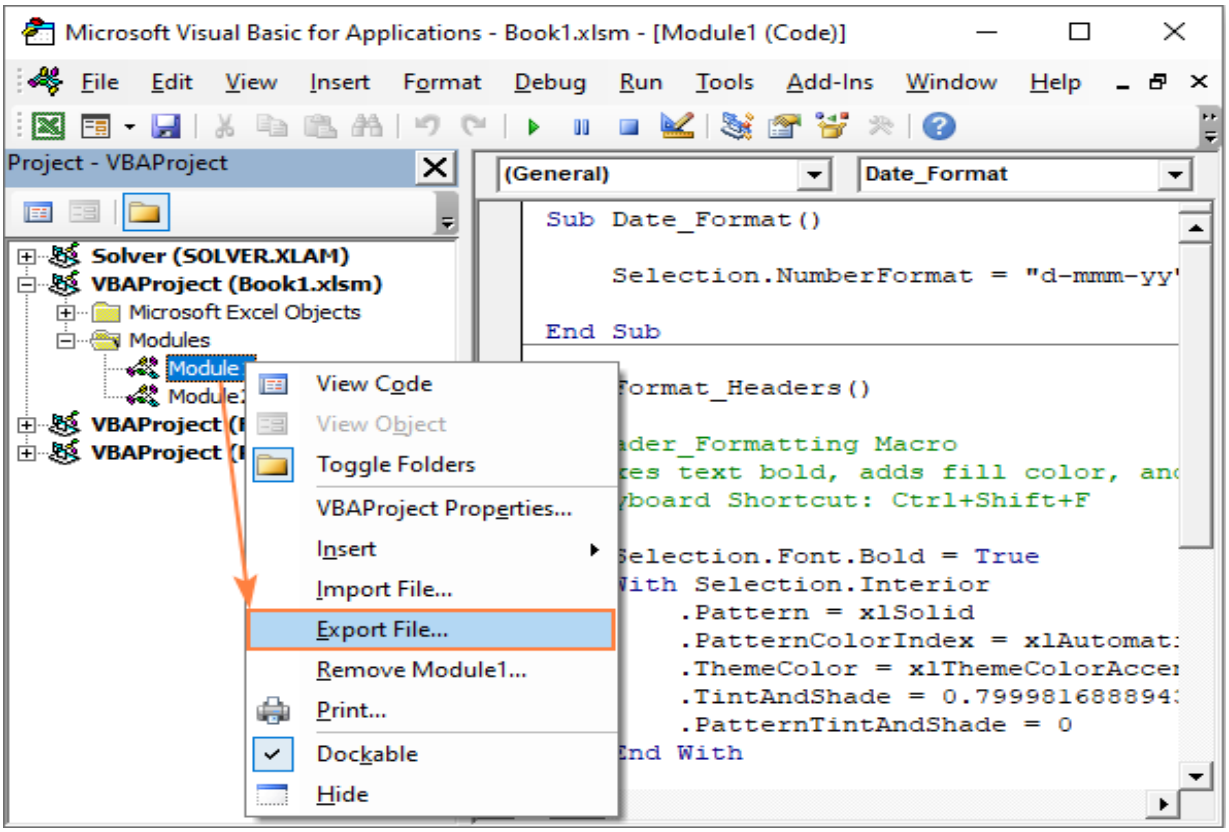
How to export and import macros in Excel

If you'd like to share your VBA codes with someone or move them to another computer, the fastest way is to export the entire module as a .bas file.

Exporting macros

To export your VBA codes, this is what you need to do:

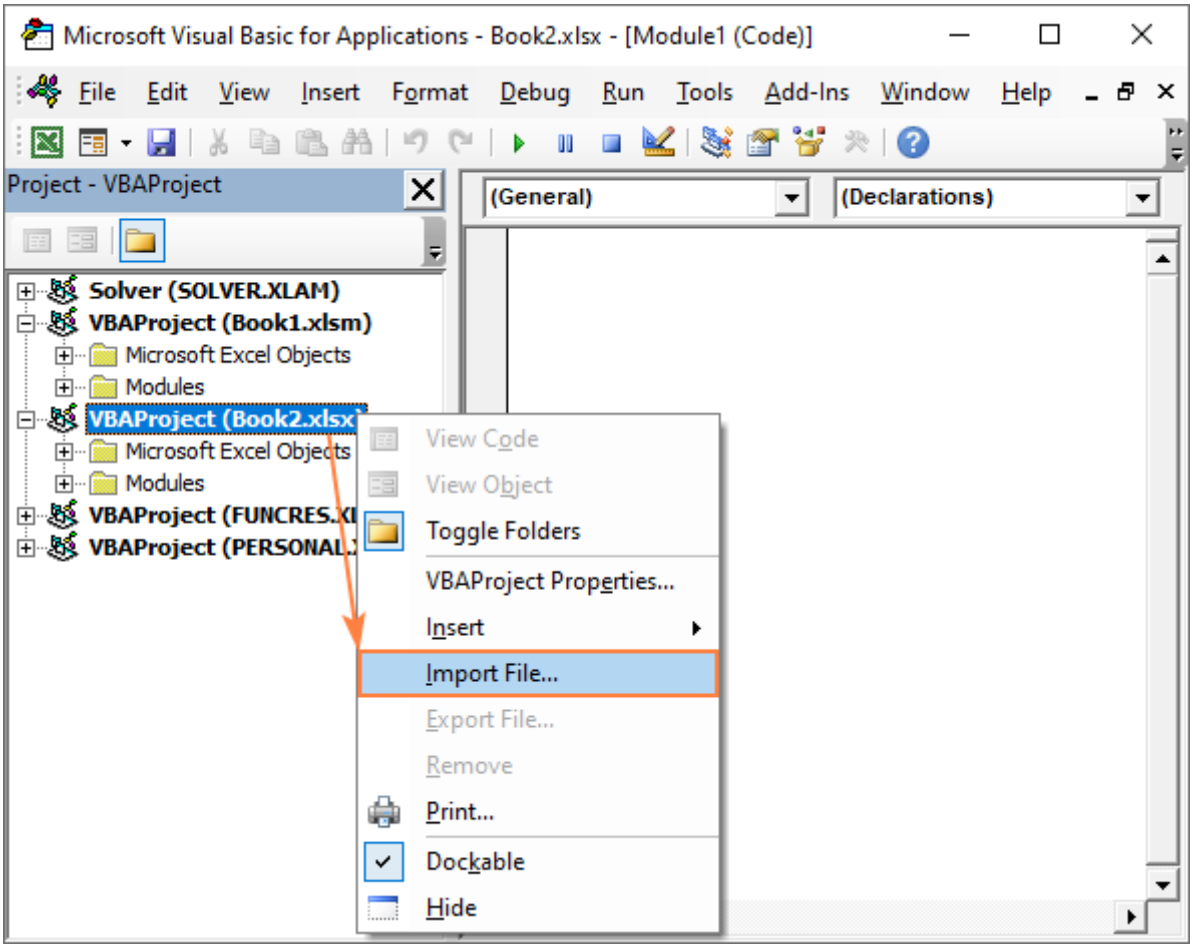
1. Open the workbook containing the macros.
2. Press Alt + F11 to open the Visual Basic Editor.
3. In the Project Explorer, right-click the Module containing the macros and select **Export File**.
4. Navigate to the folder where you want to save the exported file, name the file, and click **Save**.



Importing macros

To import a .bas file with VBA codes into your Excel, please follow these steps:

1. Open the workbook into which you want to import macros.
2. Open the Visual Basic Editor.
3. In the Project Explorer, right-click the project name and select **Import File**.
4. Navigate to the .bas file and click *Open*.



Excel macro examples

One of the best ways to learn Excel VBA is by exploring code samples. Below you will find examples of very simple VBA codes that automate some basic operations. Of course, these examples won't teach you coding, for this there exist hundreds of professional-grade VBA tutorials. We just aim to illustrate a few common features of VBA that will hopefully make its philosophy a little more familiar to you.

Unhide all sheets in a workbook

In this example, we use the *Active Workbook* object to return the currently active workbook and the *For Each* loop to go through all the sheets in the workbook one-by-one. For each found sheet, we set the *Visible* property to *xlSheetVisible*.

```
Sub Unhide_All_Sheets () Dim wks. As Worksheet For Each wks. In ActiveWorkbook.Worksheets wks. Visible = xlSheetVisible Next wks. End Sub
```

Hide active worksheet or make it very hidden

To manipulate the currently active sheet, use the *Active Sheet* object. This sample macro changes the *visible* property of the active sheet to *xlSheetHidden* to hide it. To make the sheet very hidden, set the *visible* property to *xlSheetVeryHidden*.

```
Sub Hide_Active_Sheet () ActiveSheet.Visible = xlSheetHidden End Sub
```

Unmerge all merged cells in selected range

If you want to perform certain operations on a range rather than the entire worksheet, use the *Selection* object. For example, the below code will unmerge all the merged cells in a selected range at one fell swoop.

```
Sub Unmerge Cells () Selection.Cells.UnMerge End Sub
```

Show a message box

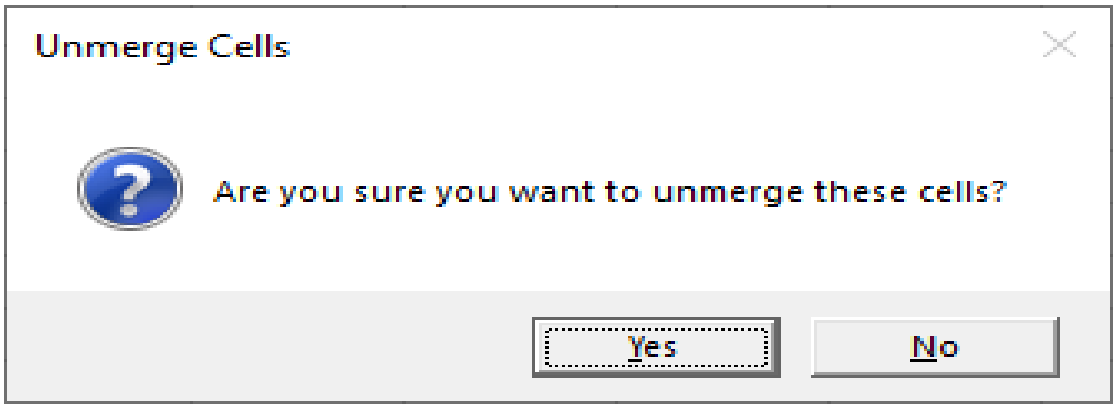
To show some message to your users, use the *MsgBox* function. Here's an example of such a macro in its simplest form:

```
Sub Show Message () MsgBox ("Hello World!") End Sub
```

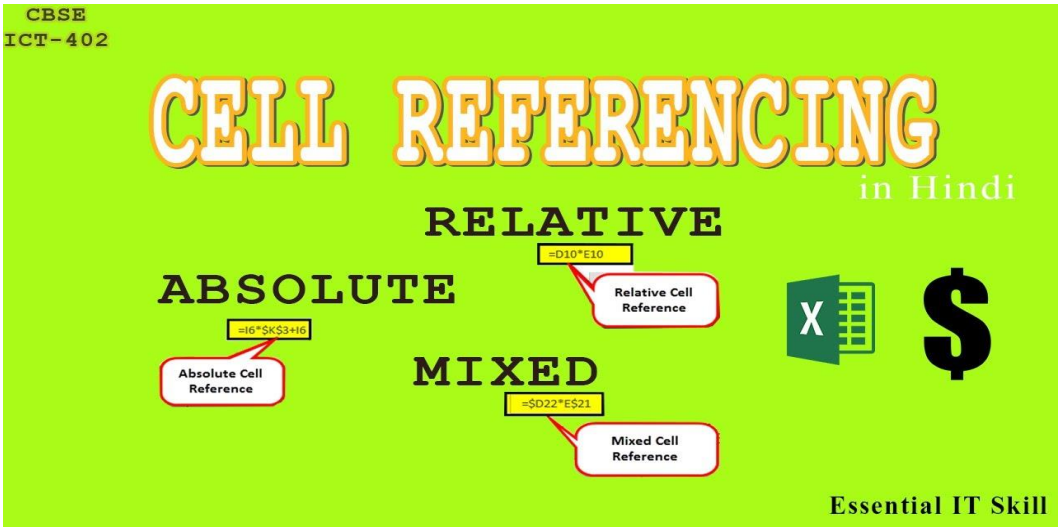
In real-life macros, a message box is typically used for information or confirmation purposes. For instance, before performing a action (unmerging cells in our case), you display a *Yes/No* message box. If the user clicks "Yes", the selected cells are unmerged.

```
Sub Unmerge_Selected_Cells () Dim Answer As String Answer = MsgBox ("Are you sure you want to unmerge these cells?" vbQuestion + vbYesNo, "Unmerge Cells") If Answer = vbYes Then Selection.Cells.UnMerge End If End Sub
```

To test the code, select one or more range containing merged cells and run the macro. The following message will appear:



Cell reference-Relative, Absolute, Row Absolute & Column Absolute, Reference form other sheet



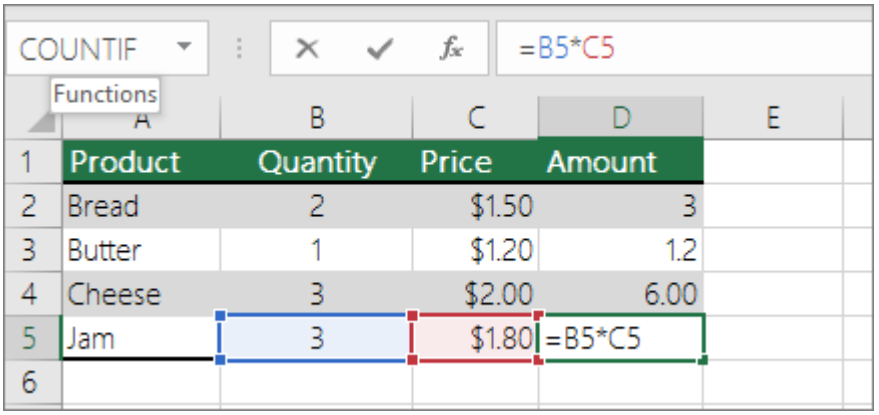
Relative, Absolute, and Mixed Cell References in Excel and Sheets

A cell reference in spread sheet programs such as Excel and Google Sheets identifies the location of a cell in the worksheet. These references use Auto fill to adjust and change information as needed in your spread sheet.

By default, a cell reference is a relative reference, which means that the reference is relative to the location of the cell. If, for example, you refer to cell A2 from cell C2, you are actually referring to a cell that is two columns to the left (C minus A)—in the same row (2). When you copy a formula that contains a relative cell reference, that reference in the formula will change.

As an example, if you copy the formula **=B4*C4** from cell D4 to D5, the formula in D5 adjusts to the right by one column and becomes **=B5*C5**. If you want to maintain the original cell reference in this example when you copy it, you make the cell reference absolute by preceding the columns (B and C) and row (2) with a dollar sign (**$**). Then, when you copy the formula **=$B$4*$C$4** from D4 to D5, the formula stays exactly the same.

Note: The information in this article applies to Excel versions 2019, 2016, 2013, Excel for Mac, Excel Online, and Google Sheets.



Less often, you may want to mixed absolute and relative cell references by preceding either the column or the row value with a dollar sign—which fixes either the column or the row (for example, $B4 or C$4).

To change the type of cell reference:

1. Select the cell that contains the formula.
2. In the formula bar, select the reference that you want to change.
3. Press F4 to switch between the reference types.

   The table below summarizes how a reference type updates if a formula containing the reference is copied two cells down and two cells to the right.

The Different Types of Cell References

The three types of references that can be used in Excel and Google Sheets are easily identified by the presence or absence of dollar signs ($) within the cell reference. A dollar sign tells the program to use that value every time it runs a formula.

- **Relative cell references** contain no dollar signs (i.e., A1).
- **Mixed cell references** have dollar signs attached to either the letter or the number in a reference but not both (i.e., $A1 and A$1).
- **Absolute cell references** have dollar signs attached to each letter or number in a reference (i.e., $A$1).

You'll typically use an absolute or mixed cell reference if you set up a formula. For example, if you have a number in Cell A1, more numbers in Column B, and Column C contains the sums of A1 and each of the values in B, you'll use "$A$1" in the SUM formula so that when you auto fill, the program knows to always use the number in A1 instead of the empty cells below it.

A cell is one of the boxlike structures that fill a worksheet, and you can locate one by its references, such as A1, F26, or W345. A cell reference consists of the column letter and row number that intersect at the cell's location. When listing a cell reference, the column letter always appears first. Cell references appear in formulas, functions, charts, and other Excel commands.

How Cell References Use Automatic Updating

One advantage of using cell references in spread sheet formulas is that, normally, if the data located in the referenced cells changes, the formula or chart automatically updates to reflect the change.

If a workbook has been set not to update automatically when you make changes to a worksheet, you can carry out a manual update by pressing the **F9** key on the keyboard.

You Can Reference Cells From Different Worksheets

Cell references are not restricted to the same worksheet where the data is located. Other worksheets in the same file can reference each other by including a notation that tells the program which sheet to pull the cell from.

You don't need a sheet notation if you're referring to a cell in the same worksheet.

Similarly, when you reference data in a different workbook, the name of the workbook and the worksheet are included in the reference along with the cell location.

To reference a cell on a different sheet, preface the cell reference with "Sheet [number]" with an exclamation point after it, and then the name of the cell. So if you want to pull info from Cell A1 in Sheet 3, you'll type, "**Sheet3! A1**."

A notation referring to another workbook in Excel also includes the name of the book in brackets. To use the information contained in Cell B2 in Sheet 2 of Workbook 2, you'll type, "**[Book2] Sheet2!B2**."

Cell Range: A Quick Primer

While references often refer to individual cells, such as A1, they can also refer to a group or range of cells. You identify ranges of cells by the starting and ending cells. In the case of ranges that occupy multiple rows and columns, you'll use the cell references of the cells in the upper left and lower right corners of the range.

Separate the limits of a cell range with a colon (:), which tells Excel or Google Sheets to include all the cells between these start and end points. So to grab everything between Cell A1 and D10, you'd type, "**A1:D10**."

To capture an entire row or column, you still use the cell range notation, but you only use the column numbers or row letters. To include everything in Column A, the range will be "**A:A**." To use Row 8, you'll type, "**8:8**." For everything in Columns B through D, you'll type, "**B:D**."

Copying Formulas and Different Cell References

Another advantage of using cell references in formulas is that they make it easier to copy formulas from one location to another in a worksheet or workbook.

Relative cell references change when copied to reflect the new location of the formula. The name **relative** comes from the fact that they change relative to their location when copied. This is usually a good thing, and it is why relative cell references are the default type of reference used in formulas.

At times, cell references need to stay static when formulas are copied. Copying formulas is the other major use of an absolute reference such as =$A$2+$A$4. The values in those references don't change when you copy them.

At other times, you may want part of a cell reference to change, such as the column letter, while having the row number stay static or vice versa when you copy the formula. In this case, you'll use a mixed cell reference such as =$A2+A$4. Whichever part of the reference has a dollar sign attached to it stays static, while the other part changes when copied.

So for $A2, when it is copied, the column letter is always A, but the row numbers change to $A3, $A4, $A5, and so on.

The decision to use the different cell references when creating the formula is based on the location of the data that the copied formulas will use.

Toggling Between Types of Cell References

The easiest way to change cell references from relative to absolute or mixed is to press the **F4** key on the keyboard. To change existing cell references, Excel must be in **edit mode**, which you enter by double-clicking on a cell with the mouse pointer or by pressing the **F2** key on the keyboard.

To convert relative cell references to absolute or mixed cell references:

- Press **F4** once to create a cell reference fully absolute, such as $A$6.
- Press **F4** a second time to create a mixed reference where the row number is absolute, such as a$6.
- Press **F4** a third time to create a mixed reference where the column letter is absolute, such as $A6.
- Press **F4** a fourth time to make the cell reference relative again, such as A6.

Row and Column cell references (R1C1)

Excel normally displays cell references in the A1 style i.e with rows each given a number and columns given an alphabetic character.

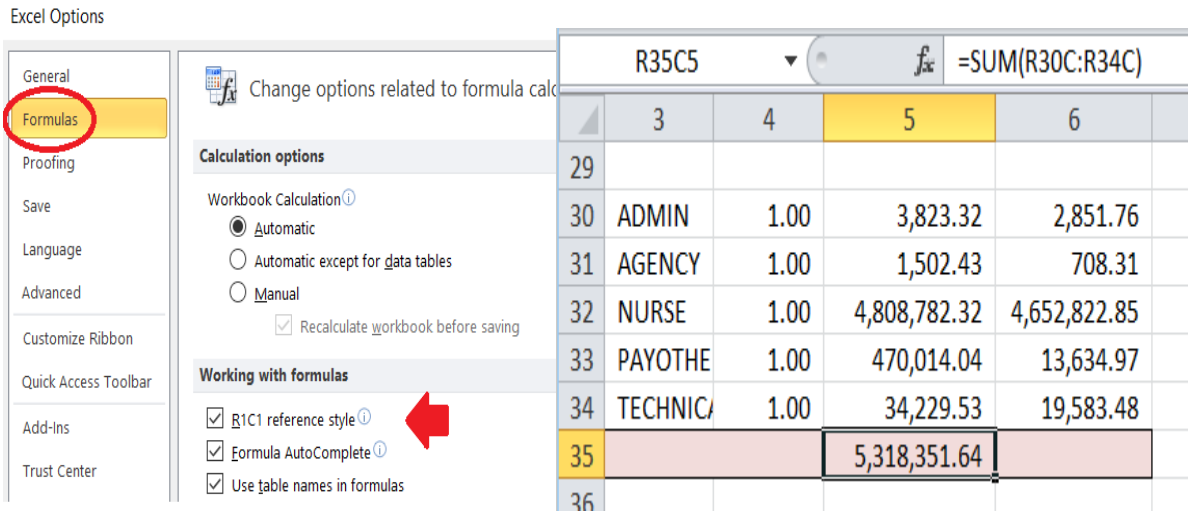
Absolute or Relative cell references determine whether ranges are incremented as they are copied to other cells. Placing the dollar symbol ($) in front of a column letter or row number will fix it if the formula is copied to other cells. If the relative formula SUM(A5:A10) is copied to the adjacent cell, it will update to SUM(B5:B10). The absolute formula SUM($A$5:$A$10) will refer to the same range, regardless of where it is copied to.

Excel can also handle cell references using a different format or notation. The R1C1 notation describes a cell location in terms of a row number and a column number. It can also distinguish between absolute and relative references. R5C1 is an absolute reference (for cell $A$5) whereas R[4]C[1] is four rows below and one column to the right, relative to the current cell.

	A	B	C	D	E	F	G
1	**Expenditure**						
2			Month number	**3**			**Total**
3			April	May	June	July	**to M03**
4		Ward 10	89,752	44,324	81,193	65,063	**215,269**
5		Ward 11	35,324	87,338	56,219	91,235	**178,881**
6		Ward 12	63,290	15,295	59,293	86,468	**137,878**
7		Ward 13	60,277	69,067	81,691	2,068	**211,035**
9		**Totals**	**248,643**	**216,024**	**278,397**	**244,833**	
10			**[C9] =SUM($C$4:$C$7) OR =SUM(R4C3:R7C3)**				
11				**[D9] =SUM(D4:D8) OR =SUM(R[-5]C:R[-1]C)**			
12					**[E9] =SUM(E4:E8) OR =SUM(R[-5]C:R[-1]C)**		

In the above example the formulas in Cells C9, D9 and E9 are shown in both A1 and R1C1 notation. The first formula contains absolute references. The next two are relative formulas. Note however that in R1C1 format, these two are identical.

Select File | Options and Formulas to modify the worksheet appearance and display references as R1C1. Formulas change and column labels will switch from letters to numbers.



Use Excel options to toggle the Style Worksheet with R1C1 references ON

These alternative R1C1 references can be applied using the Indirect function without switching Excel's formula properties. e.g. =SUM(INDIRECT("R[-5]C[0]:R[-1]C[0]",0)) will sum the five cells above the current cell. Note that an extra argument must be supplied to the Indirect function. =INDIRECT(*TextRng, Type_TF*). If *TextRng* is an R1C1 reference, the optional *Type_TF* argument must be set to FALSE or zero. If it is any other value or omitted the *TextRng* is assumed to be in normal A1 notation.

The next example uses the Indirect function to read the R1C1 style reference in cell F1. That string in turn reflects the month number in cell D2. The reference currently represents the first 3 columns of values on the current row. The nature of R1C1 references means that the exact same range string can be applied (using INDIRECT) against all of the cells in G4:G7. With the A1 notation a different INDIRECT reference would be required for each row. *This example has been created to demonstrate INDIRECT() and R1C1 references. If I was trying to construct a table like this with dynamic formulas I would probably use INDEX() or OFFSET() in preference to this method.*

	A	B	C	D	E	F	G	H	I	J	K	L
1		**Expenditure**			Reference:	R[0]C3:R[0]C5			[F1] ="R[0]C3:R[0]C" & TEXT(D2+2,"0")			
2			Month number	3			**Total**					
3			April	May	June	July	**to M03**		[G3] ="to M" & TEXT(D2,"00")			
4		Ward 10	89,752	44,324	81,193	65,063	**215,269**		[G4] =SUM(INDIRECT(F$1,0))			
5		Ward 11	35,324	87,338	56,219	91,235	**178,881**		[G5] =SUM(INDIRECT(F$1,0))			
6		Ward 12	63,290	15,295	59,293	86,468	**137,878**		[G6] =SUM(INDIRECT(F$1,0))			
7		Ward 13	60,277	69,067	81,691	2,068	**211,035**		[G7] =SUM(INDIRECT(F$1,0))			

In the following (embedded web app) example you can edit the month number value in cell D3 and thereby change the R1C1 string in cell F1. This string is used in each row in column G to supply the INDIRECT function with a dynamic range.

	A	B	C	D	E	F	G
1	**Expenditure**						
2			Month number	**3**			**Total**
3			April	May	June	July	**to M03**
4		Ward 10	89,752	44,324	81,193	65,063	**215,269**
5		Ward 11	35,324	87,338	56,219	91,235	**178,881**
6		Ward 12	63,290	15,295	59,293	86,468	**137,878**
7		Ward 13	60,277	69,067	81,691	2,068	**211,035**
9		**Totals**	**248,643**	**216,024**	**278,397**	**244,833**	

R1C1 references are most useful when writing Visual Basic code. If you wish to use VBA to write cell formulas, it is much easier to write code to increment 1, 2, 3 rather than A, B, C. Also, a single R1C1 formula with relative references can be copied (using VBA) to a range of cells and will adjust to the appropriate rows and columns.

How to Create Named Ranges in Excel

What's in the name?

If you are working with Excel spreadsheets, it could mean a lot of time saving and efficiency.

Named Ranges in Excel – An Introduction

If someone has to call me or refer to me, they will use my name (instead of saying a male is staying in so and so place with so and so height and weight).

Right?

Similarly, in Excel, you can give a name to a cell or a range of cells.

Now, instead of using the cell reference (such as A1 or A1:A10), you can simply use the name that you assigned to it.

For example, suppose you have a data set as shown below:

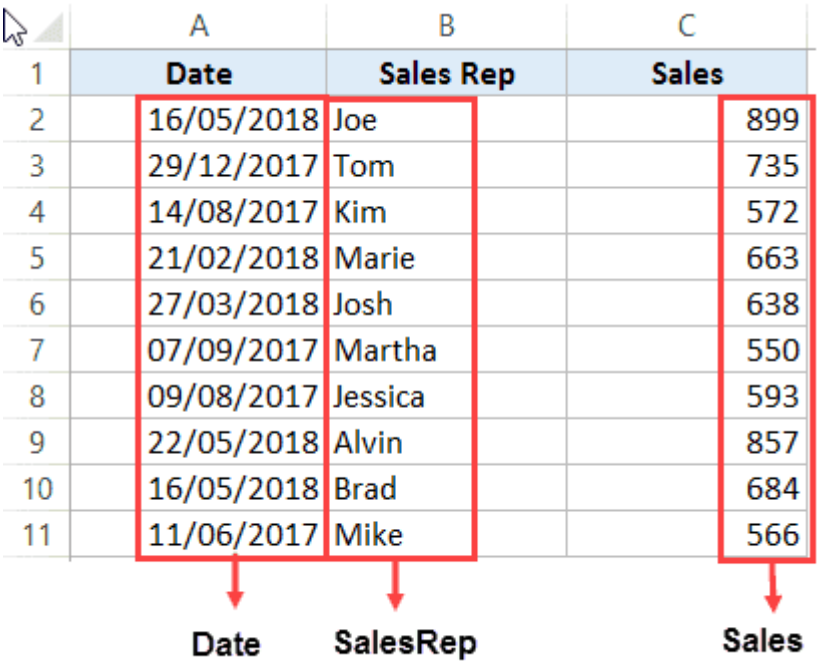
	A	B	C
1	**Date**	**Sales Rep**	**Sales**
2	16/05/2018	Joe	899
3	29/12/2017	Tom	735
4	14/08/2017	Kim	572
5	21/02/2018	Marie	663
6	27/03/2018	Josh	638
7	07/09/2017	Martha	550
8	09/08/2017	Jessica	593
9	22/05/2018	Alvin	857
10	16/05/2018	Brad	684
11	11/06/2017	Mike	566

In this data set, if you have to refer to the range that has the Date, you will have to use A2:A11 in formulas. Similarly, for Sales Rep and Sales, you will have to use B2:B11 and C2:C11.

While it's alright when you only have a couple of data points, in case you have huge complex data sets, using cell references to refer to data could be time-consuming.

Excel Named Ranges makes it easy to refer to data sets in Excel.

You can create a named range in Excel for each data category, and then use that name instead of the cell references. For example, dates can be named 'Date', Sales Rep data can be named 'SalesRep' and sales data can be named 'Sales'.



You can also create a name for a single cell. For example, if you have the sales commission percentage in a cell, you can name that cell as 'Commission'.

Benefits of Creating Named Ranges in Excel

Here are the benefits of using named ranges in Excel.

Use Names instead of Cell References

When you create Named Ranges in Excel, you can use these names instead of the cell references.

For example, you can use =SUM(SALES) instead of =SUM(C2:C11) for the above data set.

Have a look at the formulas listed below. Instead of using cell references, I have used the Named Ranges.

- Number of sales with value more than 500: =COUNTIF(Sales,">500″)
- Sum of all the sales done by Tom: =SUMIF(SalesRep,"Tom",Sales)
- Commission earned by Joe (sales by Joe multiplied by commission percentage): =SUMIF(SalesRep,"Joe",Sales)*Commission

You would agree that these formulas are easy to create and easy to understand (especially when you share it with someone else or revisit it yourself.

No Need to Go Back to the Dataset to Select Cells

Another significant benefit of using Named Ranges in Excel is that you don't need to go back and select the cell ranges.

Named Ranges Make Formulas Dynamic

By using Named Ranges in Excel, you can make Excel formulas dynamic.

For example, in the case of sales commission, instead of using the value 2.5%, you can use the Named Range.

Now, if your company later decides to increase the commission to 3%, you can simply update the Named Range, and all the calculations would automatically update to reflect the new commission.

How to Create Named Ranges in Excel

Here are three ways to create Named Ranges in Excel:

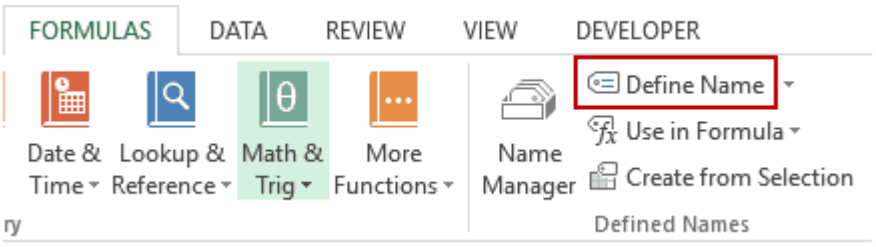
Method #1 – Using Define Name

Here are the steps to create Named Ranges in Excel using Define Name:

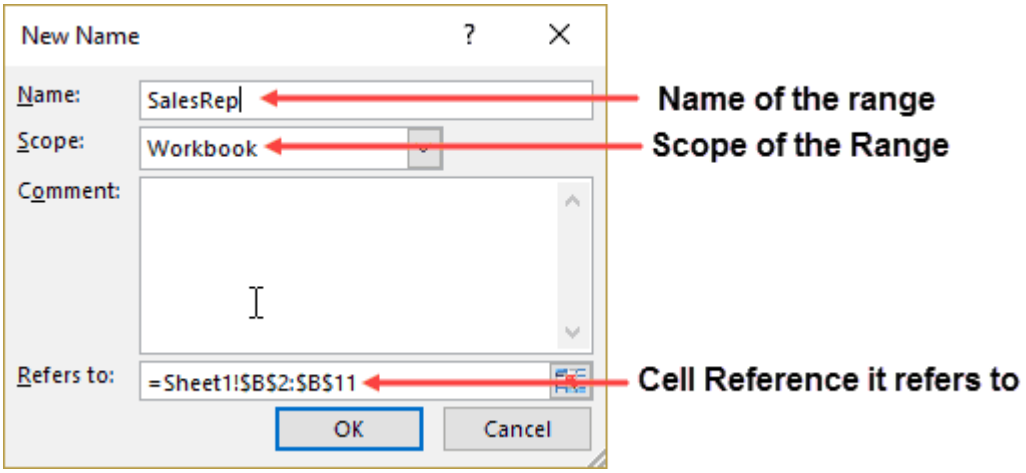
- Select the range for which you want to create a Named Range in Excel.

	A	B	C
1	Date	Sales Rep	Sales
2	16/05/2018	Joe	899
3	29/12/2017	Tom	735
4	14/08/2017	Kim	572
5	21/02/2018	Marie	663
6	27/03/2018	Josh	638
7	07/09/2017	Martha	550
8	09/08/2017	Jessica	593
9	22/05/2018	Alvin	857
10	16/05/2018	Brad	684
11	11/06/2017	Mike	566

- Go to Formulas –> Define Name.



In the New Name dialogue box, type the Name you wish to assign to the selected data range. You can specify the scope as the entire workbook or a specific worksheet. If you select a particular sheet, the name would not be available on other sheets.



- Click OK.

This will create a Named Range SALES REP.

Method #2: Using the Name Box

- **Select the range for which you want to create a name (do not select headers).**
- Go to the Name Box on the left of the Formula bar and Type the name of the with which you want to create the Named Range. 

- Note that the Name created here will be available for the entire Workbook. If you wish to restrict it to a worksheet, use Method 1.

Method #3: Using Create From Selection Option

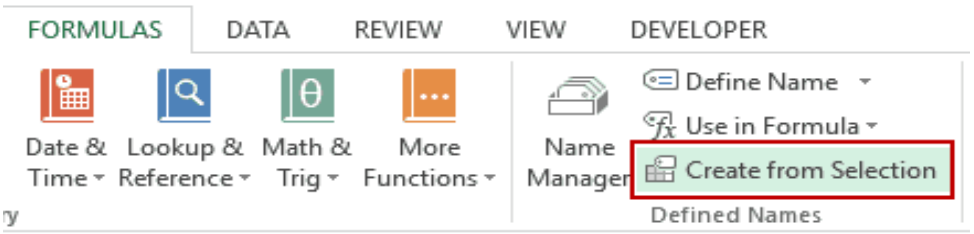
This is the recommended way when you have data in tabular form, and you want to create a named range for each column/row.

For example, in the dataset below, if you want to quickly create three named ranges (Date, Sales_Rep, and Sales), then you can use the method shown below.

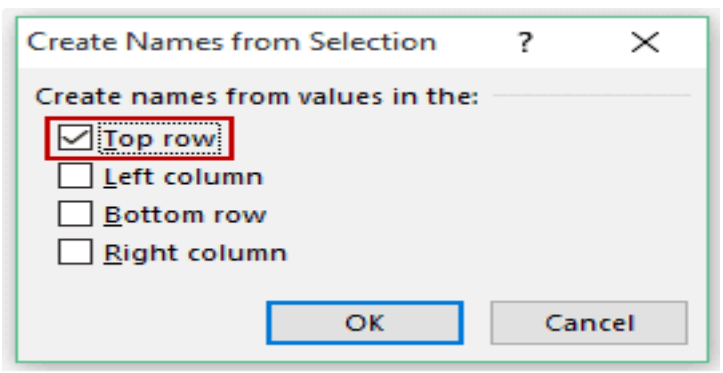
	A	B	C
1	**Date**	**Sales Rep**	**Sales**
2	16/05/2018	Joe	899
3	29/12/2017	Tom	735
4	14/08/2017	Kim	572
5	21/02/2018	Marie	663
6	27/03/2018	Josh	638
7	07/09/2017	Martha	550
8	09/08/2017	Jessica	593
9	22/05/2018	Alvin	857
10	16/05/2018	Brad	684
11	11/06/2017	Mike	566

Here are the steps to quickly create named ranges from a dataset:

- Select the entire data set (including the headers).
- Go to Formulas –> Create from Selection (*Keyboard shortcut – Control + Shift + F3*). It will open the 'Create Names from Selection' dialogue box.



- In the Create Names from Selection dialogue box, check the options where you have the headers. In this case, we select the top row only as the header is in the top row. If you have headers in both the top row and left column, you can choose both. Similarly, if your data is arranged when the headers are in the left column only, then you only check the Left Column option.



This will create three Named Ranges – Date, Sales_Rep, and Sales.

Note that it automatically picks up names from the headers. If there are any space between words, it inserts an underscore (as you can't have spaces in named ranges).

Naming Convention for Named Ranges in Excel

There are certain naming rules you need to know while creating Named Ranges in Excel:

- The first character of a Named Range should be a letter and underscore character(_), or a backslash(\). If it's anything else, it will show an error. The remaining characters can be letters, numbers, special characters, period, or underscore.
- You can not use names that also represent cell references in Excel. For example, you can't use AB1 as it is also a cell reference.
- You can't use spaces while creating named ranges. For example, you can't have Sales Rep as a named range. If you want to combine two words and create a Named Range, use an underscore, period or uppercase characters to create it. For example, you can have Sales_Rep, SalesRep, or SalesRep.
- While creating named ranges, Excel treats uppercase and lowercase the same way. For example, if you create a named range SALES, then you will not be able to create another named range such as 'sales' or 'Sales'.
- A Named Range can be up to 255 characters long.

What Are Excel Errors

Excel is a powerful tool for working with data, but it can also be frustrating when errors occur. While some errors are easy to fix, others can be more difficult to troubleshoot. By understanding the different types of Excel errors, you can learn how to avoid them and quickly fix them when they occur. This will help you save time and ensure that your Excel workbooks are accurate and error-free.

Below is the list of some most common errors that we can find in the Excel formula:

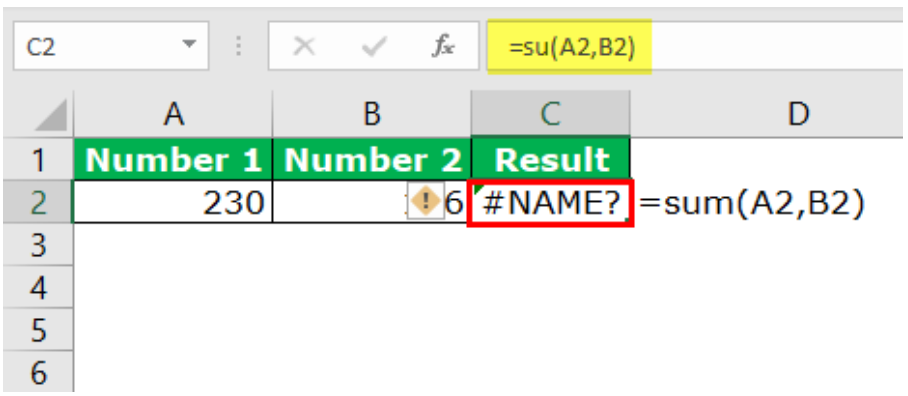
1. **#NAME? Error:** This Excel error usually occurs because of the non-existent function.
2. **#DIV/0! Error:** This Excel error because if we try to divide the number by zero or vice-versa.
3. **#REF! Error:** This error arises due to a reference missing.
4. **#NULL! Error:** This error comes due to unnecessary spaces inside the function.
5. **#N/A Error:** The function cannot find the required data. Maybe the wrong reference is given.
6. **###### Error:** This is not a true Excel formula error, but it occurs because of a formatting issue. Probably, the value in the cell is more than the column width.
7. **#VALUE! Error:** This is one of the common Excel formula errors we see in Excel. It occurs due to the wrong data type of the parameter given to the function.
8. **#NUM! Error:** Excel formula error because the number we have supplied to the formula is not proper.

#1 #NAME? Error

The #NAME? Excel formula error is when Excel cannot find the supplied function or the parameters we gave do not match the standards of the function.

Just because of the display value of #NAME? It does not mean Excel is asking your name.

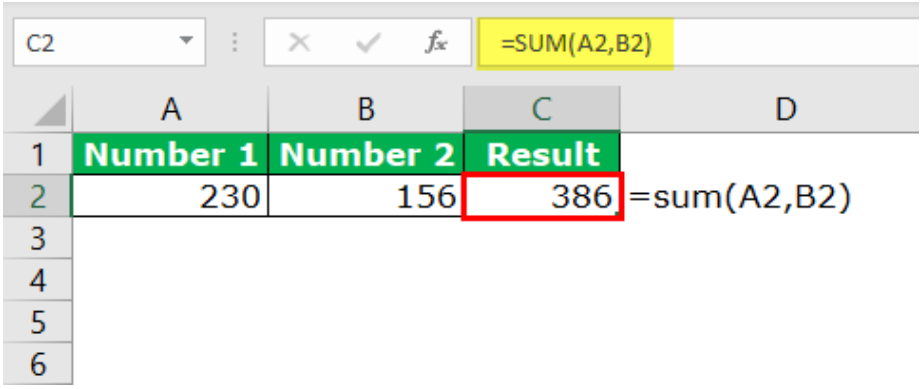
Rather, it is due to the wrong data type for the parameter.



If we notice in the formula bar, instead of the Sum formula in excel , we have misspelt the formula as **su.** So the result of this function is #NAME?.

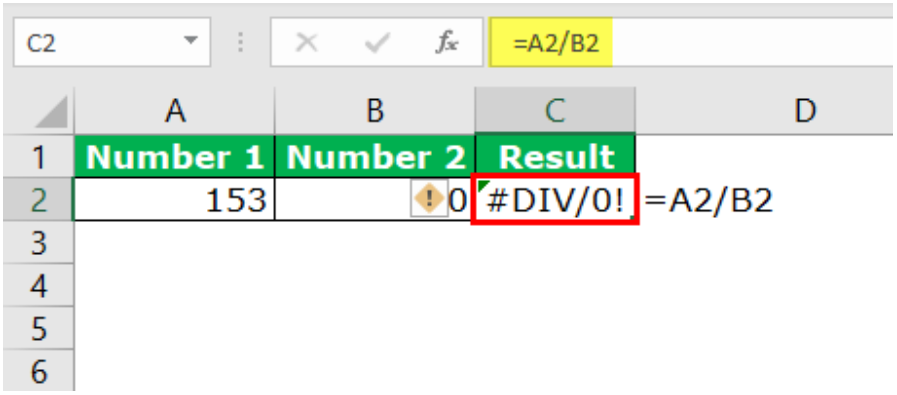
How to Fix the #Name? ERROR Issue?

To fix the Excel formula error, we must look for the formula bar and check if the formula we have inserted is valid. If the formula spelling is inaccurate, we must change that to the correct wording.



#2 #DIV/0! Error

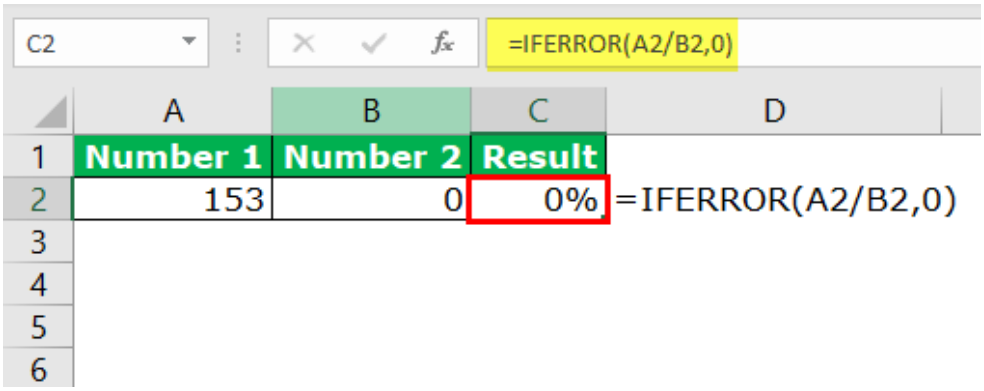
The #DIV/0! Error is due to the wrong calculation method, or one of the operators is missing. This error occurs in calculations. For example, if we have a "Budgeted" number in cell A1 and the "Actual" number in cell B1, we must divide the B1 cell by the A1 cell to calculate the efficiency. If any cells are empty or zero, we may get this error.



How to Fix the #DIV/o! ERROR Issue?

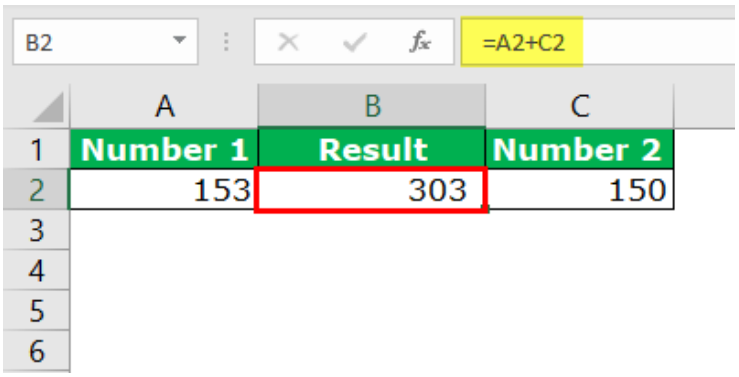
To fix this Excel formula error, we must use one formula to calculate the efficiency level. Therefore, we can use the IFERROR function in excel

and calculate inside the function.

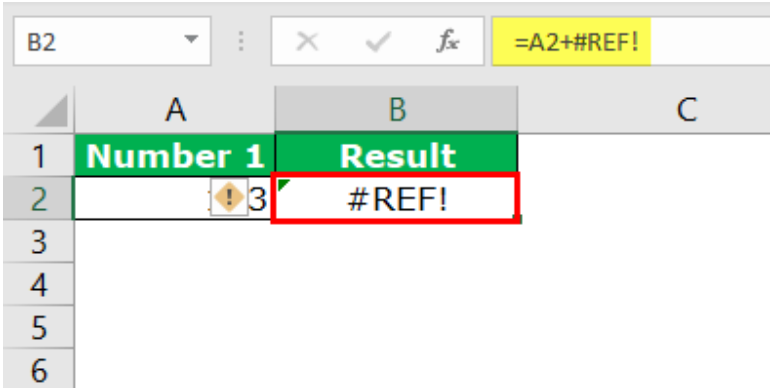


#3 #REF! Error

The #REF! Error is due to the supply of the reference missing suddenly. Look at the below example in cell B2. We have applied the formula "A2 + C2."



Now, we will delete column C2 and see the result in cell B2.



How to Fix the #REF! ERROR Issue?

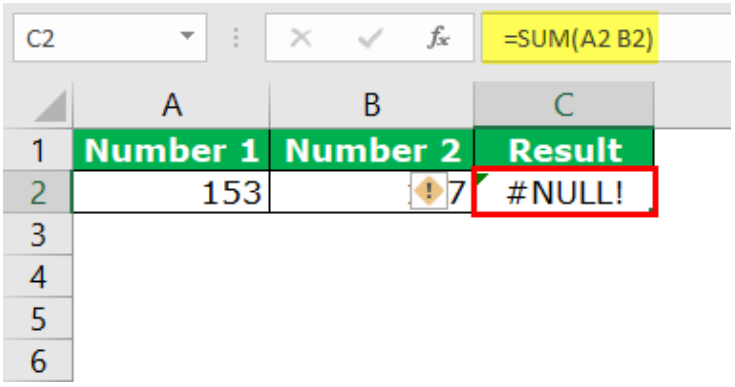
Before adding or deleting anything to the existing data set, we must ensure all the formulas are pasted as values. If the deleting cell is referred to any of the cells, we may encounter this error.

We must always undo the action if we accidentally delete any rows, columns, or cells.

#4 #NULL! Error

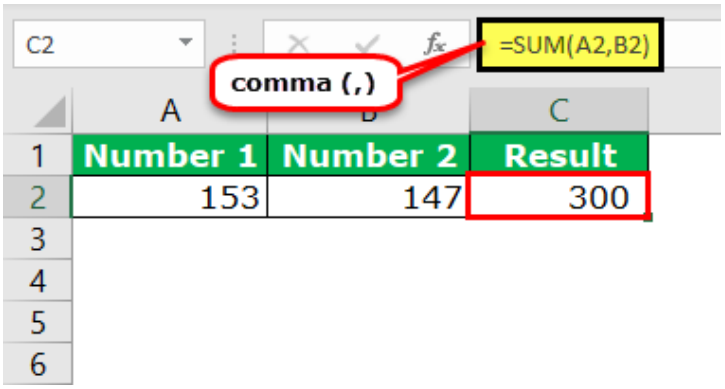
The #NULL! Error is due to the wrong value supplied to the required parameters; for example, after the improper supply of range operator, incorrect mention of parameter separator.

Look at the below image. We have applied the SUM formula to calculate the sum of the values in cells A2 and B2. The mistake we made here is after the first argument. We should give a comma (,) to separate the two arguments. Instead, we have provided space.

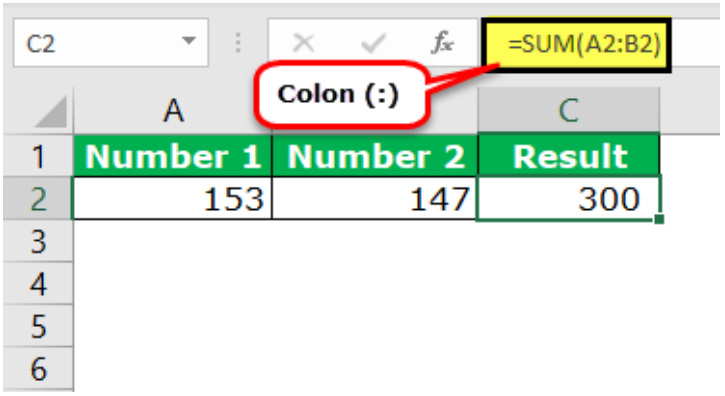


How to Fix the #NULL! ERROR Issue?

In these cases, we need to mention the exact argument separators. For example, we should use the comma (,) after the first argument in the above image.



In the case of a range, we need to use a colon (:).



#5 #VALUE! Error

The #VALUE! error occurs if the formula cannot find the specified result. It is due to non-numerical values or wrong data types to the argument.

Look at the image below. We have calculated the commission amount based on the sales value and commissions.

	A	B	C	D	E
1	ID	Sales Value	Commission %	Commission Amt	
2	153	2179	5.00%	108.95	=C2*B2
3	154	1677	5.50%	92.235	=C3*B3
4	155	2322	6.00%	139.32	=C4*B4
5	156	2076	7.00%	145.32	=C5*B5
6	157	1538	Not Decided	#VALUE!	=C6*B6
7	158	3246	5.00%	162.3	=C7*B7
8	159	3249	Not Decided	#VALUE!	=C8*B8
9	160	2448	5.00%	122.4	=C9*B9
10					

If we notice the cells D6 and D8, we get an error as #VALUE!. The reason we got #VALUE! Error because there is no commission percentage in the cells C6 and C8.

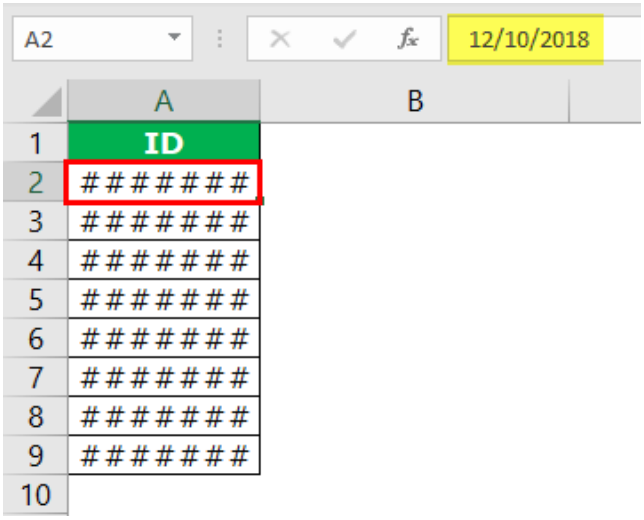
We cannot multiply the text value with numerical values.

How to Fix the #VALUE! ERROR Issue?

In these cases, we must replace all the text values with zero until we get further information.

#6 ###### Error

The ###### error, is not an error. Rather, it is just a formatting issue. For example, look at the below image in cell A1 that has entered the date values.

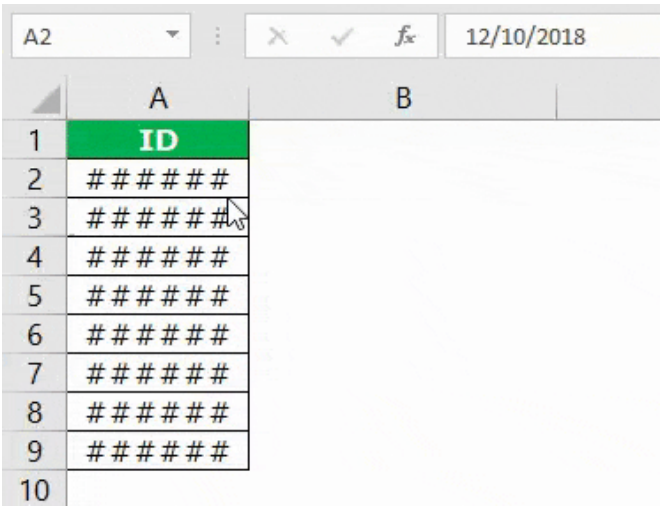


It is due to the length issue of the characters. The values in the cell are more than the column width. In simple terms, the column width is not wide enough.

How to Fix the ###### ERROR Issue?

We must double-click on the column to adjust the column width

to get the full values visible.

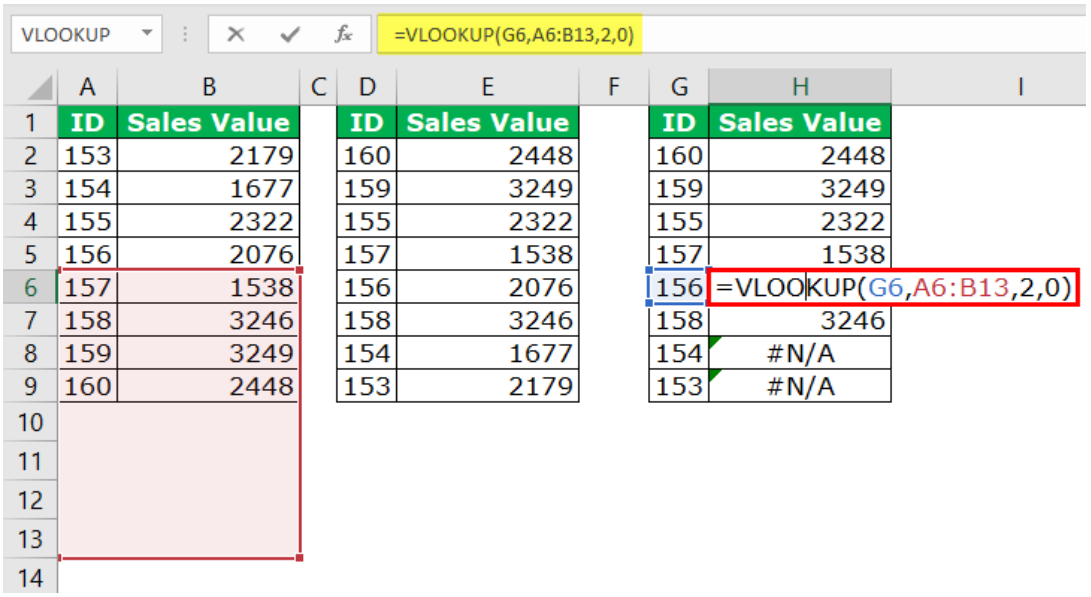


#7 #N/A! Error

The #N/A! error is because the formula cannot find the value in the data. It usually occurs when the Excel lookup functions like VLOOKUP, HLOOKUP, MATCH, and VLOOKUP cannot find the value you are looking for within the formula in the specified range.

	A	B	C	D	E	F	G
1	ID	Sales Value		ID	Sales Value		
2	153	2179		160	2448	=VLOOKUP(D2,A2:B9,2,0)	
3	154	1677		159	3249	=VLOOKUP(D3,A3:B10,2,0)	
4	155	2322		155	2322	=VLOOKUP(D4,A4:B11,2,0)	
5	156	2076		157	1538	=VLOOKUP(D5,A5:B12,2,0)	
6	157	1538		156	#N/A	=VLOOKUP(D6,A6:B13,2,0)	
7	158	3246		158	3246	=VLOOKUP(D7,A7:B14,2,0)	
8	159	3249		154	#N/A	=VLOOKUP(D8,A8:B15,2,0)	
9	160	2448		153	#N/A	=VLOOKUP(D9,A9:B16,2,0)	
10							

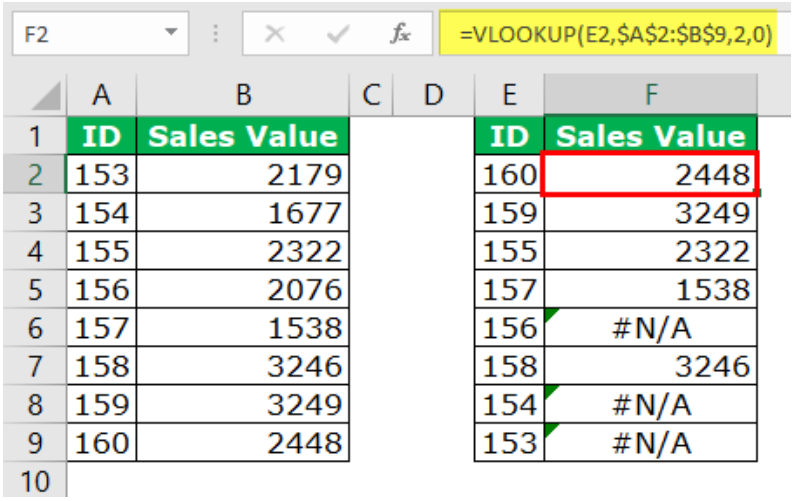
We got some errors as #N/A in the cells E6, E8, and E9. If we look at the ranges for these cells, it does not include the values against those IDs.



ID 156 is not in the range from A6 to B13; we got an error. Similarly, for the remaining two cells, we have the same issue.

How to Fix the #N/A! ERROR Issue?

We need to make this an absolute reference when referencing a table range.

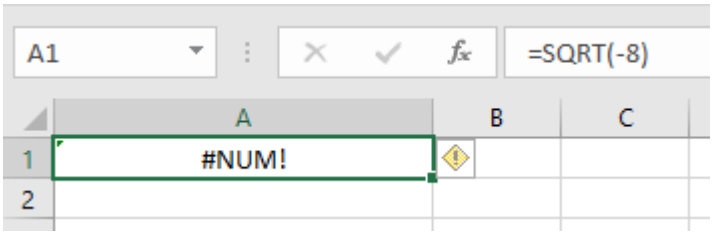


We must press the F4 key to make it an absolute reference.

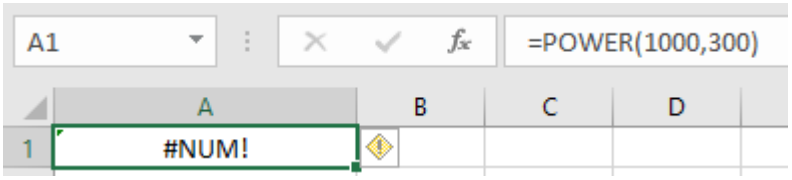
#8 #NUM! Error

Excel error occurs when Excel usually cannot display the result of a mathematical operation. This type of error can occur for two reasons:

For example, a formula or function contains numeric values that aren't valid. Calculating the square root of a negative number =SQRT(-8). This is because, in Excel, imaginary numbers are not considered.



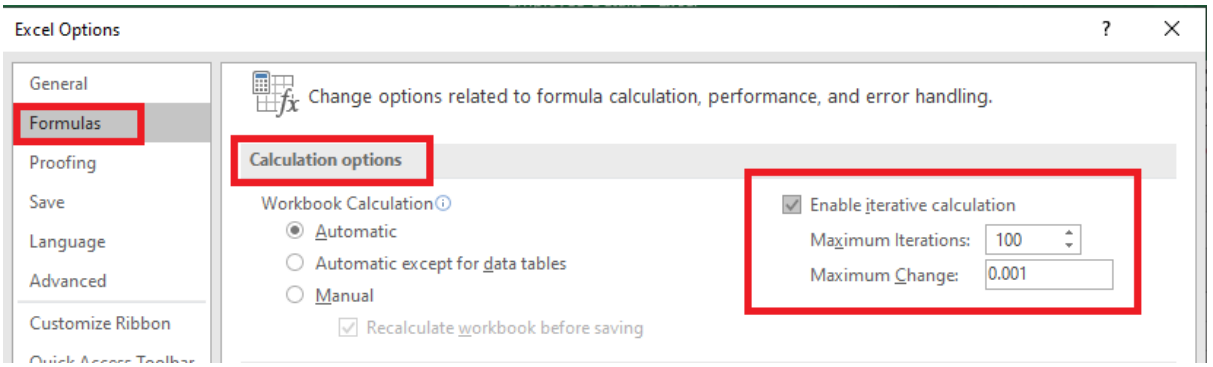
Or it can also be because the result of an operation is too large or small for Excel to display it. For example: Calculating the power of 1000 raised to 300 =POWER(1000,300) will give us a result Excel error type #NUM!



How to Fix the #NUM! ERROR Issue?

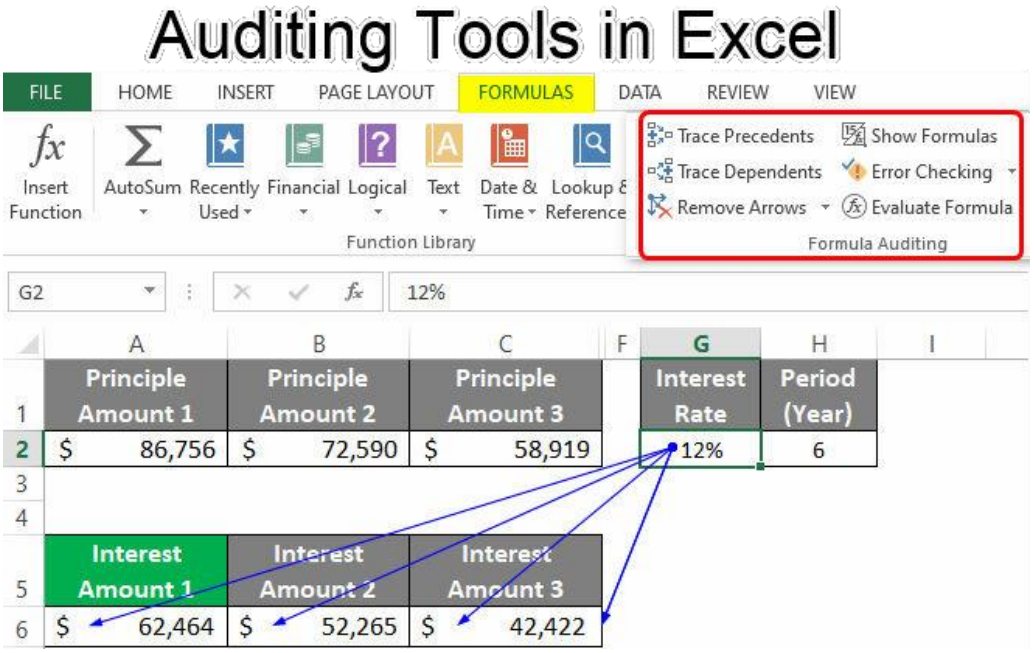
To fix this error in Excel, change the number of times Excel iterates the formula –

1. Go to File < Options.
2. The dialogue box will open. Go to Formulas and then Calculation options. Check the Enable iterative calculation box.
3. You will see two options – Maximum Iterations and Maximum Change. In the Maximum Iterations box, mention the number of times you want Excel to recalculate. The number of iterations is directly proportional to the time Excel takes to calculate a worksheet.
4. Now type the amount of change you will accept between calculation results in the Maximum Change box. The smaller the number, the less time Excel calculates a worksheet.



Excel Auditing Tools:

Excel auditing tools provide a suite of functionalities that will enable you to review, validate, and troubleshoot formulas and data. Suppose we have a dataset of some projects' **Principal Amount**, **Interest Amount**, **Monthly Amount**, and **Interest Rate**. Now we will apply all the auditing tools using this data table.



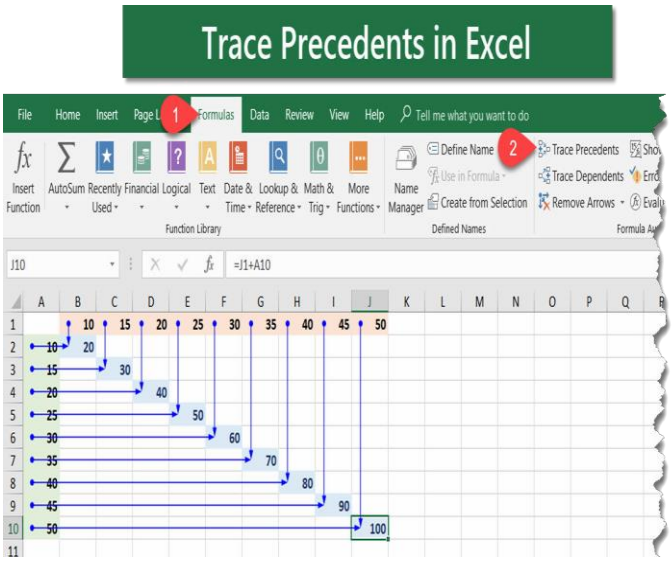
Advantages of Using Excel AuditingTools

- Auditing tools like "**Trace Dependents**" and "**Trace Precedents**" help identify cells that contribute to a specific formula, making it easier to locate errors.
- The "**Show Formulas**" feature allows you to view the actual formulas in cells, aiming toward understanding complex calculations.
- Tools like "**Error Checking**" automatically detect and highlight common errors like division by zero or incorrect cell references, aiding in quick error resolution.

Trace Precedents

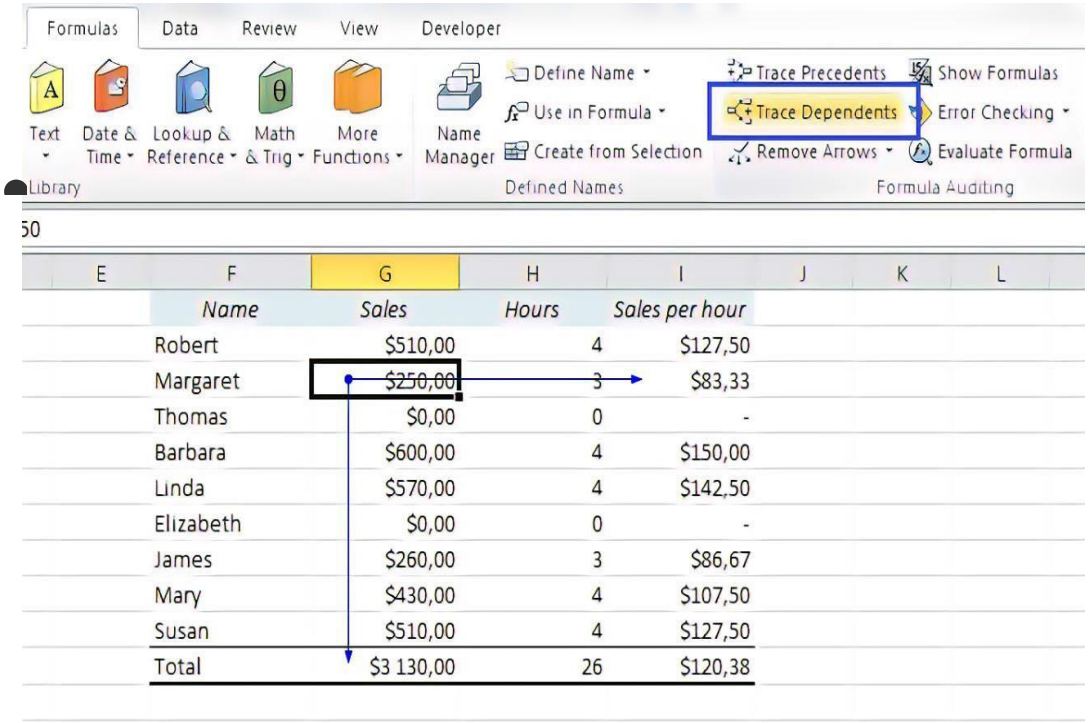
Trace Precedents is a dynamic tool to sort out the complex chain of cell relationships in your spreadsheets. Trace Precedents provide you the ability to understand formula dependencies by highlighting the connections that have an impact on a chosen cell. As we have calculated the interest amount by multiplying the principal amount with the interest rate, let's see what the trace precedent tool show for this calculation.

- To do so, choose a **cell** (**D5**), and visit the **Trace Precedents** option from the **Formulas** tab.
- As a result, we will see two arrows from **cell** (**C5**) and **cell** (**C11**) indicating towards **cell** (**D5**) as the interest amount is calculated using the principal amount and interest rate.



Trace Dependents

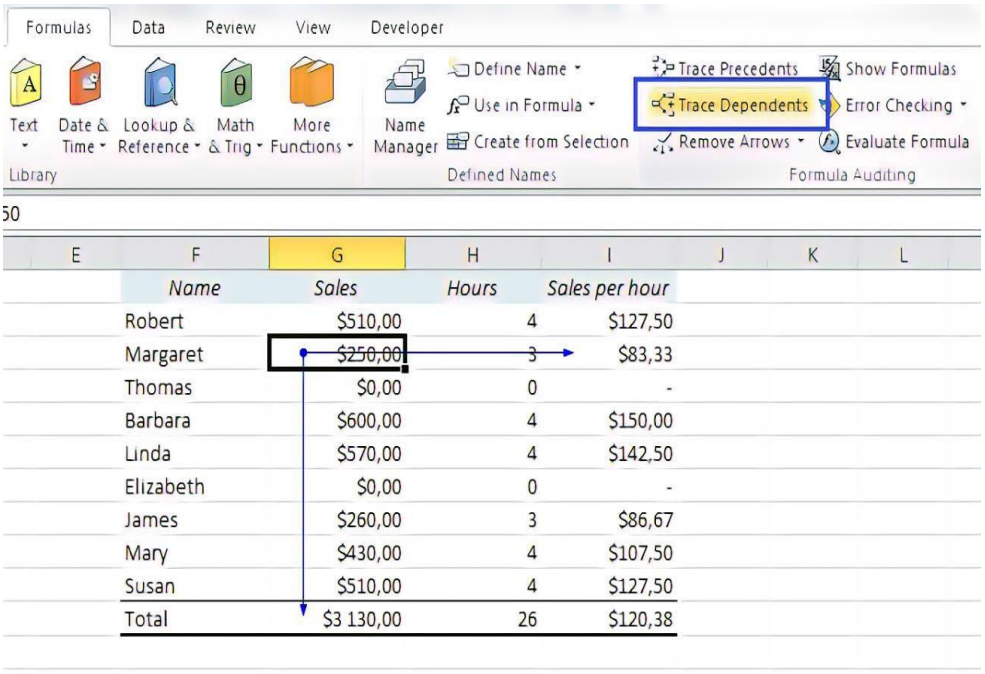
In order to visually highlights the cells that depend on the value of a selected cell, you can try the Trace Dependents feature in Excel. This is a powerful tool for understanding the relationship between cells. Here, let's see how the interest rate is dependent on the cells.



Name	Sales	Hours	Sales per hour
Robert	$510,00	4	$127,50
Margaret	$250,00	3	$83,33
Thomas	$0,00	0	-
Barbara	$600,00	4	$150,00
Linda	$570,00	4	$142,50
Elizabeth	$0,00	0	-
James	$260,00	3	$86,67
Mary	$430,00	4	$107,50
Susan	$510,00	4	$127,50
Total	$3 130,00	26	$120,38

- Simply, choose a **cell** (**G22**), and then visit the **Trace Dependents** feature from the **Formulas** tab.

  Finally, you will see the arrows from the **cell** (**G11**) to other cells indicating the cells that are dependent on the value of the selected cell.



Name	Sales	Hours	Sales per hour
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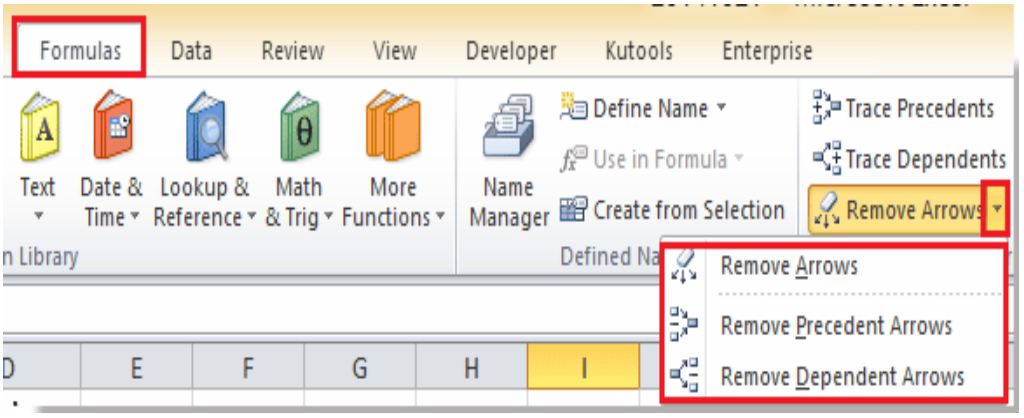
James	$260,00	3	$86,67
Mary	$430,00	4	$107,50
Susan	$510,00	4	$127,50
Total	$3 130,00	26	$120,38

Remove Arrows

After inserting arrows using the above features, you can also delete them by utilizing the Remove Arrows option.

- Start with, selecting the **cell** (**C11**) and clicking the **Remove Arrows** option from the **Formulas** tab.
- Within a blink of an eye, the arrows will be removed.

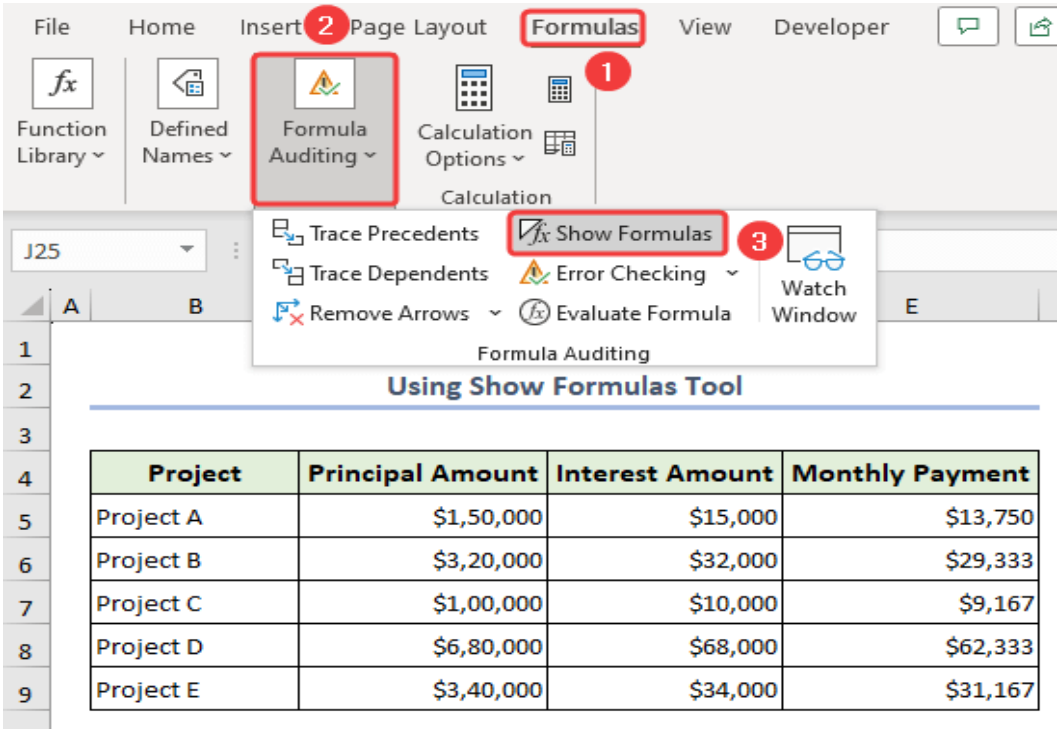
  It's that simple.



Show Formulas

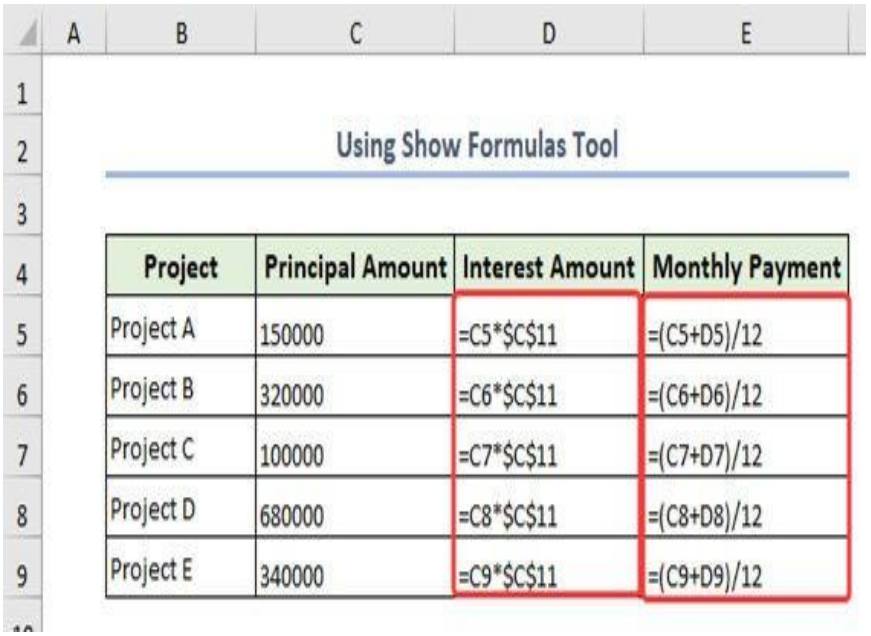
Show Formulas in Excel is a helpful tool that allows you to view the actual formulas within cells instead of their calculated results. This feature offers transparency into complex calculations, aiding in formula debugging and verification.

- While the worksheet is open, visit the Formulas tab and press the Show Formulas option.



Project	Principal Amount	Interest Amount	Monthly Payment
Project A	$1,50,000	$15,000	$13,750
Project B	$3,20,000	$32,000	$29,333
Project C	$1,00,000	$10,000	$9,167
Project D	$6,80,000	$68,000	$62,333
Project E	$3,40,000	$34,000	$31,167

Immediately, all the cells with formulas will represent the formulas inside the cells.



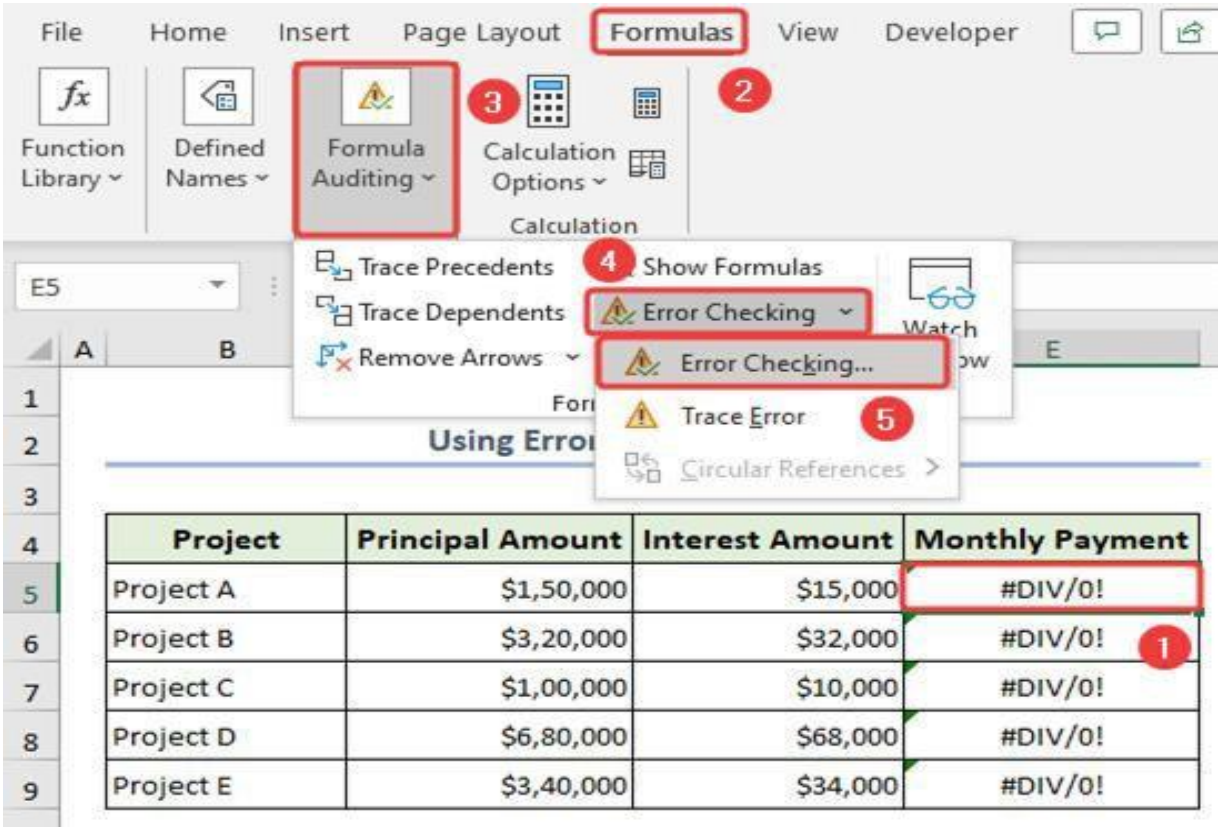
Project	Principal Amount	Interest Amount	Monthly Payment
Project A	150000	=C5*$C$11	=(C5+D5)/12
Project B	320000	=C6*$C$11	=(C6+D6)/12
Project C	100000	=C7*$C$11	=(C7+D7)/12
Project D	680000	=C8*$C$11	=(C8+D8)/12
Project E	340000	=C9*$C$11	=(C9+D9)/12

Error Checking (Includes Error Checking, Trace Error, Circular References)

Sometimes while applying formulas, you will get errors like

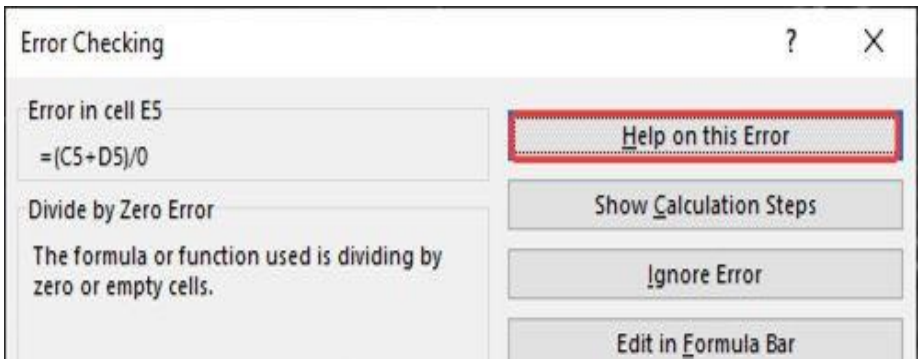
#DIV/0!, **#VALUE!**, **#NAME?** Errors. To check why it's happening you can visit **Error Checking** option from the **Formula** tab.

- Select a **cell** (**E5**), and hit the **Error Checking**

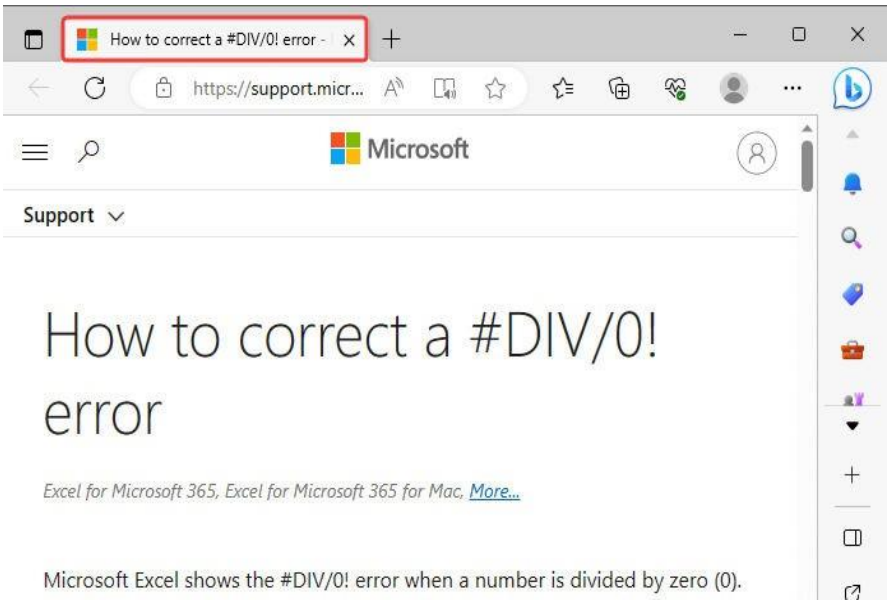


option from the **Formulas** tab.

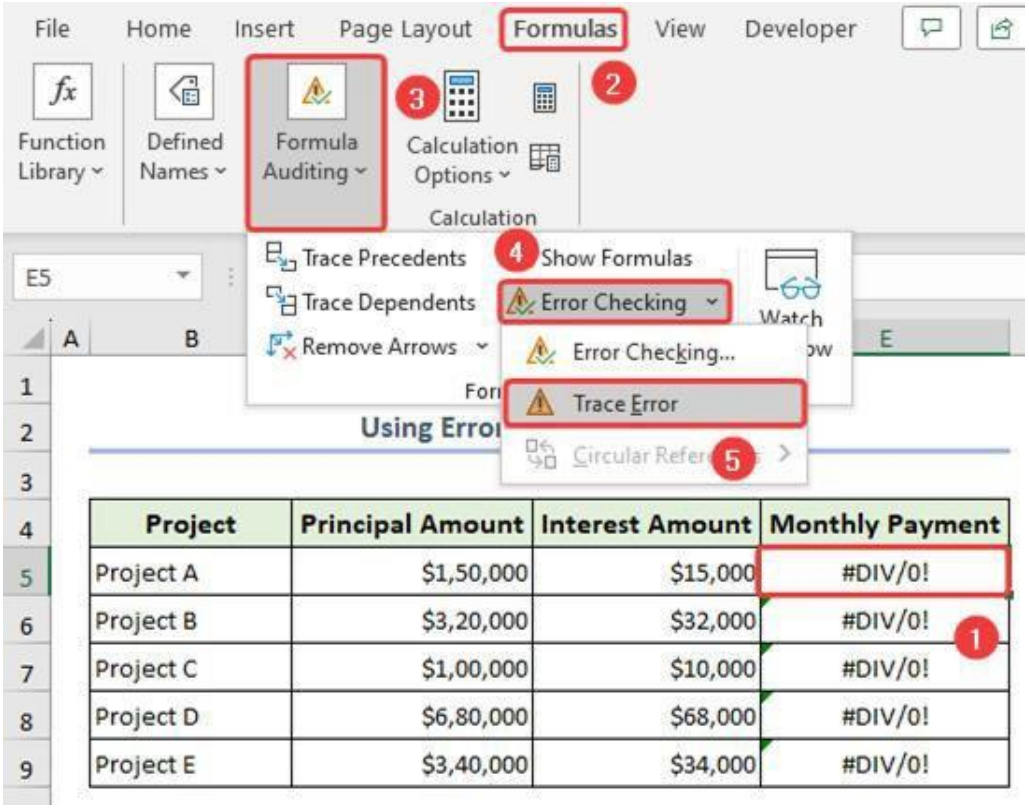
- Now, you can click the **Help on this Error** option to check in detail about the error.



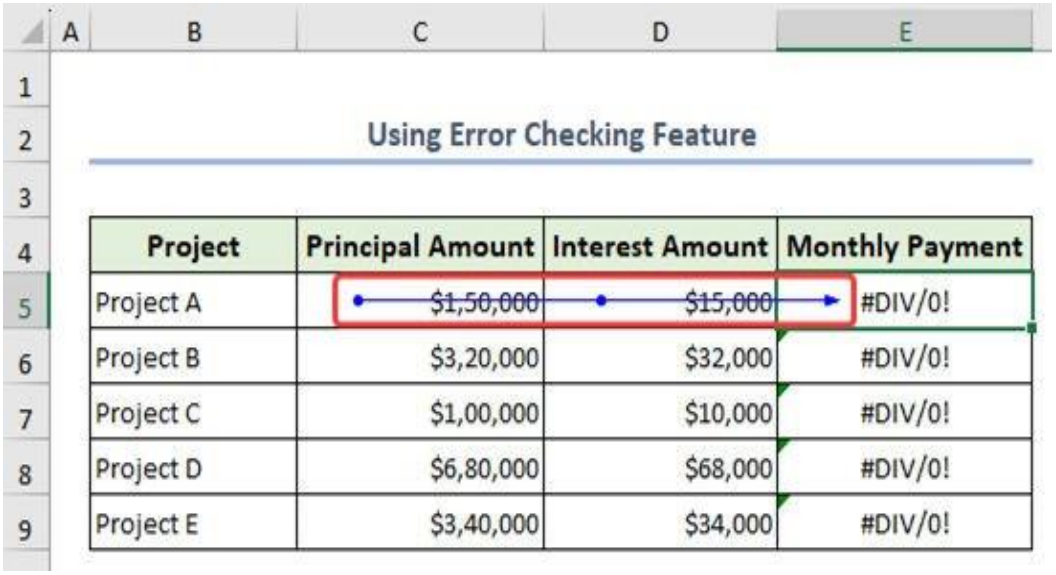
- As a result, a new window will open in your browser providing you details about the error and its solution.



- In order to trace from which cells these are happening, click the **Trace Error** option from the **Formulas** tab.



- Immediately, an arrow will appear to indicate the error and its corresponding cells.



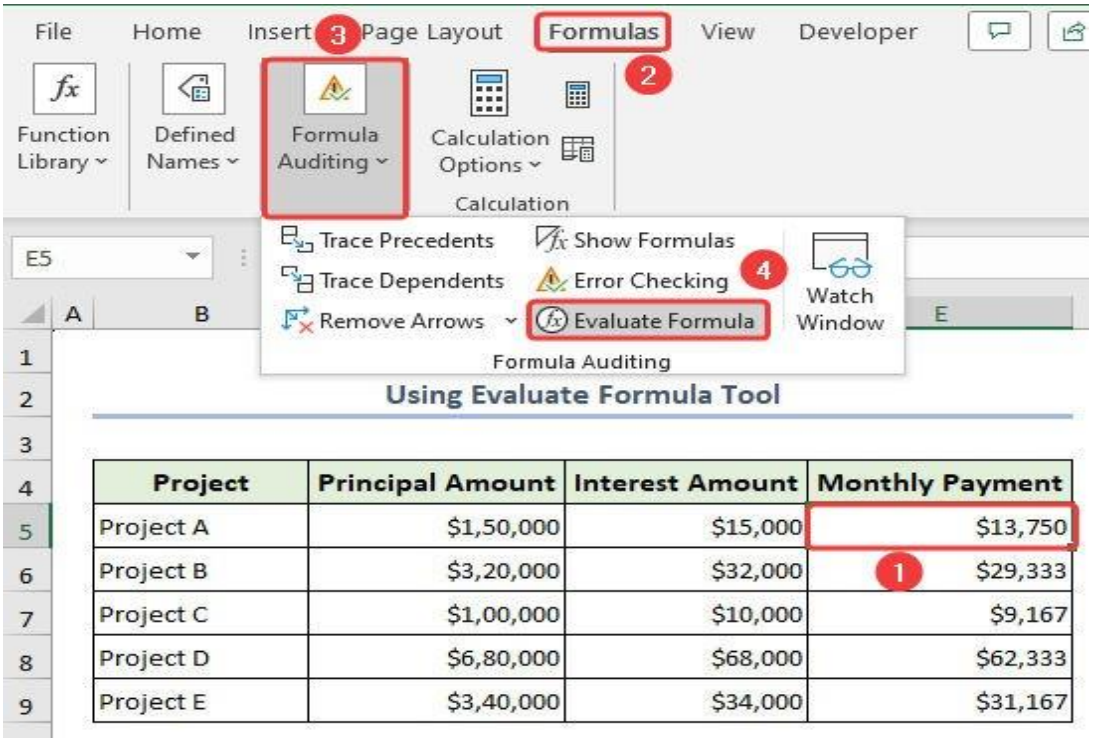
Using Error Checking Feature

Project	Principal Amount	Interest Amount	Monthly Payment
Project A	$1,50,000	$15,000	#DIV/0!
Project B	$3,20,000	$32,000	#DIV/0!
Project C	$1,00,000	$10,000	#DIV/0!
Project D	$6,80,000	$68,000	#DIV/0!
Project E	$3,40,000	$34,000	#DIV/0!

Evaluate Formula

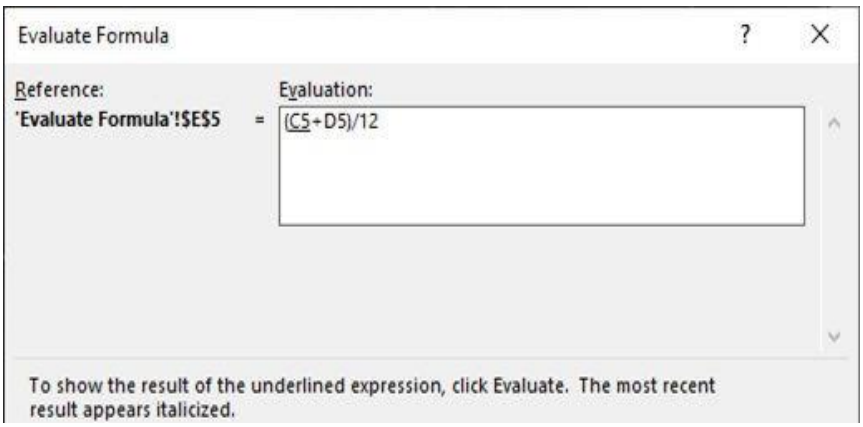
When you are dealing with complex formulas and you are having trouble understanding the formulas, at that time you can visit the **Evaluate Formula** option to have a better understanding.

- Simply, choose a **cell** (**E5**) consisting of the formula and hit the **Evaluate Formula** option.

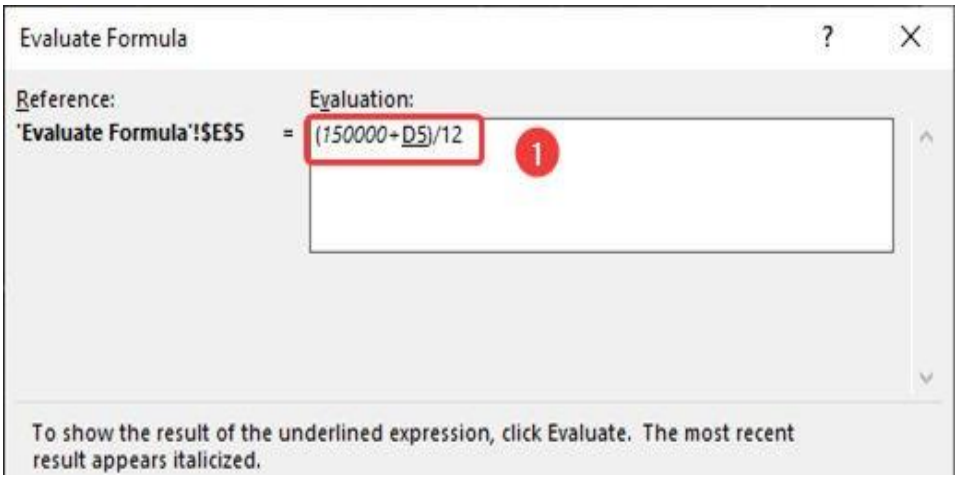


Project	Principal Amount	Interest Amount	Monthly Payment
Project A	$1,50,000	$15,000	$13,750
Project B	$3,20,000	$32,000	$29,333
Project C	$1,00,000	$10,000	$9,167
Project D	$6,80,000	$68,000	$62,333
Project E	$3,40,000	$34,000	$31,167

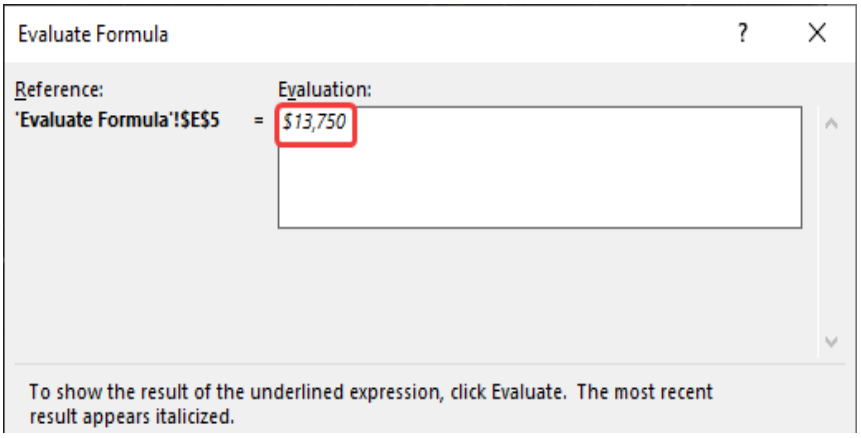
- Immediately, a window will open evaluating the formula.
- From there to evaluate more deeply click the **Evaluate** option.



Another update will come describing the formula. Click **Evaluate** again to get the result.



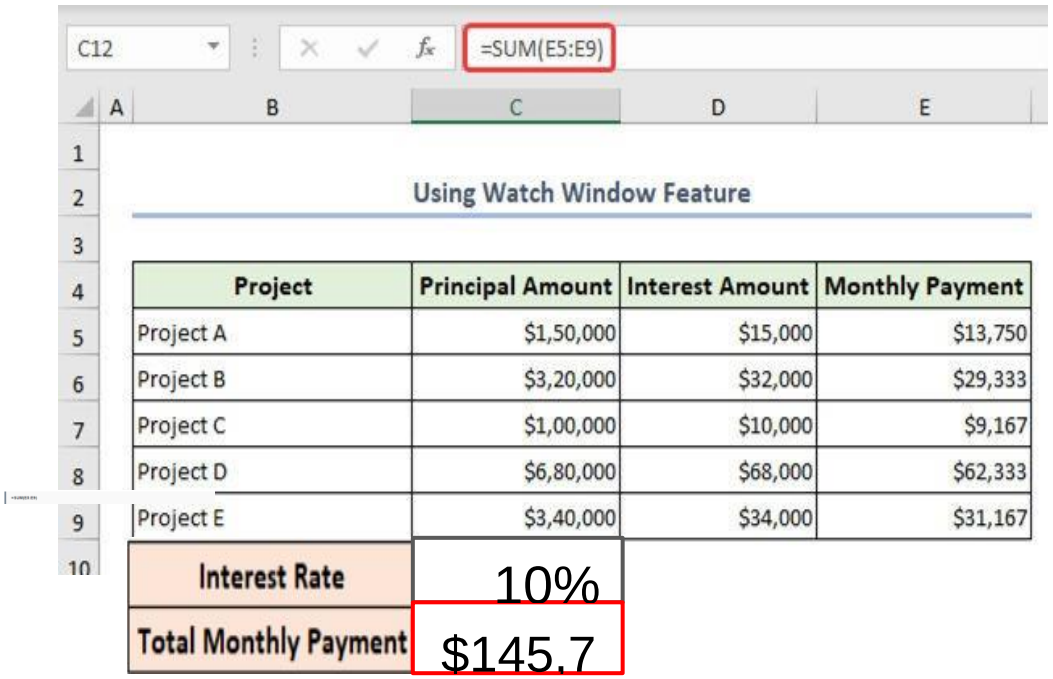
- After completing the evaluation, you will get the cell value in the window.



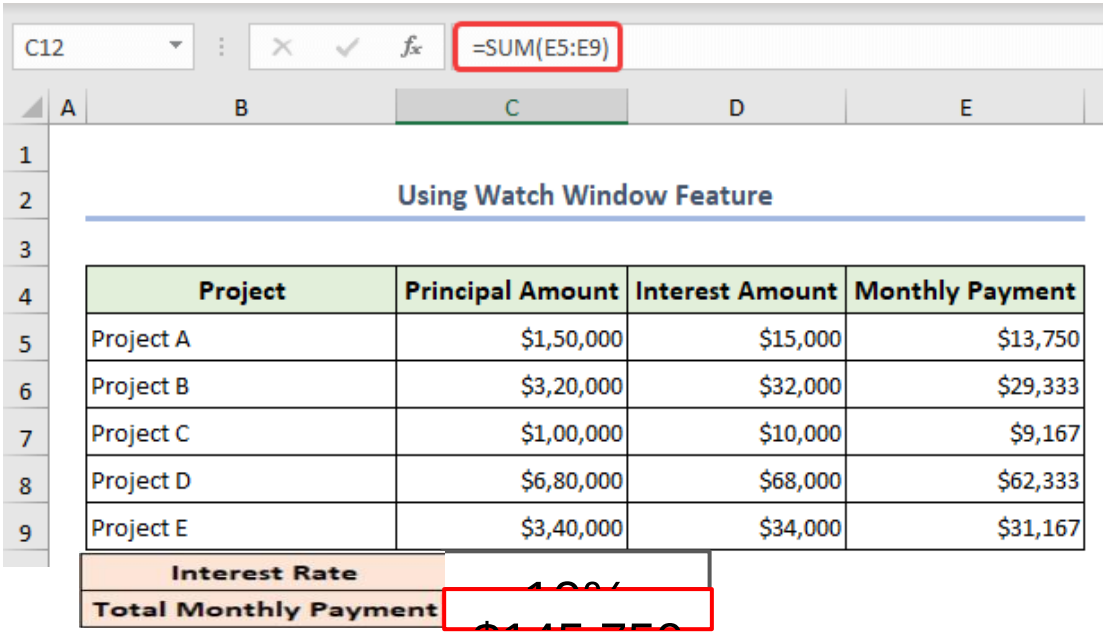
Watch Window

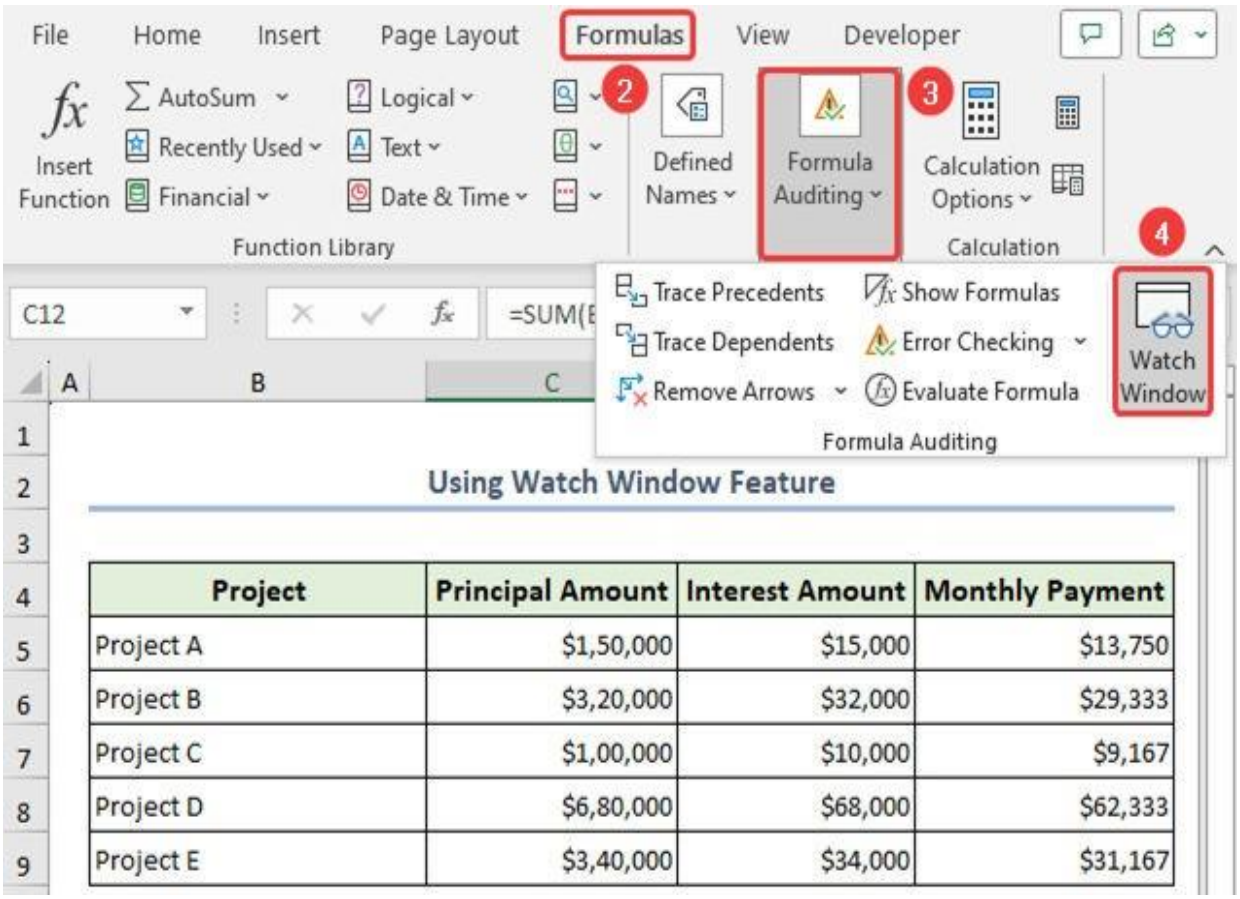
While working with a large dataset sometimes you might need to look over some cell values immediately and all time in a specific space. For that, you can add a watch window at the top of the spreadsheet. Here, we have calculated the total monthly payment amount using **the SUM function** in Excel.
Now we will add a watch window for this specific cell.

- Choose a **cell** (**C12**), apply the below formula, and hit **ENTER**.



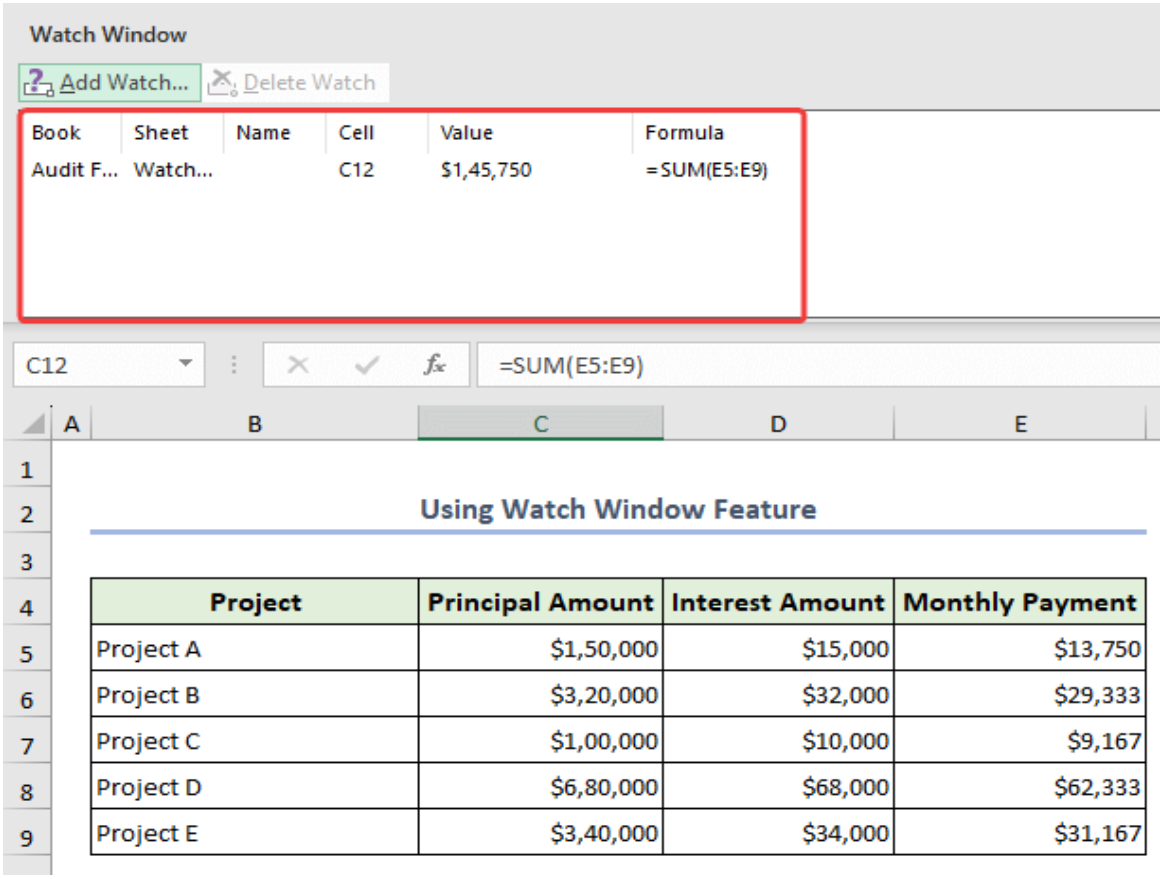
- Now choosing the **cell** (**C12**), hit the **Watch Window** feature from the **Formulas** tab.





Project	Principal Amount	Interest Amount	Monthly Payment
Project A	$1,50,000	$15,000	$13,750
Project B	$3,20,000	$32,000	$29,333
Project C	$1,00,000	$10,000	$9,167
Project D	$6,80,000	$68,000	$62,333
Project E	$3,40,000	$34,000	$31,167

- *Within a glimpse, a window will open at the top of the spreadsheet showing cell value and formula. This watch window is really a helpful tool for making a summary of your dataset. And if you scroll or jump to another sheet the watch window will always be visible on that place.*



Array Formulas in Excel

Excel is among the most powerful and widely used spreadsheet tools which eases organizing numbers and data within the sheets with pre-built formulas and functions. In this article, we are going to study Array Formulas. Arrays are one of them. Using Excel Array Formulas, make it super easy to handle a lot of data. Before understanding and using the Array formulas, let's first understand what is Array in Excel?

Array in Excel

An Array in Excel is the structure that holds a collection of data. These data can be in the form of numbers or texts. There could be an array of 1-D or 2-D as well in Excel. For example, the array of fruits in excel would be written something like this:-

{"Apple", "Banana", "Grapes", "Guava"}

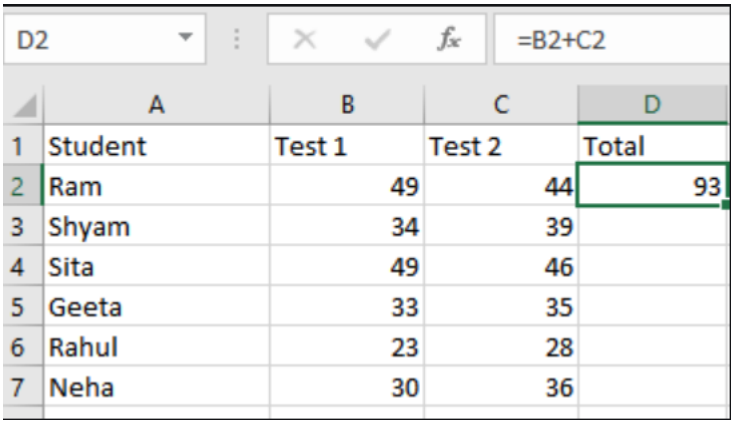
We can directly enter it into the sheet by selecting the cells where you want to enter the data and then writing the array preceded by an "=" sign. After these press Ctrl+Shift+Enter. For example, let's enter these values in cells A1 to D1.

Array-in-excel

The array created here is a horizontal array. You can also create a vertical array by changing the selected cells. You can create an array by specifying the starting and the ending positions, for example, if you wish to make an array of elements between A1 to F1 then you can write A1:F1. Now. let's move to array formulas.

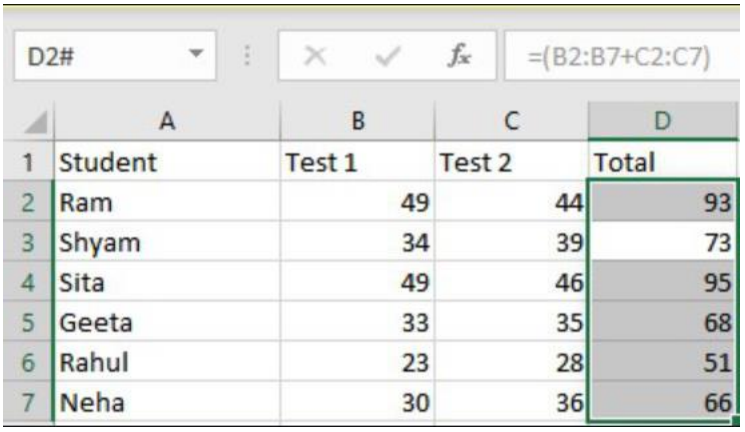
Array formulas

Array formulas enable to process of several values and give several outputs. In a simple world, it can do multiple calculations and reduce a lot of human efforts. In other words, we can say that it solves array calculations and give an array as output too. Let's understand more of them with an example, of students with their test marks,



	A	B	C	D
1	Student	Test 1	Test 2	Total
2	Ram	49	44	93
3	Shyam	34	39	
4	Sita	49	46	
5	Geeta	33	35	
6	Rahul	23	28	
7	Neha	30	36	

Here, we have used a formula to evaluate the result in the 'Total' field. For inserting the formula, click on the cell where you want to store the answer and write the formula. Now, let's try to calculate the same for all students



	A	B	C	D
1	Student	Test 1	Test 2	Total
2	Ram	49	44	93
3	Shyam	34	39	73
4	Sita	49	46	95
5	Geeta	33	35	68
6	Rahul	23	28	51
7	Neha	30	36	66

For calculating the total for all the students, select the field where you want to store them, now select the range, and insert the formula. Array formulas are available in every version of Excel, so you don't worry about your excel version. There are hundreds of operations possible using array formulas, which we will discuss in this article later. But before proceeding let's understand what is the need to use an array formula.

Why use an Array Formula?

Array formulas are to most powerful yet most easy-to-use calculation tools which could be used to perform complex calculations and take place of hundreds of formulas with a single formula. You can further specify conditions for the calculation of data. Not just calculations you can also count the chars in cells, add date, day, or time, and even pick random data.

How to insert an Array Formula?

Before entering the Array formula fir of all we understand some important points about the Array formula:

- After typing the formula you have to press keys CTRL+SHIFT+ENTER together. It will automatically change the normal formula into an array formula.
- If you manually type braces around the formula then it will not convert the formula into an array formula. You have to use CTRL+SHIFT+ENTER keys to convert the formula into an array formula.
- Whenever you edit the array formula the braces will disappear automatically and you have to again press the combination of CTRL+SHIFT+ENTER keys.
- If you forget to press the CTRL+SHIFT+ENTER keys then your formula will work as the normal formula.

Now let's understand inserting an array formula.

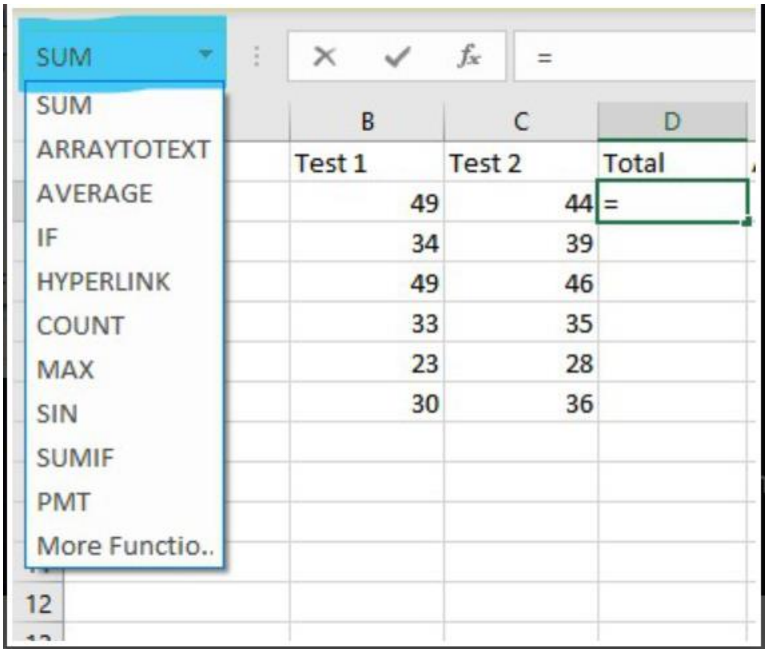
Single Cell Array formula

Every array formula returns the result in either single or in multiple cells. So when an array formula returns its result in the single-cell then such type of formula is known as a single-cell array formula. Such types of formulas are SUM, AVERAGE, AGGREGATE, MAX, MIN, etc. Follow the following steps to use the single-cell array formula:

Step 1: Select the cell where you want to store the answer.

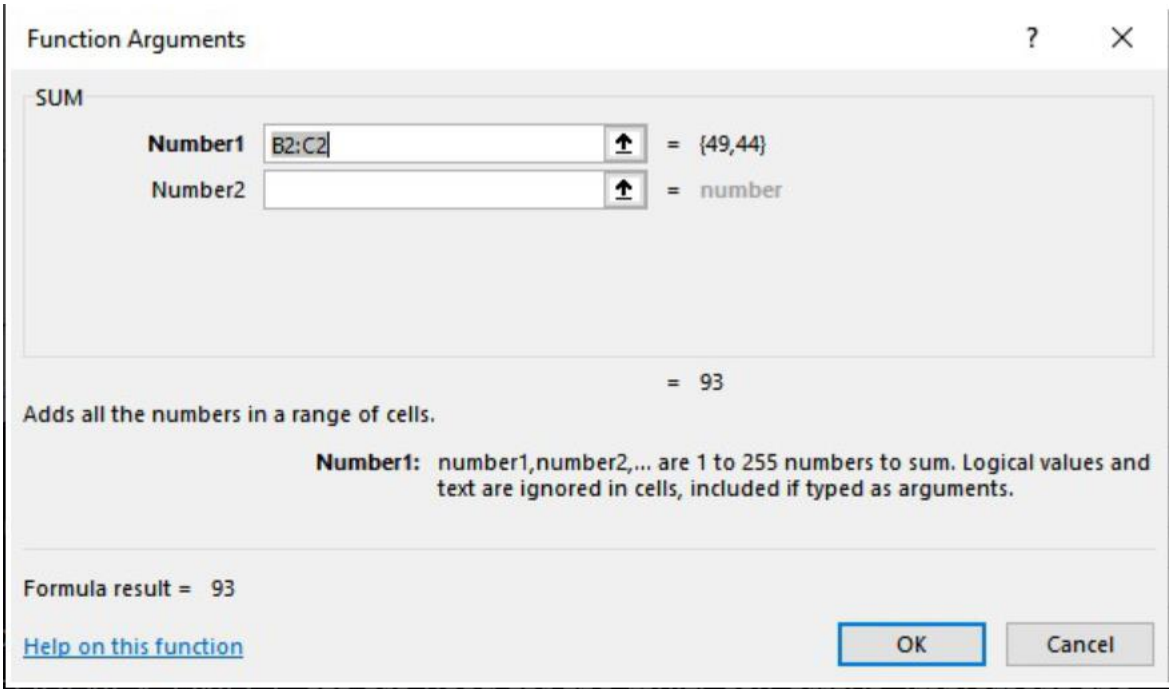
Step 2: Now go to the formula bar and write an "=" sign.

Step 3: Now to formulas (highlighted below), and select the operation you want to perform.



Single-cell-array

Step 4: Here we want to perform the sum operation. Click on sum and a new popup will open. Write the cells you want to perform the operation with.

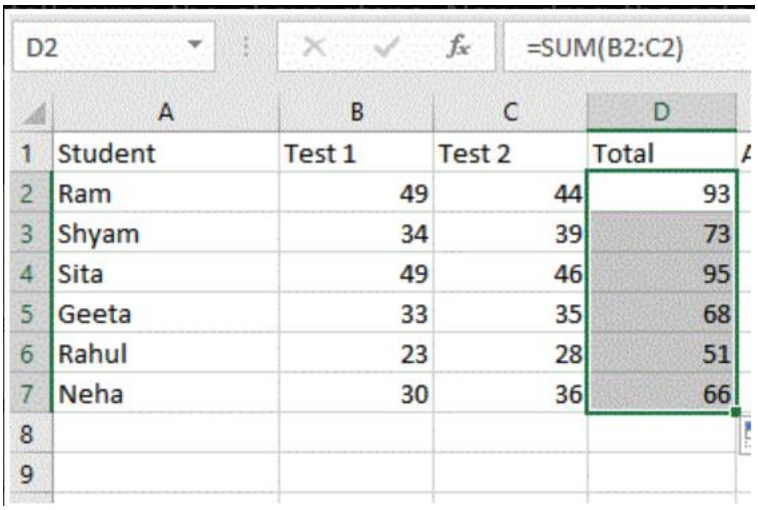


Function-arguments

Multi-Cell Array Formula

If you wish to perform the same calculation with more cells then you can use the multi-cell formula. You can implement it in two ways. Functions like TRANSPOSE, TREND,

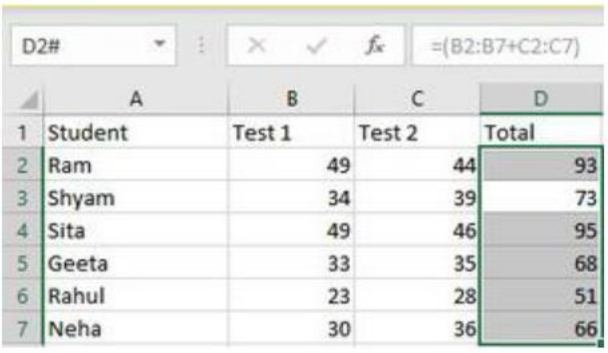
FREQUENCY, LINEST, etc are used for the multi-cell arrays. Implement the formula in single-cell by following the above steps. Now, drag the selection up to the cells you want to implement the formula. Below is the implementation of doing that.



Multi-cell-array-formula

Alternatively,

Specify the range of cells and an operator between them. For example, =(B1:B7 + C2:C7) and press Ctrl+Shift+Enter.



Operator-in-multi-cell

Excel Array Constants

Excel array contacts are a set of static values and can't be changed. These values remain constant regardless of the operations performed on them. Now we will see how to create Array Constants in Excel and will perform different actions on them. There are three types of array constant available:

1. Horizontal or Row Array constant

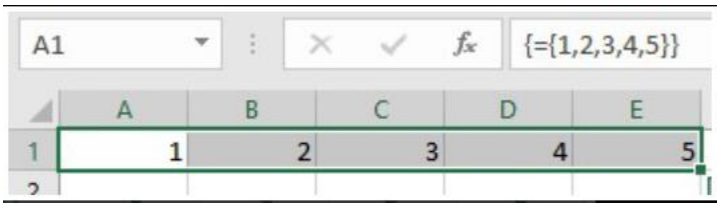
A horizontal constant is present in a row. To create a horizontal constant we have to type multiple values separated by a comma in the enclosed braces. To enter a row array follow these steps below:

Step 1: Select the cells you want to work with.

Step 2: Go to the formula bar and start with an equal sign.

Step 3: Now enter the array you want to create in braces {}, separated by commas(,). Ex:- ={1,2,3,4,5}

Step 4: Now press Ctrl+Shift+Enter.



Horizontal-or-Row-Array-constant

2. Vertical or Column Array

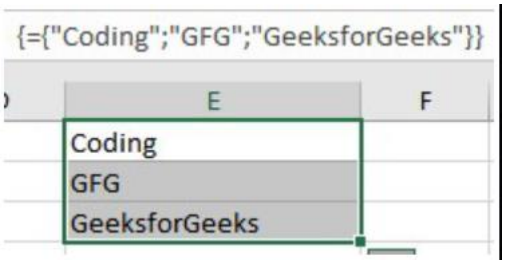
Vertical array constants are generally present in Column Array. To create a vertical constant we have to type multiple values separated by a semicolon in the enclosed braces. To enter a column array follow these steps below:

Step 1: Select the cells you want to work with.

step 2: Go to the formula bar and start with an equal sign.

Step 3: Now enter the array you want to create in braces {} separated with termination sign(;). Ex:- ={“Coding”;”GFG”;”GeeksforGeeks”}

Step 4: Now press Ctrl+Shift+Enter.



Vertical-or-Column-Array

3. 2-D array

In Excel, you are allowed to create a 2-D array. So to create a 2-D array constant, we have to type multiple values in which rows are separated by semicolons and d columns are separated by commas. Let’s understand the implementation of a 2-d array.

Step 1: Select the cells you want to work with.

Step 2: Go to the formula bar and start with an equal sign.

Step 3: Now enter the array you want to create in braces {} separated with commas(,) for entering the values in same row, termination sign(;) for row change. Ex:- ={1,2,3;”Coding”,”GFG”,”GeeksforGeeks”}

Step 4: Now press Ctrl+Shift+Enter.

Working with Constant arrays

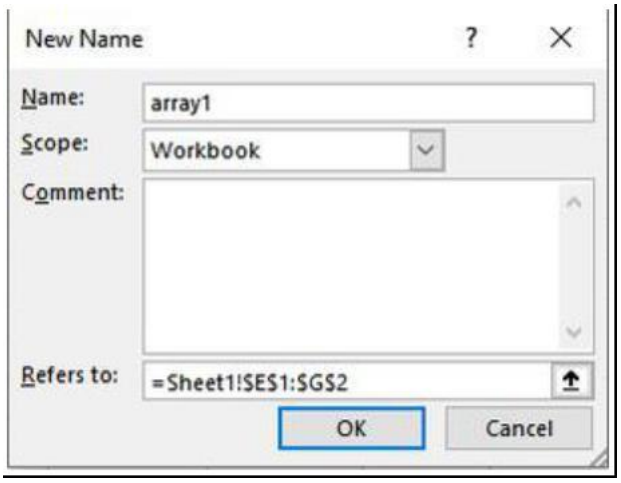
In the Excel formula, array constants are the important part. Some of the important concepts of Array constant are:

1. Elements: To create elements of array constant we have to follow the following points:

1. The elements of an array constant must be of numeric, alphabetic, boolean, or scientific notation and each of them is separated by commas or semicolons.
2. The elements of an array constant do not contain an array, cell reference, dates functions formulas, defined names, etc.
3. You can also be allowed to use text in the array of the element but the text is surrounded by hyphens(“”).

2. Naming Array Constants: You can name any array and use them as a variable for further references. For naming an array, follow the steps below:

1. Go to the formula tab. and select Define Name.
2. Write the array name in the name. You can also add some comments related to your array.
3. Click on OK.



3. Common Errors: Following are the common errors that will happen while working with array constants:

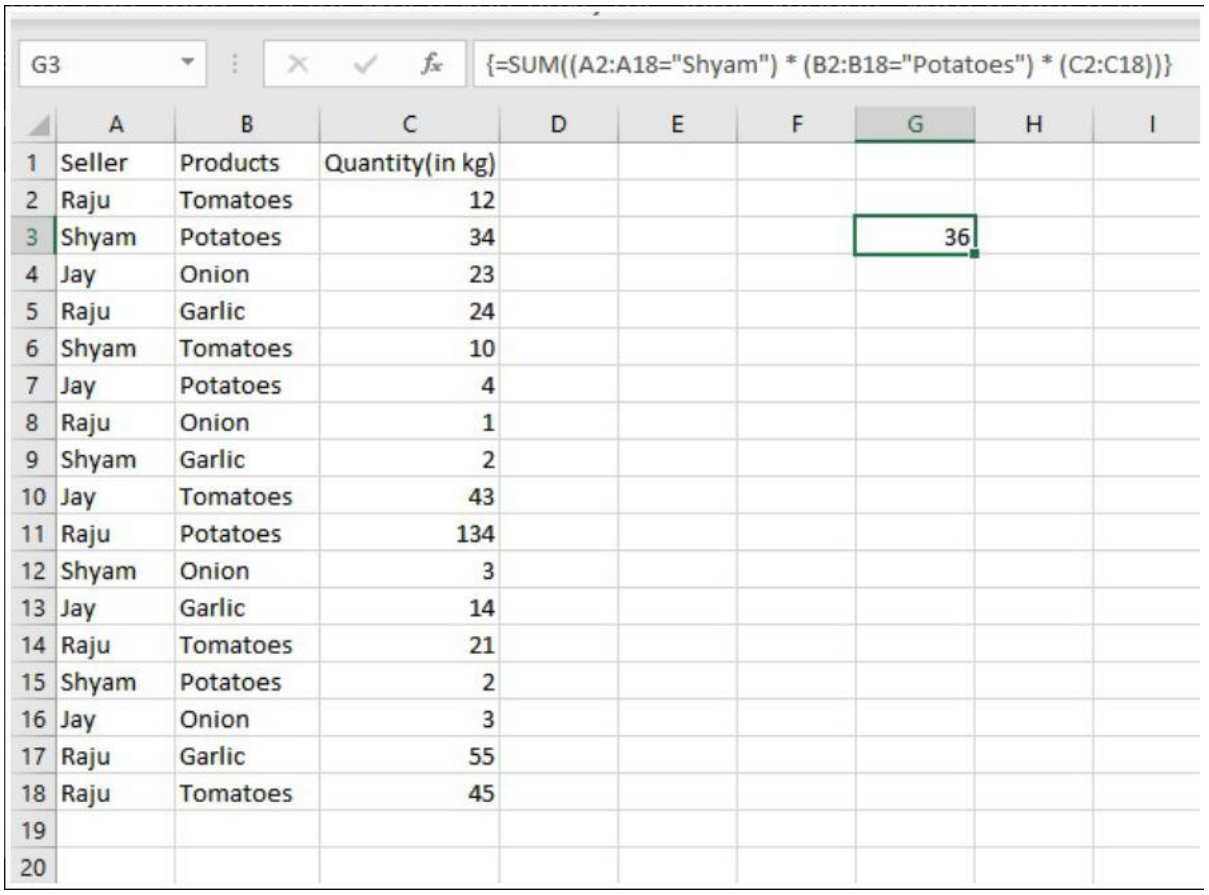
1. The use of delimiters in between the elements.
2. The selection of range is also an important point to remember.

Unary Operator in Excel Array Formulas

Using unary operators we can process the array using AND and OR operators.

1. **AND:** It is denoted by an asterisk(*) symbol. It returns true if and only if all conditions are true,
2. **OR:** It is denoted by a plus(+) symbol. It returns true if any of the statement is true.

These operators are more useful when you have the same variable with a different value. For example, let's consider a case, where data of 3 sellers of different months are given and you have to how much Shyam sold potatoes.



G3 | {=SUM((A2:A18="Shyam") * (B2:B18="Potatoes") * (C2:C18))}

	A	B	C	D	E	F	G	H	I
1	Seller	Products	Quantity(in kg)						
2	Raju	Tomatoes	12						
3	Shyam	Potatoes	34				36		
4	Jay	Onion	23						
5	Raju	Garlic	24						
6	Shyam	Tomatoes	10						
7	Jay	Potatoes	4						
8	Raju	Onion	1						
9	Shyam	Garlic	2						
10	Jay	Tomatoes	43						
11	Raju	Potatoes	134						
12	Shyam	Onion	3						
13	Jay	Garlic	14						
14	Raju	Tomatoes	21						
15	Shyam	Potatoes	2						
16	Jay	Onion	3						
17	Raju	Garlic	55						
18	Raju	Tomatoes	45						
19									
20									

Using-and-operator

Excel Lookup - the basics

Before we dive into the arcane twists of Excel Lookup formulas, let's define the key terms to ensure that we are always on the same page.

Lookup - searching for a specified value in a table of data.

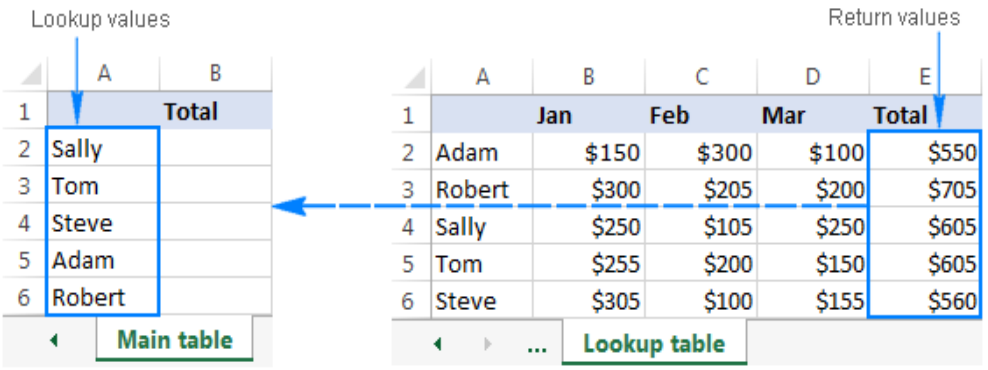
Lookup value - a value to search for.

Return value (matching value or match) - a value at the same position as the lookup value but in another column or row (depending on whether you do vertical or horizontal lookup).

Lookup table. In computer science, a lookup table is an array of data, which is generally used to map input values to output values. In terms of this tutorial, an Excel lookup table is nothing else but a range of cells where you search for a lookup value.

Main table (master table) - a table into which you pull matching values.
Your lookup table and main table may have different structure and size, however they should always contain at least one common unique identifier, i.e. a column or row that holds identical data, depending on whether you want to perform a vertical or horizontal lookup.

The following screenshot shows a sample lookup table that will be used in many of the below examples.



Excel Lookup functions

Below is a quick overview of the most popular formulas to perform lookup in Excel, their main advantages and drawbacks.

LOOKUP function

The LOOKUP function in Excel can perform the simplest types of vertical and horizontal lookups.

Pros: Easy-to-use.

Cons: Limited functionality, cannot work with unsorted data (requires sorting the lookup column/row in ascending order).

For more information, please see How to use Excel

LOOKUP function.

VLOOKUP function

It's an improved version of the LOOKUP function specially designed to do vertical lookup in columns.

Pros: Relatively easy to use, can work with exact and approximate match.

Cons: Cannot look at its left, stops working when a column is inserted into or removed from the lookup table, a lookup value cannot exceed 255 characters, requires much processing power on large datasets.

For more information, please see Excel VLOOKUP tutorial for beginners.

HLOOKUP function

It's a horizontal counterpart of VLOOKUP that searches for a value in the first row of the lookup table and returns the value in the same position from another row.

Pros: Easy to use, can return exact and approximate matches.

Cons: Can only search in the topmost row of the lookup table, is affected by the insertion or deletion of rows, a lookup value should be under 255 characters.

For more information, please see How to use HLOOKUP in Excel.

VLOOKUP MATCH / HLOOKUP MATCH

A dynamic column or row reference created by MATCH makes this Excel lookup formula immune to the changes made in the dataset. In other words, with some help from MATCH, the VLOOKUP and HLOOKUP functions can return correct values no matter how many columns/rows have been inserted to or deleted from a lookup table.

Formula for Vertical lookup

```
VLOOKUP(lookup_value,              lookup_table,
MATCH(return_column_name,                 column_headers,          0),
FALSE)
```

Formula for Horizontal lookup

```
HLOOKUP(lookup_value,              lookup_table,
MATCH(return_row_name,                row_headers,        0),    FALSE)
```

Pros: An improvement over regular Hlookup and Vlookup formulas immune to data insertion or deletion.

Cons: Not very flexible, requires a specific data structure (the lookup value supplied to the MATCH function should be exactly equal to the name of the return column), cannot work with lookup values exceeding 255 characters.

For more information and formula examples, please see: Excel Vlookup and Match

Excel Hlookup and Match

OFFSET MATCH

A more complex but a more powerful lookup formula, free of many limitations of Vlookup and Hlookup.

Formula for VLookup

```
OFFSET(lookup_table, MATCH(lookup_value,

OFFSET(lookup_table, 0, n, ROWS(lookup_table), 1) ,0) -1,

m, 1, 1)
```

Where:

n - is the lookup column offset, i. e. the number of columns to move from the starting point to the lookup column.

m - is the return column offset, i. e. the number of columns to move from the starting point to the return column.

Formula for HLookup

```
OFFSET(lookup_table, m, MATCH(lookup_value,

OFFSET(lookup_table, n, 0, 1, COLUMNS(lookup_table)), 0) -

1, 1, 1)
```

Where:

n - is the lookup row offset, i. e. the number of rows to move from the starting point to the lookup row.

m - is the return row offset, i. e. the number of rows to move from the starting point to the return row.

Formula for matrix lookup (by row and column)

```
{=OFFSET (starting_point, MATCH (vertical_lookup_value,
lookup_column, 0), MATCH (horizontal_lookup_value, lookup_row, 0))}
```

Please pay attention that this is an array formula, which is entered by pressing Ctrl + Shift + Enter keys at the same time.

Pros: Allows performing a left-side Vlookup, an upper Hlookup and two- way lookup (by column and row values), unaffected by changes in the data set.

Cons: Complex and difficult to remember syntax.

For more information and formula examples, please see: Using OFFSET function in Excel

INDEX MATCH

It's the best way to do vertical or horizontal lookup in Excel that can replace most of the above formulas. The Index Match formula is my personal preference and I use it for almost all of my Excel lookups.

Formula for V-Lookup

```
INDEX (return_column, MATCH (lookup_value,
lookup_column, 0))
```

Formula for H-Lookup

```
INDEX (return_row, MATCH (lookup_value, lookup_row,
0))
```

Formula for matrix lookup

An extension of the classic Index Match formula to return a value at the intersection of a specific column and row:

INDEX (*lookup_table*, MATCH (*vertical_lookup_value*, *lookup_column*, 0), MATCH (*horizontal_lookup_value*, *lookup_row*, 0))

Cons: Just one - you need to remember the formula's syntax. Pros: The most versatile Lookup

formula in Excel, superior to Vlookup, Hlookup and Lookup functions in many respects:

It can do left and upper lookups.

Allows safely extending or collapsing the lookup table by inserting or deleting columns and rows. No limit to the lookup value's size.

Works faster. Because an Index Match formula references columns/rows rather than an entire table, it requires less processing power and won't slow down your Excel.
For more information, please check out:
INDEX MATCH as a better alternative to VLOOKUP

INDEX MATCH MATCH formula for two-dimensional lookup

Excel Lookup comparison table
As you see, not all Excel Lookup formulas are equivalent, some can handle a number of different lookups while others can only be used in a specific situation. The table below outlines the capabilities of each Lookup formula in Excel.

Formula	Vertical lookup	Left lookup	Horizontal lookup	Upper lookup	Matrix lookup	Allows data insertion/deletion
Lookup	✓		✓			
Vlookup	✓					
Hlookup			✓			
Vlookup Match	✓					✓
Hlookup Match			✓			✓
Offset Match	✓	✓	✓	✓		✓
Offset Match Match					✓	✓
Index Match	✓	✓	✓	✓		✓
Index Match Match					✓	✓

Excel Settings in the Registry:

The *Windows Registry* is essentially a central hierarchical database that is used by the operating system and by application software. The Registry first appeared in Windows 95 and replaces the old INI files that stored Windows and application settings.

You can use the Registry Editor program to browse the Registry - and even edit its contents if you know what you're doing. The Registry Editor is named regedit.exe . Before beginning your explorations, take a minute to read the upcoming sidebar (titled "Before You Edit the Registry "). Figure 4-9 shows what the Registry Editor looks like.

The Registry Editor lets you browse and make changes to the Registry.
The Registry consists of keys and values, arranged in a hierarchy. The top-level keys are:

- HKEY_CLASSES_ROOT
- HKEY_CURRENT_USER
- HKEY_LOCAL_MACHINE
- HKEY_USERS
- HKEY_CURRENT_CONFIG
- HKEY_DYN_DATA

Excel's settings:

Information used by Excel 2007 is stored in this Registry section:

HKEY_CURRENT_USER\Software\Microsoft\Office.0\Excel

Before You Edit the Registry:

You can use the regedit.exe program to change anything in the Registry, including information that is critical to your system's operation. In other words, if you change the wrong piece of information, Windows may no longer work properly.

Get into the habit of choosing the File ⇨ Export command in Regedit. This command enables you to save an ASCII version of the entire Registry or just a specific branch of the Registry.

If you find that you messed up something, you can always import the ASCII file to restore the Registry to its previous condition (choose the Registry ⇨ Import Registry File command). Refer to the Help file for Regedit for details. In this section of the Registry, you'll find a number of keys that contain specific values that determine how Excel operates.

The Registry settings are updated automatically by Excel when Excel closes.

Note: It's important to understand that Excel reads the Windows Registry only once - when it starts up. In addition, Excel updates the Registry settings only when Excel closes normally. If Excel crashes (unfortunately , not an uncommon occurrence), the Registry information is not updated. For example, if you change one of Excel's settings, such as the visibility of the Formula bar, this setting is not written to the Registry until Excel closes by normal means.

Table1 lists the Registry sections that are relevant to Excel 2007. You might not find all these sections in your Registry database.

Table1: EXCEL CONFIGURATION INFORMATION IN THE REGISTRY

Section	Description
Add-in Manager	Lists add-ins that appear in the Add-Ins dialog box. Add-ins that are included with Excel do not appear in this list. If you have an add-in entry in this list box that you no longer use, you can remove it by using the Registry Editor.
Converters	Lists additional (external) file converters that are not built into Excel.
Error Checking	Holds the settings for formula error checking.
File MRU	Holds information about the most recently used files (which appears in the Recent Documents list when you click the Office button).
Options	A catch-all section; holds a wide variety of settings.
Recent Templates	Stores the names of templates you've used recently.
Resiliency	Information used for recovering documents.
Security	Specifies the security options for opening files that contain macros.
Spell Checker	Stores information about your spelling checker options.
StatusBar	Stores the user choices for what appears in the status bar.
UserInfo	Stores information about the user.

Although you can change most of the settings via the Excel Options dialog box, a few settings cannot be changed directly from Excel (but you can use the Registry Editor to make changes). For example, when you select a range of cells, you may prefer that the selected cells appear in high contrast white-on-black. There is no way to specify this in Excel, but you can add a new Registry key like this:

1. Open the Registry Editor and locate this section:
   HKEY_CURRENT_USER\Software\Microsoft\Office.0\Excel\Options
2. Right-click and select New ⇨ DWORD Value.
3. Name this value **Options6** .
4. Right-click the Options6 key and select Modify.
5. In the Edit DWORD Value dialog box, click the Decimal option and enter **16**

Setting a value for a Registry setting.

When you restart Excel, range selections will appear with a black background rather than gray. If you don't like this look, just delete the Options6 Registry entry.

Tip If you have trouble starting Excel, it's possible that the Registry keys have become corrupt. You can try using the Registry Editor to delete the entire Excel section:
HKEY_CURRENT_USER\Software\Microsoft\Office.0\Excel

The next time Excel is started, it will rebuild the Registry keys. You will, however, lose all of the customization information that was stored there.

Advanced Excel tips and tricks

Advanced Excel tips and tricks can greatly enhance your productivity and efficiency when working with complex spreadsheets and large datasets. By mastering techniques such as keyboard shortcuts, conditional formatting, data validation, PivotTables, VLOOKUP and INDEX-MATCH functions, Excel tables, named ranges, Power Query, macros, and array formulas, you can streamline your workflow, automate tasks, perform sophisticated data analysis, and save valuable time. These advanced features empower you to work more efficiently, make informed decisions, and unlock the full potential of Excel for your data-driven tasks.

- Advanced Excel Tips and Tricks for Productivity and Efficiency
  - Master Keyboard Shortcuts.
  - Conditional Formatting.
  - Data Validation.
  - PivotTables.
  - VLOOKUP and INDEX-MATCH Functions.
  - Excel Tables.
  - Named Ranges.
  - Power Query.
  - Macros.
  - Array Formulas.

Advanced Excel Tips and Tricks for Productivity and Efficiency

Master Keyboard Shortcuts:

Learn commonly used keyboard shortcuts to perform tasks more efficiently. Some essential shortcuts include:

- Ctrl+C for copy, Ctrl+V for paste, Ctrl+Z for undo, and Ctrl+S for save.
- Ctrl+X for cut, Ctrl+B for bold, Ctrl+I for italic, and Ctrl+U for underline.
- Ctrl+Home to go to the beginning of the worksheet and Ctrl+End to go to the last cell with data.
- Ctrl+Page Up to switch between worksheets and Ctrl+Tab to cycle through open workbooks.

Conditional Formatting:

Utilize conditional formatting to visually highlight and format cells based on specific conditions or criteria. This feature helps you identify patterns, outliers, or important data at a glance. Some advanced techniques include:

- Color scales to represent data ranges using different colors.
- Icon sets to display symbols or icons based on data values.
- Data bars to create horizontal bars proportional to the cell values.

- Formulas to create custom formatting rules based on specific criteria.

Data Validation:

Apply data validation to control and validate the type and range of data entered into cells. This ensures data accuracy and consistency. Some advanced techniques include:

- Drop-down lists to provide predefined choices for data input.
- Custom formulas to create complex validation rules based on specific conditions.
- Input messages to provide instructions or guidance to users when entering data.
- Error alerts to display custom error messages when invalid data is entered.

PivotTables:

Become proficient in creating and using PivotTables to analyze and summarize large datasets. PivotTables allow you to:

- Summarize data by grouping and aggregating values based on different criteria.
- Add calculated fields to perform custom calculations within the PivotTable.
- Use slicers to filter data and easily analyze subsets of information.
- Create Pivot Charts to visualize and explore data interactively.
- Refresh data automatically when the source data changes.

VLOOKUP and INDEX-MATCH Functions:

Master the use of VLOOKUP and INDEX-MATCH functions for advanced data retrieval and analysis. These functions allow you to search for a value in one column and return a corresponding value from another column. Some tips for using these functions effectively are:

- Use the INDEX-MATCH combination when the lookup value is not in the leftmost column of the table.
- Combine multiple criteria by nesting INDEX-MATCH functions.
- Utilize approximate match for finding values within a range.

Excel Tables:

Convert your data range into an Excel table to leverage advanced features and enhance data management. Excel tables provide:

- Dynamic range references that automatically expand when new data is added.
- Automatic formatting and styles to make your data visually appealing.
- Easy sorting and filtering options for quick data analysis.
- Structured referencing in formulas for better readability and maintainability.
- Total rows that automatically calculate sums or other aggregations for each column.

Named Ranges:

Assign names to cell ranges to make formulas more readable and easier to manage. By using named ranges, you can:

- Replace complex cell references with meaningful names in formulas.
- Improve formula transparency and reduce the risk of errors.
- Create more flexible and adaptable formulas that can refer to named ranges across worksheets or workbooks.
- Easily update formulas by modifying the named range instead of manually adjusting cell references.

Power Query:

Power Query is a powerful data transformation and cleaning tool available in newer versions of Excel. It allows you to:

- Import and combine data from various sources, such as databases, CSV files, or websites.
- Perform data cleaning operations, such as removing duplicates, filtering rows, or splitting columns.
- Merge or append multiple datasets into a single table.
- Apply transformations and calculations to shape the data before loading it into Excel.
- Establish a connection to external data sources for automatic data refresh.

Macros:

Use macros to automate repetitive tasks in Excel. Macros are recorded sequences of actions that can be played back with a single click or assigned to a keyboard shortcut. With macros, you can:

- Automate formatting tasks, such as applying specific styles, adjusting column widths, or adding headers and footers.
- Perform data manipulations, such as sorting, filtering, or removing blank rows.
- Create custom functions or calculations that are
- not available in built-in Excel functions.
- Generate reports or charts automatically based on predefined templates.
- Combine multiple actions into a single macro to streamline complex tasks.

Array Formulas:

Array formulas allow you to perform calculations on multiple cells simultaneously. By using array formulas, you can:

- Perform complex calculations, such as array multiplication, matrix operations, or advanced statistical calculations.
- Manipulate multiple cells within a single formula, eliminating the need for intermediate columns or helper calculations.

- Apply conditional logic or perform calculations across multiple dimensions.
- Remember to enter array formulas by pressing Ctrl+Shift+Enter instead of just pressing Enter.

By incorporating these advanced Excel tips and tricks into your workflow, you can significantly increase your productivity and efficiency when working with complex data and tasks. These techniques enable you to streamline processes, automate repetitive tasks, and extract valuable insights from your data more effectively.

What is a Pivot Table:

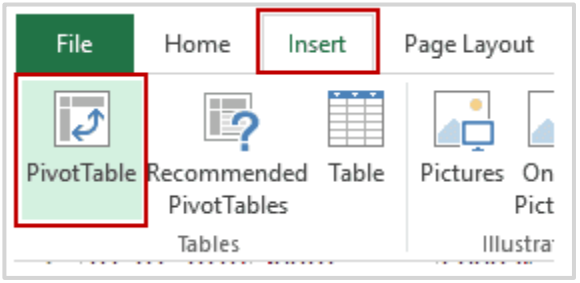
A Pivot Table is a tool in Microsoft Excel that allows you to quickly summarize huge datasets (with a few clicks).

Even if you're absolutely new to the world of Excel, you can easily use a Pivot Table. It's as easy as dragging and dropping rows/columns headers to create reports.

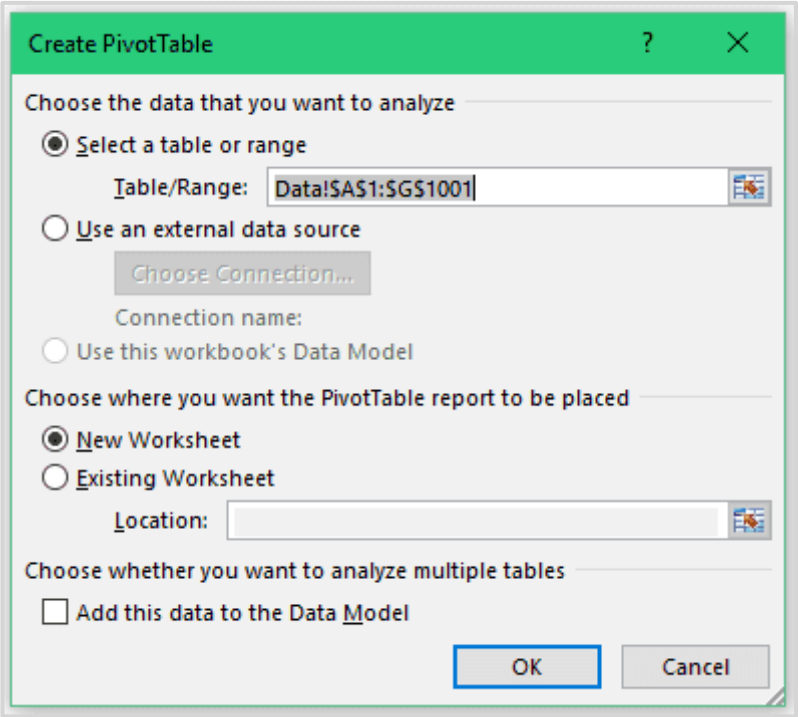
Inserting a Pivot Table in Excel:

Here are the steps to create a pivot table using the data shown above:

- Click anywhere in the dataset.
- Go to Insert –> Tables –> Pivot Table.



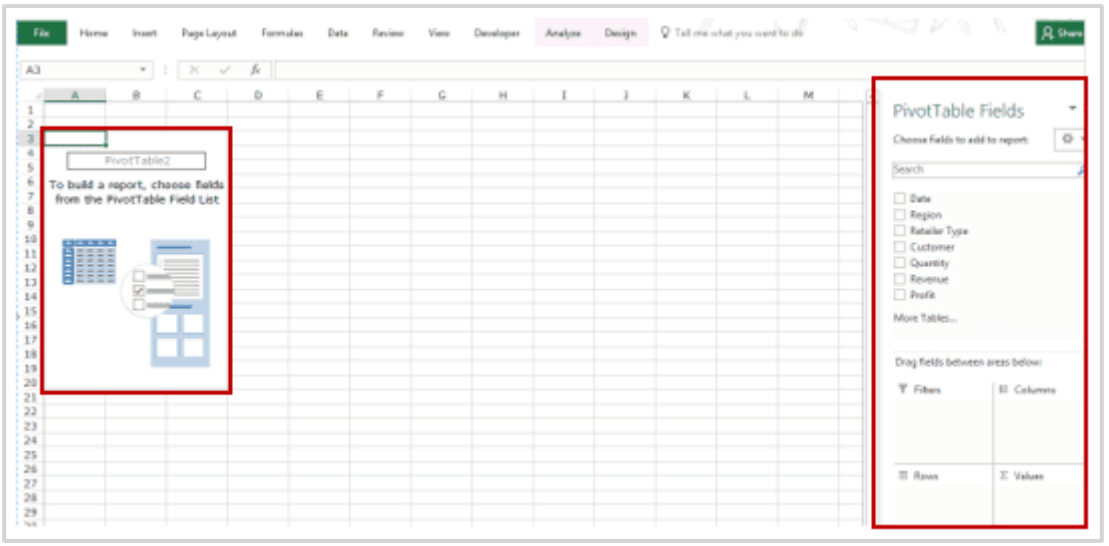
- In the Create Pivot Table dialog box, the default options work fine in most of the cases. Here are a couple of things to check in it:
  - *Table/Range:* It's filled in by default based on your data set. If your data has no blank rows/columns, Excel would automatically identify the correct range. You can manually change this if needed.
  - If you want to create the Pivot Table in a specific location, under the option 'Choose where you want the PivotTable report to be placed', specify the Location. Else, a new worksheet is created with the Pivot Table.



- Click OK.

As soon as you click OK, a new worksheet is created with the Pivot Table in it.

While the Pivot Table has been created, you'd see no data in it. All you'd see is the Pivot Table name and a single line instruction on the left, and Pivot Table Fields on the right.



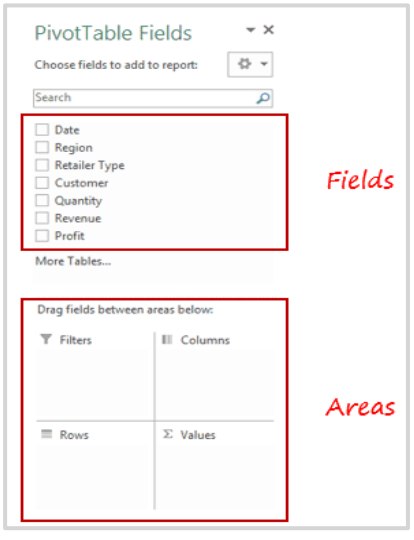
Now before we jump into analyzing data using this Pivot Table, let's understand what are the nuts and bolts that make an Excel Pivot Table.

Analyzing Data Using the Pivot Table:

Now, let's try and answer the questions by using the Pivot

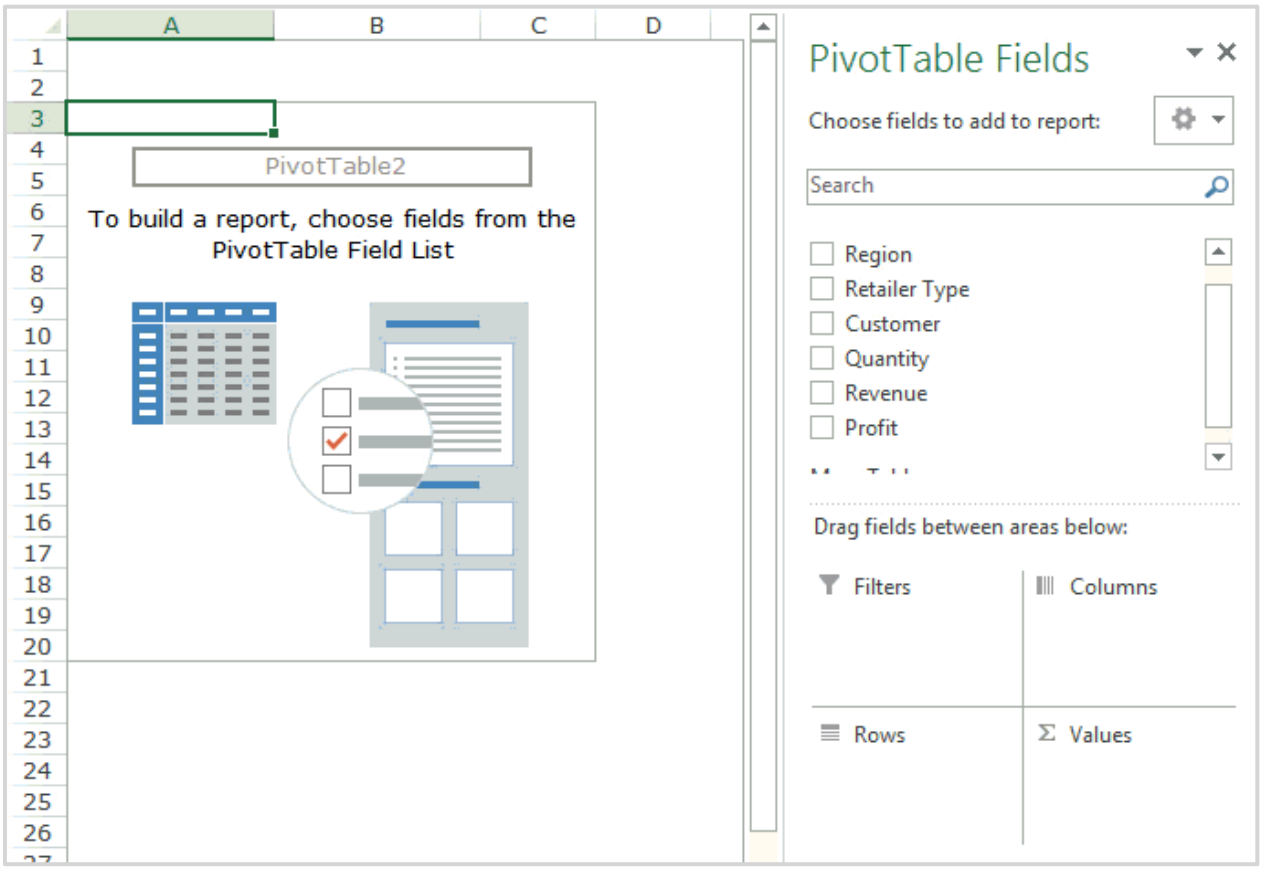
To analyze data using a Pivot Table, you need to decide how you want the data summary to look in the final result. For example, you may want all the regions in the left and the total sales right next to it. You have this clarity in mind, you can simply drag and drop the relevant fields in the Pivot Table.

In the Pivot Table Fields section, you have the fields and the areas (as highlighted below):



The Fields are created based on the backend data used for the Pivot Table. The Areas section is where you place the fields, and according to where a field goes, your data is updated in the Pivot Table.

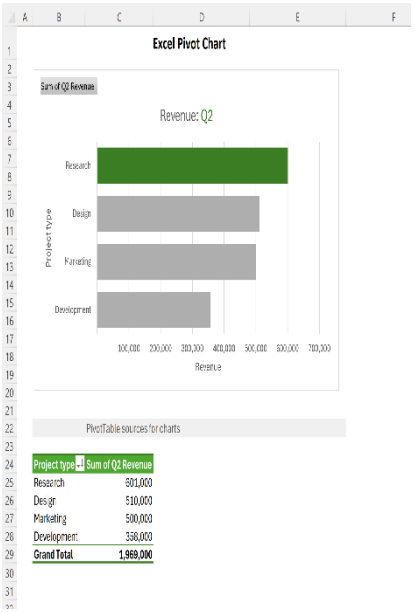
It's a simple drag and drop mechanism, where you can simply drag a field and put it in one of the four areas. As soon as you do this, it will appear in the Pivot Table in the worksheet.



Note that by default, the items (in this case the customers) are sorted in an alphabetical order.

What is pivot chart ?

Pivot Chart is a dynamic visualization tool that works together with Excel PivotTables. While PivotTables provide a way to summarize and analyze large datasets, Pivot Charts offer a graphical representation of that summarized data, making trends and patterns easier to spot.



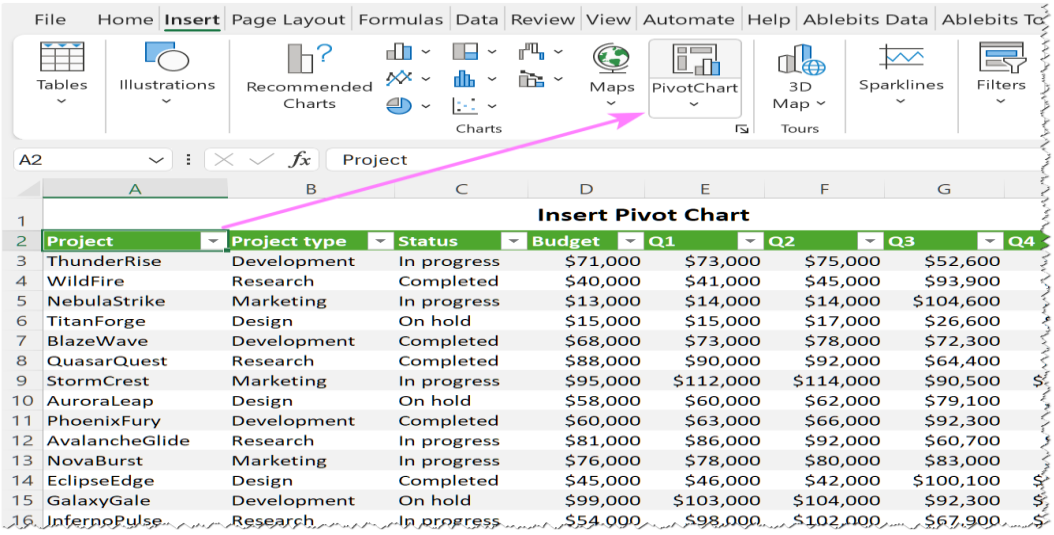
How to make a pivot chart in Excel:

Before you start creating a pivot chart, it's important to make sure your data is well-organized and structured. Each column should represent a different variable or category, and each row should contain a unique record. Don't forget to remove any blank rows or columns and double-check your data for errors or inconsistencies.

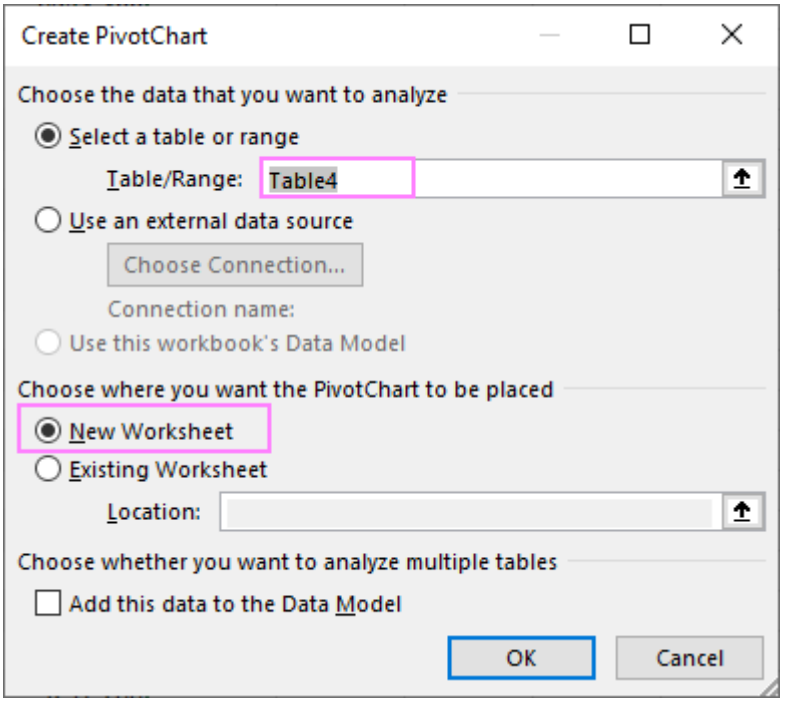
Tip. If you want your graph to automatically include new records, then format your source data as a table.

Step 1. Insert a pivot chart

1. Select any cell in your dataset.
2. On the *Insert* tab, in the Charts group, click *PivotChart.*



3. The *Create PivotChart* dialog window will pop up, automatically selecting the entire data range or table. It will then prompt you to choose where to insert your visual - either in a new worksheet or an existing one. Select your preferred location and **click OK**.



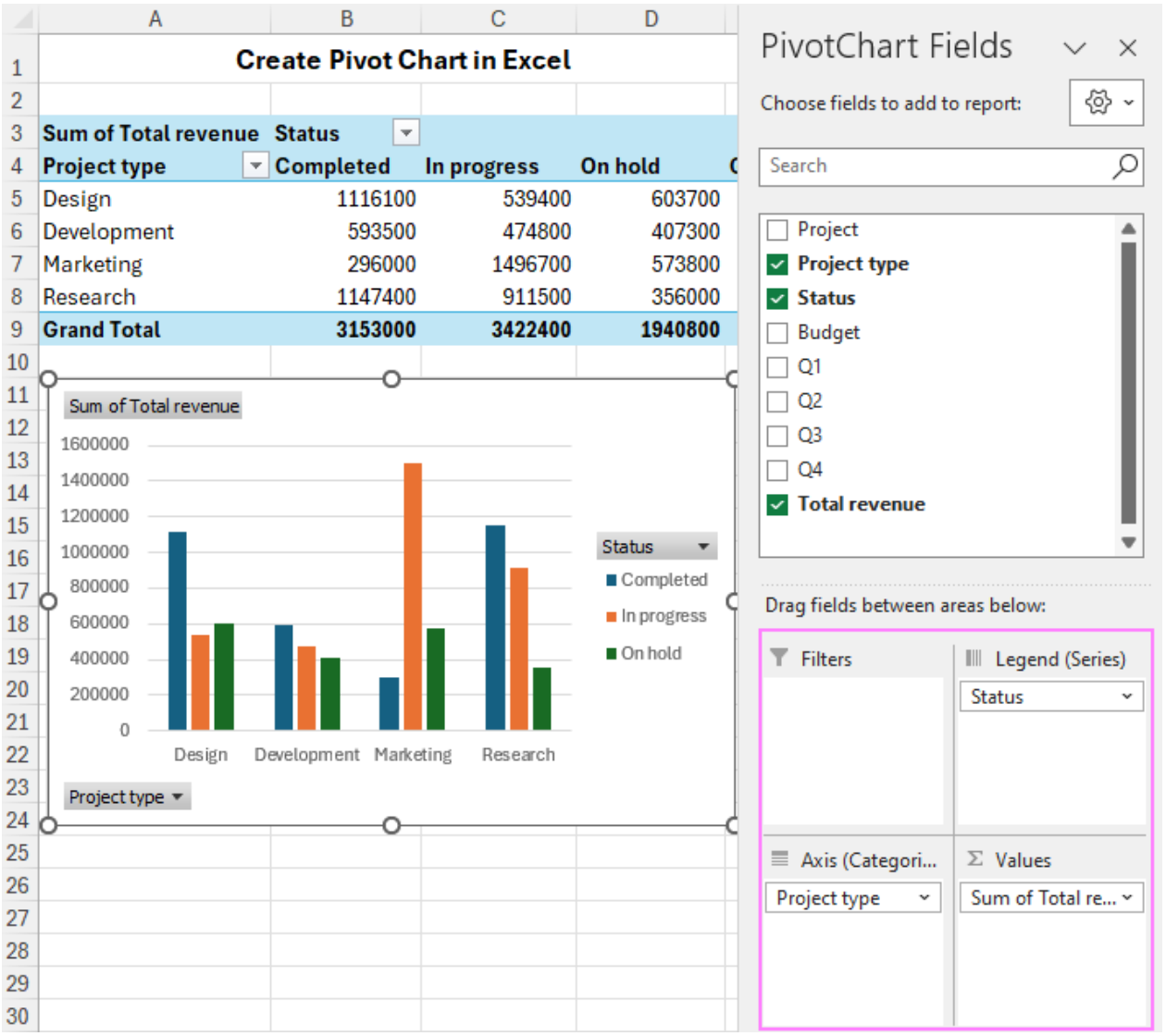
Note. Inserting a pivot chart will automatically include a pivot table alongside it, as these two things are closely related.

Step 2. Configure pivot chart

Now that you have a blank pivot table and pivot chart ready, it's time to set them up to display your data trends. In the PivotChart pane that appears on the left, you'll find a list of all the fields from your dataset. Select the fields you want to display in the graph, and then drag and drop them into the corresponding areas.

- **Filters -** add filters to display or hide certain data.
- **Axis (Categories)** – define what data categories to display along the horizontal axis (placed in pivot table rows).
- **Legend (Series)** – indicate what data series to display (placed in pivot table columns).
- **Values** – define the values that will be depicted in the chart.

For example, to visualize the total revenue for different project types and statuses, you could drag the "Status" field to the *Legend* area, "Project type" to the *Axis* area, and "Total revenue" to the *Values* area.

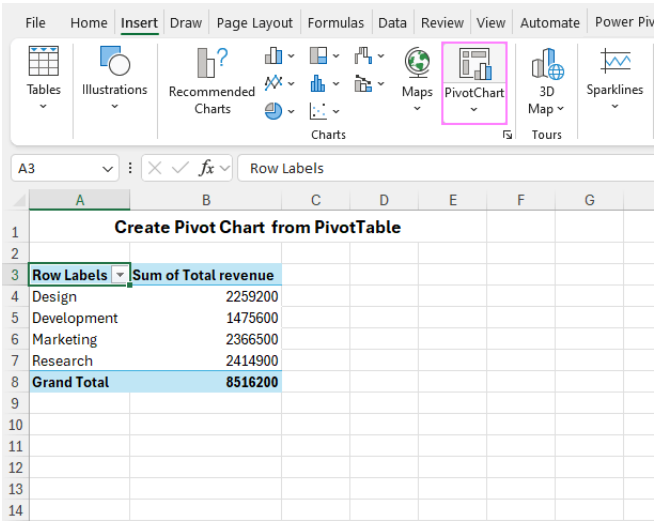


How to create a chart from a pivot table

If you already have a pivot table set up, here's how you can easily create a graph from it:

1. Select any cell within your PivotTable.

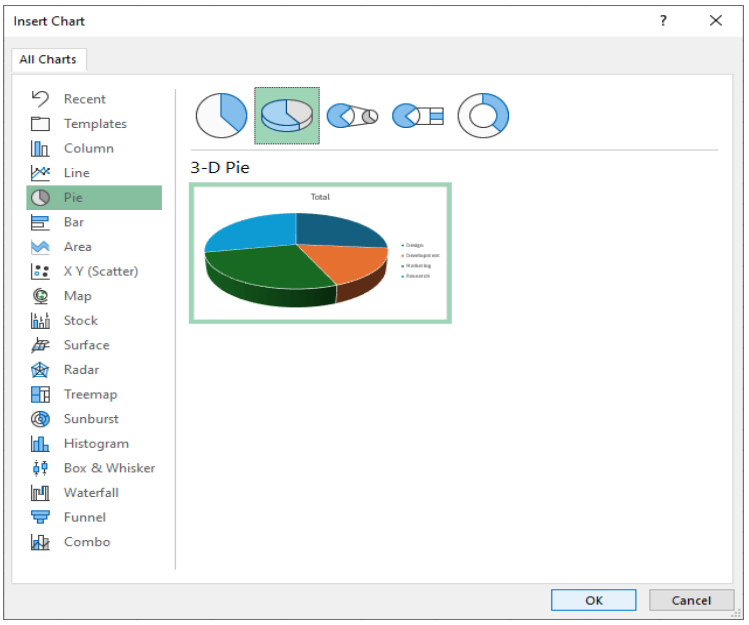
2. Navigate to the *Insert* tab on the Excel ribbon and click on the *PivotChart* button.



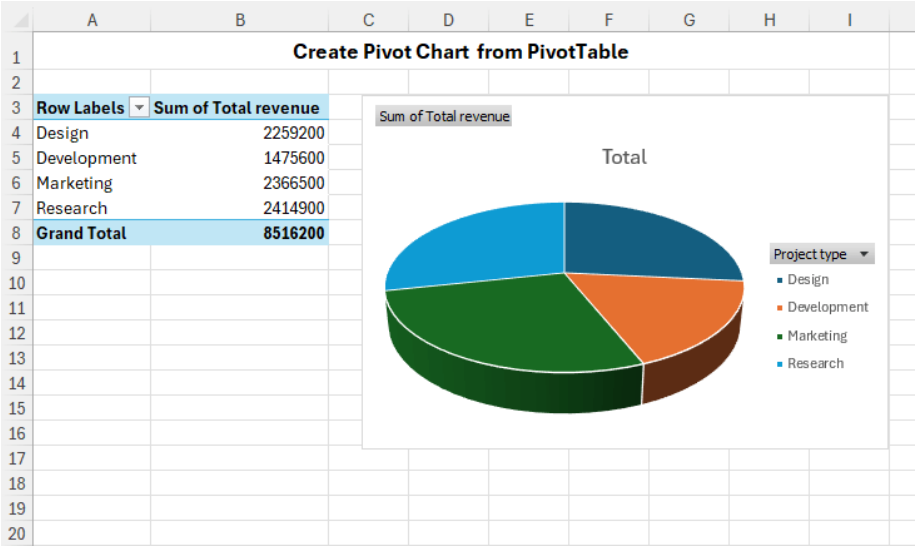
3. In the dialog box that appears, choose the type of graph you want to create. Here are some recommendations:

   - Bar charts are ideal for comparing values across different categories or time periods.
   - Line charts work well for illustrating trends over time or continuous data series.
   - Pie charts are effective for showing the proportion of each category in a dataset.
   - Scatter plots are useful for visualizing the relationship between two variables and identifying any correlations or patterns.

4. Once you've selected your desired type, click OK.



5. You will find the visual in the same worksheet next to your PivotTable. You can move it to a different location by dragging and change its size using the resize handles, just as you would with any Other graph in Excel.



Pivot chart shortcut key

To swiftly make a graph based on a pivot table, you can use the following keyboard shortcuts:

1. Select any cell within the pivot table.
2. Press the F11 key to create a graph in a new Chart sheet.
3. Alternatively, use the Alt + F1 shortcut to insert a chart on the active sheet.

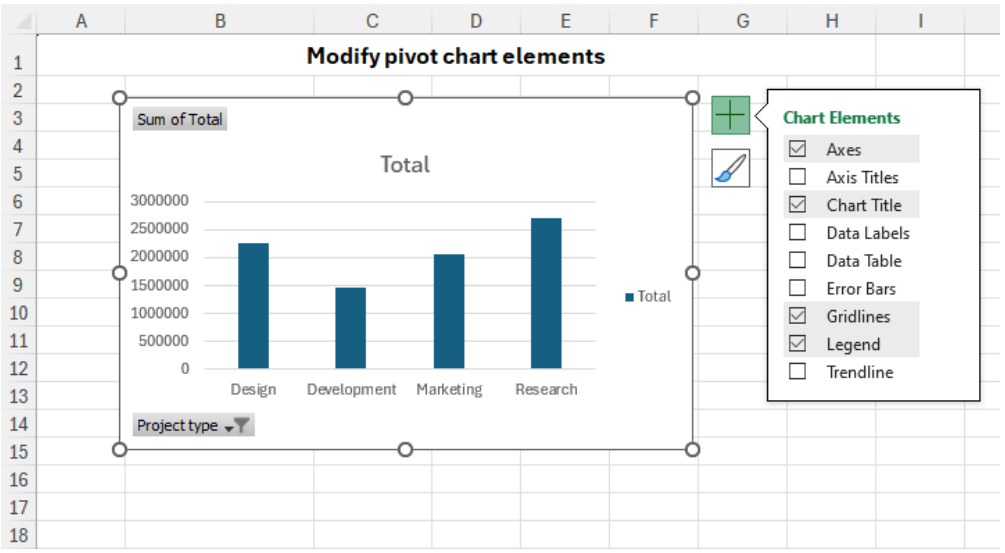
The newly created pivot chart will automatically use the default type. From there, you can easily modify it to suit your preferences by selecting a different chart type.

How to modify a pivot chart

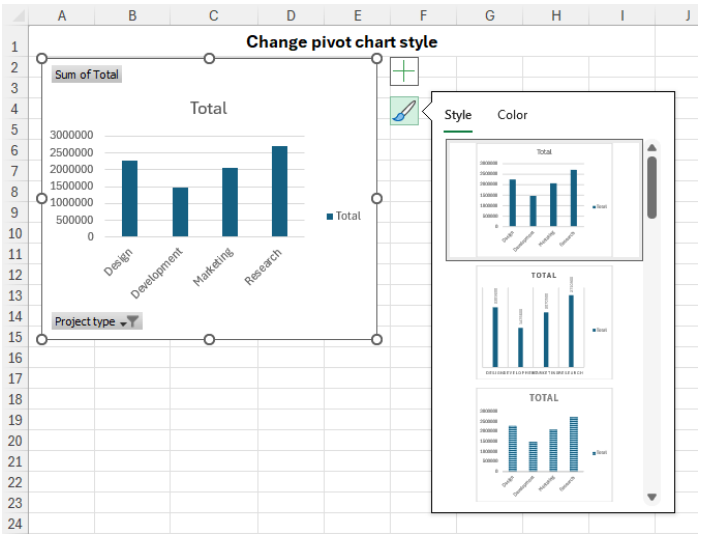
Pivot charts are not just powerful visualization tools; they're also incredibly flexible, allowing you to tweak nearly every aspect to suit your needs.

To show, hide or format graph elements like axes, labels, and legend, simply click the *Chart Elements* button (a plus sign) at the upper right.

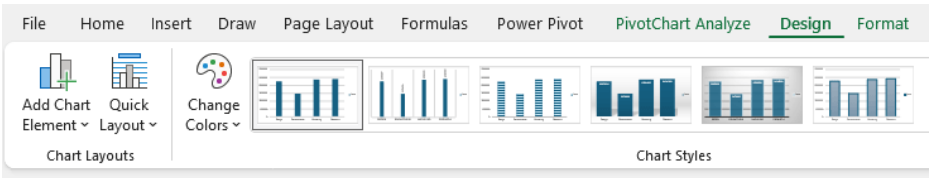
Corner of the graph:

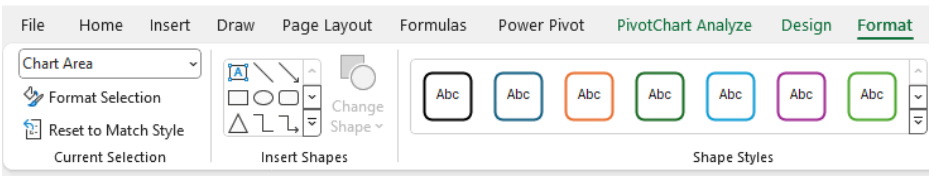


From For changing the chart style, click the *Style* icon at the upper right corner and choose various predefined styles:



For more options to adjust colours and styles, explore the *Design* and *Format* tabs on the ribbon. These tabs offer additional settings and tools to fine-tune your pivot chart to perfection.

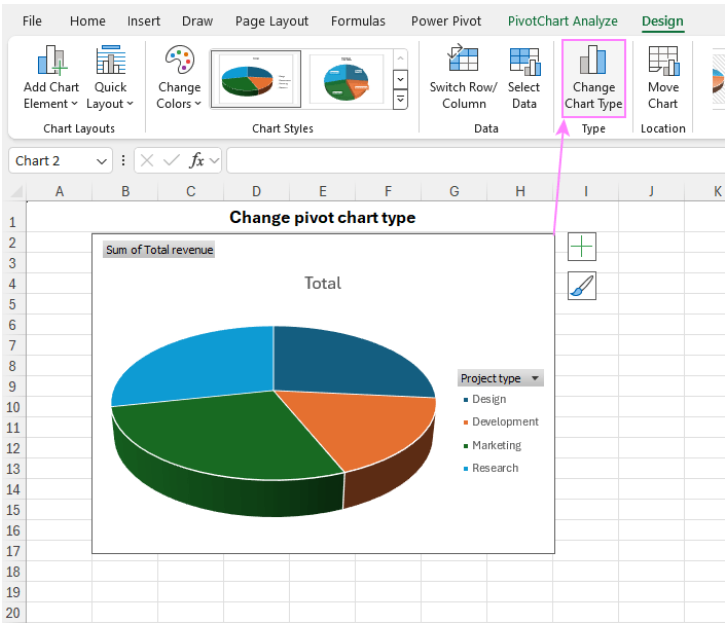




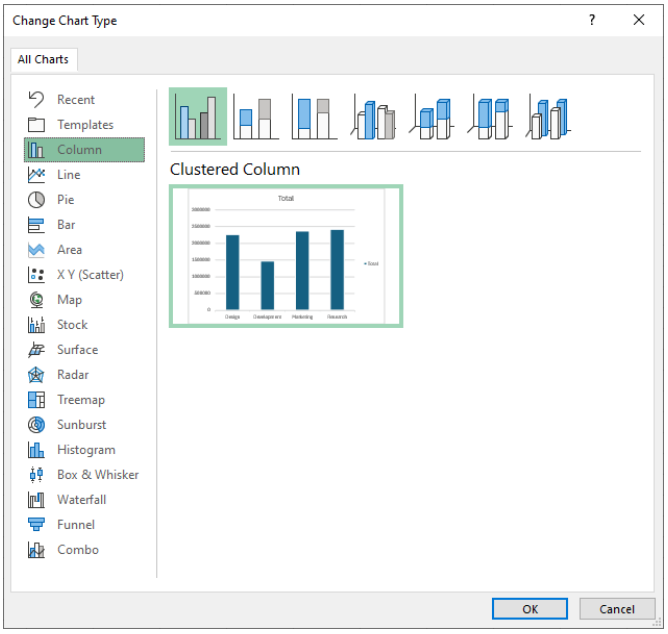
How to change pivot chart type

You can change the type of your pivot graph at any time after you make it. Here are the steps:

1. Click anywhere within your graph to activate the pivot chats tabs on the ribbon.
2. On the *Design* tab, in the *Type* group, click *Change Chart Type*.



3. Select the desired chart type from the options provided, and then click OK.



With these simple steps, you can quickly change the appearance of your pivot graph to better suit your data visualization goals.

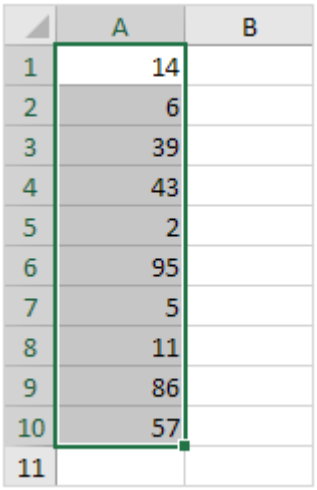
Conditional Formatting

*Use **conditional formatting in Excel** to automatically highlight cells based on their content. Simply apply a rule or use a formula to determine which cells to format.*

Highlight Cells Rules

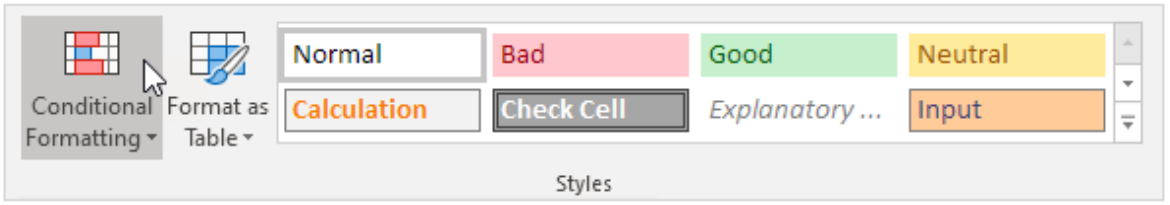
To highlight cells that are greater than a value, execute the following steps.

1. Select the range A1:A10.

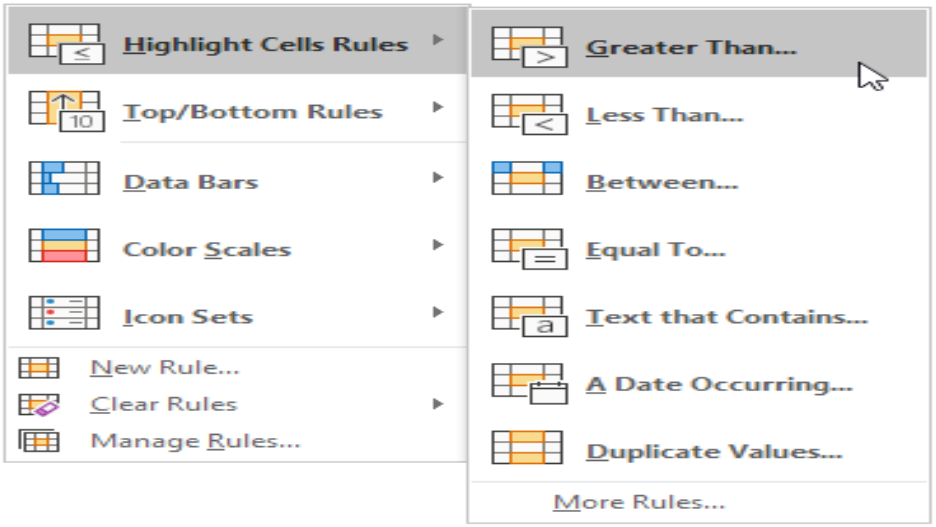


	A	B
1	14	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

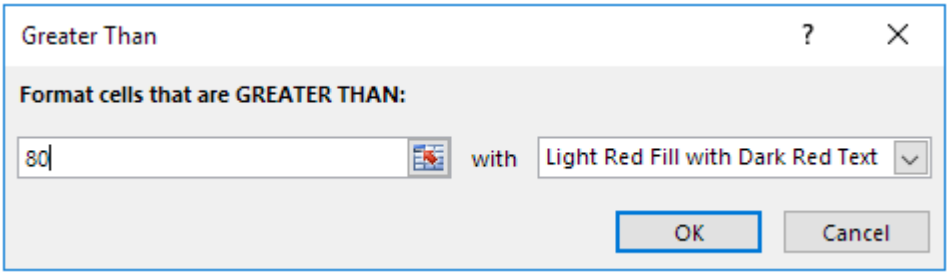
2. On the Home tab, in the Styles group, click Conditional Formatting.



3. Click Highlight Cells Rules, Greater Than.



4. Enter the value 80 and select a formatting style.



5. Click OK.

Result. Excel highlights the cells that are greater than 80.

	A	B
1	14	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

6. Change the value of cell A1 to 81.

Result. Excel changes the format of cell A1 automatically.

	A	B
1	81	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

Note: you can also use this category (see step 3) to highlight cells that are less than a value, between two values, equal to a value, cells that contain specific text, dates (today, last week, next month, etc.), duplicates or unique values.

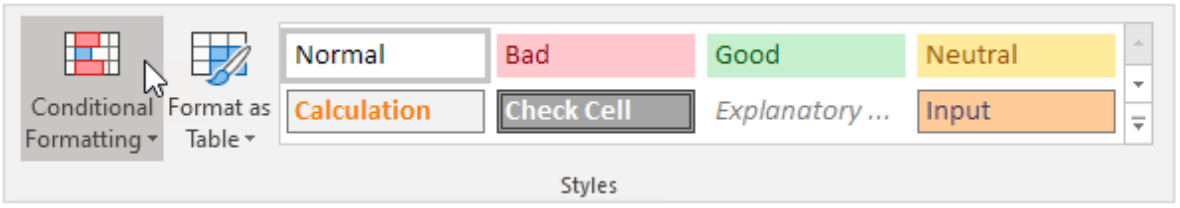
Clear Rules:

To clear a **conditional formatting rule**, execute the following steps.

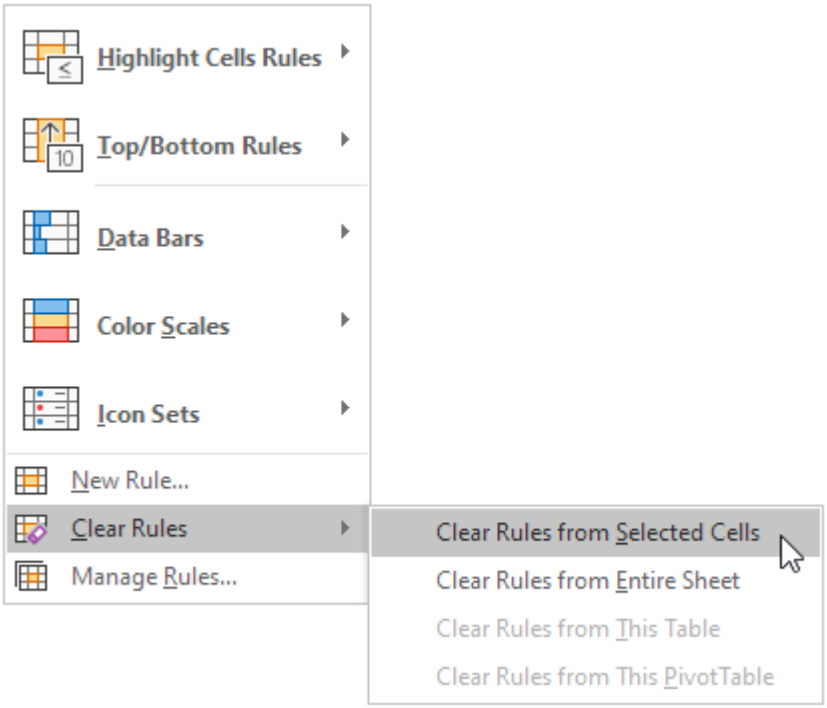
1. Select the range A1:A10.

	A	B
1	81	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

2. On the Home tab, in the Styles group, click Conditional Formatting.



3.Click Clear Rules, Clear Rules from Selected Cells.



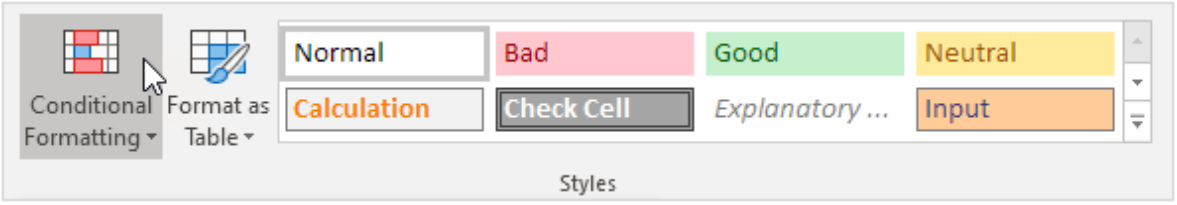
Top/Bottom Rules

To highlight cells that are above average, execute the following steps.

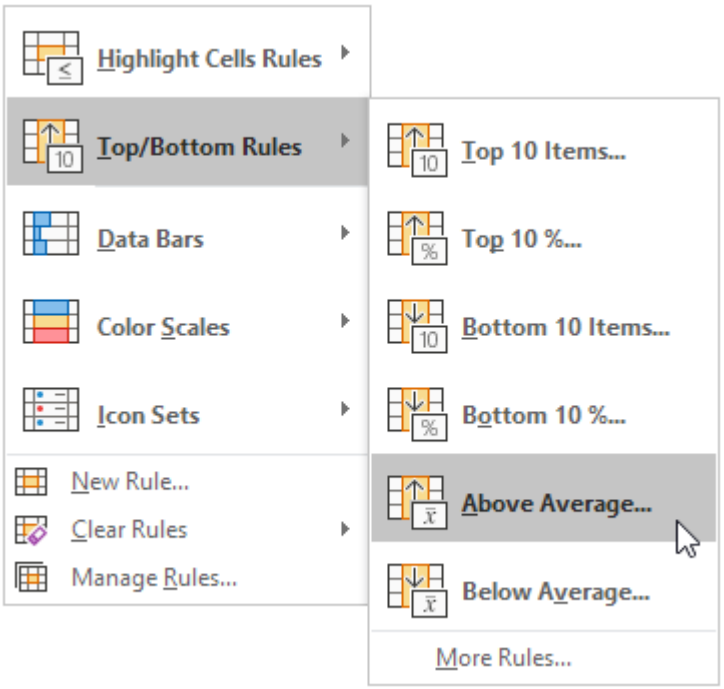
1. Select the range A1:A10.

	A	B
1	81	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

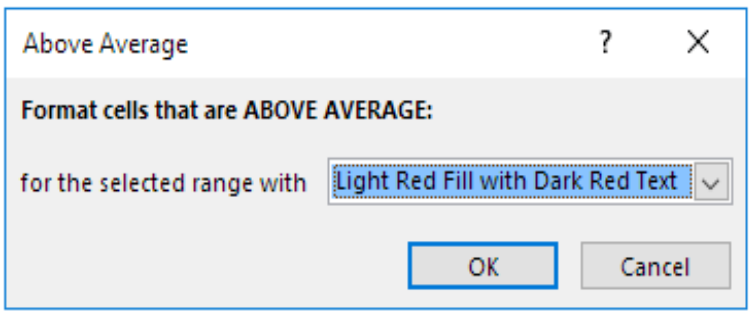
2. On the Home tab, in the Styles group, click Conditional Formatting.



3. Click Top/Bottom Rules, Above Average.



4. Select a formatting style.

5. 

5. Click OK.

Result. Excel calculates the average (42.5) and formats the cells that are above this average.

	A	B
1	81	
2	6	
3	39	
4	43	
5	2	
6	95	
7	5	
8	11	
9	86	
10	57	
11		

Note: you can also use this category (see step 3) to highlight the top n items, the top n percent, the bottom n items, the bottom n percent or cells that are below average.

ADVANCE CHART & GRAPH:

The excel charts and graphs are the tools used to visualise the data by representing their values. Now, let's discuss the advanced charts and its usage in excel.

What is an advanced chart in Excel ?

Advanced charts are the charts that are beyond the basic charts in excel. If the user has more than one set of data and if the user wants to compare the data values on the same chart, then the advanced charts come in handy. The user can create the basic chart for one set of data and then they can add more datasets to that chart. The user can also format the charts, etc.

The importance of advanced charts in Excel

1. Advanced charts provide more consolidated information in a single chart. It paves way for the user to compare more than one data set and it helps alot to draw decisions.

2. Advanced charts allow the user to customize the way it appears.

How to Create an Advance Chart in Excel:

In this example, we will create a **column chart and format its various chart elements**. We will use **random sales data for different courses** for this.

Step 1: Create a Dataset in a workbook

In this step, we will be **creating the dataset using the following random sales data** for different courses.

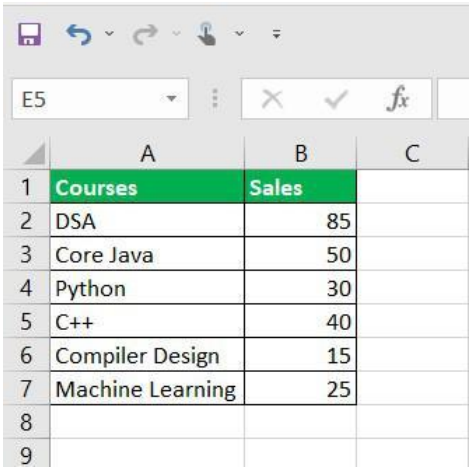


Fig 1 – Dataset

Step 2: Insert Chart

Now, we will be **inserting the chart for our dataset.** To do this, we need to **Select Data** and then **navigate to Insert**. Then click on **Charts** and then select **Column Chart** there.

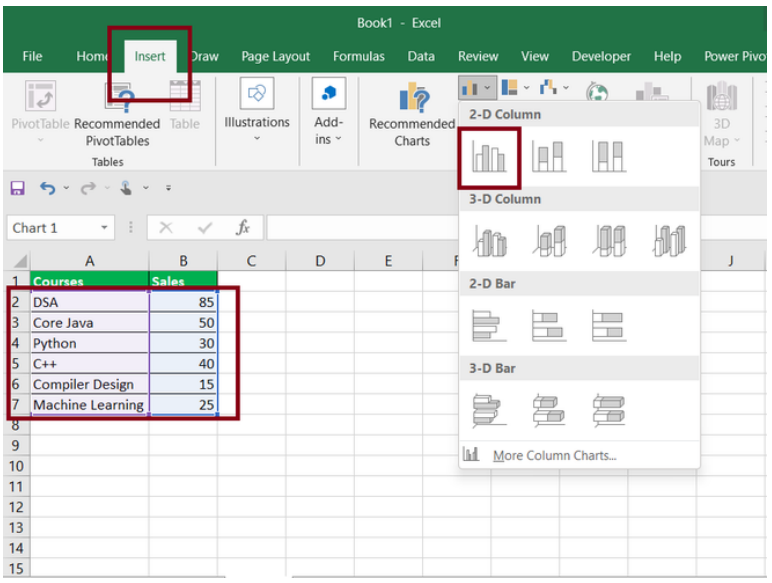


Fig 2 – Insert Chart

By doing this, Excel will **automatically insert a column chart** for our dataset.

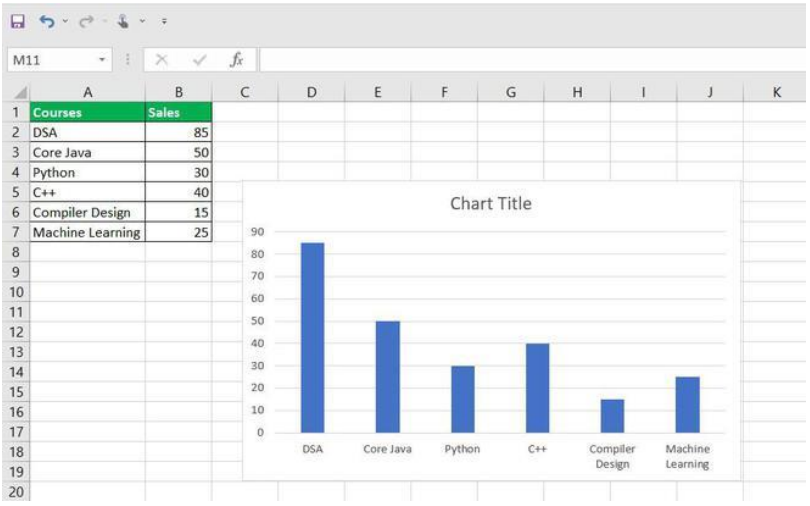


Fig 3 – Column Chart

The Format Pane is introduced in Excel 2013 which provides a chart formatting option for various chart elements. To access the formatting pane, we need to Select Chart Element > Right-Click > Format<chart_element> Excel will open a Format Pane for that particular chart element on the right side of the spreadsheet.

Step 3: Format Axis

In this step, we will format the chart axis. First, Select Axis, then Right-Click on it, and then **select Format Axis.**

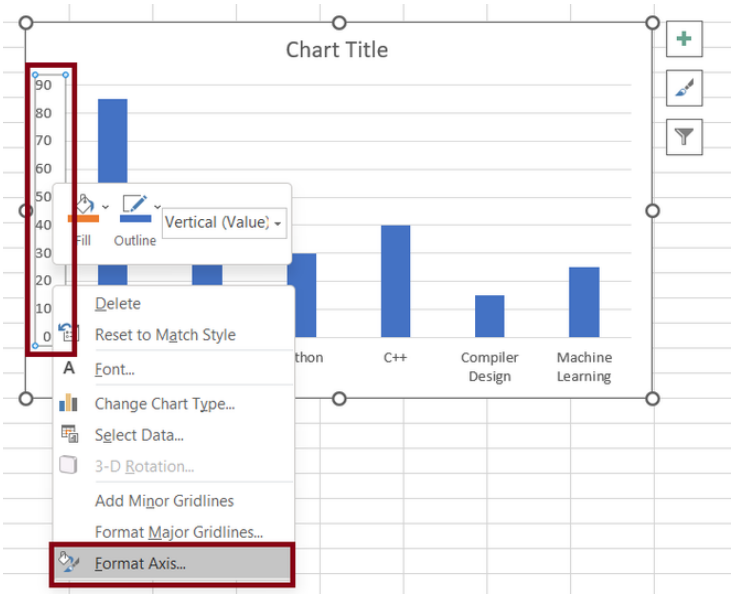


Fig 4 – Format Axis

Once we click on the **Format Axis option,** Excel will automatically **open a Format Axis Pane.**

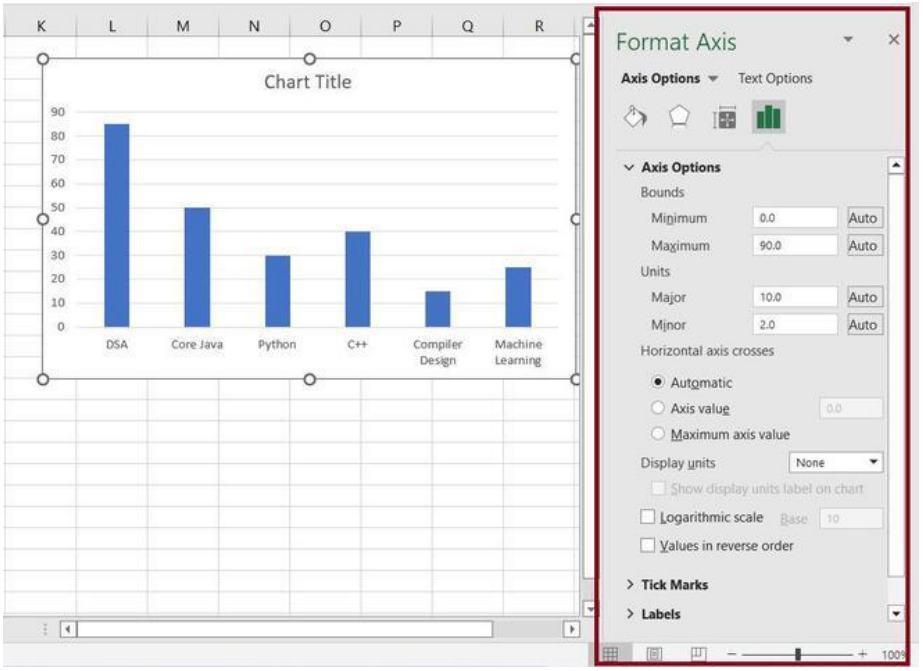


Fig 5 – Format Axis

Using the **format axis pane**, we can **format our chart axis** according to our requirements. Here, we are going to **change units to display in Hundreds** and **Tick Mark as Inside for Minor** Type.

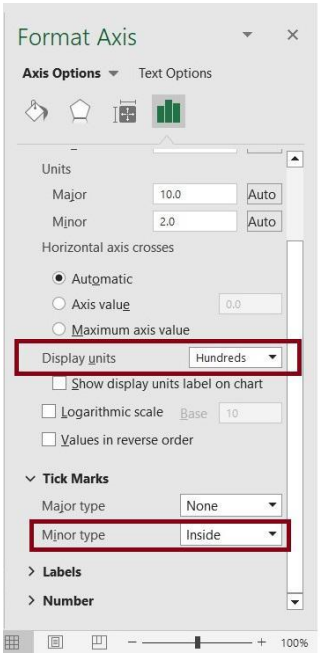


Fig 6 – Format Axis

Similarly, **we will also change the Tick Marks for Minor Type to Inside for Horizontal-Axis** and we will get the following output.

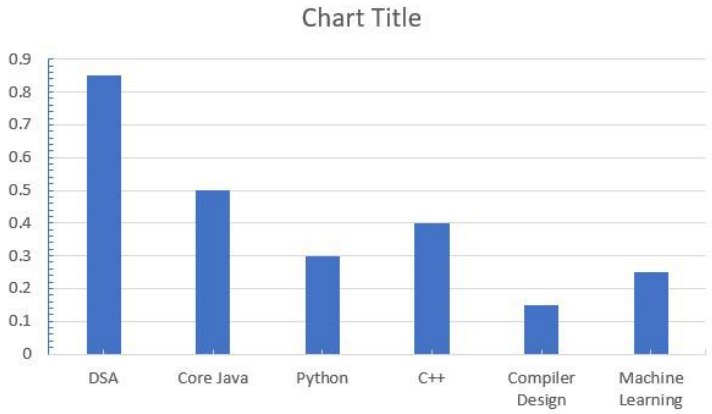


Fig 7 – Formatted Axis Output

Step 4: Format Chart Area

In this step, we will **format the Chart Area**. To make the chart look more enhanced and cleaner. For this **Select Chart Area** and then **Right Click** on it and select **Format Chart Area**. Please, make sure to **click on Chart Area, not the Plot** Area.

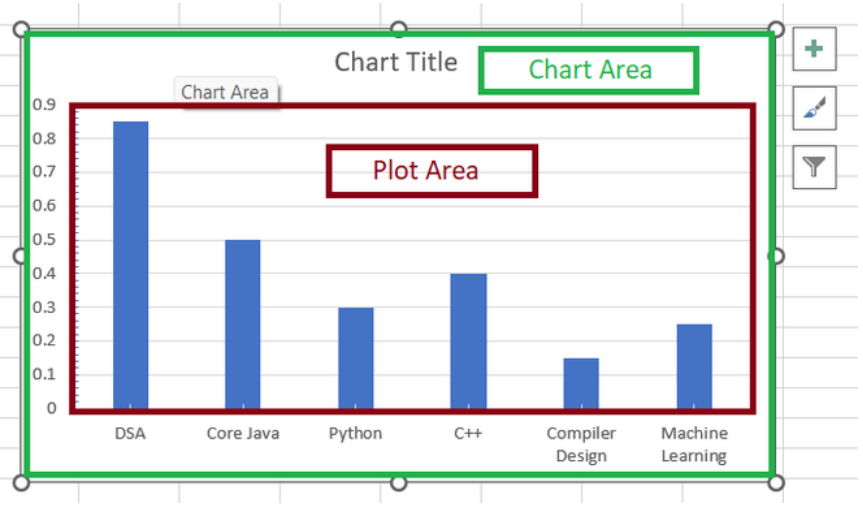


Fig 8 – Chart Area & Plot Area

Once we select the **chart area** and perform the above operation, **excel will open the Format Chart Area pane.**

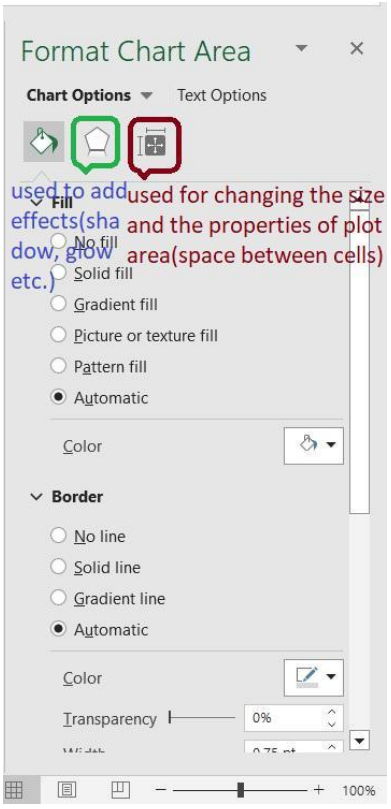


Fig 9 – Format Char Area Options

To format the chart area pane, we are **adding gradient colour to our chart**. Go to Format Chart Area, click on Fill & Line, and select **Gradient Fill**.

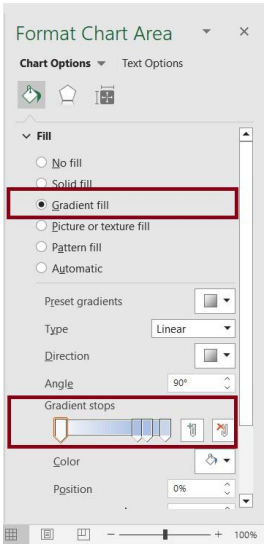


Fig 10 – Gradient Fill

Once we choose the **Gradient fill option,** excel will automatically fill the **gradient colour to our Chart Area.** Similarly, we will also **add the Gradient Fill to our Plot Area,** and we will get the **following output.**

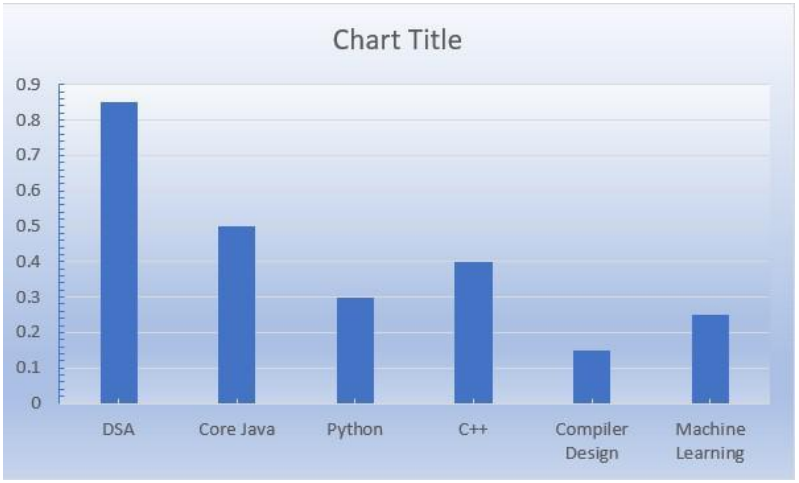


Fig 11 – Formatted Chart & Plot Area Output

Step 5: Format Chart Title

In this step, we will **format the Chart Title**.

To make the chart look more enhanced and cleaner. For this Select **Chart Title** and then **Right Click** on it and select **Format Chart Title**. This will open the **Format Chart Title pane on the right side** of the spreadsheet.

Using Format Chart Title, we are choosing the Gradient Fill option to **fill gradient colour to our chart title.** Also, we will change the title to **Sales Chart**. After adding these changes, we will get the following output.

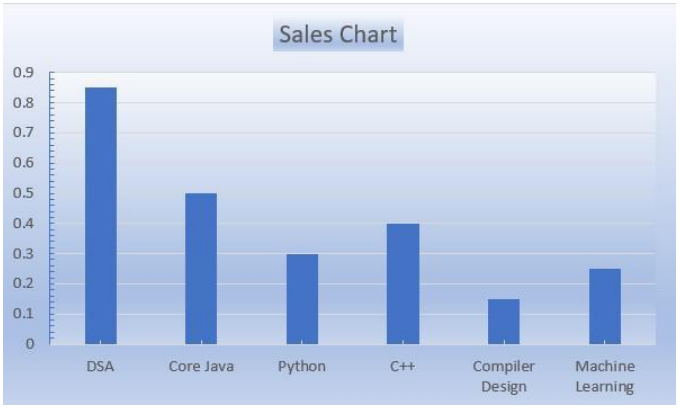


Fig 13 – Formatted Chart Title

Step 6: Format Data Series

In this step, we will **format the Chart Data Series**. To make the chart look more enhanced and cleaner. For this **Select Chart Data Series** and then **Right Click** on it and select **Format Data Series**.

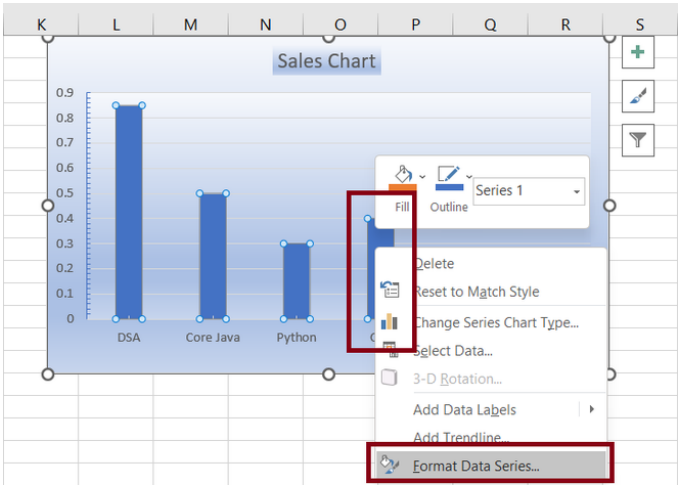


Fig 14 – Format Data Series

This will open **the Format Data Series pane on the right side of the Excel** spreadsheet. Using the **Format Data Series, we will add a 3-D effect** to our data series.

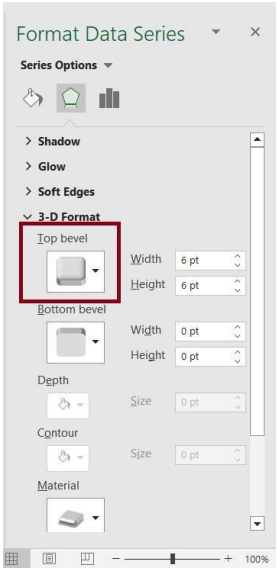


Fig 15 – Format Data Series

Once **we add the 3-D effect to our data series** we will get the following **final output.**

Fig 16 – Output

FAQs on Chart Formatting?

What is the need of formatting a chart?

Formatting the chart makes the chart easier to read and also qualifies you to explain the data in detail.

What are the best-advanced Graphs in Excel?

- Sankey diagram
- Likert Scale chart
- Comparison Bar Chart
- Gauge Chart
- Multi-Axis Line Chart
- Sunburst Chart
- Radar Chart
- Radial Bar Chart
- Box and Whisker Chart
- Dot Plot Chart

What is Power Query?

Power Query is a business intelligence tool available in Excel that allows you to import data from many different sources and then clean, transform and reshape your data as needed.

It allows you to set up a query once and then reuse it with a simple refresh. It's also pretty powerful. Power Query can import and clean millions of rows into the data model for analysis after. The user interface is intuitive and well laid out so it's really easy to pick up. It's an incredibly short learning curve when compared to other Excel tools like formulas or VBA.

The best part about it, is you don't need to learn or use any code to do any of it. The power query editor records all your transformations step by step and converts them into the M code for you, similar to how the Macro recorder with VBA.

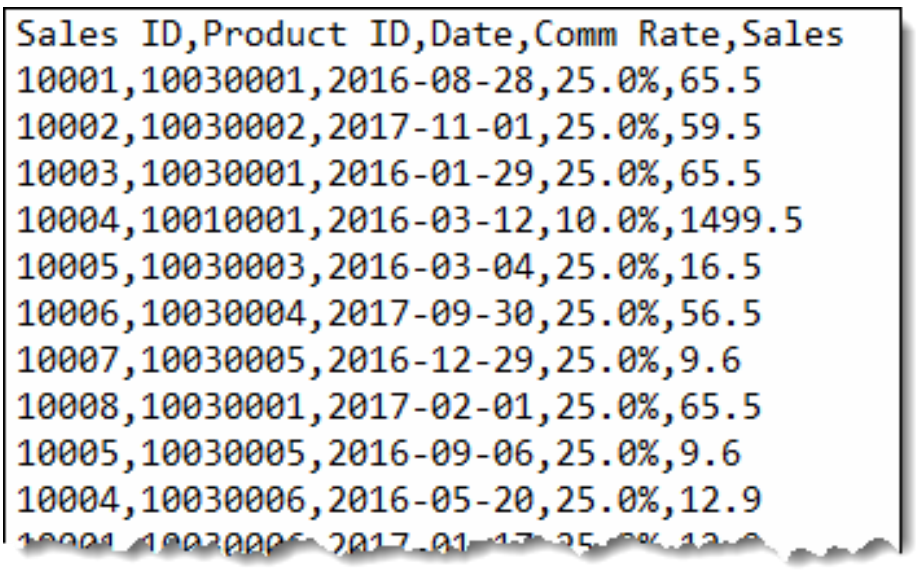
If you want to edit or write your own M code, you certainly can, but you definitely don't need to.

What Can Power Query Do?

Imagine you get a sales report in a text file from your system

on a monthly basis that looks like this.

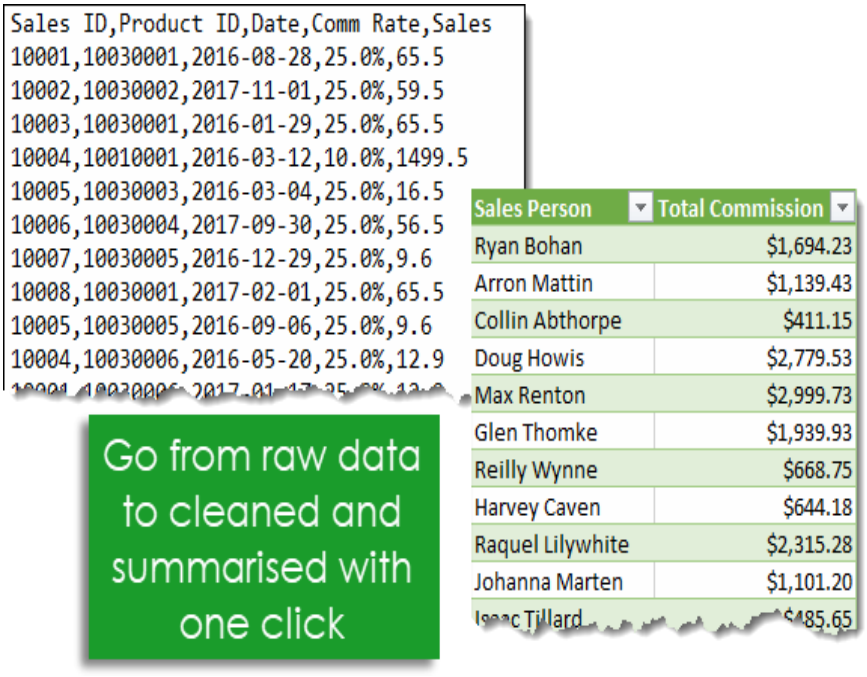
Every month you need to go to the folder where the file is uploaded and open the file and copy the contents into Excel. You then use the text to column feature to split out the data into new columns.
The system only outputs the sales person's ID, so you need to add a new column to the data and use a VLOOKUP to get the salesperson associated with each ID. Then you need to summarize the sales by salesperson and calculate the commission to pay out.



```
Sales ID,Product ID,Date,Comm Rate,Sales
10001,10030001,2016-08-28,25.0%,65.5
10002,10030002,2017-11-01,25.0%,59.5
10003,10030001,2016-01-29,25.0%,65.5
10004,10010001,2016-03-12,10.0%,1499.5
10005,10030003,2016-03-04,25.0%,16.5
10006,10030004,2017-09-30,25.0%,56.5
10007,10030005,2016-12-29,25.0%,9.6
10008,10030001,2017-02-01,25.0%,65.5
10005,10030005,2016-09-06,25.0%,9.6
10004,10030006,2016-05-20,25.0%,12.9
```

You also need to link the product ID to the product category but only the first 4 digits of the product code relate to the product category. You create another column using the LEFT function to get the first 4 digits of the product code, then use a VLOOKUP on this to get the product category. Now you can summarize the data by category.

Maybe it only takes an hour a month to do, but it's pretty mindless work that's not enjoyable and takes away from time you can actually spend analyzing the data and producing meaningful insight.

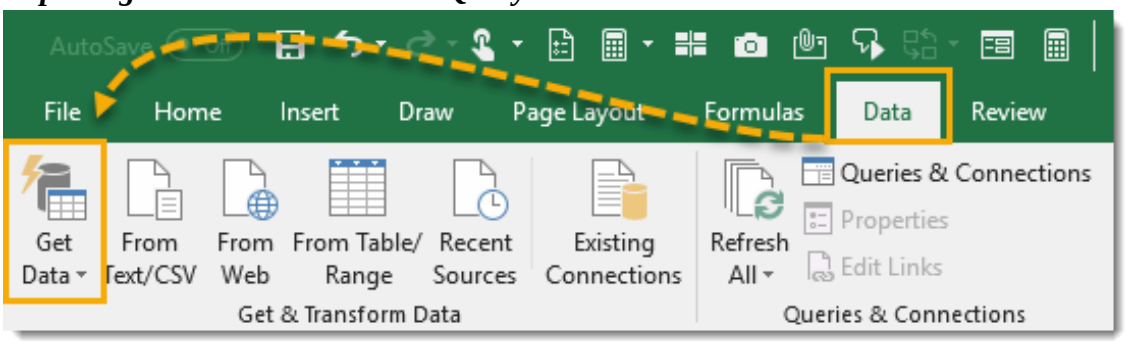


With Power Query, this can all be automated down to a click of the refresh button on a monthly basis. All you need to do is build the query once and reuse it, saving an hour of work each and every month!

Where is Power Query?

Power Query is available as an add-in to *download and install* for Excel 2010 and 2013 and will appear as a new tab in the ribbon labelled **Power Query**. In 2016 it was renamed to **Get & Transform** and appears in the **Data** tab without the need to install any add-in.

Importing Your Data with Power Query

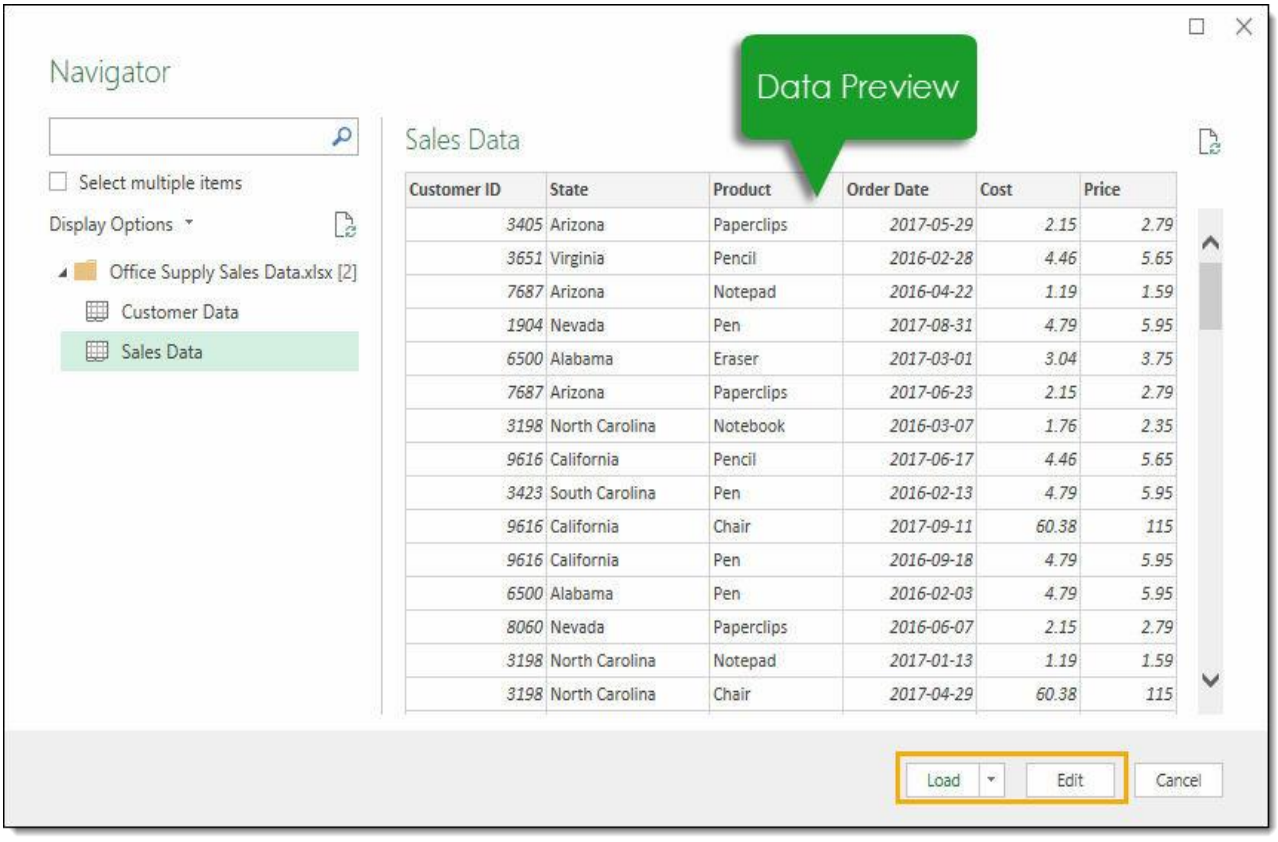


Importing your data with **Power Query** is simple. Excel provides many common data connections that are accessible from the **Data** tab and can be found from the **Get Data** command.

- Get data from a **single file** such as an Excel workbook, Text or CSV file, XML and JSON files. You can also import multiple files from within a given folder.
- Get data from **various databases** such as SQL Server, Microsoft Access, Analysis Services, SQL Server Analysis Server, Oracle, IBM DB2, MySQL, PostgreSQL, Sybase, Teradata and SAP HANA databases.
- Get data from **Microsoft Azure**
- Get data from **online services** like Sharepoint, Microsoft Exchange, Dynamics 365, Facebook and Salesforce.
- Get data from **other sources** like a table or range inside the current workbook, from the web, a Microsoft Query, Hadoop, OData feed, ODBC and OLEDB.
- We can **merge two queries together** similar to joining two queries in SQL.
- We can **append a query to another query** similar to a union of two queries in SQL.

Note: The available data connection options will depend on your version of Excel.

There are a couple of the more common query types available in the top level of the ribbon commands found in the **Get & Transform** section of the **Data** tab. From here we can easily access the **From Text/CSV**, **From Web** and **From Table/Range** queries. These are just duplicated outside of the **Get Data** command for convenience of use, since you'll likely be using these more frequently.
Depending on which type of data connection you choose, Excel will guide you through the connection set up and there might be several options to select during the process.

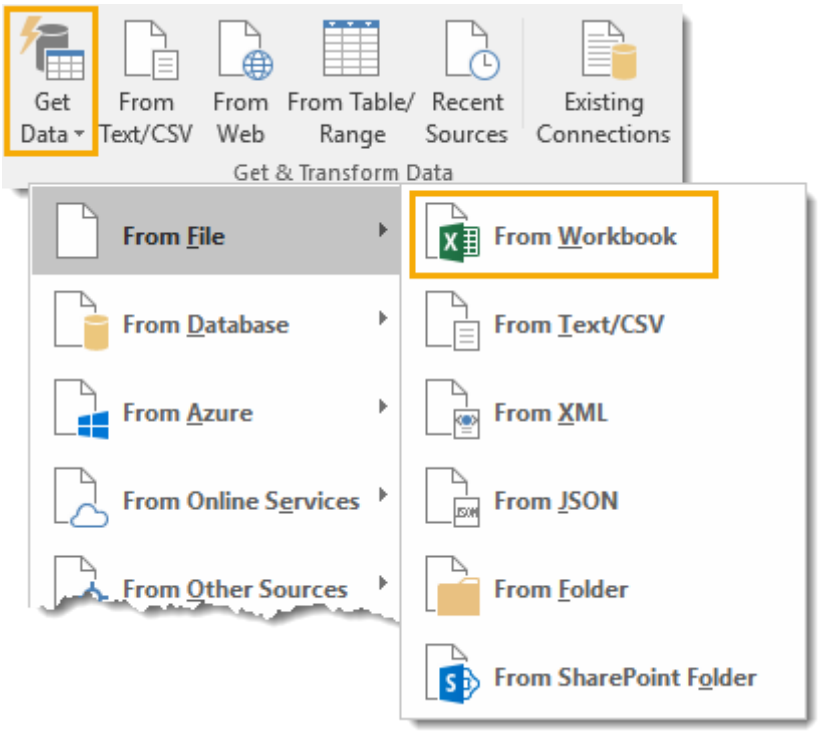


Customer ID	State	Product	Order Date	Cost	Price
3405	Arizona	Paperclips	2017-05-29	2.15	2.79
3651	Virginia	Pencil	2016-02-28	4.46	5.65
7687	Arizona	Notepad	2016-04-22	1.19	1.59
1904	Nevada	Pen	2017-08-31	4.79	5.95
6500	Alabama	Eraser	2017-03-01	3.04	3.75
7687	Arizona	Paperclips	2017-06-23	2.15	2.79
3198	North Carolina	Notebook	2016-03-07	1.76	2.35
9616	California	Pencil	2017-06-17	4.46	5.65
3423	South Carolina	Pen	2016-02-13	4.79	5.95
9616	California	Chair	2017-09-11	60.38	115
9616	California	Pen	2016-09-18	4.79	5.95
6500	Alabama	Pen	2016-02-03	4.79	5.95
8060	Nevada	Paperclips	2016-06-07	2.15	2.79
3198	North Carolina	Notepad	2017-01-13	1.19	1.59
3198	North Carolina	Chair	2017-04-29	60.38	115

At the end of the setup process, you will come to the data preview window. You can view a preview of the data here to make sure it's what you're expecting. You can then load the data as is by pressing the **Load** button, or you can proceed to the query editor to apply any data transformation steps by pressing the **Edit** button.

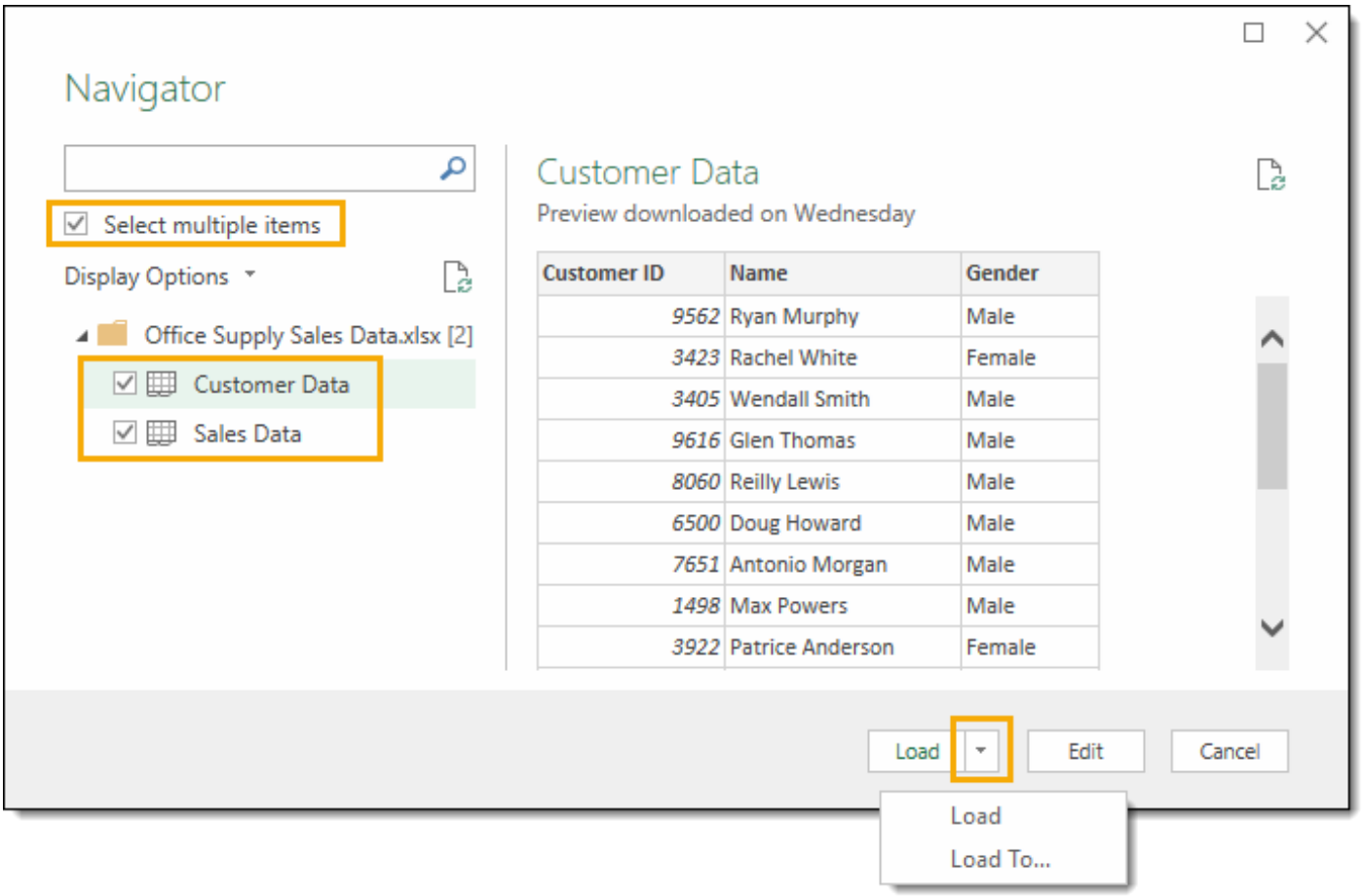
A Simple Example of Importing *Data in an Excel File*

Let's take a look at importing some data from an Excel workbook in action. We're going to import an Excel file called **Office Supply Sales Data.xlsx**. It contains sales data on one sheet called **Sales Data** and customer data on another sheet called **Customer Data**. Both sheets of data start in cell A1 and the first row of the data contains column headers.



Go to the **Data** tab and select the **Get Data** command in the **Get & Transform Data** section. Then go to **From File** and choose **From Workbook**.

This will open a **file picker** menu where you can navigate to the file you want to import. Select the file and press the **Import** button.

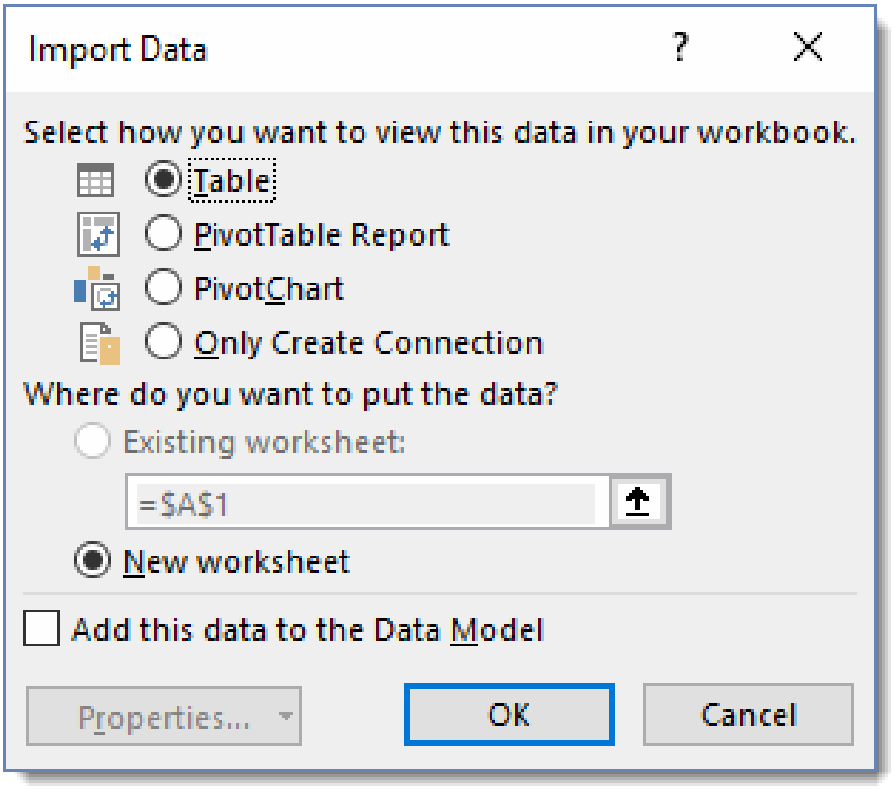


After selecting the file you want to import, the data preview **Navigator** window will open. This will give you a list of all the objects available to import from the workbook. Check the box to **Select multiple items** since we will be importing data from two different sheets. Now we can check both the **Customer Data** and **Sales Data**.

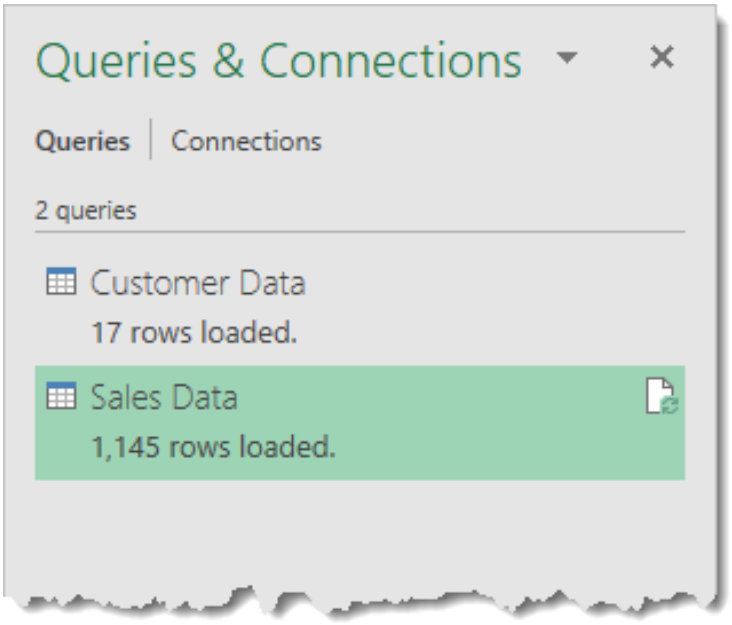
When you click on either of the objects in the workbook, you can see a preview of the data for it on the right hand side of the navigator window. This is great for a sense check to make sure you've got the correct file.

When you're satisfied that you've got everything you need from the workbook, you can either press the **Edit** or **Load** buttons. The edit button will take you to the query editor where you can transform your data before loading it. Pressing the load button will load the data into tables in new sheets in the workbook.

In this simple example, we will bypass the editor and go straight to loading the data into Excel. Press the small arrow next to the Load button to access the **Load To** options. This will give you a few more loading options.



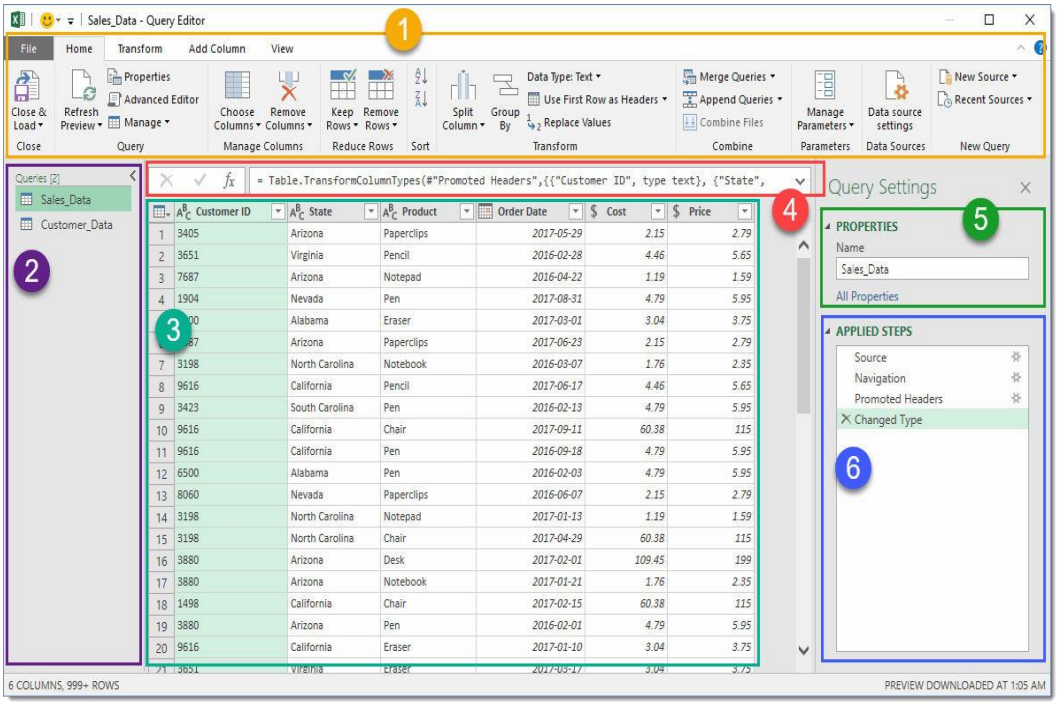
We will choose to load the data into a table in a new sheet, but there are several other options. You can also load the data directly into a pivot table or pivot chart, or you can avoid loading the data and just create a connection to the data.



Now the tables are loaded into new sheets in Excel and we also have two queries which can

quickly be refreshed if the data in the original workbook is ever updated.

The Query Editor

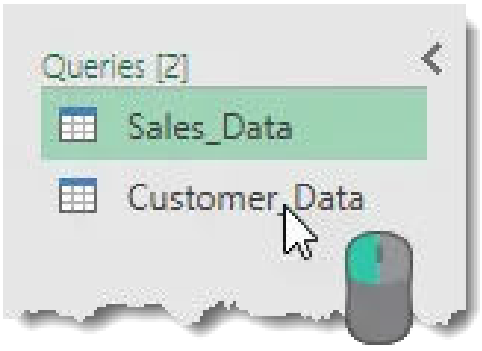


After going through the guide to connecting your data and selecting the **Edit** option, you will be presented with the **query editor**. This is where any data transformation steps will be created or edited. There are **6 main area** in the editor to become familiar with.

1. **The Ribbon** – The user interface for the editor is quite similar to Excel and uses a visual ribbon style command center. It organizes data transformation commands and other power query options into 5 main tabs.
2. **Query List** – This area lists all the queries in the current workbook. You can navigate to any query from this area to begin editing it.
3. **Data Preview** – This area is where you will see a preview of the data with all the transformation steps currently applied. You can also access a lot of the transformation commands here either from the filter icons in the column headings or with a right click on the column heading.

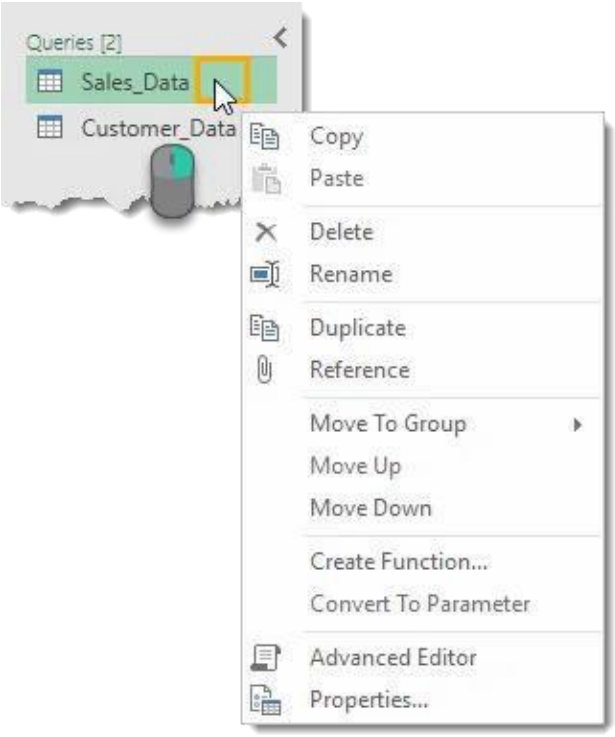
The Query List:

1. **Formula Bar** – This is where you can see and edit the M code of the current transformation step. Each transformation you make on your data is recorded and appears as a step in the applied steps area.
2. **Properties** – This is where you can name your query. When you close and load the query to an Excel table, power query will create a table with the same name as its source query if the table name isn't already taken. The query name is also how the M code will reference this query if we need to query it in another query.
3. **Applied Steps** – This area is a chronological list of all the transformation steps that have been applied to the data.



One of the primary functions of the query list is navigation. There's no need to exit the query editor to switch which query you're working on. You can **left click** on any query to switch. The query you're currently on will be highlighted in a light green colour.

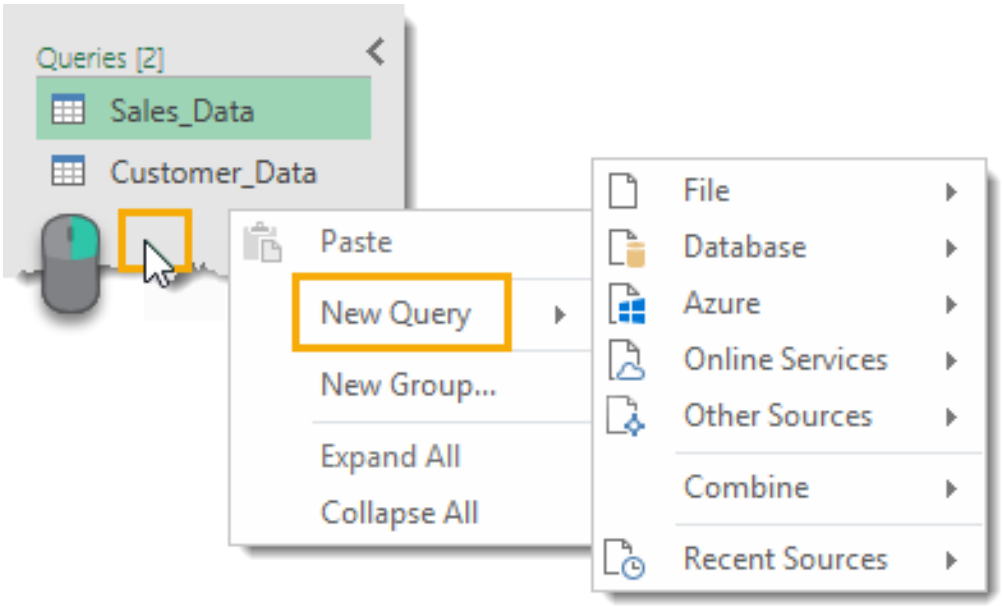
When you do eventually exit the editor with the close and load button, changes in all the queries You can hide the query list to create more room for the data preview. **Left click** on the small arrow in the upper right corner to toggle the list between hidden and visible.



If you right click on any query in the list, there are a variety of options available.

- **Copy and Paste** – Copy and paste a query to make another copy of it.
- **Delete** – Delete the query. If you accidentally delete a query, there's no undo button, but you can exit the query editor without saving via close and load to restore your query.
- **Rename** – Rename your query. This is the same as renaming it from the properties section on the left hand side of the editor.
- **Duplicate** – Make another copy of the query. This is the same as copy and paste but turns the process into one step.
- **Move To Group** – Place your queries into a folder like structure to keep them organised when the list gets large.
- **Move Up and Move Down** – Rearrange the order your queries appear in the list or within the folder groups to add to your organisational efforts. This can also be done by dragging and dropping the query to a new location.
- **Create Function** – Turn your query into a query function. They allow you to pass a parameter to the query and return results based on the parameter passed.
- **Convert To Parameter** – Allows you to convert parameters to queries or queries to parameters.
- **Advanced Editor** – Open the advanced editor to edit the M code for the query.

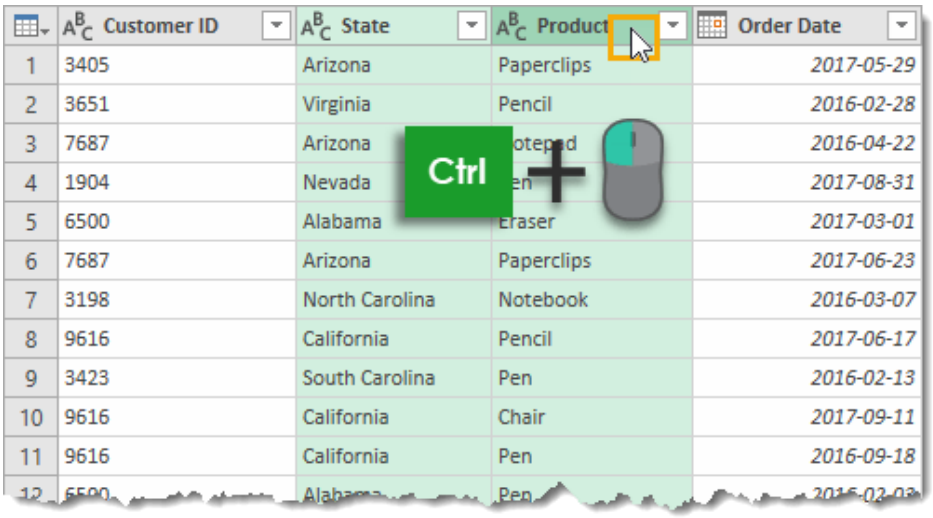
- **Properties** – Allows you to change the query name, add a description text and enable **Fast Data Load** option for the query.



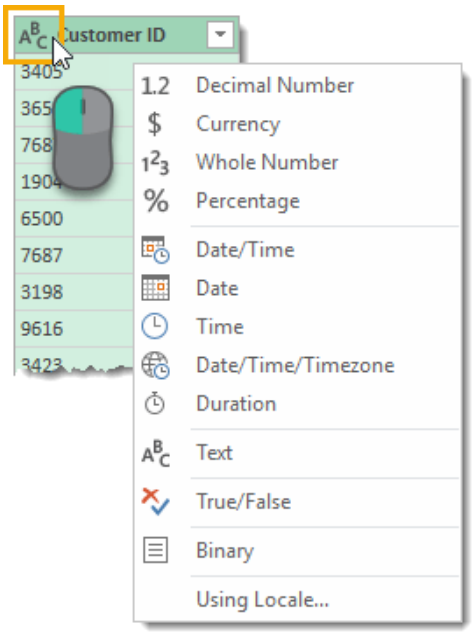
If you **right click** any empty area in the query list, you can create a **new query**.

The Data Preview

The main job of the data preview area is to apply transformation steps to your data and show a preview of these steps you're applying



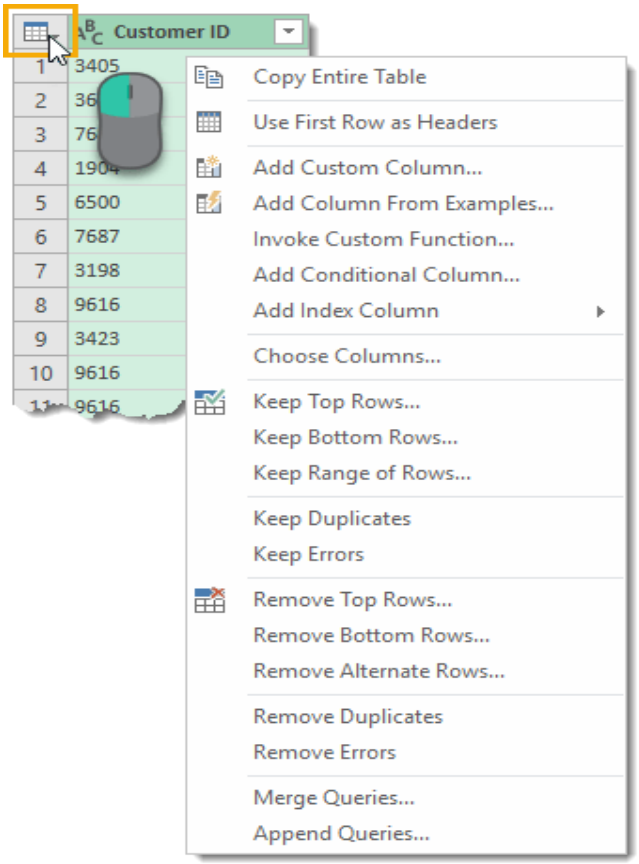
In the data preview area, you can select columns with a few different methods. A column will be highlighted in a light green colour when it's selected.



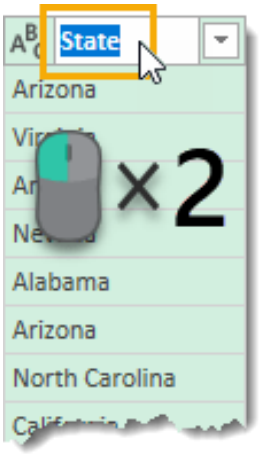
- Select a single column with a **left click** on the column heading.
- Select multiple adjacent columns with a **left click** on the first column heading, then hold ***Shift*** and **left click** on the last column heading.
- Select multiple non-adjacent columns by holding ***Ctrl*** then **left click** on any column headings you want to select.

You can then apply any relevant data transformation steps on selected columns from the **ribbon** or certain steps can be accessed with a **right click** on the column heading. Commands that are not available to your selected column or Each column has a data type icon on the left hand of the column heading. You can **left click** on it to change the data type of the column.

You can choose from decimal numbers, currency, whole numbers, percentages, date and time, dates, times, timezone, duration, text, Boolean, and binary.
Using the **Locale** option allows you to set the data type format using the convention from different locations. For example, if you wanted to display the date in the American **m/d/yyyy** format instead of the usual **dd/mm/yyyy** then you could select United States as the locale.

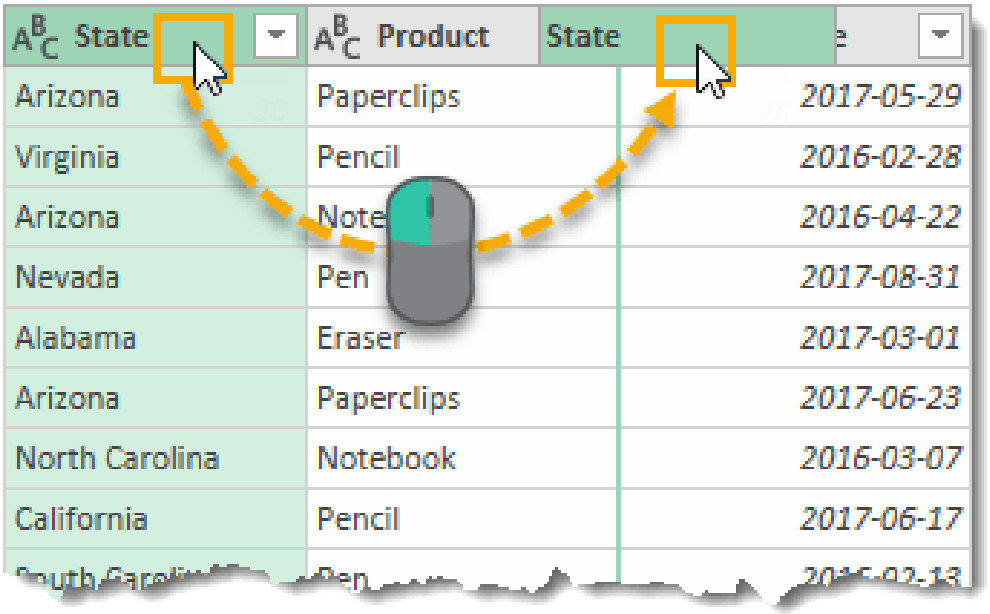


There's a small **table icon** in the top left hand corner of the data preview, you can **right click** or **left click** this to access various actions that affect the whole table.

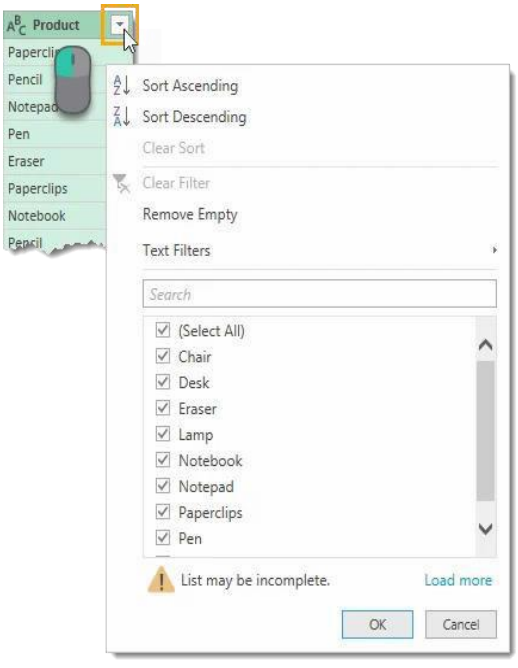


Renaming any column heading is really easy.

Double left click on any column heading then type your new name and press ***Enter*** when you're done.

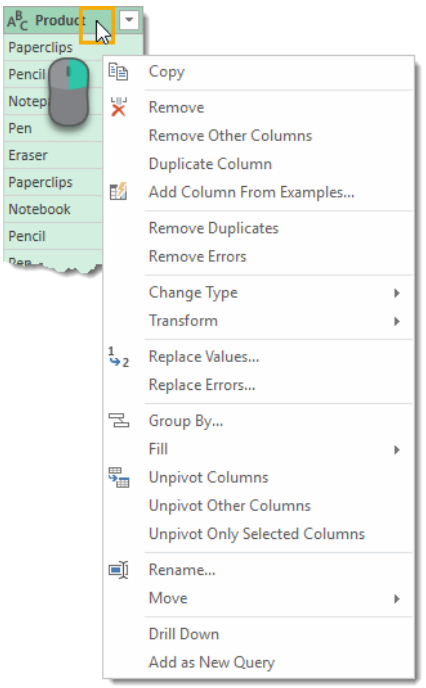


You can change around the order of any of the columns with a **left click** and **drag** action. The green border between two columns will become the new location of the dragged column when you release the left click.



Each column also has a filter toggle on right hand side. **Left click** on this to sort and filter your data. This filter menu is very similar to the filters found in a regular spreadsheet and will work the same way.

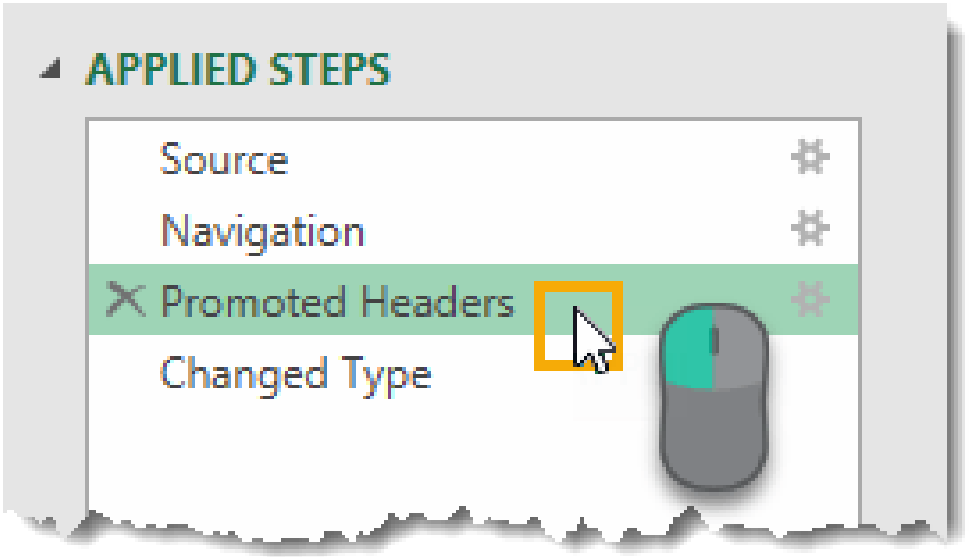
The list of items shown is based on a sample of the data so may not contain all available items in the data. You can load more by clicking on the **Load more** text in blue.



Many transformations found in the ribbon menu are also accessible from the data preview area using a **right click** on the column heading. Some of the action you select from this right click menu will replace the current column. If you want to create a new column based, use a command from the **Add Column** tab instead.

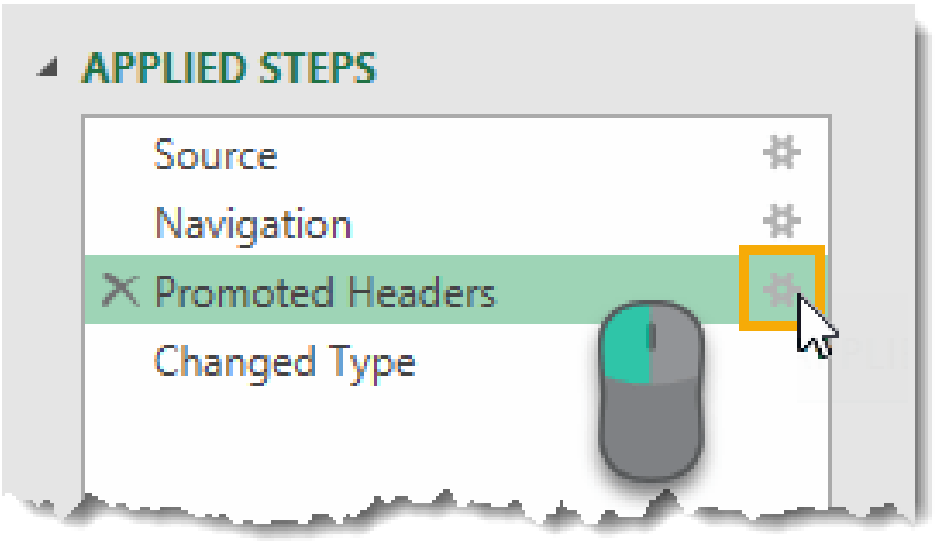
The Applied Steps

Any transformation you make to your data will appear as a step in the **Applied Steps** area. It also allows you to navigate through your query. **Left click** on any step and the data preview will update to show all transformations up to and including that step.

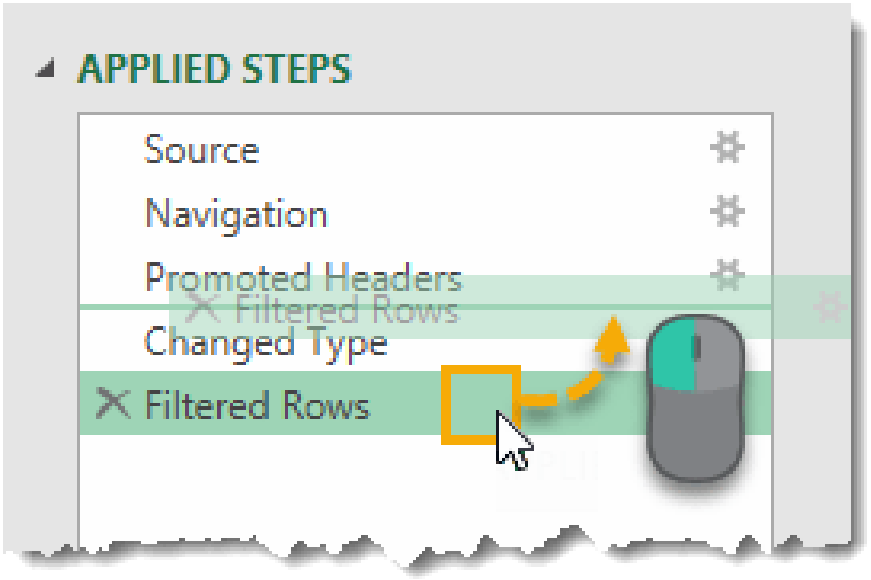


You can insert new steps into the query at any point by selecting the previous step and then creating the transformation in the data preview. Power Query will then ask if you want to insert this new step. Careful though, as this may break the following steps that refer to something you changed.

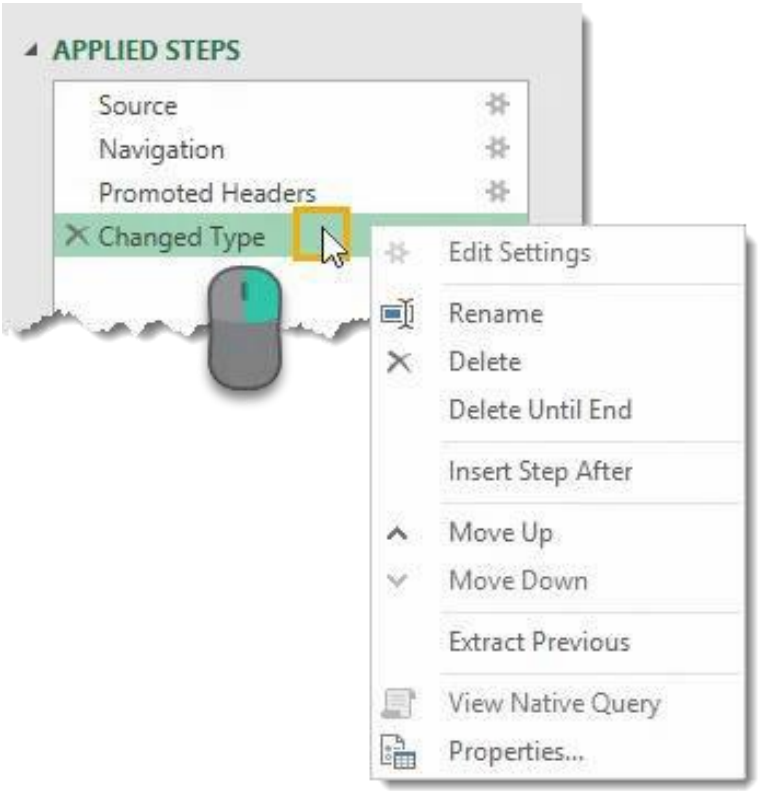
You can delete any steps that were applied using the **X** on the left hand side of the step name in the **Applied Steps** area. Caution is needed though, as if any of the following steps depend on the step you're trying delete, you will break your query. This is where **Delete Until End** from the right click menu can be handy.



A lot of transformation steps available in power query will have various user input parameters and other setting associated with them. If you apply a filter on the product column to show all items **not starting with Pen**, you might later decide you need to change this filter step to show all items **not equal to Pen**. You can make these edits from the **Applied Step** area.
Some of the steps will have a small gear icon on the right hand side. This allows you to edit the inputs and settings of that step.



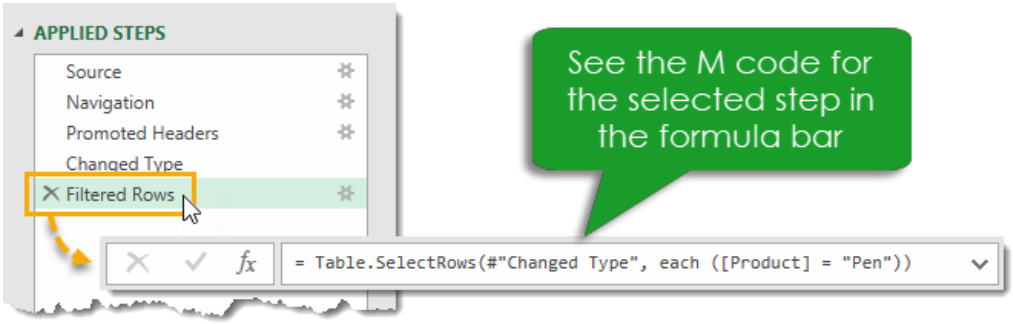
You can rearrange the order the steps are performed in your query. Just **left click** on any step and **drag** it to a new location. A green line between steps will indicate the new location. This is another one you'll need to be careful with as a lot of steps will depend on previous steps, and changing ordering can create errors because of this.



Right click on any step to access a menu of options.

- **Edit Settings** – This allows you to edit the settings of the step similar to using the gear icon on the right hand side of the step.
- **Rename** – This allows you to rename the steps label. Instead of the displaying the generic name like "**Filtered Rows**", you could have this display something like "**Filtered Product Rows on Pens**" so you can easily identify what the step is doing.
- **Delete** – This deletes the current step similar to the **X** on the left hand side of the step.
- **Delete Until End** – This allows you to delete the current step plus all steps up until the end. Since steps can depend on previous steps, deleting all steps after a step is a good way to avoid any errors.
- **Insert Step After** – This allows you to insert a new step after the current step.
- **Move Up and Move Down** – This allows you to rearrange the query steps similar to the dragging and dropping method.
- **Extract Previous** – This can be a really useful option. It allows you to create a new copy of the query up to the selected step.

The Formula Bar

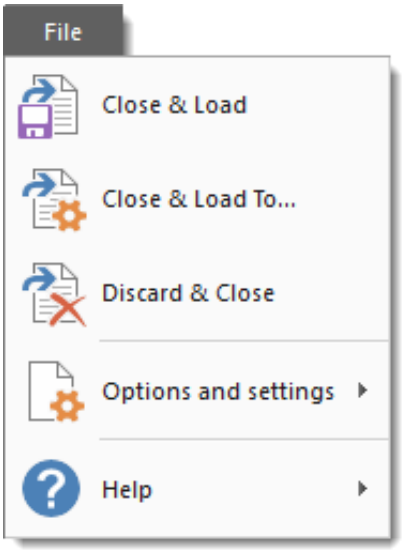


When you click on different steps of the transformation process in the Applied Steps area, the formula bar updates to show the M code that was created for that step. If the M code generated is longer than the formula bar, you can expand the formula bar using the arrow toggle on the right hand side.

You can edit the M code for a step directly from the formula bar without the need to open the advanced editor. In this example, we've changed our filter from "**Pen**" to "**Chair**" by typing in the formula bar and then pressing ***Enter*** or using the check mark on the left to confirm the change. Press ***Esc*** or use the **X** on the

left to discard any changes.

The File Tab



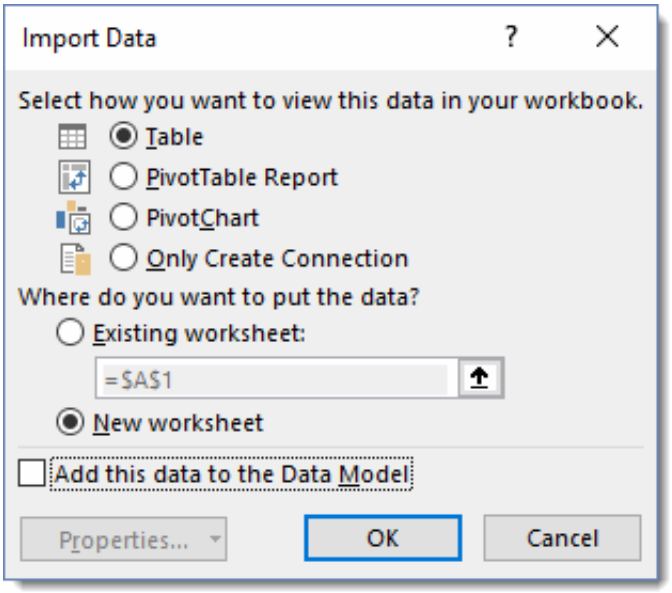
The **File** tab contains various options for saving any changes made to your queries as well as power query options and settings.

- **Close & Load** – This will save your queries and load your current query into an Excel table in the workbook.
- **Close & Load To** – This will open the **Import Data** menu with various data loading options to choose from.
- **Discard & Close** – This will discard any changes you made to the queries during your session in the editor and close the editor.

Data Loading Options

When you use the **Close & Load To** option to exit the editor, this will open the **Import Data** menu.

You can choose to load the query to a **table**, **pivot table**, **pivot chart** or **only create a connection** for the query. The connection only option will mean there is no data output to the workbook, but you can still use this query in other queries. This is a good option if the query is an intermediate step in a data transformation process.
You'll also be able to select the location to load to in your workbook if you selected either a table, pivot table or pivot chart in the previous section. You can choose a cell in an existing worksheet or load it to a new sheet that Excel will create for you automatically.



The other option you get is the **Add this data to the Data Model**. This will allow you to use the data output in **Power Pivot** and use other Data Model functionality like building relationships between tables. The Data Model Excel's new efficient way of storing and using large amounts of data.

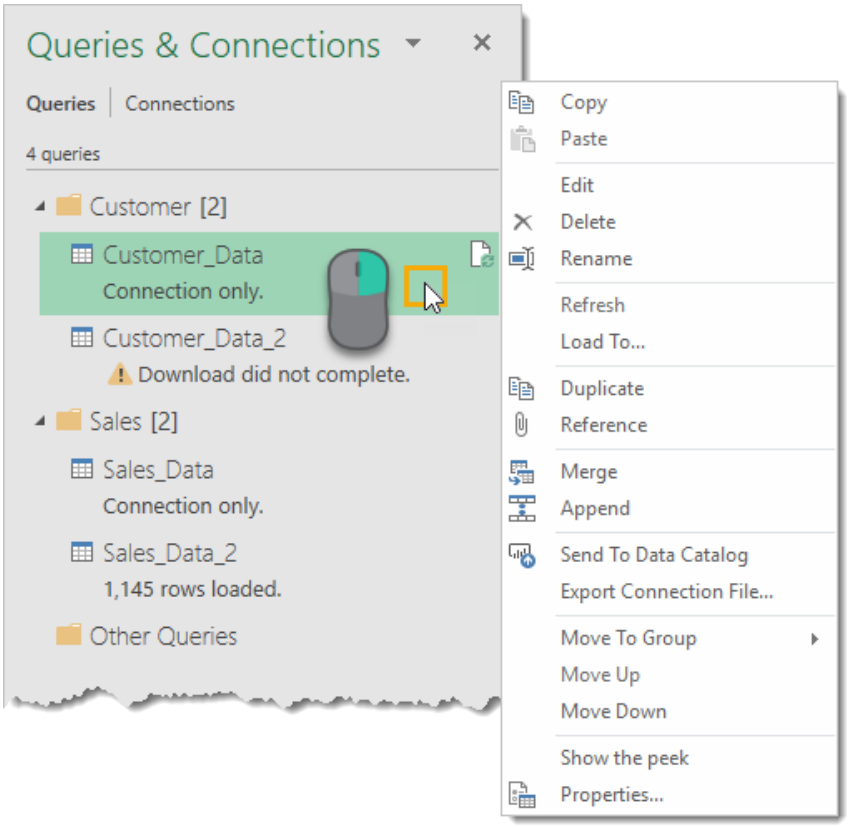
The Queries & Connections Window

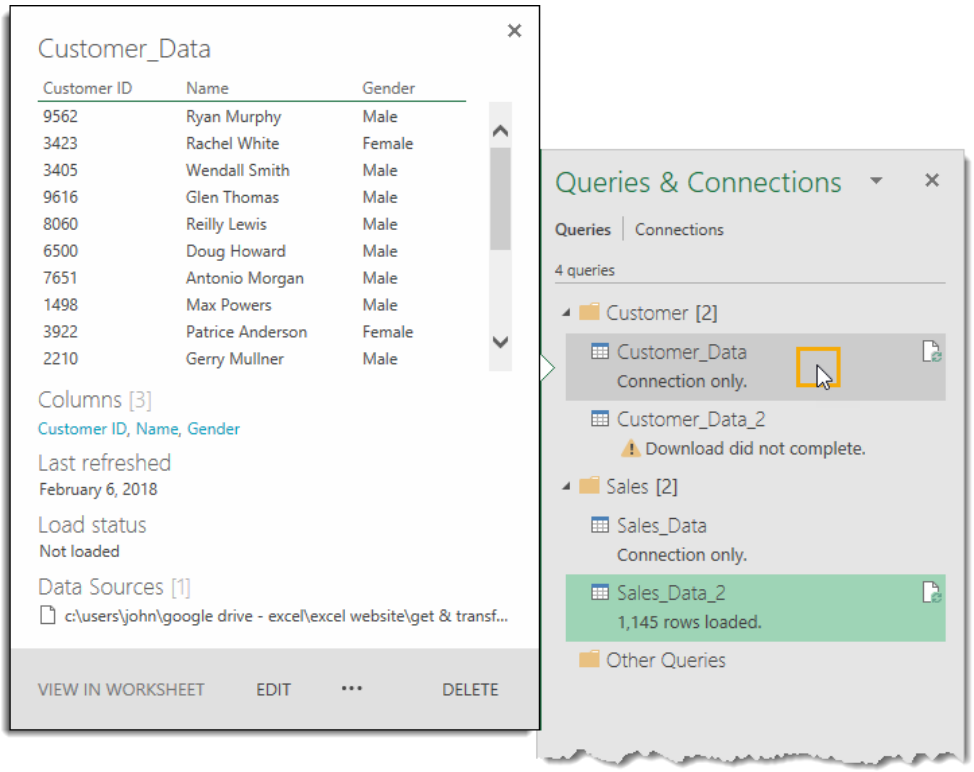
When you're working outside of the power query editor, you can see and interact with all the queries in the workbook through the **Queries & Connections** window. To open this, go to the **Data** tab in the regular Excel ribbon, then press the **Queries & Connections** command button found in the **Queries & Connections** section.

When opened it will be docked to the right hand side of the workbook. You can undock it by left clicking on the title and dragging it. You can drag it to the left hand side and dock it there or leave it floating. You can also resize the window by left clicking and dragging the edges.

This is very similar to the query list in the editor and you can perform a lot of the same actions with a **right click** on any query.

One option worth noting that's not in the query list right click menu, is the **Load To** option. This will allow you to change the loading option for any query, so you can change any **Connection only** queries to load to an Excel table in the workbook.

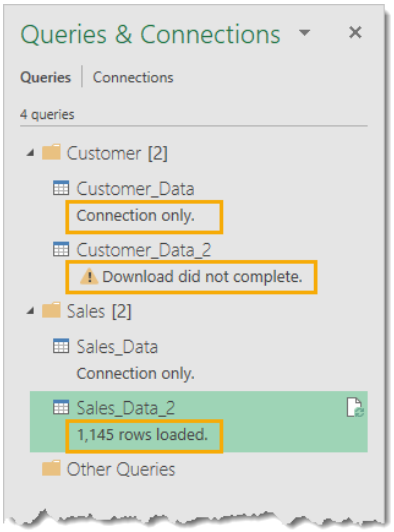




Another thing worth noting is when you **hover over a query with the mouse cursor**, Excel will generate a **Peek Data Preview**. This will show you some basic information about the query.

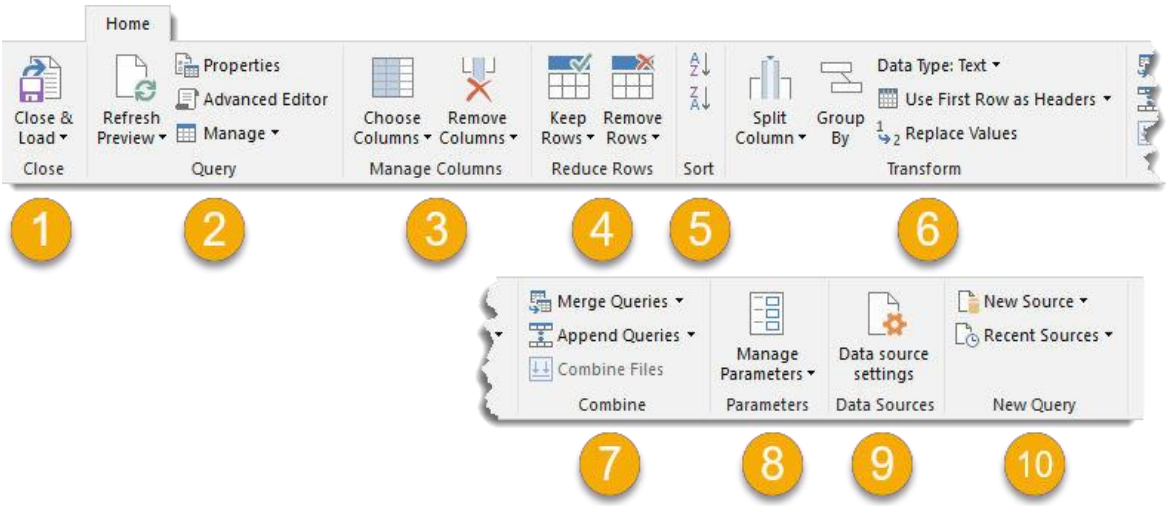
- **Data Preview** – This is a live preview of the data similar to when first setting up a query.
- **Columns** – This will give you a list of all the columns contained in the final results of the query along with a count of how many columns there are. Clicking on any of them will highlight the column in the data preview.
- **Last Refreshed** – This will tell you when the data was last refreshed.
- **Load Status** – This displays whether the data is loaded to a table, pivot table, pivot chart or is a connection only.
- **Data Sources** – This will show you the source of the data along with a count of the number of files if you're it's a from folder query.
- **View in Worksheet** – Clicking on this will take you to the output table if the query is loaded to a table, pivot table or pivot chart.

You can also access this **Peek** view by **right clicking** on the query and selecting **Show the peek**.



There are also some useful **messages** displayed in the Queries & Connections window for each query. It will show you if the query is a connection only, if there were any errors when the query last ran, or how many rows loaded.

The Home Tab



The **Home** tab contains all the actions, transformations, and settings that will affect the whole table.

1. **Close** – You can access the **Close & Load** and **Close & Load To** options from here. These are also available in the **File** tab menu.
2. **Query** – You can refresh the data preview for the current query or all query connections. You can also open the properties settings and the advanced editor for the current query and there are options under the **Manage** button to delete, duplicate or reference the current query.
3. **Manage Columns** – You can navigate to specific columns and choose to keep or remove columns.
4. **Reduce Rows** – You can manage the rows of data from this section. There are lots of options to either keep certain rows or remove certain rows. Keep or remove the top N rows, the bottom N rows, a particular range of rows, alternating rows, duplicate rows or rows with errors. One option only available for removing rows is to remove blank rows.
5. **Sort** – You can sort any column in either ascending or descending order.
6. **Transform** – This section contains a mix of useful transformation options.

    - Split Columns – This allows you to split the data in a column based on a delimiter or character length.
    - Group By – This allows you to group and summarize your data similar to a Group By in SQL.
    - Data Type – This allows you to change the data type of any column.
    - Use First Row as Headers – This allows you to promote the first row of data to column headings or demote the column headings to a row of data.
    - Replace Values – This allows you to find and replace any value from a column.

1. **Combine** – This sections contains all the commands for joining your query to with other queries. You can merge, append queries or combine files when working with a from folder query.
2. **Parameters** – Power Query allows you to create parameters for your queries. For example when setting up a from folder query, you may want the folder path to be a parameter as so you can easily change the location. You can create and manage existing parameters from this section.
3. **Data Sources** – This section contains the data source settings including permissions management for any data sources that require passwords to access.
4. **New Query** – You can create new queries from new data sources or previously used data sources from this section.

The Difference Between the Transform and Add Column Tabs

The bulk of all transformations available in power query can be accessed through either the **Transform** tab or the **Add Column** tab.

You might think there is a lot of duplication between these two tabs. For example, both tabs contain a **From Text** section with a lot of the same commands. It's not really the case, there is a subtle difference!

When you use a command from the **Add Column** tab that is found in both tabs, it will create a new column with the transformed data and the original column will stay intact. Whereas using the equivalent command from the **Transform** tab will change the

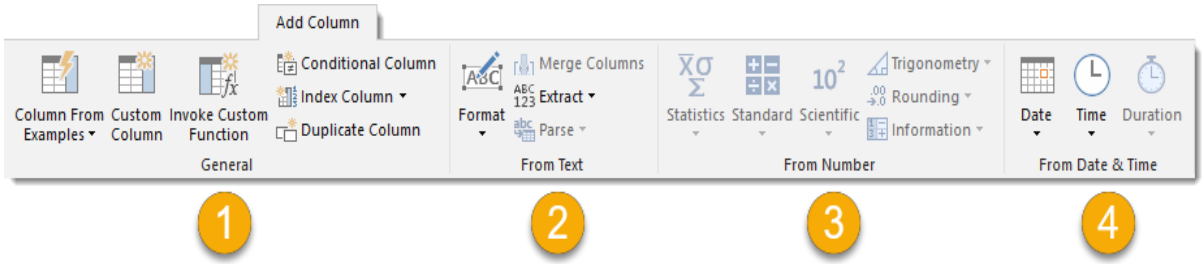
original column and no new column is created.

The Transform Tab

The **Transform** tab sections.

1. **Table** – This section contains commands that will transform the entire table. You can group and aggregate your query, promote rows to headers, demote headers to rows transpose your data, reverse row order, and count rows.
2. **Any Column** – This section contains commands that will work on any column of data regardless of data type. You can change the data type, automatically detect and change the data type, rename the column heading, find and replace values, fill values down (or up) a column to replace any blanks or nulls with the value above it (or below it), pivot or unpivot columns, move columns to a new location or convert a column to a list.
3. **Text Column** – This section contains commands for text data. You can split columns with a delimiter, format the case, trim and clean, merge two or more columns together, extract text, and parse XML or JSON objects.
4. **Number Column** – This section contains commands for numerical data. You can perform various aggregations like sums and averages, perform standard algebra operations or trigonometry and round numbers up or down.
5. **Date & Time Column** – This section contains commands for date and time data. You can extract information from your dates, times and duration data.
6. **Structured Column** – This section contains commands for working with nested data structures such as when your column contains tables.

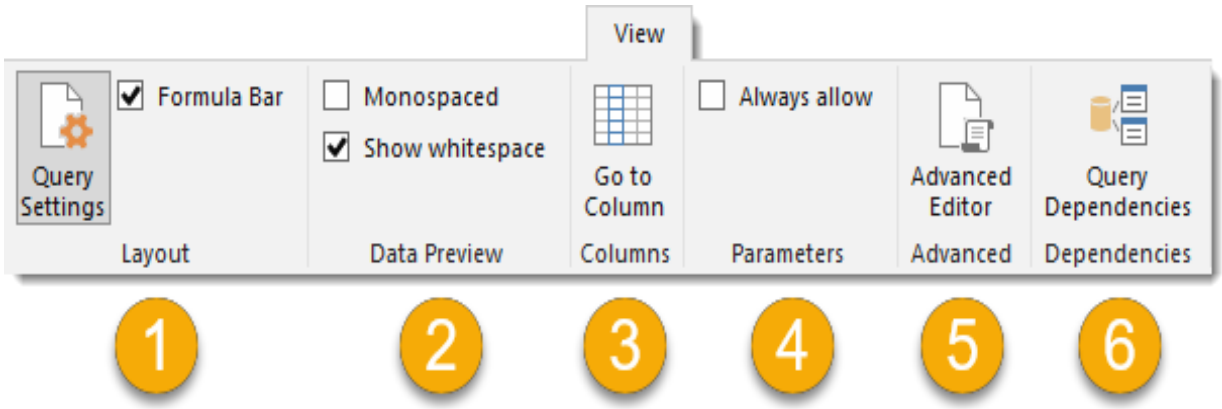
The Add Column Tab



The **Add Column** tab contains a lot of commands similar to the **Transform** tab, but the key difference is they will create a new column with the transformation.

1. **General** – This section allows you to add new columns based on formulas or custom functions. You can also add index columns or duplicate a column from here.
2. **From Text** – Very similar to the **From Text** section in the **Transform** tab, but these commands will create a new column with the transformation.
3. **From Number** – Very similar to the **From Number** section in the **Transform** tab, but these commands will create a new column with the transformation.
4. **From Date & Time** – Very similar to the **From Date & Time** section in the **Transform** tab, but these commands will create a new column with the transformation.

The View Tab



The **View** tab is quite sparse in comparison to the other tabs. There are no transformation commands to be found in it. Most Power Query users will rarely need to use this area, but there are still a few things worth knowing about.

1. **Layout** – This section allows you to either show or hide the Query Setting pane (which contain the properties and applied steps) and the Formula Bar.
2. **Data Preview** – This section allows you to show or hide whitespace characters or turn the font into a monospace font in the data preview area. This is handy when dealing with data delimited by a certain number of characters.
3. **Columns** – This allows you to go to and select a certain column in the data preview. This command is also available in the **Home** tab.
4. **Parameters** – This allows you to enable parameterization in data sources and transformation steps.
5. **Advanced** – This will open the advanced query editor which shows the M code for the query. This is also available from the **Home** tab.
6. **Dependencies** – This will open a diagram view of the query dependencies in the workbook.