# How to Use Excel Like the Cool Kids

A guide by Dominic

Microsoft Excel. It's capable of doing just about anything, but to use it, it feels like you need a Ph.D.

Excel is so ubiquitous in the worlds of business, science, engineering, and medicine that I can say with confidence that it is one skill you absolutely *will* use after you graduate. Yet, most students come to college with little experience using it. So here's a quick intro guide to some fun things you can do in Excel. It ought to help you work through homework assignments not just in the class, but for the rest of all time.

Throughout this document, I'll use large blue headings for big topics and smaller grey headings for individual skills. It should make it easier to skip the skills that you are already familiar with so you can get to the good stuff. I've tried my best to make it readable, too, so it shouldn't be total torture to go end to end.

Look for the **magic rectangle** in images to help direct your eyes. Whenever you see the **magic rectangle**, you'll know that whatever it's surrounding is what I'm trying to show you.
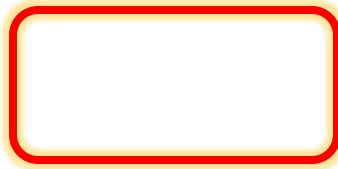
What a **magic rectangle** might look like

As usual, remember that course staff is here to help. If anything in this guide is unclear, please ask. Likewise, if there's anything you think is missing, let us know and we'll be able to make this guide even better.
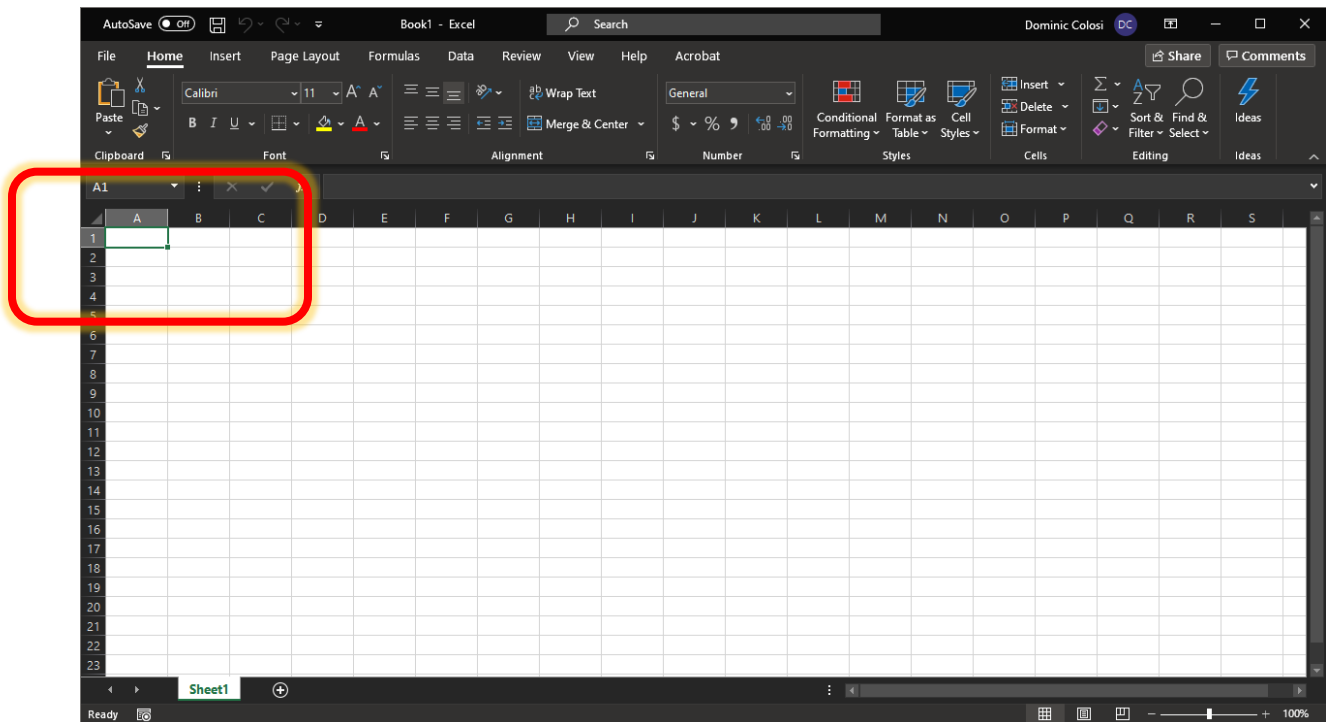
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# Contents

# The Basics

Okay, let's start with some easy stuff.
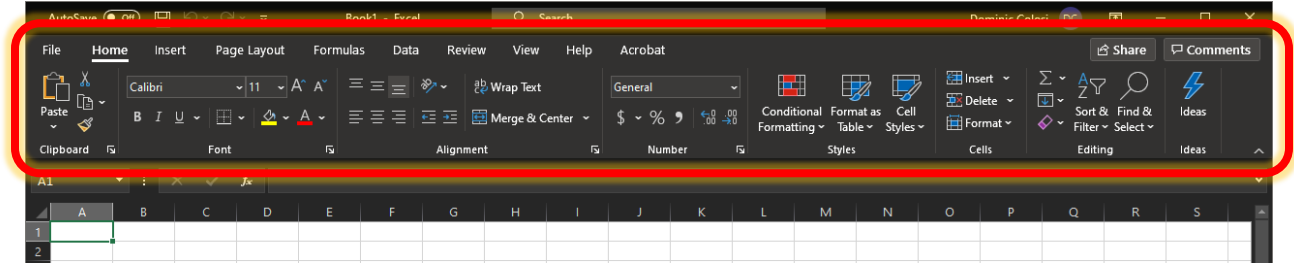
## The Excel Window



When you first open Excel, you'll be greeted with a big blank spreadsheet, in white above.

Each rectangle in the spreadsheet is called a **cell**.

The columns and rows are named using letters and numbers, respectively. Each cell is labeled according to its position. The cell highlighted in green above is cell **A1**. It lives in **column A** and **row 1**.

# The Ribbon



The top section, in a medium grey above, is called the **ribbon**. This is where many of the options for Excel live. Depending on how wide your monitor is, you may see more or fewer buttons up here.

You can click each word in the **menu bar** right above the ribbon to change its tab. Right now it's on the **Home** tab, but there are many options. Click through them as you read and get a feel for where everything is.

**File** changes the window to show options like Save, Print, Share, and Settings. To exit the File tab, you need to click the "back" arrow in the upper left.

**Home** contains commonly used formatting options and some basic editing tasks.

**Insert** contains buttons for adding images, graphs, tables, and other doodads.

**Page Layout** contains options useful for printing and display.

**Formulas** contains lists of functions that excel can perform.

**Data** contains tools for importing data from various sources and for sorting and otherwise working with data already in the spreadsheet.

**Review** contains tools for reviewers to comment on and change a spreadsheet while keeping track of every change that's made.

**View** contains settings that change the way the spreadsheet appears on screen.

**Help** contains its own training modules and advice about Excel.

Other tabs may also appear depending on other programs you have installed on your computer.

You can double click on a tab name like **Home** or **Insert** to make the ribbon appear or hide. Sometimes you want more screen space for your spreadsheet, and sometimes you want clickable ribbon buttons immediately available, so don't be afraid to change the mode frequently.

## Working with Cells and Selections

When your mouse it over a cell in the spreadsheet, it will turn into a thick cross:



This cursor indicates that you can select one or more cells. You can click to select just one or click and drag to select a range. **Ranges** can be linear, consisting of cells in the same row or column, or they can be rectangular in shape, depending on where you click and drag to.

If you hold CTRL, you can select multiple cells that aren't connected at the same time. Try selecting cells B1, B3, and B5 all at the same time this way.

If you hold your mouse over the row and column headers, the cursor changes to an arrow:



This cursor indicates that you can click to select the entire row or column. Like before, you can click and drag to select multiple rows or columns. You can also hold CTRL to select multiple unconnected rows and columns.

Try selecting Column A, Row 3, and cell D5 all at the same time.

Once you've made a selection, you can use CTRL+X, CTRL+C, and CTRL+V to cut, copy, and paste the cells around the spreadsheet.

You can also use the arrow keys on your keyboard to move around the spreadsheet. Hold shift to select the cells you move through just like you were clicking and dragging with the mouse.

# How to Find More Information Online

When searching for more information online, you should follow these steps to be sure you're getting the best help.

1. Take note of which version of Excel you're using. You can find your Excel version by clicking **File** in the ribbon, then **Account** near the bottom left of the window, and the checking the product version under the Microsoft or Office logo.
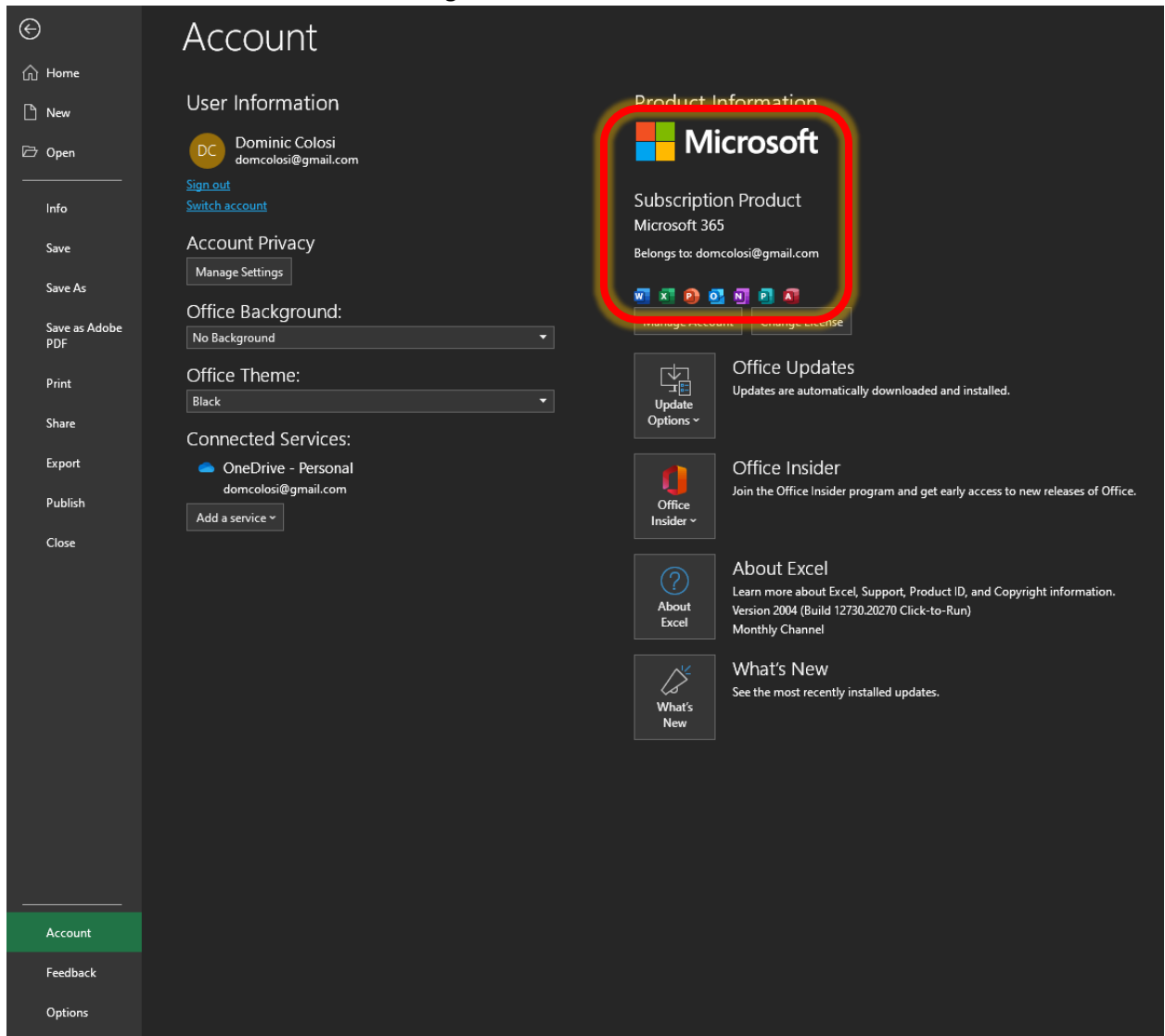


I'm running the Microsoft 365 version of Excel.

2. Check the Office Website first. https://support.office.com/en-us/excel contains lots of well written guides for you. Simply type a function name or any question you have into the search bar.

3. If you must use Google, begin your search with the version number of Excel you're using. For example: "Excel 365 IF function"

# Formulae and Functions

## Formulas

Let's try entering some information into a cell, shall we? Copy the data below into your own spreadsheet. Just click each cell and start typing.

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | | | | | | | | |
| 2 | 2 | | | | | | | | |
| 3 | 3 | | | | | | | | |
| 4 | 4 | | | | | | | | |
| 5 | 5 | | | | | | | | |
| 6 | 6 | | | | | | | | |
| 7 | 7 | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |

When you type into a cell directly, Excel assumes that what you're typing is a number if you enter only numbers. If you enter other characters, Excel will assume you're typing words.

If you like, you can also enter numbers and text into a cell by clicking the cell and then typing in the **formula bar**. This can be useful because the formula bar is usually much wider than a given cell, so it's easier to see what you're typing.

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | 1 | 3 | | | |
| 2 | 2 | | | | |
| 3 | 3 | | | | |
| 4 | 4 | | | | |
| 5 | 5 | | | | |
| 6 | 6 | | | | |
| 7 | 7 | | | | |
| 8 | | | | | |

Notice that when you highlight a cell, its formula always appears in the formula bar.

If you want Excel to do any thinking, you need to begin any cell with an "equals" character, "=". This tells excel that you are typing in a **formula** that you want it to solve.

Click on cell B1 and type the following, then press enter:

=A1

Notice that B1 now displays "1". If you change cell A1 to "3", B1 will also change to "3".

Now enter the following in cell B2 and press enter:

=A2+A3

Excel knows basic formulas that you can type like this. As long as you put an "=" at the start, excel will try to do the math that you enter. There are several other symbols Excel recognizes, for example:

+ for addition

\- for subtraction

\* for multiplication

/ for division

^ for exponents

() for use as mathematical parentheses

In addition to entering cell locations directly, you can also click on a cell to add it into a formula you are editing. Click on cell B3, type "=", then click cell A4, then type "+", then click cell A5. Notice that Excel filled the cells as you were editing, and that it also color-codes the cells.
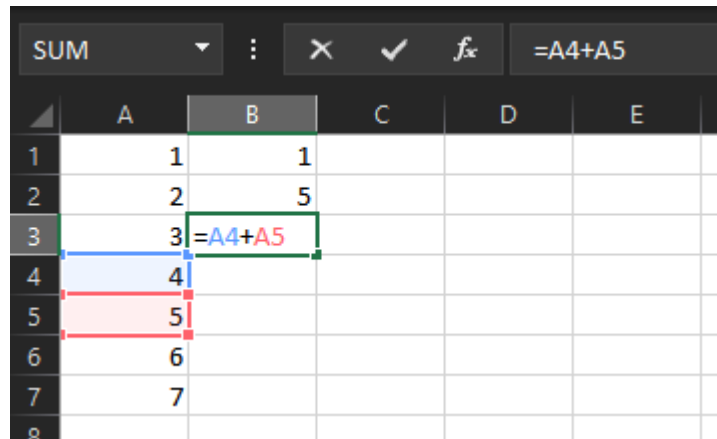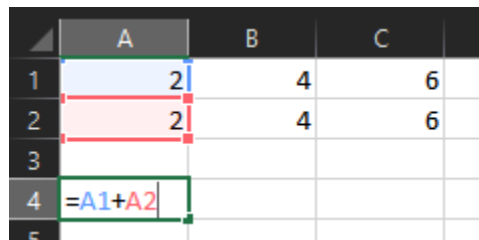
## Order of Operations

When Excel goes through a formula, it uses the standard PEMDAS (or BEDMAS) order of operations that you learned in grade school: parentheses first, the exponents, then multiplication/division, then addition/subtraction. It will perform each category, in order, from left to right. For longer formulas, it's always a good idea to add more parentheses so you can be sure Excel is doing the calculation the way you expect.
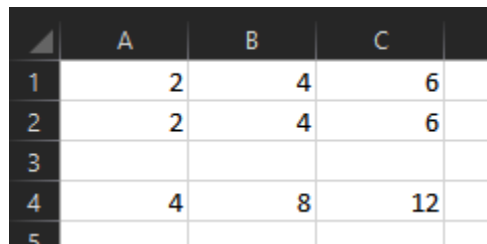
## Copying and Pasting

When you copy and paste a formula, Excel will try to adjust the references for each new cell you paste into. Try filling in this spreadsheet:

| | A | B | C |
|---|---|---|---|
| 1 | 2 | 4 | 6 |
| 2 | 2 | 4 | 6 |
| 3 | | | |
| 4 | =A1+A2 | | |
| 5 | | | |

When you press enter on cell A4, it will calculate the answer for you. If you copy cell A4 into cells B4 and C4, Excel adjusts the formula accordingly to calculate the sums B1+B2 and C1+C2, respectively.

| | A | B | C |
|---|---|---|---|
| 1 | 2 | 4 | 6 |
| 2 | 2 | 4 | 6 |
| 3 | | | |
| 4 | 4 | 8 | 12 |
| 5 | | | |

# Absolute and Relative References

By default, Excel uses **Relative Reference** in formulas. This means when you copy and paste a cell to a new location, the references change accordingly. If you wish to prevent this from happening, you can use **Absolute References** instead.

Copy the following spreadsheet:

| | A | B | C |
|---|---|---|---|
| 1 | 2 | 4 | 6 |
| 2 | 2 | 4 | 6 |
| 3 | | | |
| 4 | =A1+A2 | | |

Now copy cell A4 into cells B4 and C4. Notice that the references changed. Now edit cell A4 as follows:

| | A | B | C |
|---|---|---|---|
| 1 | 2 | 4 | 6 |
| 2 | 2 | 4 | 6 |
| 3 | | | |
| 4 | =$A$1+$A$2 | | |

Again, copy cell A4 into cells B4 and C4. You'll notice this time that the references did not change.

| | A | B | C |
|---|---|---|---|
| 1 | 2 | 4 | 6 |
| 2 | 2 | 4 | 6 |
| 3 | | | |
| 4 | 4 | 4 | =$A$1+$A$2 |

Adding a dollar sign ($) before the column and row makes the reference **Absolute**. These values will not change when you copy and paste or move the formula around the spreadsheet. You can mix & match absolute and relative references as you wish in a given formula.
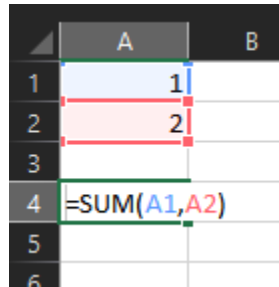
Additionally, you can create **Mixed References** by adding the dollar sign before only the column or only the row in a single reference. For example, A$1 will change column if the cell is copied into a new column, but it will not change row even if the cell is copied into a new row.

When typing a reference, you can press **F4** to automatically cycle between relative, absolute, and mixed reference types.

## Functions

For more complicated operations, you need to use **functions. Functions** are built-in operations that excel can perform. Excel 2019 currently has over 500 functions. ~~For this class you will need to memorize all of them~~. Just kidding. We'll go over some of the easy ones here, though. Work through on your own spreadsheet to see what happens.
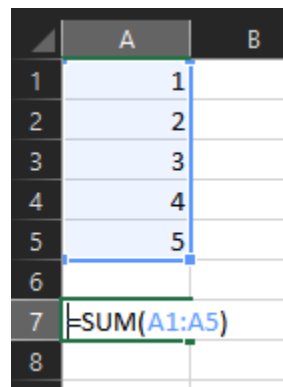
All functions work about the same way. After the equals sign, you type the **name of the function** (usually in all caps) followed by its **arguments** in parentheses. We'll explain using the SUM function.
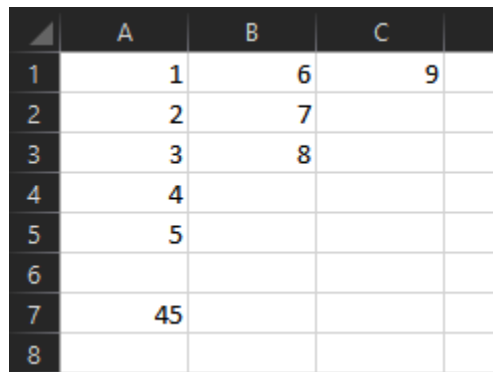


The calculate the sum of cells A1 and A2 above, we type "=SUM(A1,A2)" into cell A4. We can also select more than two cells if we like:



Here we've selected a **range** of cells by typing "=SUM(" and then **clicking and dragging** over the range, the typing ")". We can even select multiple ranges, or a combination of ranges and cells, by separating each with a comma. Try to duplicate this spreadsheet by entering the single digit numbers and using a single SUM function in cell A7:
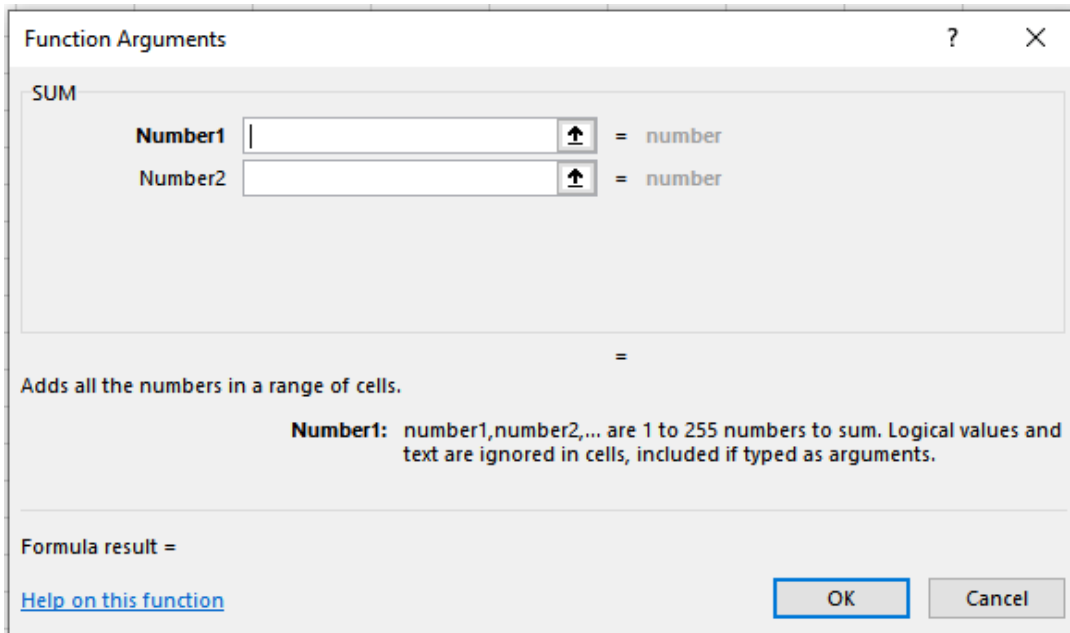
# Finding the Best Function for Your Lifestyle

A list of functions that are particularly useful to a chemistry student can be found at the end of this document. If you know the name of the function you want to use, typing it in as above is usually the fastest way to use it.

If you are trying to find a specific function and don't know the name, the best way to do so is to use the **Insert Function** dialog. You can access it by clicking the $f_x$ button next to the formula bar:
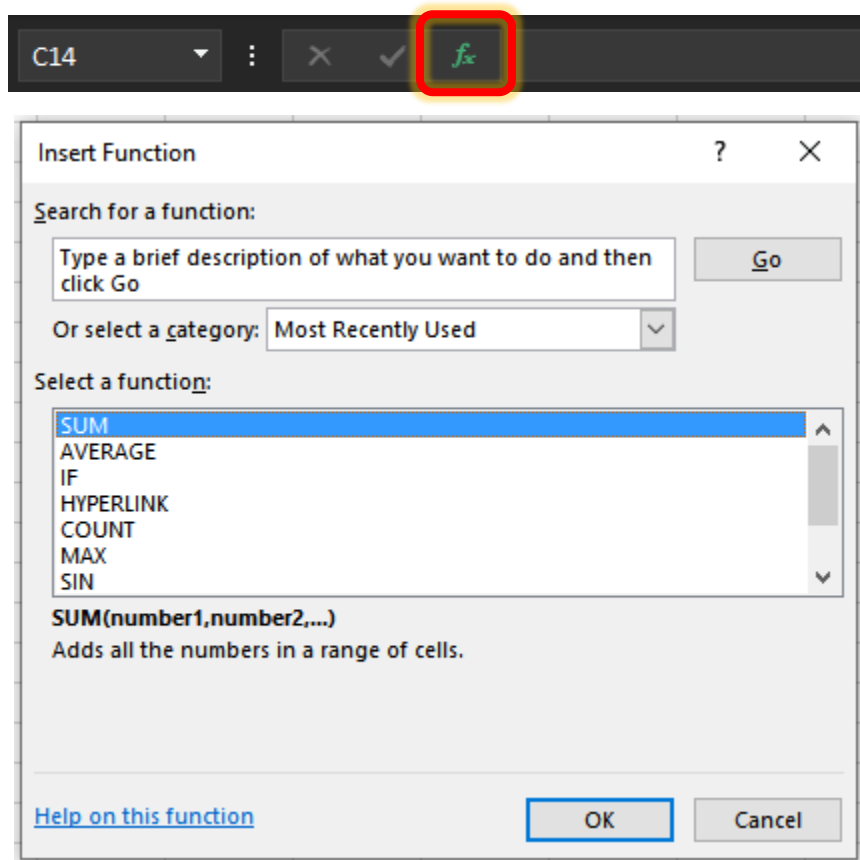


The Insert Function dialog contains a list of each function available in Excel, as well as several ways to search for the function you're looking for. This dialog also gives instructions for using each function. Notice above that the SUM function requires at least two numbers as arguments, but can take more, represented by the "…".

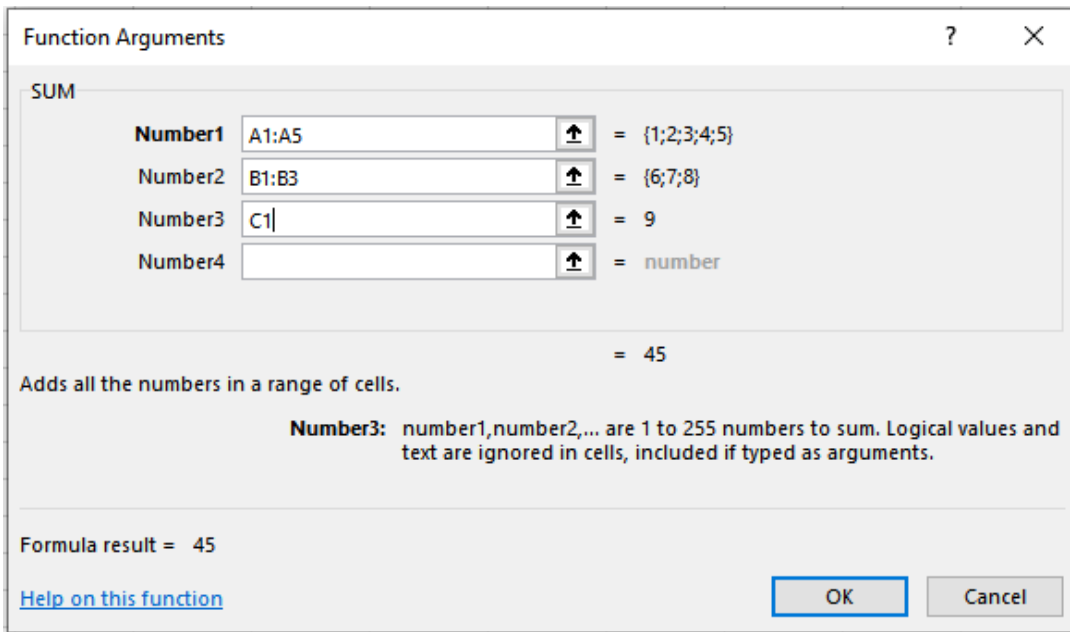Alternatively, you can select the function and click "OK" to bring up the **Arguments** dialog. Selecting SUM gives the following:

| Function Arguments | ? ✕ |
| --- | --- |

SUM

| Number1 | | = number |
| Number2 | | = number |

= 

Adds all the numbers in a range of cells.

Number1: number1,number2,... are 1 to 255 numbers to sum. Logical values and text are ignored in cells, included if typed as arguments.

Formula result =

Help on this function    OK    Cancel

We can type in actual numbers for each argument, or we can type cell names and ranges. If we want to select a cell or range of cells with our mouse, we can click the ⬆ button, select the range we're interested in, and then press enter.

| Function Arguments | ? ✕ |
| --- | --- |

SUM

| Number1 | A1:A5 | = {1;2;3;4;5} |
| Number2 | B1:B3 | = {6;7;8} |
| Number3 | C1 | = 9 |
| Number4 | | = number |

= 45

Adds all the numbers in a range of cells.

Number3: number1,number2,... are 1 to 255 numbers to sum. Logical values and text are ignored in cells, included if typed as arguments.

Formula result = 45

Help on this function    OK    Cancel

Note a couple things: Since SUM takes as many arguments as you like, Excel adds a line as you fill them. Excel also displays the values of each cell as you select them to help you stay organized. Finally, Excel displays the result of the formula at the bottom for you to check. Click "OK" to insert the function into the spreadsheet.
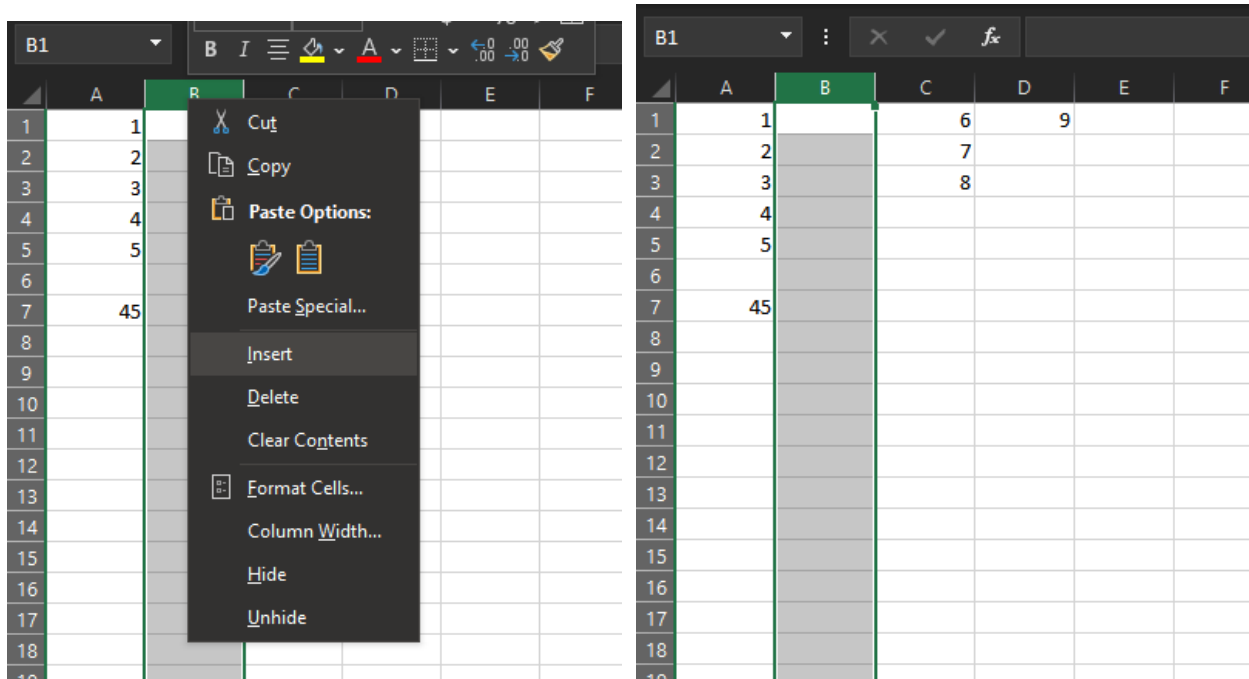
# Sheets

As your spreadsheets become more complicated and more densely packed with data, you'll need some special tools to help you organize and understand everything. Excel is packed with many helpful tricks that will make working with large amounts of data easier.

## Adding and Deleting Rows or Columns

Sometimes, you'll have a large amount of data in a spreadsheet and realize you need to squeeze an extra row or column in there. By adding a new row or column, Excel will slide everything out of the way *and* keep all your existing references and formulae intact.

To add a new column, simply right click on the column header, then click **Insert**. The new column will be inserted to the left of the column you selected.



The same procedure works for adding rows. In that case, the new row will be added above the row you select.

## Adding Sheets

Excel can save multiple spreadsheets to the same file. This can be useful for separating sections of you work or for keeping different sets of related data in the same file.

When you first open a file, Excel creates one spreadsheet and puts a tab for it in the lower left:
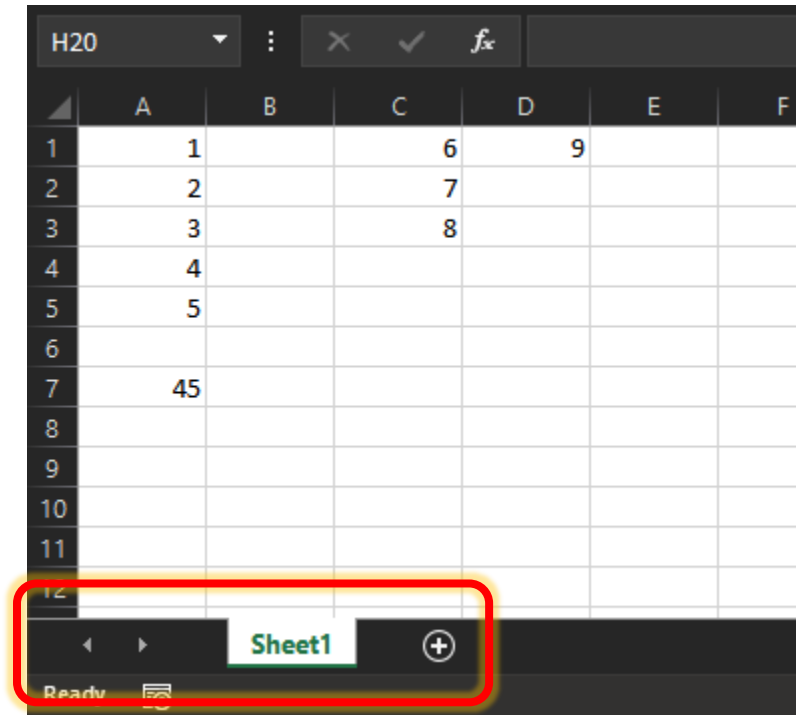


To add an additional sheet, just click the ⊕ icon next to the tab. The new tab appears to the far right.

Your new spreadsheet will be saved with the existing one in the same file and you can switch between them at any time. Cells in one sheet can reference cells in any other sheet, too: while editing a formula, you can change tabs and click cells just as you've done before.

# Renaming and Labeling Sheets

If you'd like, you can change the labels on your sheets to make it easier to keep track of them.
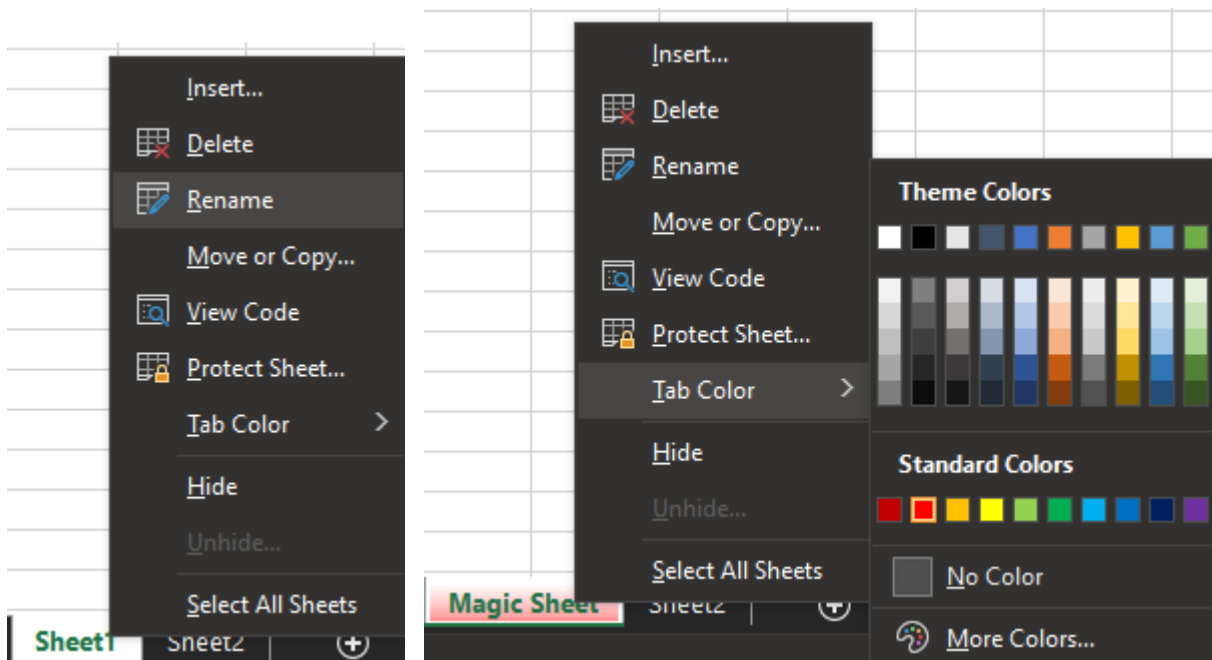


Just right click on the tab and select **Rename**, then type your new name and hit enter. You can also use the **Tab Color** option to add a highlight to your tabs.

## Copying, Deleting and Reordering Sheets

Once you've got several tabs, you can move them around by simply dragging the tabs. Alternatively, you can right click a tab and select **Move or Copy**.
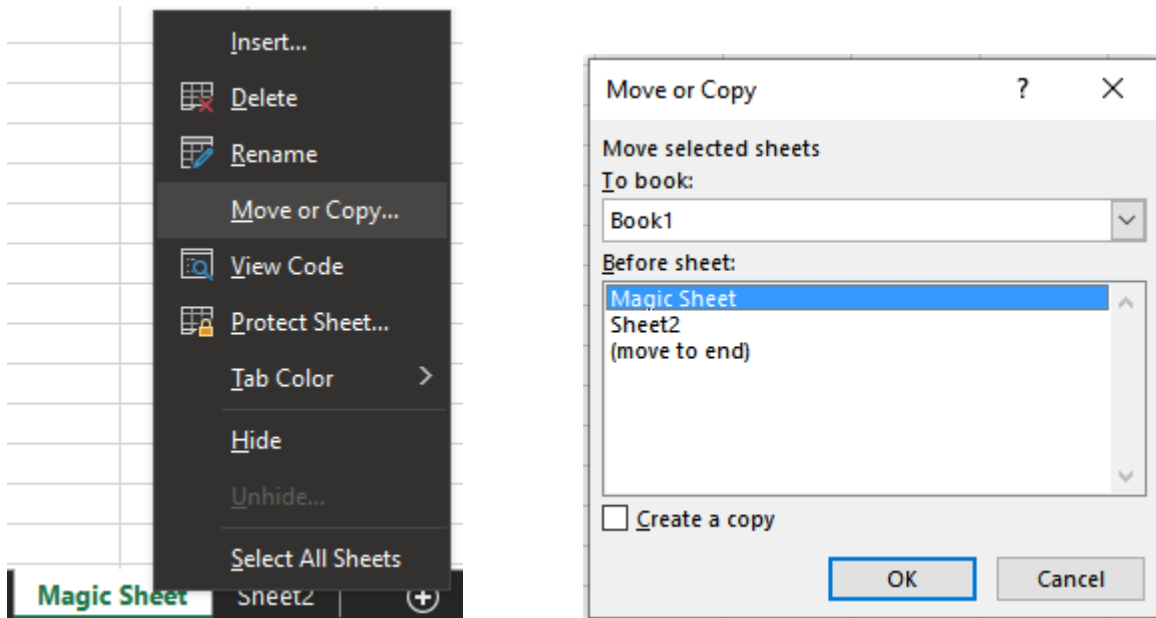


You'll see the dialog box above, which allows you to select the precise location you'd like to move your tab to. If you check the **Create a copy** tickbox, Excel will add a new copy of the sheet to the location you select while leaving the current copy where it is.

Note that you can also use this function to easily move or copy tabs between open files. The **To book:** dropdown box will list all the Excel files you currently have open, allowing you to pick whichever you like.

To delete a tab, simply select the **Delete** option on the same right click menu. Be careful: Excel does not let you undo a deletion like this.

# Split

If your data takes up more room than you have on your screen, you obviously won't be able to view it all at once. But what if you want to look at different parts of your data that aren't close enough to fit on screen at the same time? For this, we use the **Split** option.
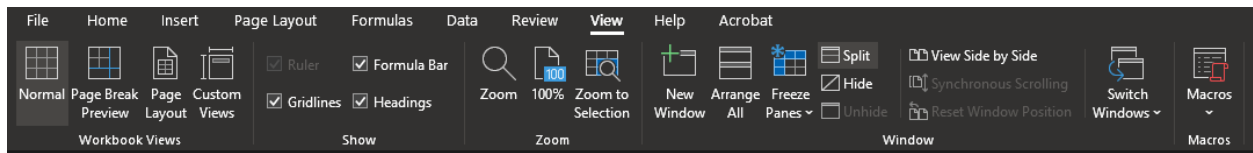


First, click cell C3 in your spreadsheet. Then, switch your ribbon to the **View** tab and select the **Split** button. You'll notice that some gray lines appear.



Those gray lines separate your spreadsheet into four separate split-windows. Each has its own scrollbars and can be moved independently. You can click and drag on the gray borders to make each split whatever size you choose.

If you wish to get rid of a split, you can simply double-click the border. If you want to get rid of all splits, you can click the **Split** button in the **View** ribbon again.

If you only want a horizontal or vertical split, you can first select a cell in row 1 or column A.

## Hide

If you have several rows or columns that you don't want cluttering up your screen, you can hide them by right clicking the row or column header and selecting **Hide**.
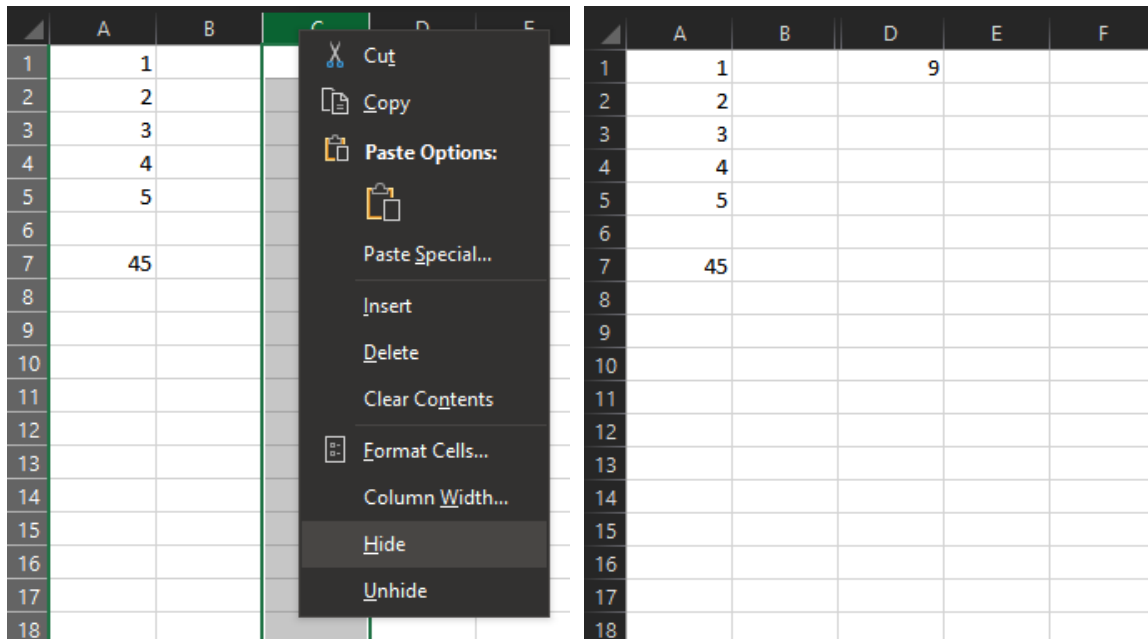


You'll notice that the column names didn't change. In our example, Excel appears to skip from column B to column C. All data in and any references to column C will still work, Excel is simply not displaying the column to you.

If you want to view a hidden column or row again, you should select a set of multiple columns or rows that overlaps with the hidden one(s). Right click and select **Unhide** and they'll appear again.
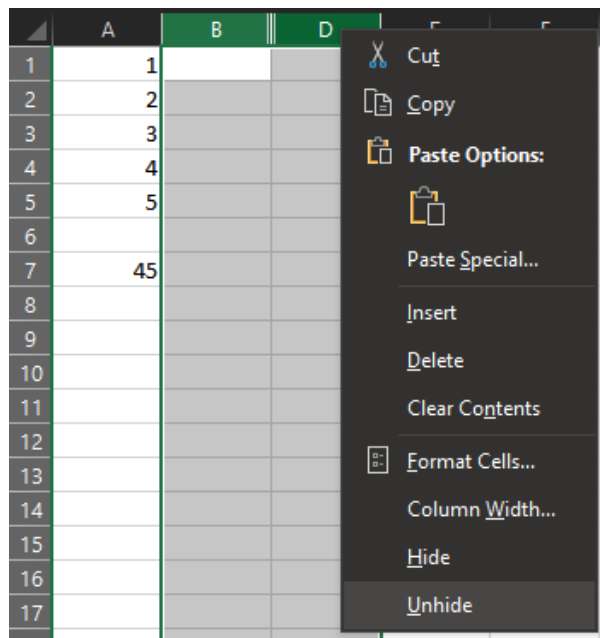
# Freeze Panes

If you have a large amount of data with labels in the first row or column (or both), you may want to keep those labels visible at all times. A neater option for this to **Freeze Panes**. This works similarly to to **Split**, except only for the first few rows or columns. You may also use it at the same time as a separate **Split**, if you're feeling adventurous.

To freeze one or more rows or columns, switch to the **View** tab in the ribbon and select **Freeze Panes**.
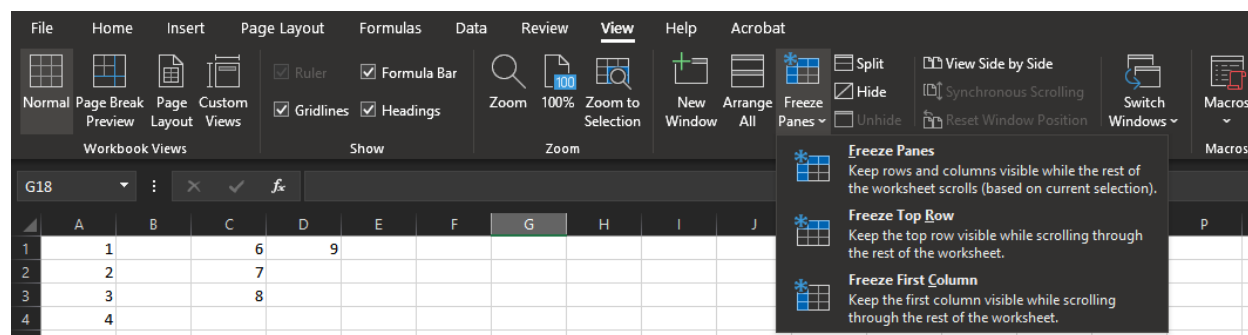


You'll notice three options. **Freeze Top Row** and **Freeze First Column** both do exactly what they say: they'll free the appropriate area and keep it on screen. **Freeze Panes** works in the same way as the **Split** button did: it will freeze based on the cell you have currently selected.

Unlinke splits, a freeze can't scroll and can't be resized. It's useful to keep you from accidentally scrolling away from your labels with your mouse wheel.

To unfreeze, simply click the **Freeze Panes** button again and select the **Unfreeze Panes** option.

# Fomatting

To a scientist, Excel sometimes formats numbers in an odd way. Excel loves to hack away trailing zeros or display way too many decimal places. Luckily, adjust what's displayed is easy. You can also label numbers and text, such as homework answers or final calculated values, to make it stand out.

## The Format Cells Dialog

Right click on any cell in your spreadsheet and click on the **Format Cells** option. You can also highlight any range of cells to change their format all at once.
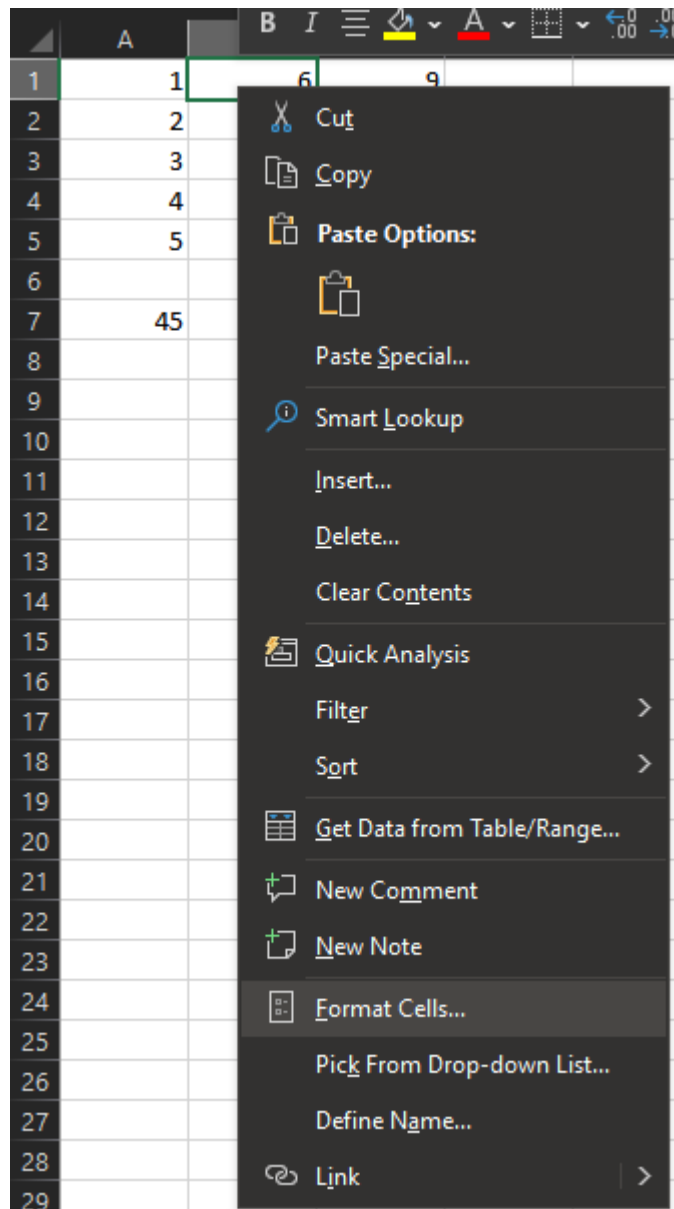
What comes up is the **Format Cells** dialog:
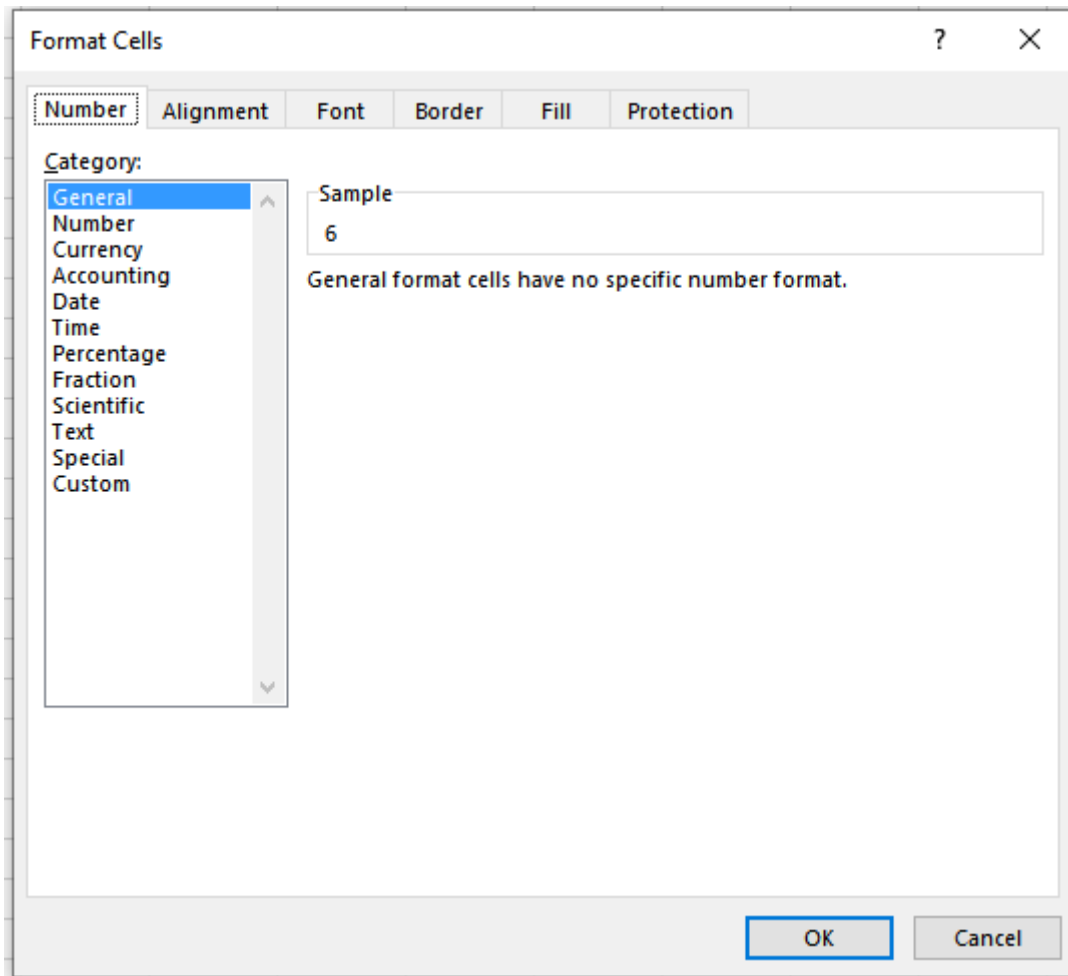


There are several tabs of options here, but we'll focus on just a few for now.

In the **Number** tab you'll find a list of ways for Excel to display your cell's data. Some highlights for an average student:

- **General** lets Excel do the choosing. This is the default option.
- **Number** forces Excel to display a certain number of decimal places, useful when your data has significant zeros at the end or when you need to limit the number of sig figs shown.
- **Accounting** will line up the decimal places in a column, which is useful for making neat tables. Be sure to select the option to turn off the currency symbol if you're not actually working with money.
- **Scientific** forces the number to display in scientific/engineering notation. It also lets you specify the number of decimal places shown.
- **Text** forces Excel to treat the cell like it is filled with plain text, so it won't try to format a number.

The other options have their time and place but are generally unneeded in most classes. You should make a note of them, though. Sometimes you might enter a number and see that Excel has reformatted your cell as if you had entered a date or time. In this case, you should go to the **Format Cells** dialog and change the category to **Number** or **Text** so things display correctly.

Also of note in this dialog are the **Font**, **Border** and **Fill** tabs. These will allow you to stylize a cell to make it stand out. You probably shouldn't use anything too flashy in a homework or labwork assignment, but making final answers stand out by **Fill**ing the cell yellow can make your grader's life easier.

Some of the above options are available on the **Home** tab of the ribbon, too:
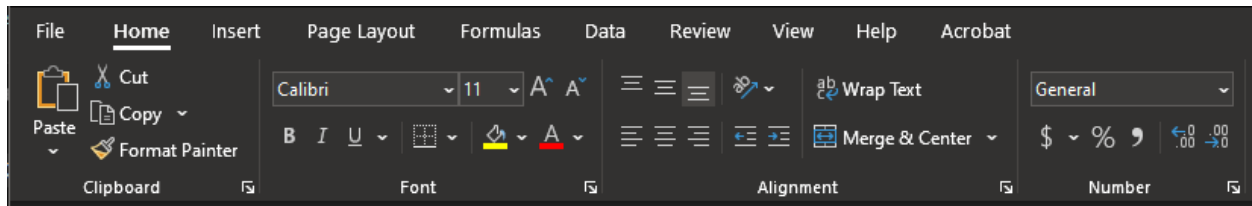


The section labeled **Font**, **Alignment**, and **Number** contain a selection of the most-used options from their respective tabs in the **Cell Styles** dialog. You can also click the ⬚ button to jump straight to their corresponding tabs in the dialog.

## Adjusting Decimal Places

Since significant figures are so important to scientific and engineering work, let's go over how to display them correctly. Enter the number "1.23456" into cell A1.
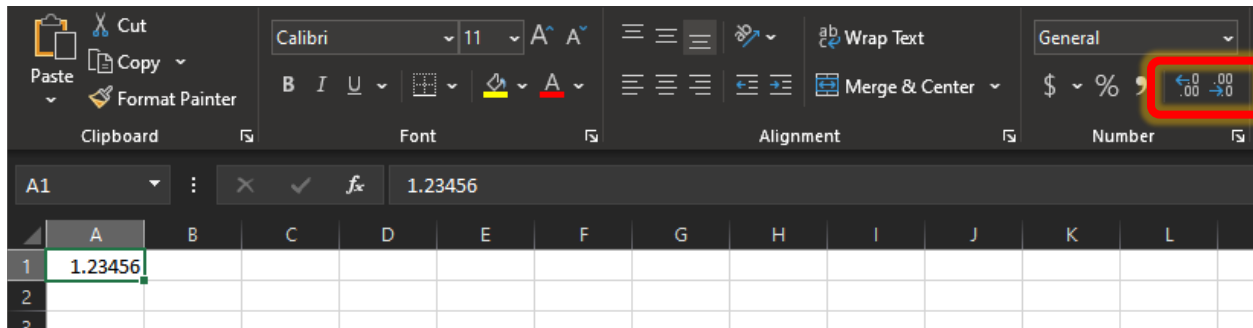


Use the  buttons on the ribbon to adjust the number of displayed decimal places quickly. Notice that you can increase the number of displayed digits to include many trailing zeros. You can also reduce the number of displayed digits and Excel will round the number accordingly.

When you reduce the number of displayed digits, Excel doesn't forget them: you can still use all of the digits that you entered in further calculations. Try reducing the displayed digits in A1 to just one decimal place and entering "=4*A1" into cell B1.
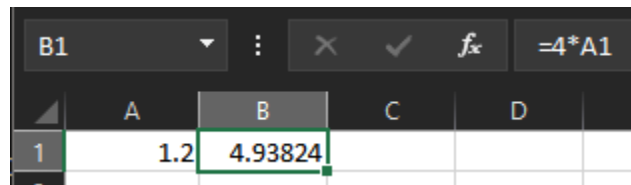


Even though we've rounded the number in cell A1 down to 1.2, Excel still uses the entire number to do our calculation. Keep this in mind when you need to report a number to a certain number of significant figures but still use the number in future calculations.

# Cell Styles

Excel contains several pre-made cell styles to make labeling data fast and easy. On the Home tab of the ribbon, you'll find the **Styles** group, which contains a list of such styles.
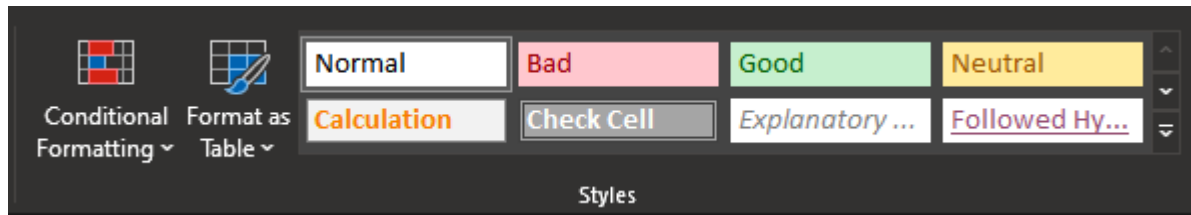


You can click the  button to see the full list of styles. If your screen is too small, you might see a button for the styles, instead. Clicking this button will bring up a list of styles to choose from.



In either case, you'll find a list of styles to help you make certain parts of your spreadsheet stand out. It's not a bad idea to get into the habit of labeling data with these styles as you go when you want to come back again later to look at it.

# Show All Formulae

When reviewing a spreadsheet, sometimes it's helpful to see every formula you've entered. To see an individual formula, you can simply click the cell of interest and look at the formula bar.
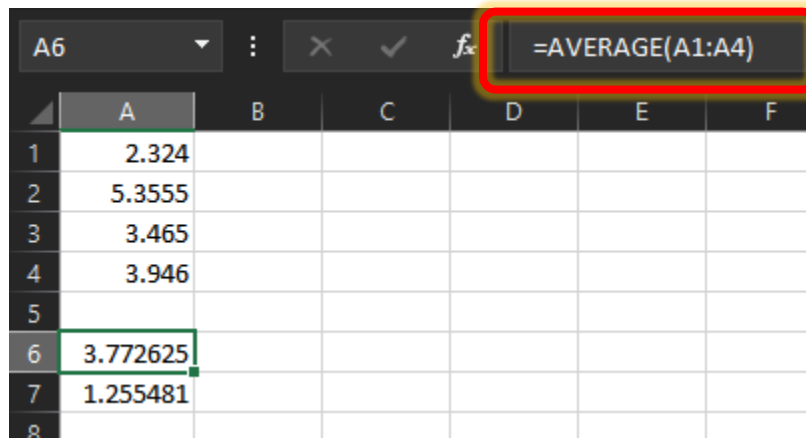


If you'd like to view the formulae for *every* cell at the same time, navigate to the **Formulas** tab in the ribbon and select the **Show Formulas** button in the **Formula Auditing** group.
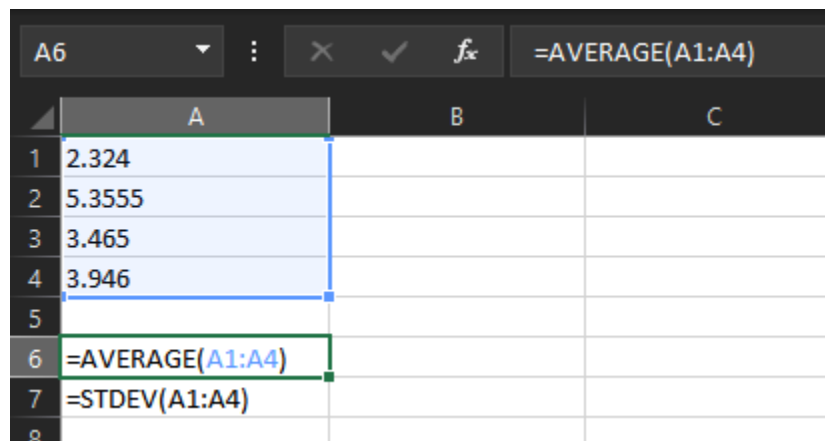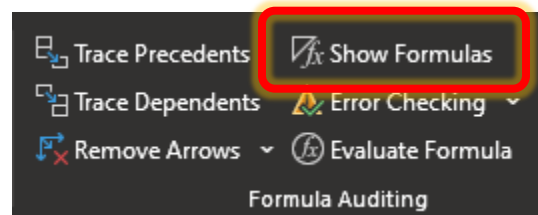




When **Show Formulas** is active, clicking on any cell will automatically highlight and color code any references, allowing you to easily check your work.

To exit **Show Formulas** mode, just click the **Show Formulas** button again.
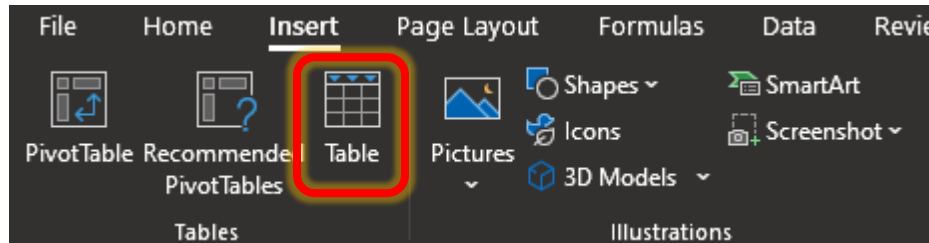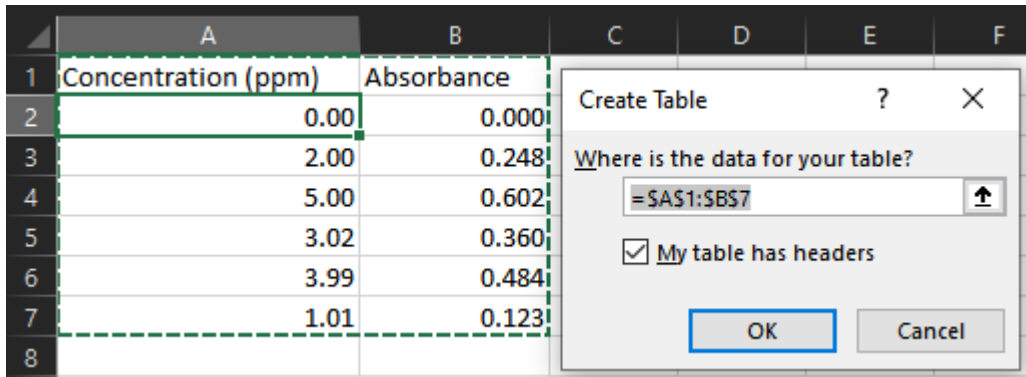
# Tables

## Creating Tables

When you enter data into Excel, it's a good idea to organize it into a table. Let's pretend we've collected some data on a range of concentrations of iron using a spectrophotometer. Enter the following data into Excel so you can follow along:

| | A | B |
|---|---|---|
| 1 | Concentration (ppm) | Absorbance |
| 2 | 0.00 | 0.000 |
| 3 | 2.00 | 0.248 |
| 4 | 5.00 | 0.602 |
| 5 | 3.02 | 0.360 |
| 6 | 3.99 | 0.484 |
| 7 | 1.01 | 0.123 |

If Excel is cutting off your trailing zeros, remember to use **Cell Styles** (instructions above).

This data is fine, but it's all out of order, and we can make it look a lot better. Click on any cell in the data set, then navigate to the **Insert** tab on the ribbon. Click the **Table** button in the **Tables** group. The **Create Table** dialog box will appear.

Notice that Excel automatically selected the set of data we entered. If it hasn't selected the data you wanted, click the ⬆ button and you can select any group you like.

Our table has headers (labels on the top cell of each column), so be sure the **My table has headers** tickbox is checked. Then click okay and see the magic.

# Sorting and Filtering



You'll notice that Excel has decorated your table to make it easier to read. It's also created a new tab on the ribbon, **Table Design**. There are some useful features that creating a table like this enables:
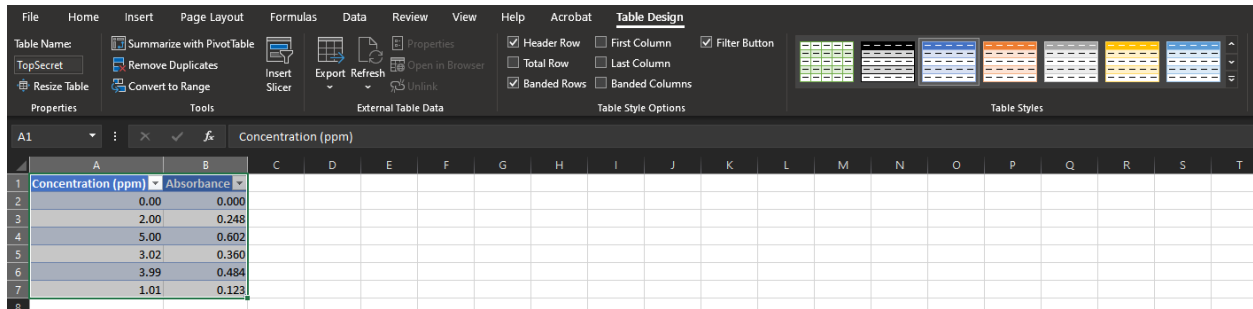
| Concentration (ppm) | Absorbance |
|---|---|
| 0.00 | 0.000 |
| 2.00 | 0.248 |
| 5.00 | 0.602 |
| 3.02 | 0.360 |
| 3.99 | 0.484 |
| 1.01 | 0.123 |

The  small arrow button next to each header brings up several sorting options for the data contained within.
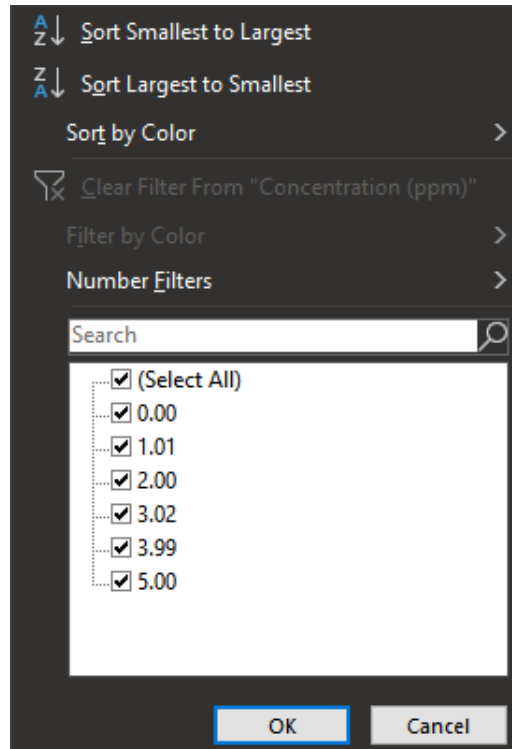
By choosing the appropriate option, we can sort the column in several ways, including by formatting. Our data is numerical, so the sorting options are numerical. Text fields can be sorted alphabetically, dates can be sorted chronologically, etc. If your data is formatted, you can even sort by the formatting options you've chosen.

Additionally, you'll notice several filtering options, again depending on the type of data in that column. Using the filter option, you can display only rows containing specific data. You can even choose the rows to display manually. This can be useful for displaying only a given range of data at a time.

Our data was out of order before, but by selecting to sort **smallest to largest** we can view the data much more easily.



Notice that the arrow button next to the Concentration (ppm) header changed to show the current sort.

# Table Styles

Multiple design options are available for tables. You'll find them in the **Table Design** tab of the ribbon. Note that this tab will only appear if you select a cell within a table.
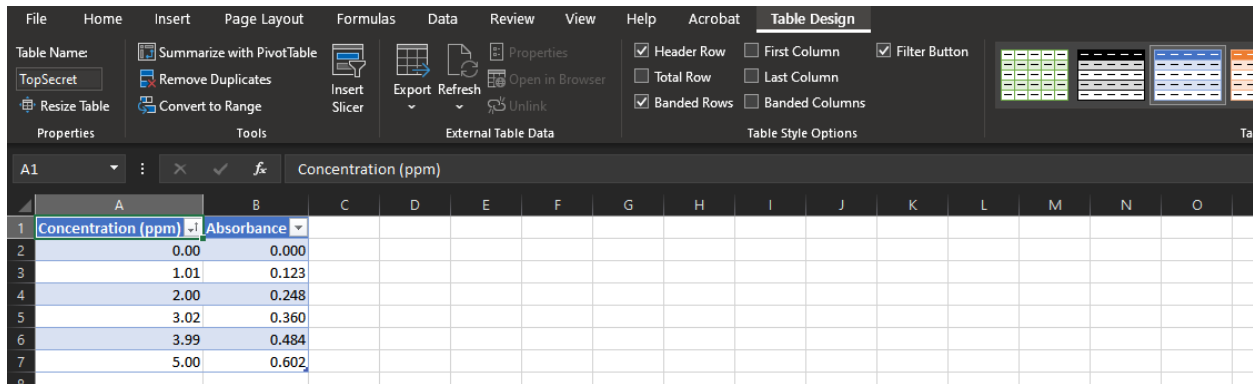


The **Table Styles** group contains a list of pre-made styles to choose from. You can click the ⏷ button to see all of them.

The **Table Style Options** group contains tickboxes that will add or remove features of a table. In particular, you can hide the header row, add or remove banding (the alternating colors along rows or columns), and hide the ⏷ button next to each header.

# Remove a Table

To convert a table back to regular cells again, click any cell in the table, then click the **Convert to Range** button in the **Table Design** tab in the ribbon.
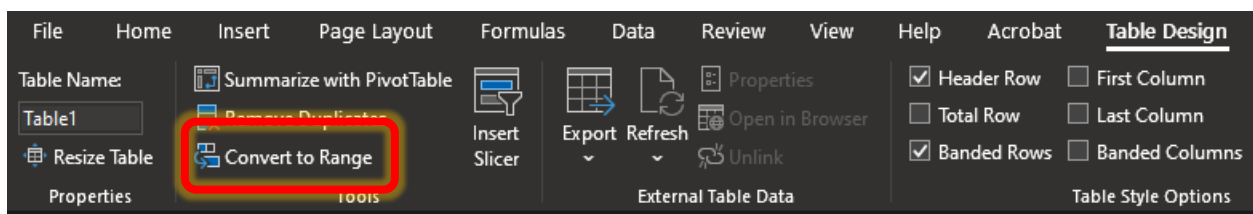


This will keep all the formatting of the table. If you wish to remove that, select all the cells in the former table, and select the **Normal** style in the **Home** tab.

# Graphs and Charts

Excel, for some reason, refers to graphs as **Charts**. We'll use the terms interchangeably. Remember that the word choice will vary based on the field that you go into the future.

## Inserting a Chart

Adding a chart is easy, simply navigate to the **Insert** tab on the ribbon to see your options in the **Charts** group. By hovering your mouse over each button, Excel will bring up a tooltip explaining the chart type. The simplest way to plot data is the **Scatter Plot**, which plots each data point on graph and does nothing more. To create one, first enter in data to make the following table:



Select the entire range of data, including the headers, then click the **Scatter Plot** button.
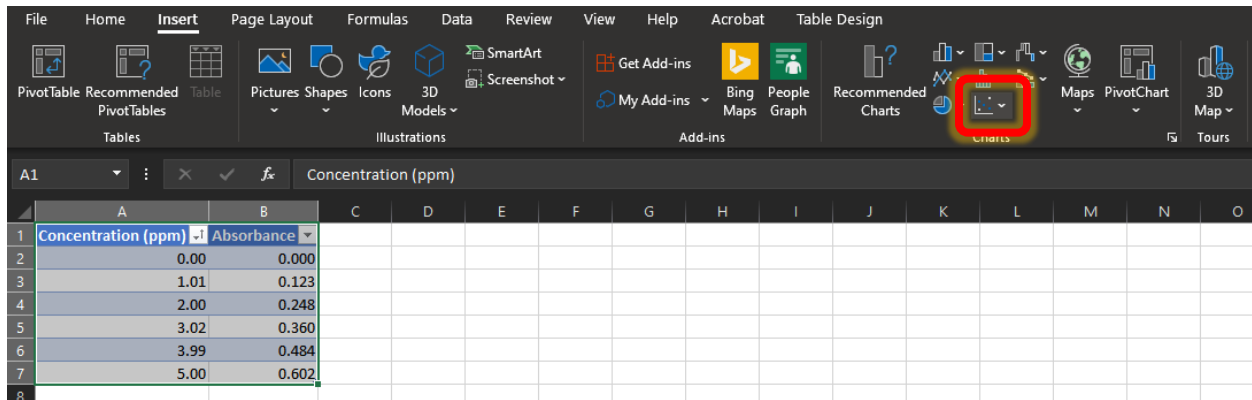


This brings up a menu with several options. In most scientific contexts we *do not* want to connect out plot points direct, so select the first option, **Scatter**.
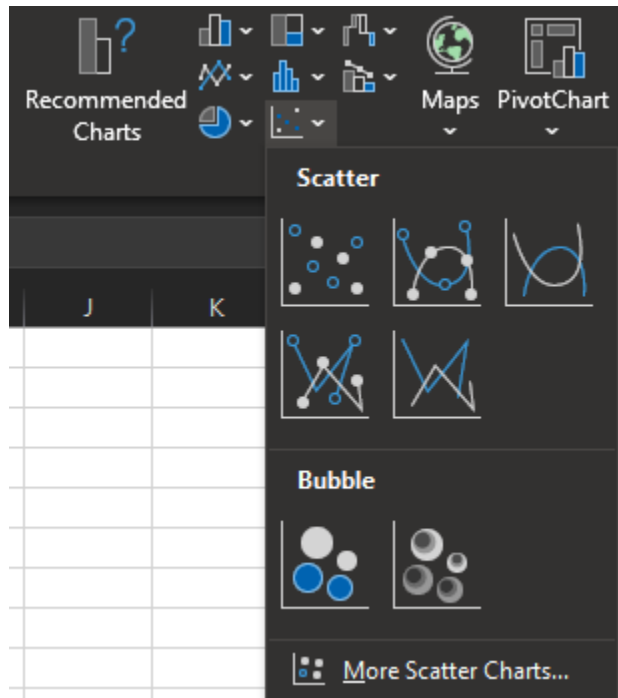
Your chart will be placed in the center of your screen. If you hold your mouse over a blank part of the chart, the cursor will change to include crossing arrows ✛. This indicates that you can drag the chart to another location if you wish. In Excel, charts do not take up a cell. They can be placed anywhere, including covering up existing data, so be sure to put your chart somewhere it won't get in the way.
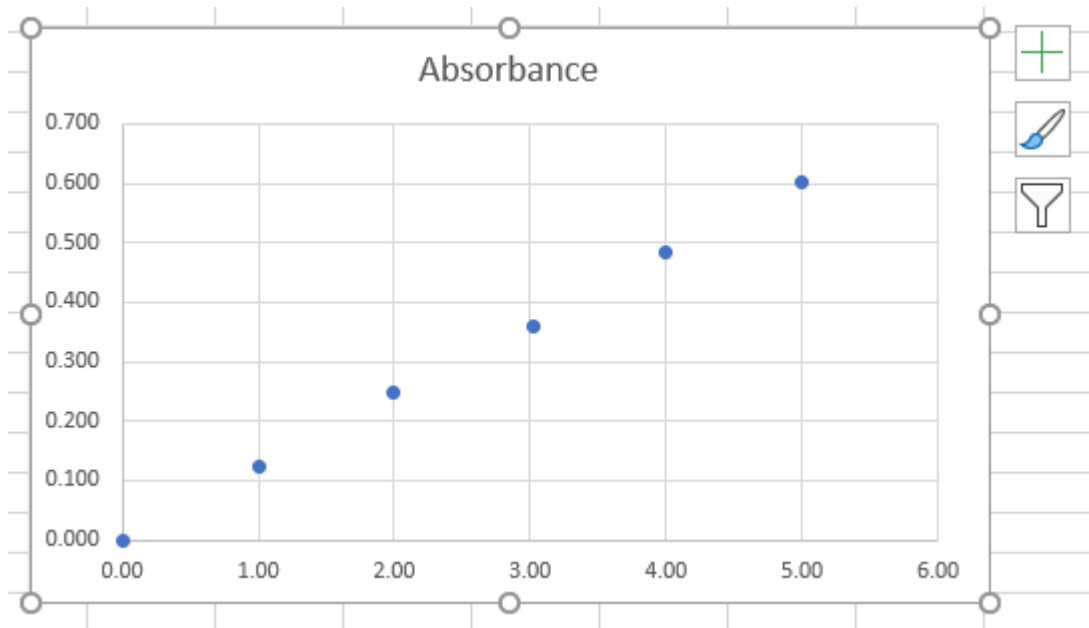


When you have your chart selected, you'll notice that two additional tabs are available on the ribbon: **Chart Design** and **Format**. These contain all the options you'll need to make your chart perfect.

# Changing or Adding Data

Once your chart is placed, you can edit the data it contains by clicking the **Select Data** button in the **Chart Design** tab of the ribbon.
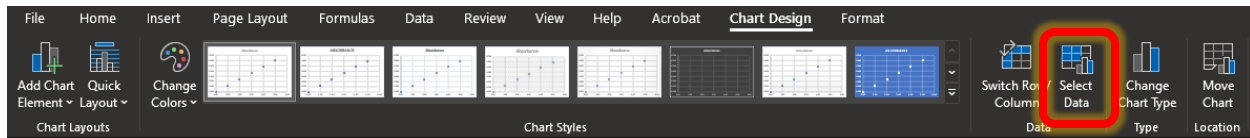


This will bring up the **Select Data** dialog:
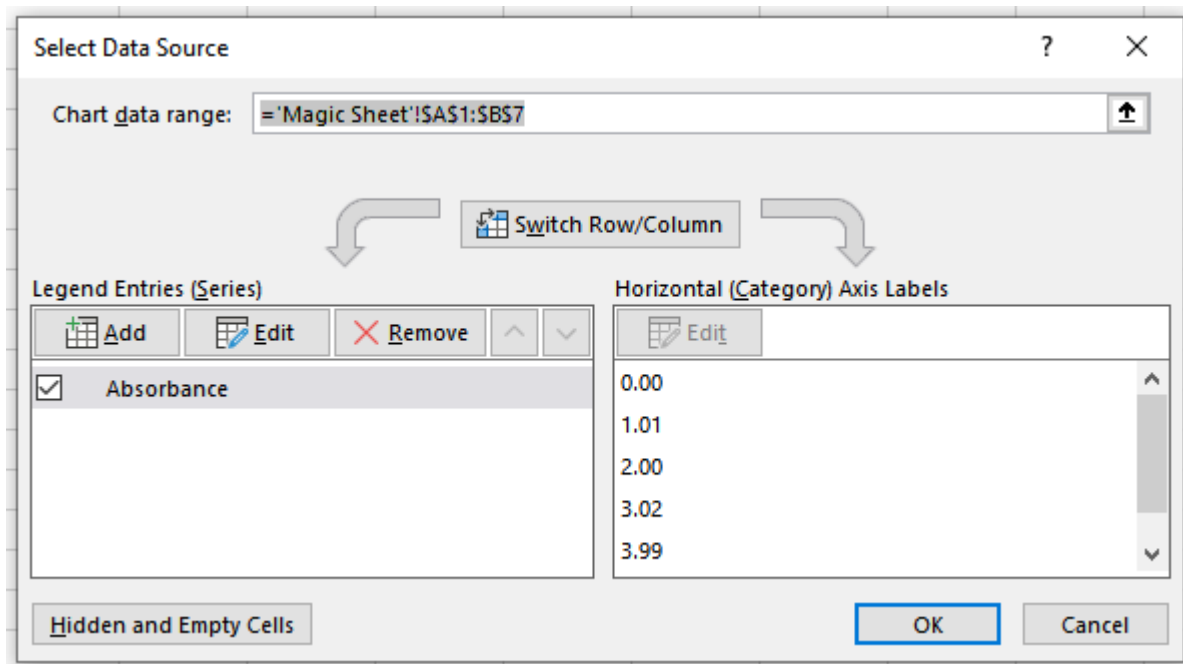


If the data that automatically populated your chart looks terrible, click the **Edit** to alter the data or the **Remove** button to start from scratch. To add a new data set, click **Add**.
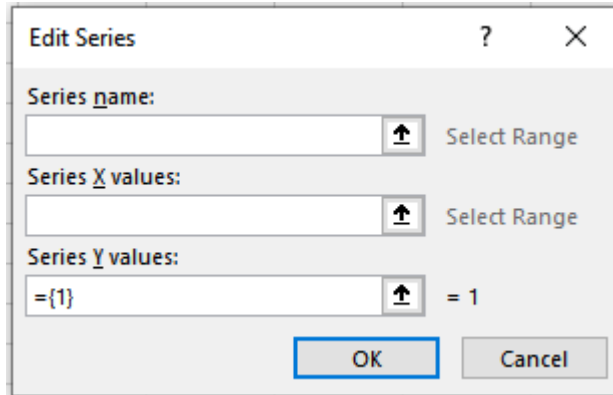
The **Add** and **Edit** buttons lead to the same dialog (except that the fields will already have data in them if you clicked **Edit**). The dialog requests three ranges, representing the name of the series and the X and Y values. To select a range, click the ⬆ button. Select the appropriate range of data and press Enter. You can also type a name into the **Series name** field if you like.

Excel likes to put "={1}" in the **Series Y values** field by default for some reason. You'll need to delete it before you add your own data.

Using this method, you can add as many data sets to the same chart as you like.

# Trendlines

You may want to add what Excel calls a "trendline" to you chart. A trendline shows the prevailing trend in a chart's data and, contrary to the name, may be linear or curved.

To add a trendline, click on your chart, navigate to the **Chart Design** tab of the ribbon, and select the **Add Chart Element** button. In the menu that appears, select **Trendline**, followed by **Linear**.

When the trendline appears, double click on the line to bring up the **Format Trendline** pane.
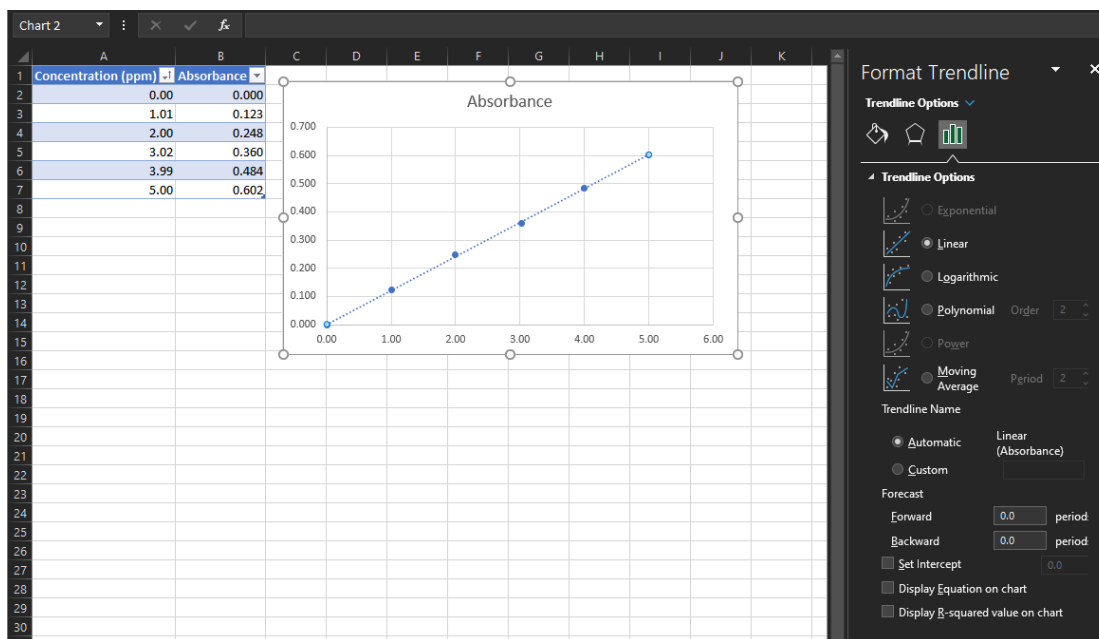


There are lots of options here, but we'll start with the third tab, **Trendline Options**. Here, you can select the shape of your trendline by clicking the appropriate radio button (note that since our data contains a zero some of the options are unavailable). Our data is clearly linear, so select that. The linear trendline is calculated using the linear least squares method.

Other options here can be useful in a variety of contexts:

- **Trendline Name** allows you to set a name which appears in the chart key, if one is added
- **Forecast** allows you to extend the trendline beyond the data points. This is especially useful to show the intercepts of the line or to compare to other data.
- **Set Intercept** allows you to force the trendline to intercept the y-axis at a specific point.
- **Display Equation on chart** will calculate and display the equation of the trendline on the chart.
- **Display R-squared value on chart** will calculate and display a value representing how well the trendline fits the available data.

For many scientific contexts, you'll want to select the **Display Equation on chart** and **Display R-squared value** on chart options. The values appear on your chart immediately:

**Absorbance**

y = 0.1203x + 0.0017
R² = 0.9997
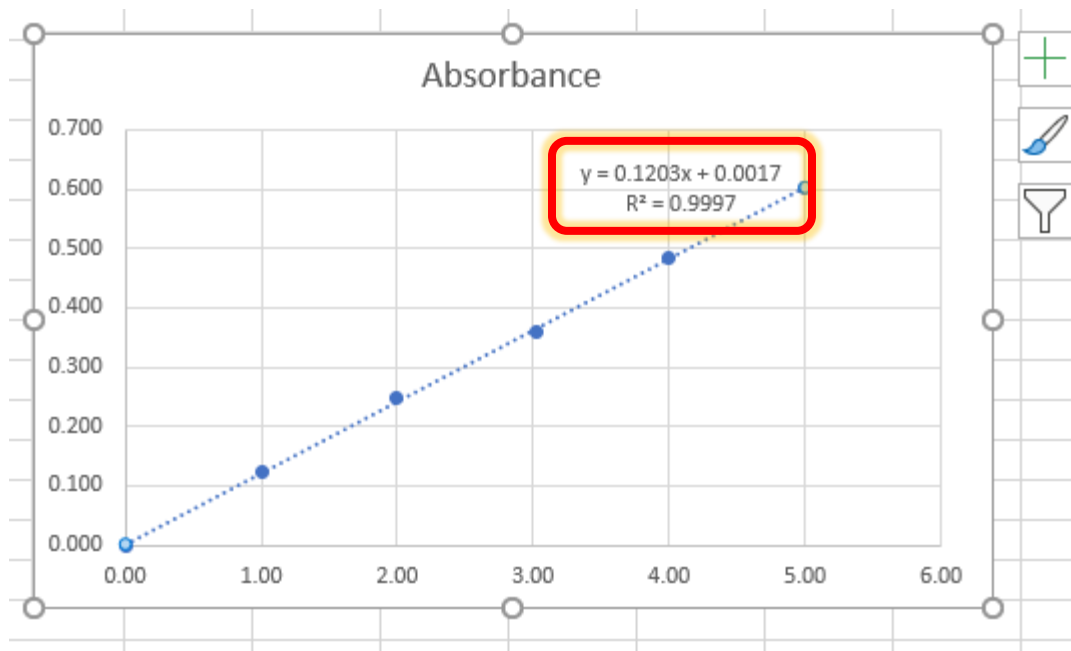
Once they appear, you can click on the equation and r-squared values and drag them around. Be sure to put them somewhere they'll be legible!

The other tabs in the **Format Trendline** pane allow you to alter the appearance of your trendline, but these changes are cosmetic only. For now, we'll leave things as they are.

# Error Bars

If your data has error associated with it, you can add several kinds of error bars to your chart to represent it. To start, click anywhere on your chart and navigate again to the **Chart Design** tab in the ribbon. Click the **Add Chart Element** button, then **Error Bars**. You'll notice that Excel offers three options: error bars based on the standard error or standard deviation of the data set, as well as error bars of a set size. While these can sometimes be useful, usually we'll want to use our own data, so select **More Error Bars Options**.
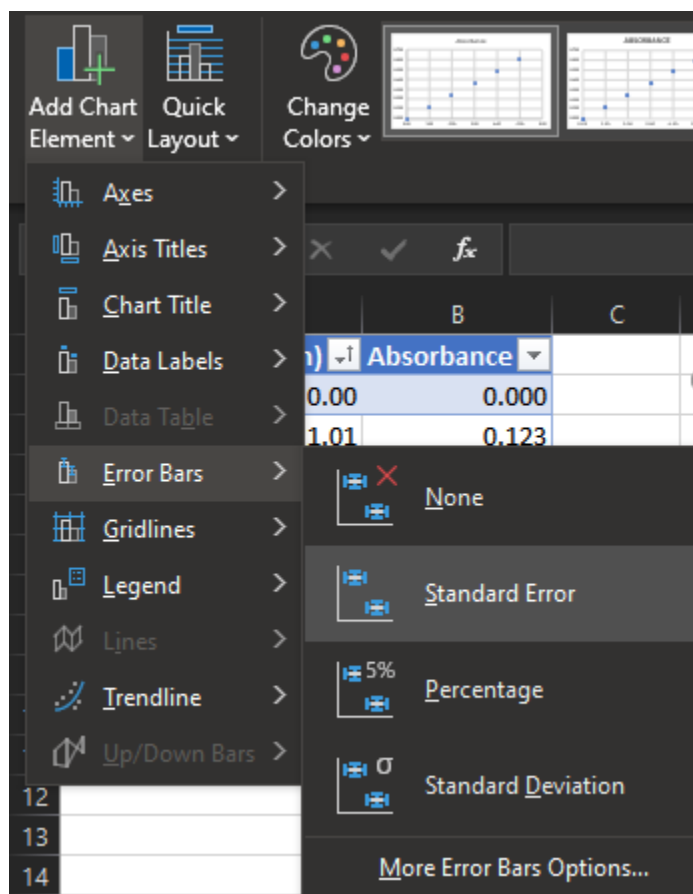
This will place some gigantic error bars on your chart and display the **Format Error Bars** pane.
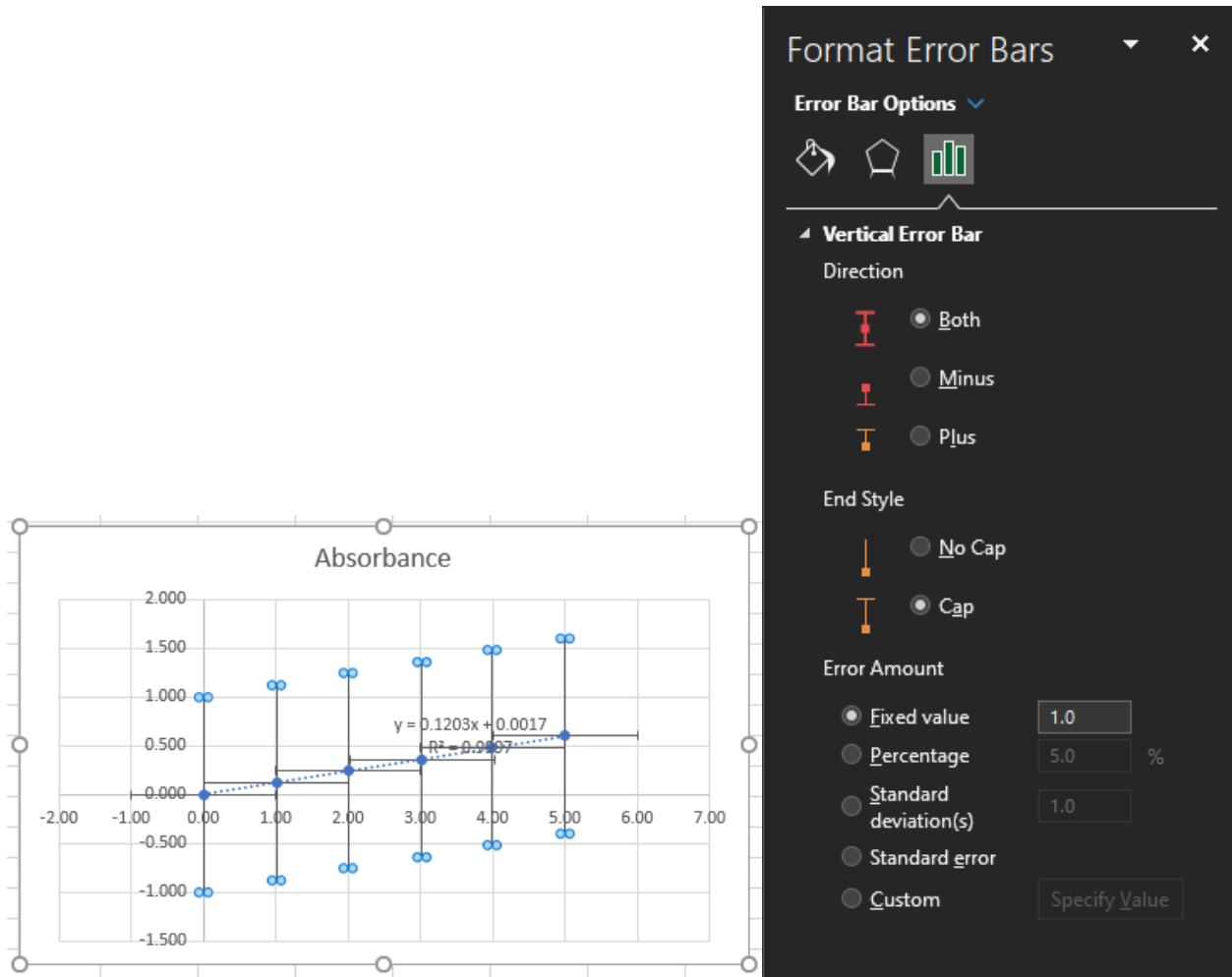


If you don't want error bars on both the vertical and horizontal axes, you can delete them. Let's delete the horizontal error bars by clicking on any one of the horizontal bars and pressing the Delete key on the keyboard.

Next, click on one of the remaining vertical error bars to select them all. Change the **Formal Error Bars** pane to the **Error Bar Options** tab by clicking the 📊 button. Here you'll see some design options:

- **Direction** allows you to choose to display error on side only if you wish.
- **End Style** enables or disables the "cap" at the end of the line.
- **Error Amount** allows you to choose how long the error bars are

If you have a column of data that you wish to use, you can click the **Custom** radio button under **Error Amount** and select that data. Otherwise, the most typical error bars are based on standard error, so select that for our chart.

# Axis and Chart Labels

A proper chart has labels on its axes and a title. To add these elements, click **Add Chart Element** in the **Chart Design** tab of the ribbon, then select the appropriate option.
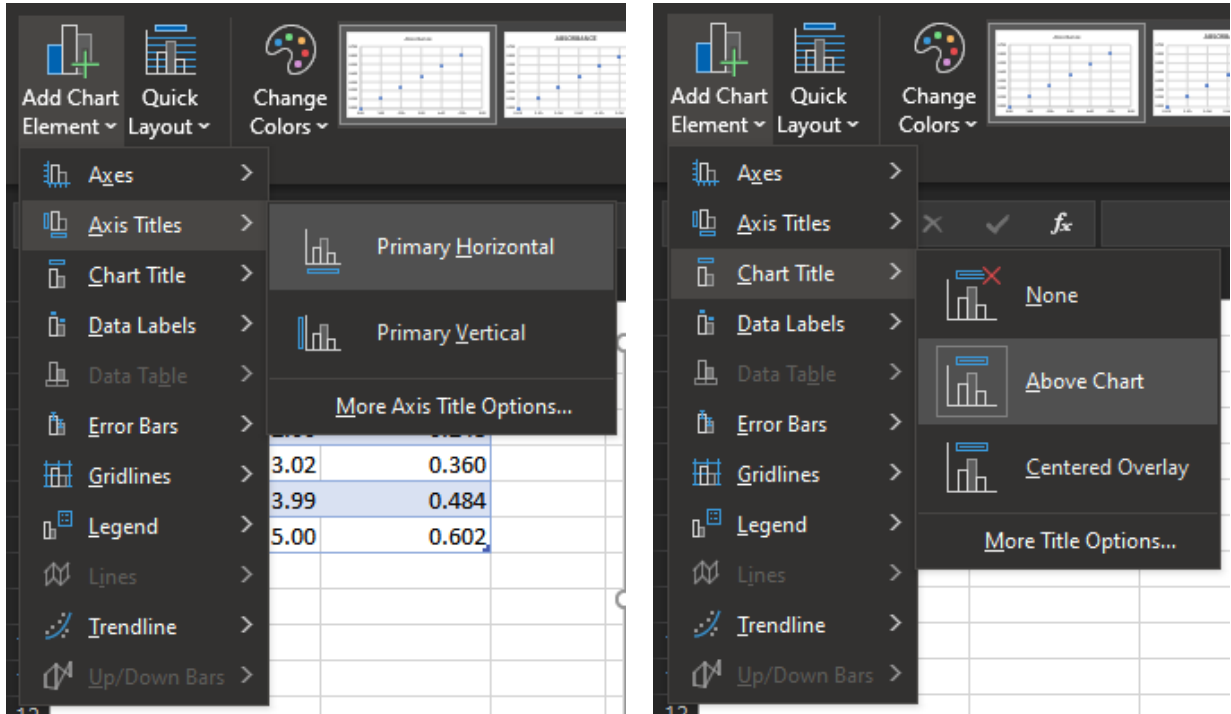


For most charts, you'll want to add both horizontal and vertical axis titles, as well as a chart title above the chart. Click each option to add them.

Once they appear on your chart, click once on the chart title to select it. A box appears around the title. You'll notice that if you hover your mouse over the text, your cursor changes to the text edit bar. Click again to place the cursor and you can edit the text. Repeat this procedure to label the axes as well.
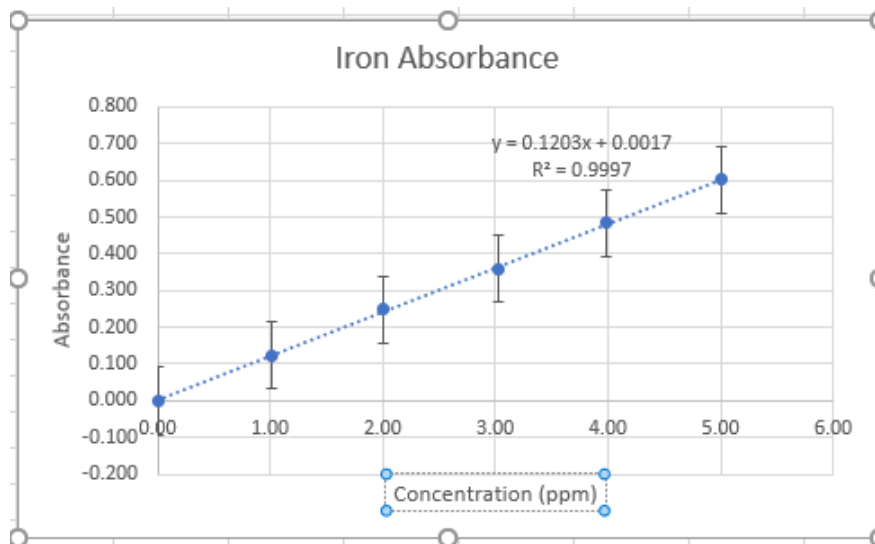
# Exporting a Chart to Microsoft Word or Powerpoint

You might be tempted to take a screenshot of your chart to paste into Microsoft Word, but this can result in a blurry or pixelated chart. What's more, a screenshot isn't editable.

Instead, right click the chart and select **Copy**. Then open your Word document, right click where you'd like the chart to go and select **Paste**. Pasting the chart directly like this has several advantages:

- The chart can be resized and will always look crisp and clean.
- The chart can be stretched to a different shape without stretching the text.
- Chart elements, such as the title or axis labels, can be edited or deleted directly in Word.
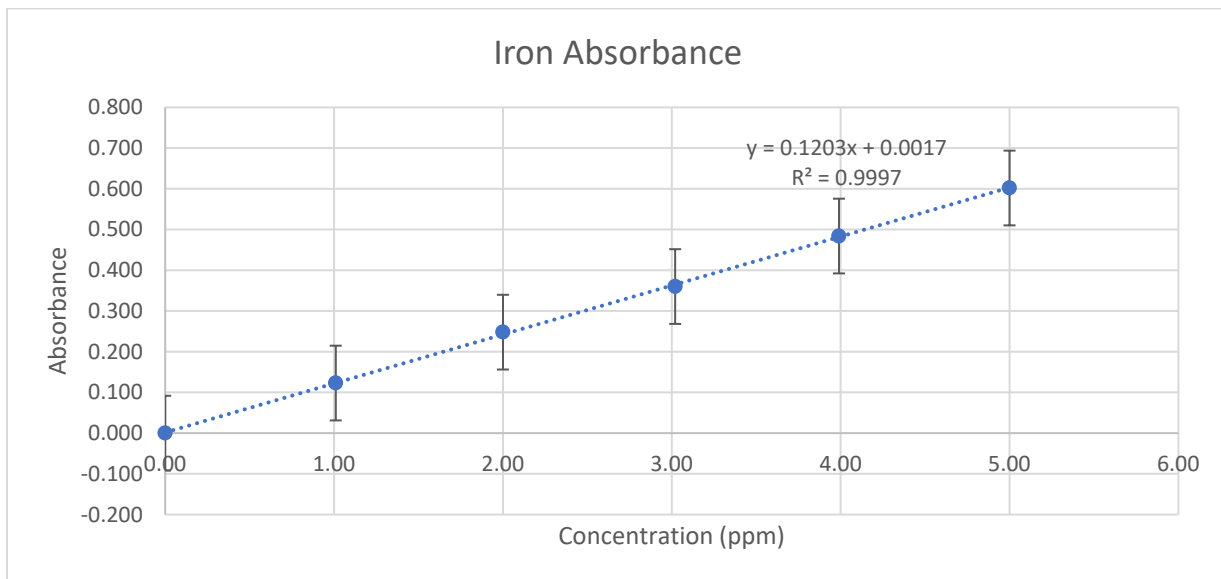


The above chart was pasted directly from Excel. You can see how much better it looks than the screenshots above, right?

# Other File Formats

In addition to the standard XLS and XLSX file formats in Excel, you'll sometimes be given data in other, more generic formats. These require a little bit of work to get correct.

## Opening a CSV File

Comma Separated Values (CSV) files are an older generic format for saving spreadsheets. While they store numbers and text in a grid format similar to Excel's, they do not store any of the extra information that Excel is capable of adding. For this reason, you'll want to be sure you're handling these files correctly.

Because CSV files normally open in Excel, you'll have to pay attention when you download a file to know its format. First, check the extension on the file. If the file ends in the .csv extension, you'll know it's a CSV file. Many computers are configured to *not* show file extensions, but Excel will always display the extension in its title bar.
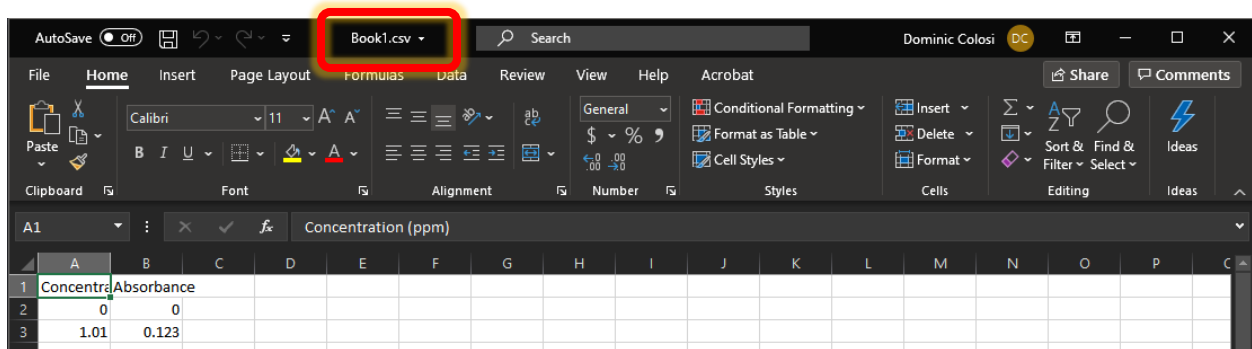


If you're going to be working on a CSV file in Excel, the first thing you should *always* do is to resave the file in XLSX format.

To do this, open **File** in the ribbon, then select **Save As**.
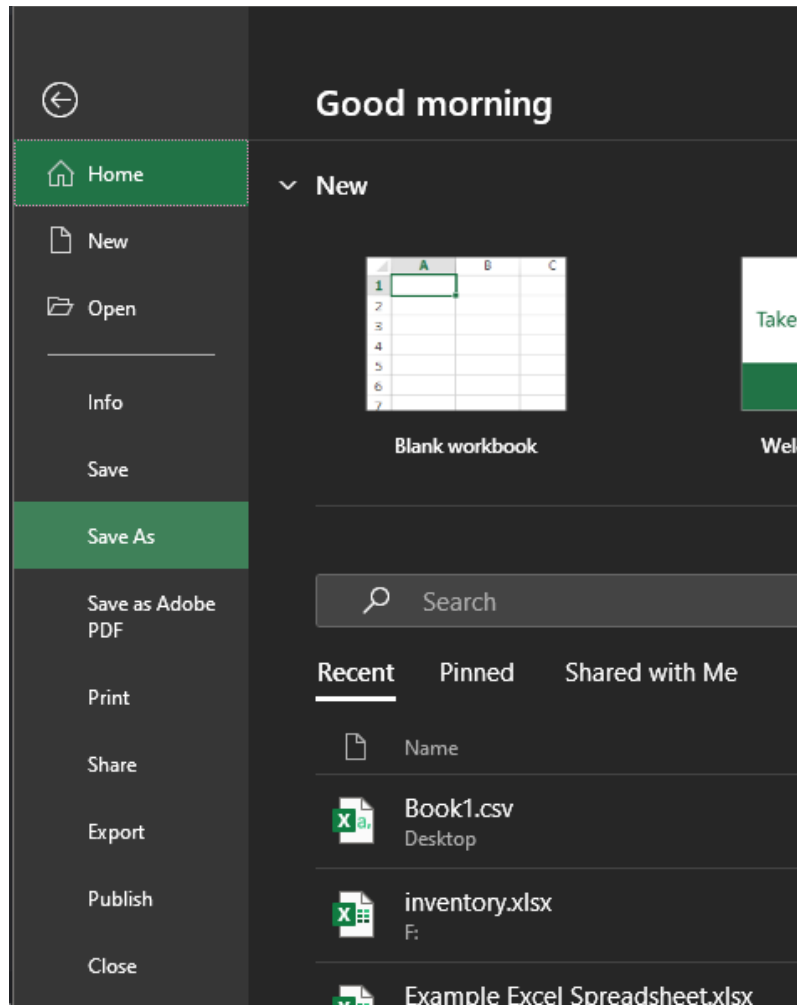


The **Save As** window will have the option to change the file format, where you should select **Excel Workbook (*.xlsx)**.
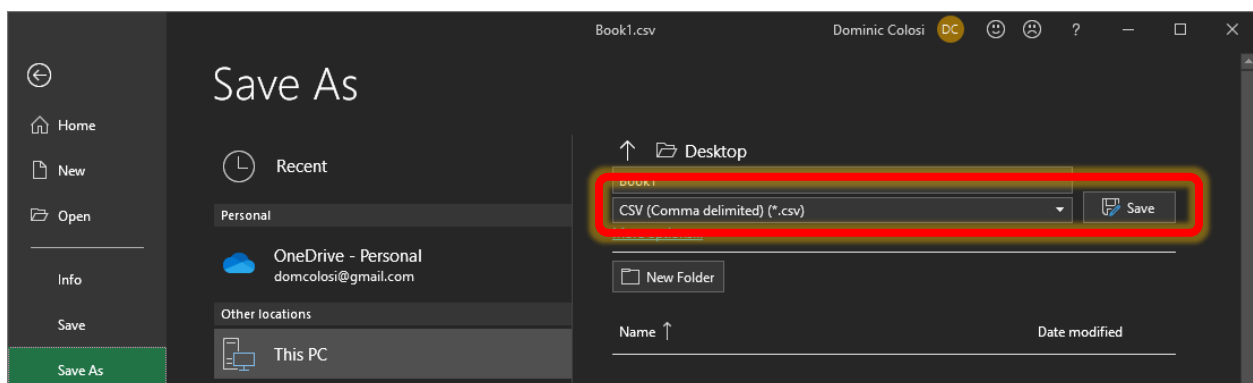


Once the file is resaved as an Excel workbook, you can edit it as normal without fear that your formatting and charts won't be saved.

# Opening a TXT File

Some instrumentation will export data in TXT format. Usually, Excel will not open these files by default. Instead, first open Excel and navigate to **File** in the ribbon, then click **Open**, followed by **Browse**.
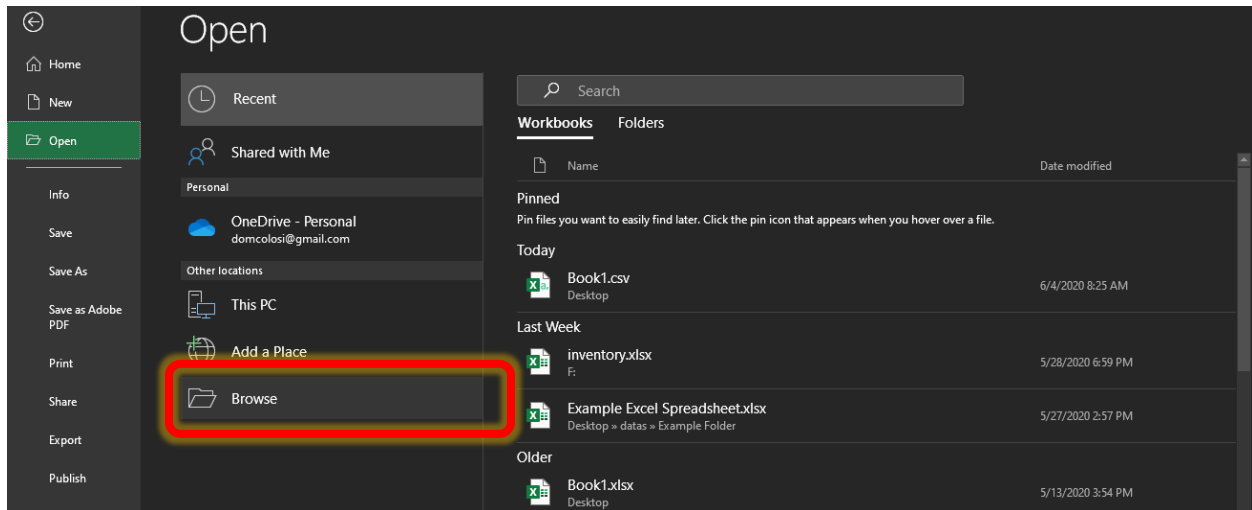


In the **Open** dialog that appears, change the file formats to **All Files (*.*)**. This will allow you to see all file formats while you browse.
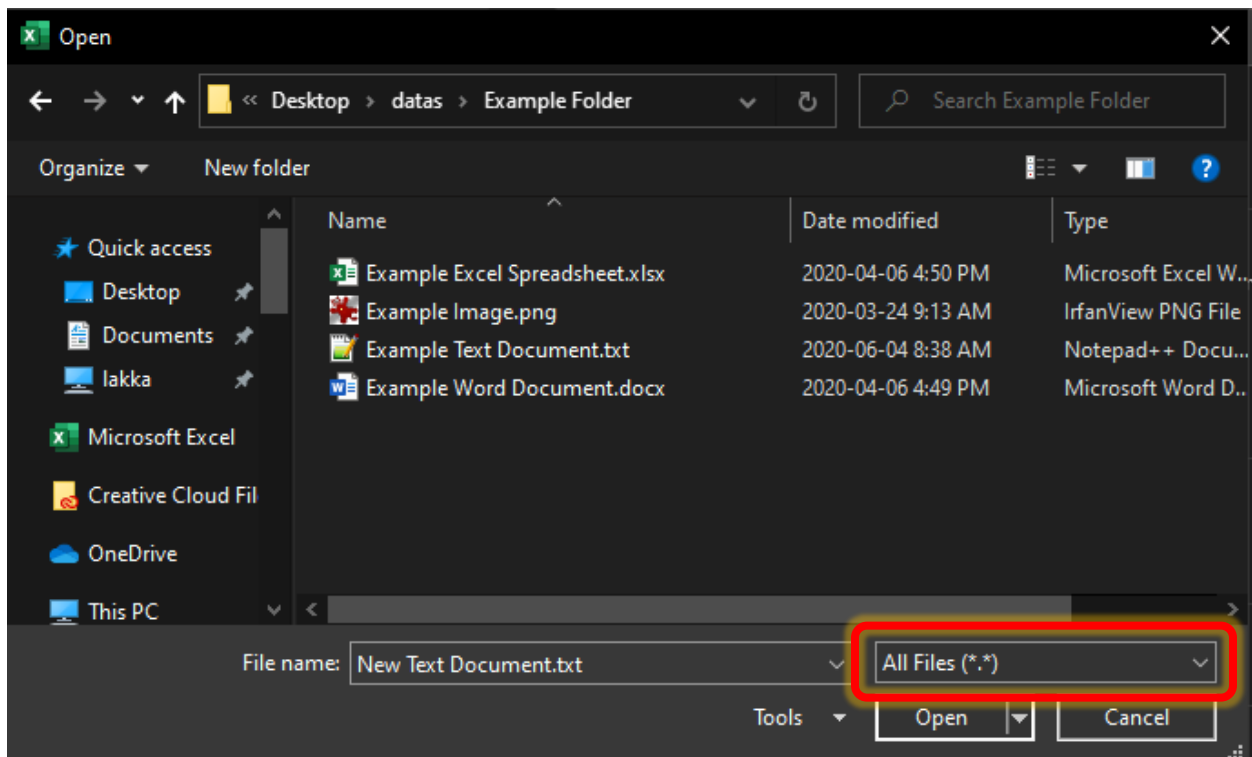


Browse to your TXT file and open it like normal. Excel will recognize that the file is in TXT format and bring up the **Text Import Wizard** dialog. If the file contains spreadsheet data, it will look something like this:
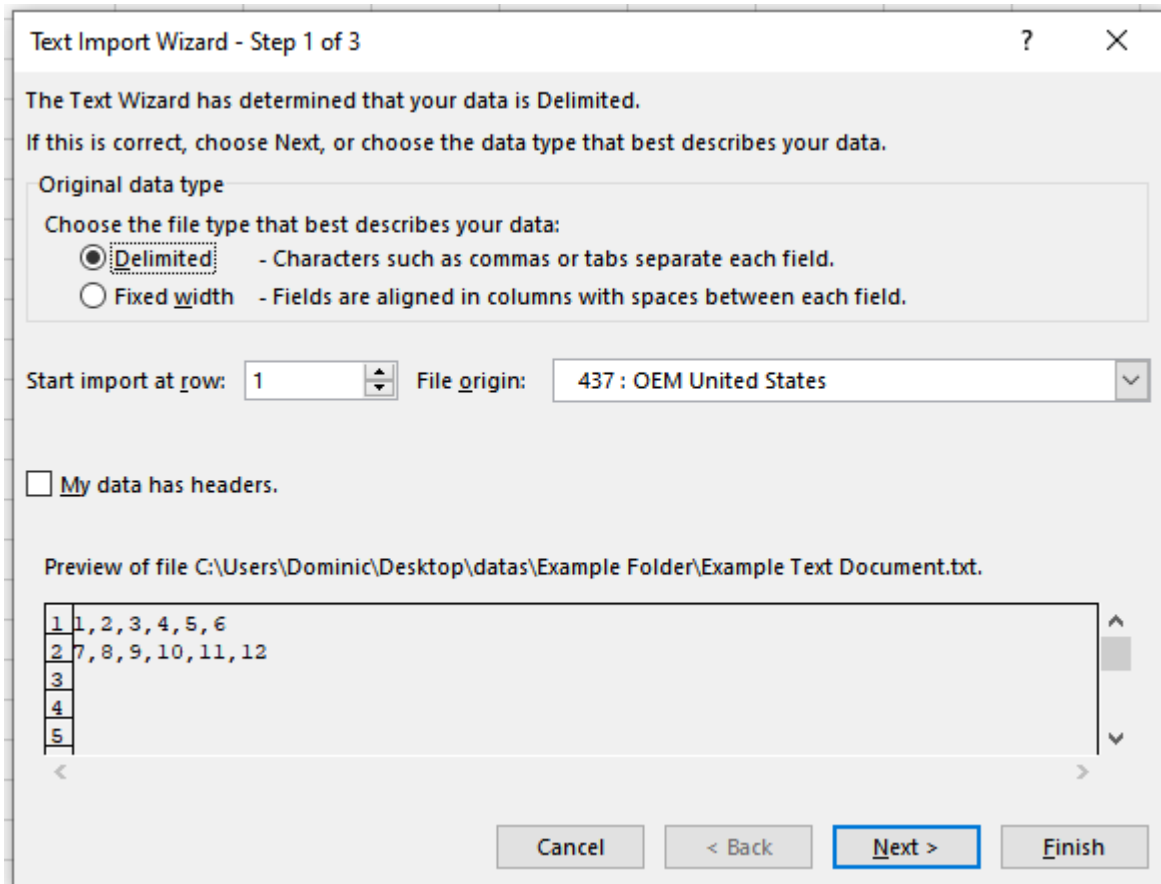
The options you select here will depend on the file itself, but Excel is usually smart enough to pre-select all the right choices for you. Our example file is comma delimited, meaning it contains lists of values separated by commas, and Excel has chosen the correct **Data Type** already. Click **Next** to move on.
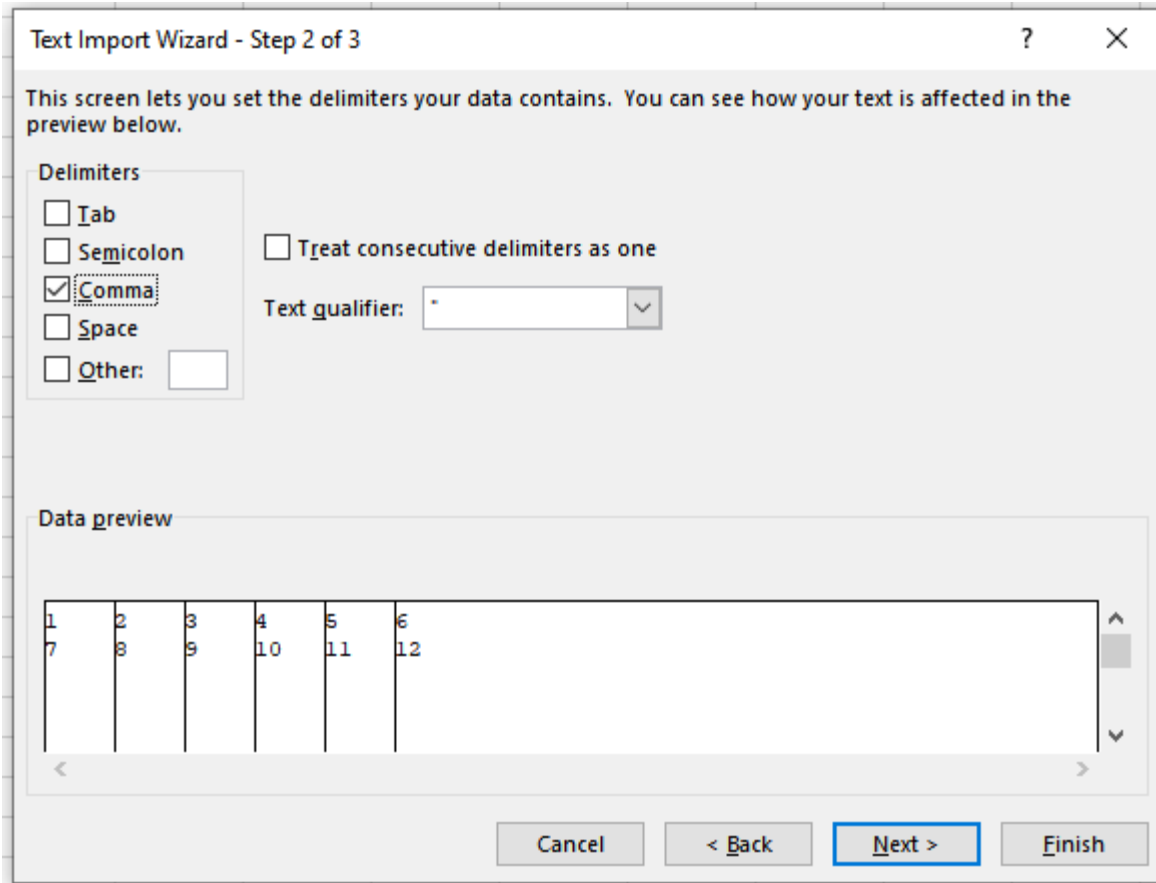
The second page of the wizard allows you to pick the delimiters used in the file. Since our file uses commas, we want to check the **Comma** tickbox but none of the others. Other files will have different delimiters, so use the preview to guide you. You'll notice that the **Data preview** changes to show the data in separate columns when you select the correct delimiter.
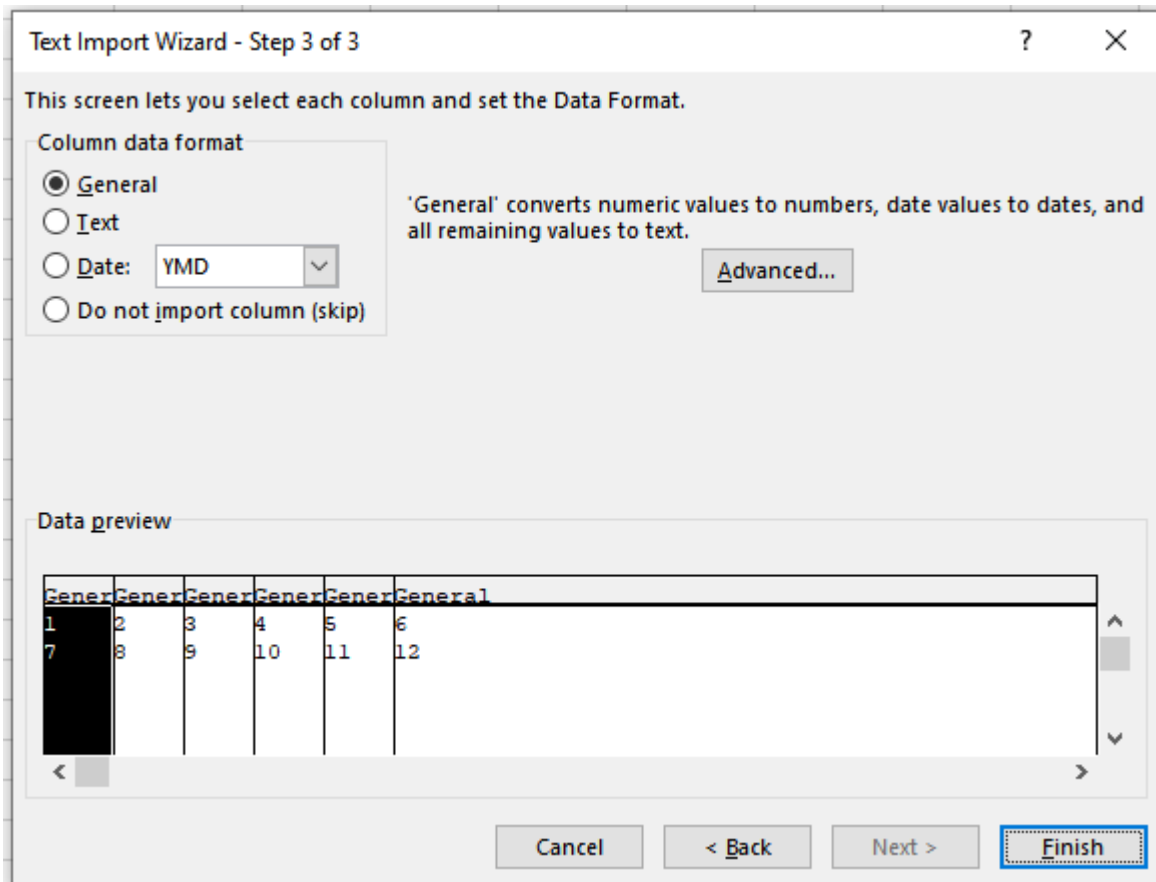
The final page of the wizard allows you to pre-set the data type. Normally, **General** will be the correct choice, especially if your document contains data. You can always change the data format later using the **Cell Styles** instructions above. Click Finish and Excel will open a workbook with your properly-formatted data.

At this point, follow the instructions in the **CSV Files** section above to use the **Save As** command and save this file as an XLSX workbook.

# Keyboard Shortcuts

Although it can be slightly slow to learn them, keyboard shortcuts in Excel (or any program, really) are much faster to use than mouse actions, and they can greatly improve your efficiency. Below are some especially helpful keyboard commands that you should be aware of.

## Basic

**TAB – Next Cell** – When editing a cell, jumps to the next cell to the right.

**ENTER – Next Line** – When editing a cell, jumps down to the next line. If editing multiple cells per line and pressing TAB to jump along, ENTER will move the selection all the way back to the left again.

**CTRL+S – Save** – Saves the current workbook. Use often!

**CTRL+A – Select All** – To select an entire range of data, click any single cell in the range and press CTRL+A. Excel will select all non-empty cells touching the cell you selected. Pressing CTRL+A again will expand the selection to cover the entire spreadsheet, including blanks.

**CTRL+C – Copy** – Stores the highlighted cells to the clipboard.

**CTRL+X – Cut** – Stores the highlighted cells to the clipboard and erases them from their current location.

**CTRL+V – Paste** – Writes the data in the clipboard to the selected location.

**CTRL+Z – Undo** – Takes away the last action you performed. This can be repeated many, many times.

**CTRL+Y – Redo** – If the last action you took was **Undo**, this re-does the action. Using CTRL+Z and CTRL+Y, you can step forward and backward through your actions. Note that all "future" actions are erased if you perform any action besides **Undo** or **Redo**.

**SHIFT+↓, SHIFT+→, SHIFT+↑, and SHIFT+← – Select Multiple Cells** – By holding shift while pressing arrow keys, Excel will select all of the range that you move the selection over.

**CTRL+↓, CTRL+→, CTRL+↑, and CTRL+← – Jump to Edge** – By holding control and pressing an arrow key, you can jump to the edge of a large data set. Excel will select the last cell in the chosen direction before a blank or before the edge of the spreadsheet.

**CTRL+ SHIFT+↓, CTRL+ SHIFT+→, CTRL+ SHIFT+↑, and CTRL+ SHIFT+← – Select to Edge** – Combining the above two commands will select all cells from the selected cell to the edge of the data. If you select the upper left cell in a set of data, you can press CTRL+SHIFT+→ then CTRL+SHIFT+↓ to quickly select the entire range.

**CTRL+D – Fill Down** – Highlight a cell and multiple empty cells below it and press CTRL+D to copy the formula in the first cell into all the other highlighted cells.

**CTRL+R – Fill Right** – Highlight a cell and multiple empty cells to the right and press CTRL+R to copy the formula in the first cell into all the other highlighted cells.

**CTRL+1 – Format Cells** – Use this command to quickly open the Format Cells dialog.

**CTRL+SHIFT+= (CTRL + SHIFT + equals) – Insert –** Opens the Insert dialog, allowing you to insert a cell, row, or column next to the current selection.

**CTRL+- (CTRL + minus) – Delete –** Opens the Delete dialog, allowing you to remove a cell, row, or column.

**ALT+ENTER – Line Break –** When editing a text cell, pressing ALT+ENTER adds a line break, rather than jumping to the next cell.


## Function Keys

**F1 – Open Excel Help –** Opens the Help pane on the right side of the window, but you're an expert now, right?

**F2 – Edit Cell –** Moves the text cursor inside the cell to allow you to edit its formula.

**F3 – Paste Name –** Opens the Paste Name dialog box (not covered in this tutorial)

**F4 – Cycle Cell References –** Cycles the reference at the text cursor between relative, absolute, and mixed reference types.

**F5 – Go To –** Opens the Go To dialog, where you can enter any cell reference to move the selection there.

**F6 – Change Pane –** Changes the currently active pane if **Split** has been used.

**F7 – Spell Check –** Opens a dialog to check the spelling of text

**F8 – Extend Mode –** Enables you to select a range of cells without holding SHIFT. Press F8 again to disable Extend Mode.

**F9 – Recalculate –** Although Excel automatically recalculates all cells whenever you make a change, you can manually force a recalculation with F9.

**F10 – Show Key Tips –** Displays keyboard shortcuts for ribbon commands. To execute a command, hold ALT and press the corresponding key.

**F11 – Quick Chart –** Creates a chart based on the currently selected data (not recommended)

**F12 – Save As –** Allows you to quickly save the current workbook under a new name.

# Functions of Interest

Some very useful functions are listed below. It would be a good idea to become familiar with all of them.

Functions are listed in the following format:

FUNCTION_NAME(required_argument_1, [optional_argument], […])

The function name is listed in all caps.
Arguments that are required to make the function work are listed in parentheses immediate after.
Optional arguments are listed inside brackets, these can be ignored if they are not needed.
[…] indicates that you can add additional arguments if you desire, but they are not required.

When referencing the result that the function puts out, we say that a function **returns** a value.

## List of Functions

**SUM** – SUM(value1, [value2], […]) – Returns the additive sum of all values selected.

**VLOOKUP** – VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup]) – Searches through the *table_array* to find the *lookup_value*. If found, returns the value in the column or the *table_array* according to *col_index_num*. If *range_lookup* is set to 0, this looks for an exact match only, otherwise it will return the closest value available.

**IF** – IF(logical_test, value_if_true, value_if_false) – Performs the logical test in *logical_test*. If the result is true, returns *value_if_true*, if the result is false, returns *value_if_false*. Examples of logical tests are strings such as "A1=3", "A2>A3", and "SUM(A1:A3)>A4".

**IFS** – IFS(logical_test, value_if_true, […]) – Similar to IF, except you can list as many logical tests as you like, each followed by its own *value_if_true* argument. If none of the listed *logical_test*s are true, returns an error.

**COUNTIF** – COUNTIF(range, criteria) – Counts each cell in *range* that satisfies *criteria* and returns the count as a number. Examples of criteria are strings such as ">10", "A1", and "15".

**COUNTIFS** – COUNTIFS(range, criteria, […]) – Similar to COUNTIF, but allows for up to 127 sets of *range* and *criteria*.

**SUMIF** – SUMIF(range, criteria, sum_range) – If *criteria* is met by *range*, sums all values in *sum_range*.

**SUMIFS** – SUMIFS(range, criteria, sum_range) – Similar to SUMIF, but allows up to 127 sets of *range*, *criteria*, and *sum_range*.

**ROUND** – ROUND(number, num__digits) – Rounds *number* down to the specified number of digits using standard rounding rules.

**ROUNDDOWN** – ROUNDDOWN(number, num_digits) – Similar to ROUND, but always rounds toward zero.

**ROUNDUP** – ROUNDUP(number, num_digits) – ~~Kills weeds.~~ Similar to ROUND, but always rounds away from zero.

**MROUND** – MROUND(number, multiple) – Similar to ROUND, but rounds to the nearest multiple of *multiple*.

**AVERAGE** – AVERAGE(number1, [number2], […]) – Returns the arithmetic mean of all arguments.

**STDEV** – STDEV(number1, [number2], […]) – Returns the standard deviation of a sample (given as arguments).

**STDEV.S** – STDEV.S(number1, [number2], […]) – Returns the standard deviation of a sample (given as arguments). Exactly the same as STDEV.

**STDEV.P** – STDEV.P(number1, [number2], […]) – Returns the standard deviation of the arguments, assuming that the arguments represent the entire population.

**F.TEST** – FTEST(array1, array2) – Returns the result of an F-Test, the two-tailed probability that the variances in *array1* and *array2* are not significantly different.

**NORM.DIST** – NORMDIST(x, mean, standard_dev, cumulative) – Returns a normal distribution for *x* based on the specified mean and standard deviation. Returns a cumulative distribution function if *cumulative*=TRUE, returns the probability density function if *cumulative*=FALSE.

**NORM.S.DIST** – NORM.S.DIST(z, cumulative) – Returns a normal distribution for *z* with a mean of zero and a standard deviation of one. *Cumulative* works as in NORM.DIST.

**NORM.S.INV** – NORM.S.INV(probability) – Returns the inverse of the standard normal cumulative distribution, with a mean of zero and a standard deviation of one.

**T.TEST** – T.TEST(array1, array2, tails, type) – Returns the probability of significance according to a Student's t-Test. *Tails* can be 1 or 2, depending on the number of tails required. *Type* can be set to 1 for a paired t-test, 2 for a two-sample test with equal variance, or 3 for a two-sample test with unequal variance.

**COUNT** – COUNT(value1, [value2], […]) – Counts the number of cells in the range that contain numbers.

**COUNTA** – COUNTA(value1, [value2], […]) – Counts the number of cells in the range that are not empty.

**ABS** – ABS(number) – ~~Checks to see if you've been doing your crunches.~~ Returns the absolute value of *number*.

**LOG10** – LOG10(number) – Returns the base-10 logarithm of *number*.

**LOG** – LOG(number, base) – Returns the logarithm of *number* to the specified *base*.

**PI** – PI() – Returns π accurate to 15 digits, 3.14159265368979.

**RAND** – RAND() – Returns a random number in the range [0,1). The number changes each time the spreadsheet is recalculated.

**CONFIDENCE.T** – CONFIDENCE.T(alpha, standard_dev, size) – Returns a confidence interval for a population mean using a Student's t-Test distribution.

**CONFIDENCE.NORM** – CONFIDENCE.NORM(alpha, standard_dev, size) – Returns a confidence interval for a population mean using a normal distribution.

**LINEST** – LINEST(known_ys, known_xs, [const], [stats]) – Returns statistics on a linear trend of the data in *known_ys* and *known_xs*. If *known_xs* is left out, Excel will use the list {1,2,3…}. *Const* can be set to FALSE to force the trendline to intercept (0,0). *Stats* can be set to TRUE to return additional statistics.

**MAX** – MAX(number1, [number2], […]) – Returns the largest value in the set of arguments. Ignores text.

**MODE** - MODE(number1, [number2], […]) – Returns the most frequently occuring value in the set of arguments.

**MODE.SNGL** – MODE.SNGL(number1, [number2], […]) – Returns the most frequently occuring value in the set of arguments. Identical to MODE.

**MODE.MULT** – MODE.MULT(number1, [number2], […]) – Returns the most frequently occuring value in the set of arguments, but returns multiple values if applicable.

**MIN** – MIN(number1, [number2], […]) – Returns the smallest value in the set of arguments. Ignores text.

**MEDIAN** – MEDIAN(number1, [number2], […]) – Returns the middle value in the set of arguments. Ignores text.

**RANK** – RANK(number, ref, [order]) – Returns the rank of *number* in the array *ref*. If *order* is 0 or omitted, ranks *ref* in descending order. If *order* is 1, ranks *ref* in ascending order.

# Further Reading

Microsoft's Excel support website has detailed descriptions of all functions and options in Excel: https://support.office.com/en-us/excel.

Much information in this guide was adapted from online tutorials at https://www.excel-easy.com/ and https://www.guru99.com/introduction-to-microsoft-excel.html.

The Best in the World: At What I Have No Idea by Chris Jericho & Peter Fornatale (ISBN: 1592409431) is just an excellent read that has nothing to do with Excel whatsoever.