

PowerPoint: Basics

Creating a Slide Show Presentation



Microsoft PowerPoint 2016 Basics

Creating a Slide Show Presentation

This workshop assumes no experience with Microsoft PowerPoint.

Topics:

- | | |
|-------------------------------|--------------------------|
| - Intro to PowerPoint | - Adding Content |
| - Creating a New Presentation | - Applying Designs |
| - Slide Layouts | - Printing Presentations |

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What is PowerPoint?

PowerPoint is a graphical presentation program used to organize and present information. PowerPoint presentations consist of a number of individual pages or "slides." Slides may contain text, graphics, sound, movies, and other objects that can be freely arranged.

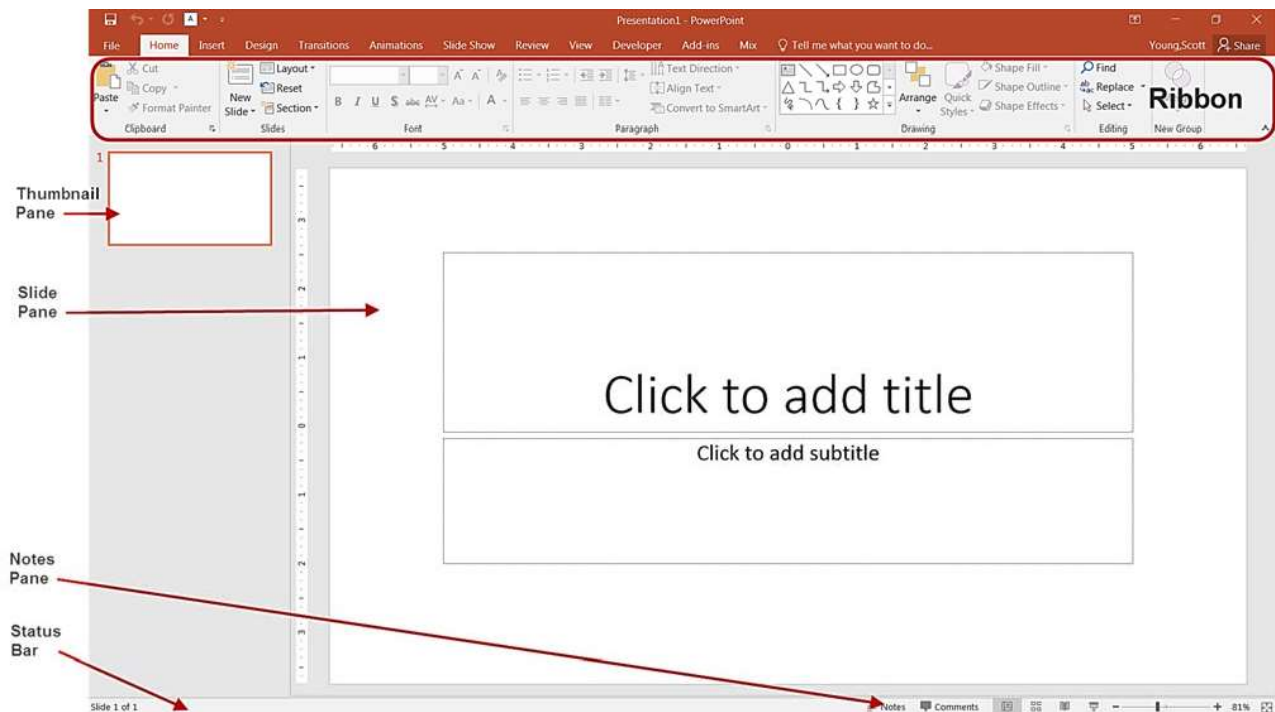
Presentations can be printed, displayed live on a computer, or navigated through at the command of the presenter. For larger audiences, the presentation is often projected onto a large screen. Handouts, speaker notes, or outlines can also be produced from the slides.

PowerPoint 2016 Editing Window (Normal View)

The **Normal View** in PowerPoint features several commonly used **Tabs**, **Panes**, and **Tools**. We'll use **Normal View** as we create and design our presentation.

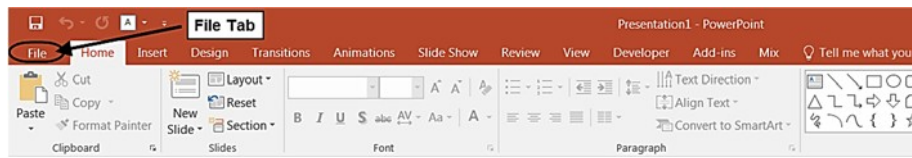
The Ribbon

The Ribbon replaces the menu bar seen in previous versions of PowerPoint. The Ribbon groups items that are most likely to be used together. There are several frequently used tabs, such as **File**, **Home**, **Insert**, **Design** and **View**. Clicking on each tab activates a group of relative commands, menus, and buttons. There are also contextual tabs that only show up only when needed, such as **Text Box Tools**, **Picture Tools**, **Drawing Tools** and **Chart Tools**. To activate those tools, click on the associated object.



Opening PowerPoint

To open a PowerPoint 2016 presentation, click on the **File** tab in the upper left corner.



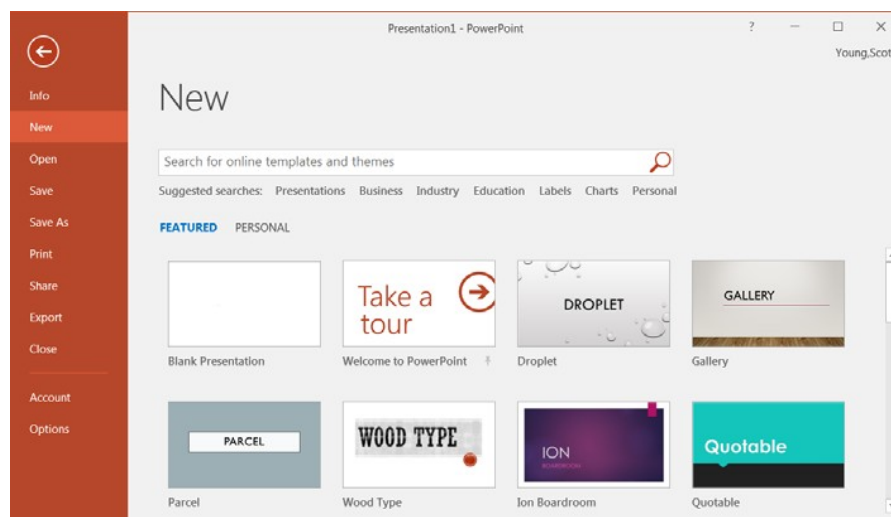
- The most common choices for opening a presentation are:
 - **New** - allows you to open a **Blank presentation** or you may choose from a selection of **Templates** and **Themes**.
 - **Open** - lets you navigate to an existing file to view and/or modify a presentation that has already been created.
 - **Recent** - displays a list of your most recently created presentations and their file locations.

Creating New Presentations

The **New** selection gives you several options:

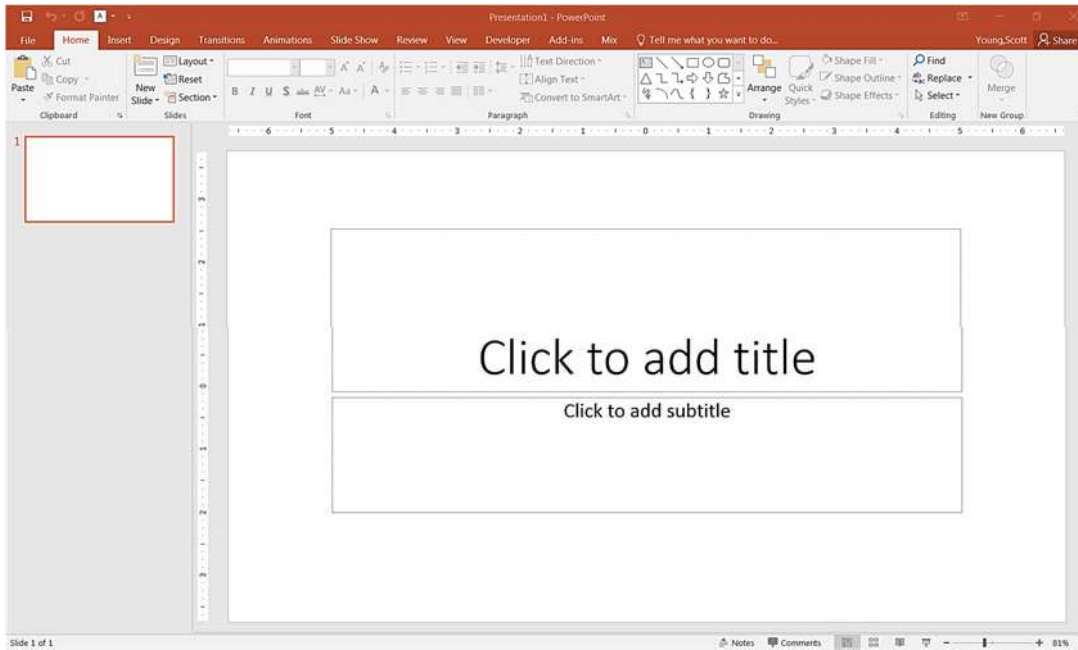
- **Blank presentation** creates a new presentation using default settings for text and color. These slides will not include content or design elements.
- **Templates** and **Themes** are used to create a new presentation based on pre-designed slide styles. These options also do not include content.
- **New from existing** will use the formatting of a previously created presentation.

For this exercise, we'll start with a **Blank presentation**. Select **New**, choose **Blank presentation** and click on the **Create** icon.

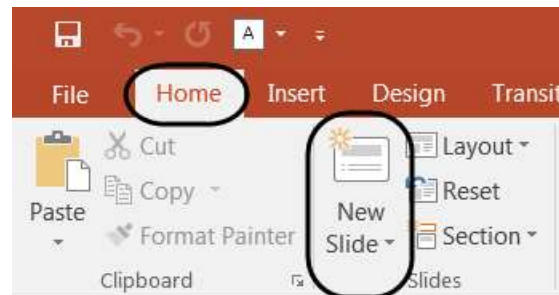


PowerPoint Slides

When you choose to create a blank presentation, PowerPoint will open a presentation with a **Title Slide**. Once the **Title Slide** is open, you'll see a slide with two placeholder text boxes for a title and a subtitle. Click inside the placeholder box and type to add the title. If you want a subtitle, click and type inside the smaller placeholder. If you don't want a subtitle, you can just ignore its placeholder box.



To add a **New Slide**, make sure you're on the **Home** tab. The **New Slide** button will add slides to your presentation.



The **New Slide** button has two parts:



Clicking on the top part will automatically insert a new slide. If you have just created a **Title** slide, the new default layout will be a **Title and Content** slide (for details, see the section on slide layouts).



Clicking on the bottom will give you a choice of layouts. You can choose which layout you want for your next slide. Select a slide layout by clicking on its image in the **Office Theme** gallery.

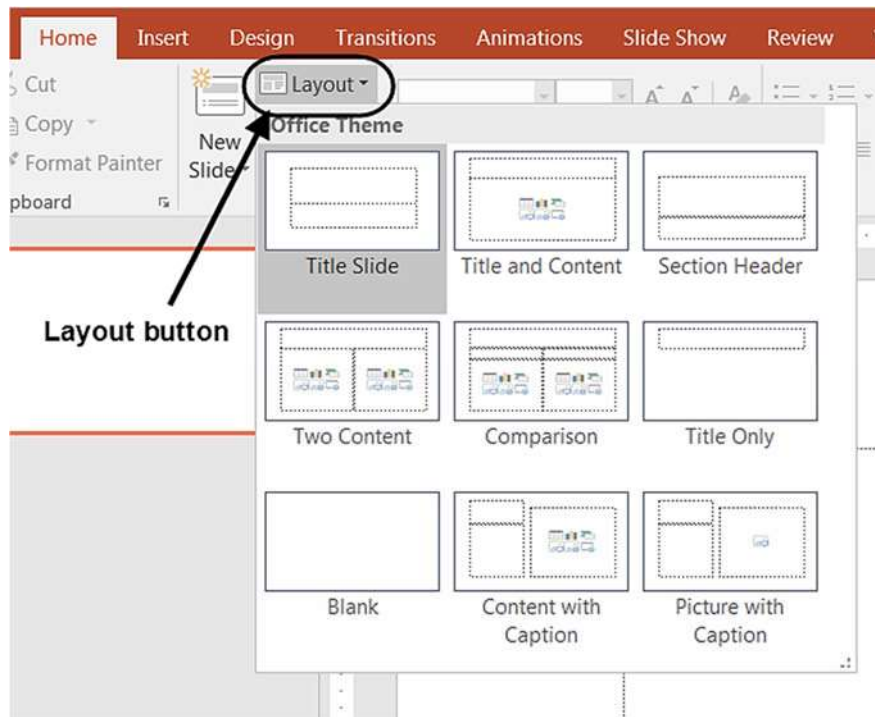
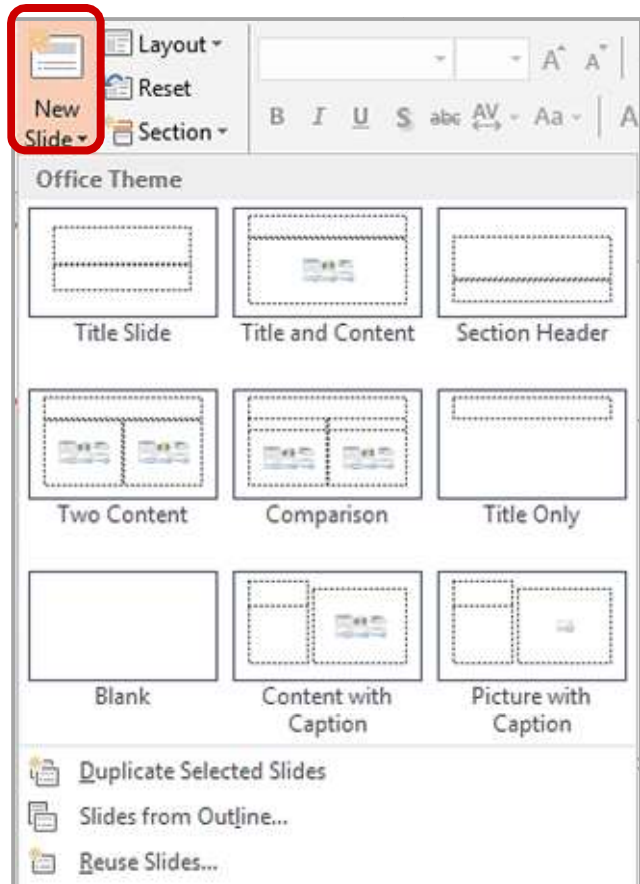
Slide Layouts

There are several standard slide layouts to choose from when adding new slides.

A unique layout can be chosen by clicking on the bottom half of the **New Slide** button in the **Home** tab. When the layout gallery opens, click on the style you want and a new slide with that layout will appear in your presentation.

Each layout caption describes the layout type. Content can be text, tables, charts, graphics, pictures, clip art, or video.

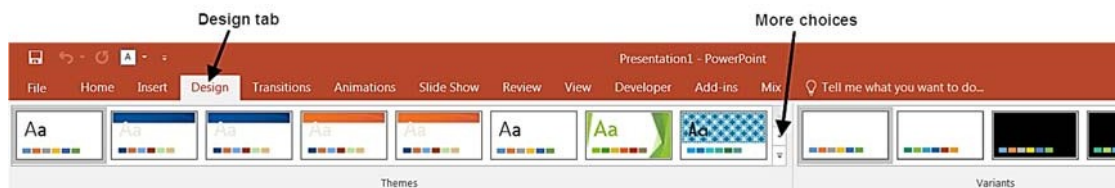
If you decide later that the layout you chose doesn't work well for a particular slide, select the slide by clicking on it in the **Thumbnail** pane. Next, click on the **Layout** button in the **Slides** group of the **Home** tab. Click on a new layout and it will change the layout of the slide.



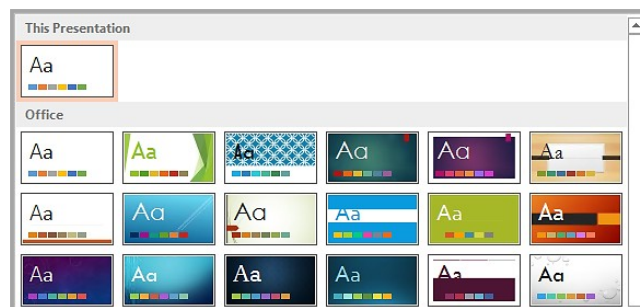
Applying a Theme

Once a new presentation has been created, a design or color scheme can be added. Remember to use color carefully to enhance your presentation, not detract from it. You will want to maintain good contrast between the background color and the text color. Consider using a light colored background and dark text (or vice versa), but avoid busy backgrounds and primary colors. Use sans serif fonts like Arial, Calibri, and Helvetica for titles and size them between 44 - 60 points. Sub-headings should be between 32 - 40 points, and body text between 18 - 32 points. Try not to use more than two fonts.

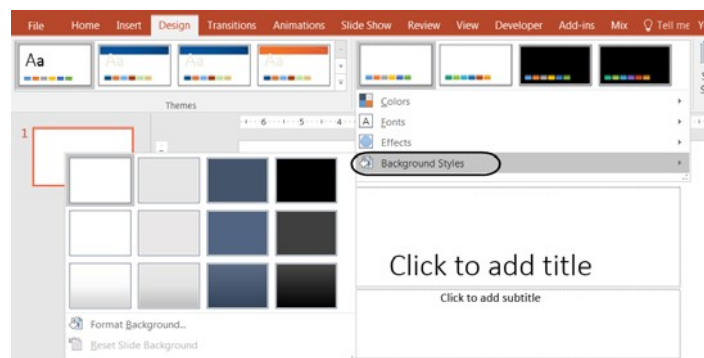
PowerPoint has many pre-set designs and themes that include complimentary colors and fonts. To add a theme to a presentation, go to the **Design** tab in the ribbon. There are several themes immediately available. To use one of the built-in themes, just click on its thumbnail.

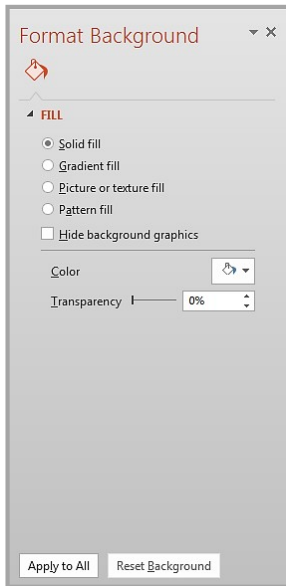


On the right side of the **Theme** thumbnails, there's a scroll bar and an **Arrow Down** button, which will offer more designs, as seen below. If you're online, you can get more themes from Microsoft Office Online. (Your office program must be a genuine Office product to get online templates).



If you don't want to use a theme, you can add **Background Styles**. From this selection, you can add some preset background styles that change according to the colors you've chosen.





Using the **Format Background** feature, you can choose fill colors, gradients, transparencies, textures, or pictures for your background.

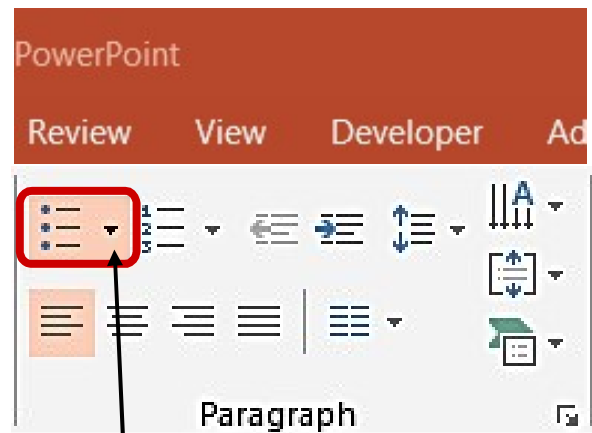
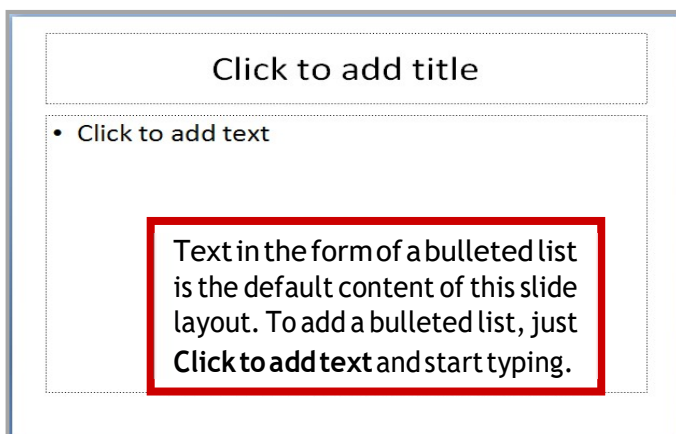
When you have the desired background fill effect, select **Close** to apply it to the selected slide or choose **Apply to All** to add the background to all of the slides in the presentation.

Designs can be added to all of the slides or to selected slides. To select multiple slides, click on a slide in the **Thumbnail** pane of the navigation bar and then hold down the control key and click on any other slides you want to apply the design to.

Text

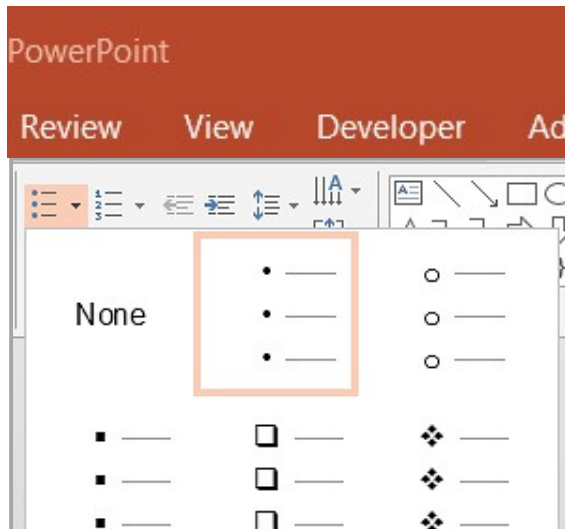
Formatting Bulleted Lists

In PowerPoint, you can easily modify a slide's default bulleted list. Click inside the text box, and the **Format** tab will automatically be highlighted. Click on the dropdown triangle next to the **Bullets** button in the **Paragraph** group.



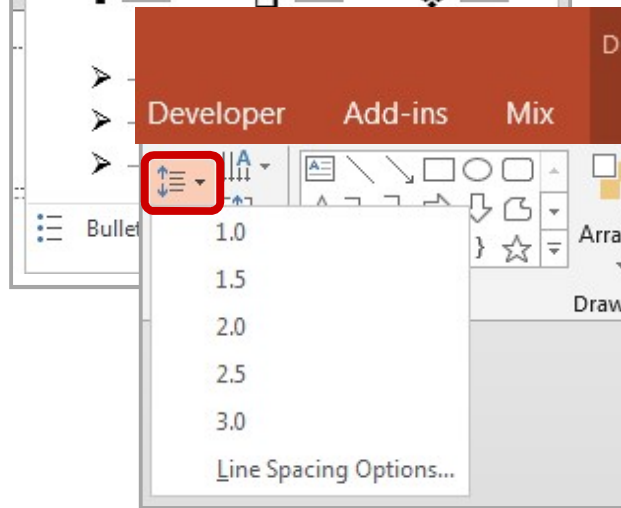
Bullets Drop Down Button

From the **Bullets and Numbering** menu you can make various changes to your list:

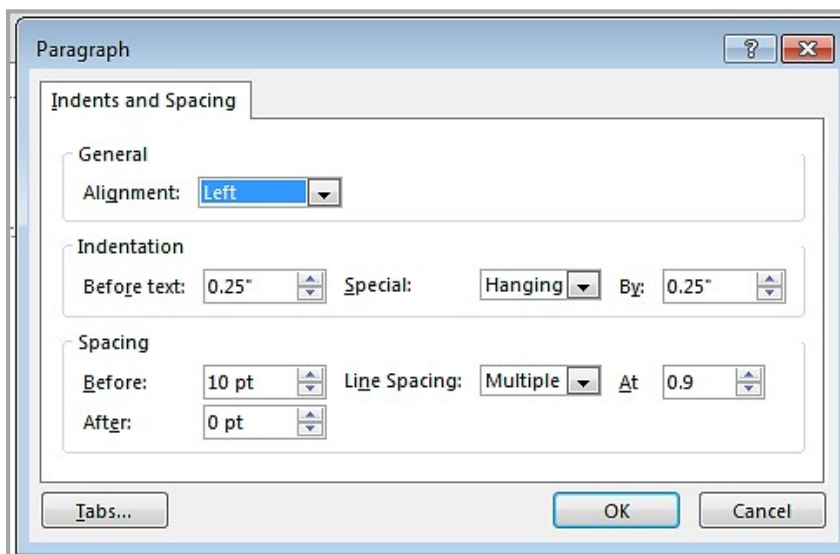


- The bullet size relative to the text
- The color of the bullet
- The shape of the bullet using either a picture or a character

You may also want to adjust line spacing between paragraphs or lists. You can do this through the **Paragraph** group of tools by clicking the **Line Spacing** button and selecting **Line Spacing Options**.

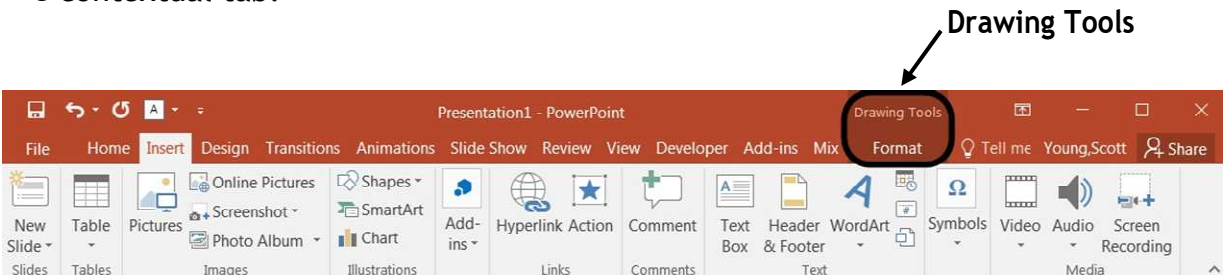


Indents and Spacing controls will open in a separate dialog box.

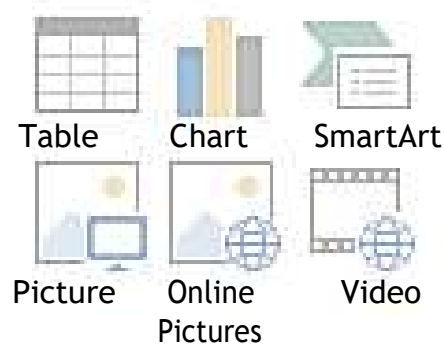


Adding Content

Text is the default content of the slide below. The format for the default text is a bulleted list. To add text, click and begin typing. To add other content, click on the icon within the content group on the new slide. Each icon will open the appropriate dialog box or task pane in the **Drawing Tools** contextual tab.



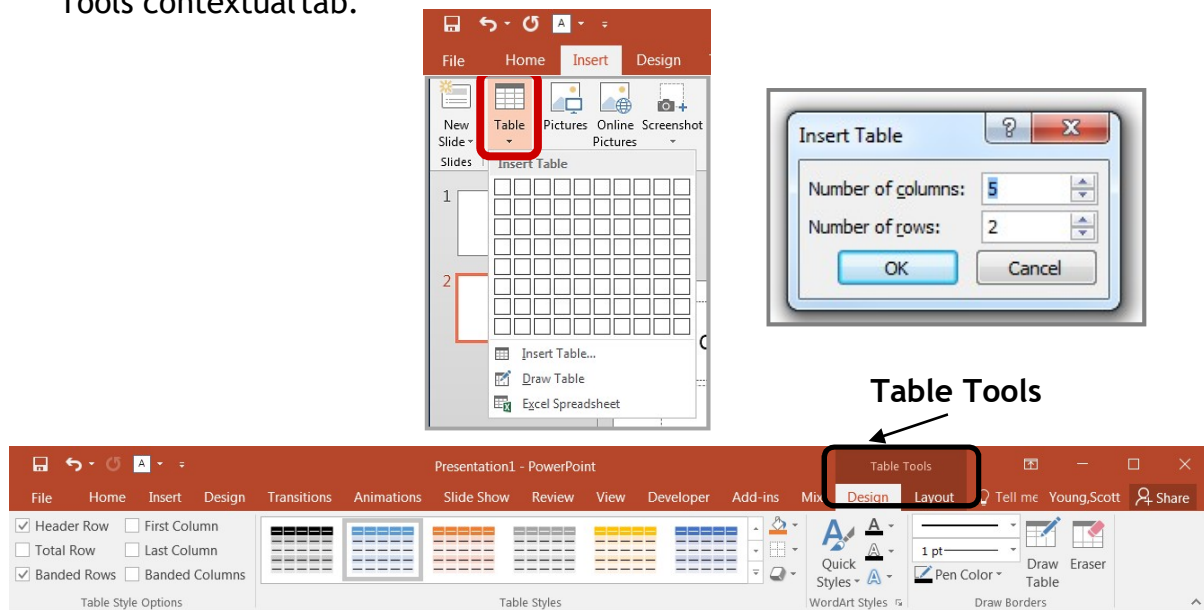
The icons represent the six standard graphical elements that you might want to insert.



Clicking on an icon will open the associated dialog box. Note that these icons, as well as several other insertion options, are also displayed in the **Insert** tab on the Ribbon.

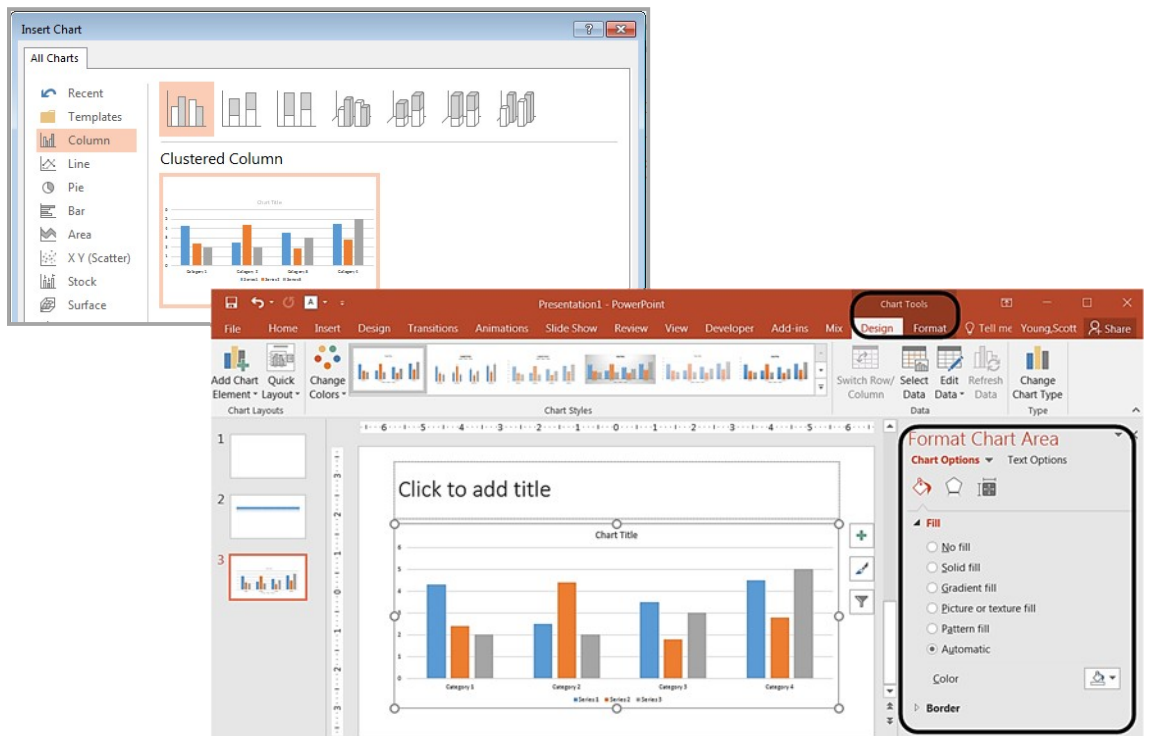
Tables

Set the number of columns and rows as needed in the Insert Table dialog box and click OK. Methods for editing and the design and layout of your table are located on the Table Tools contextual tab.



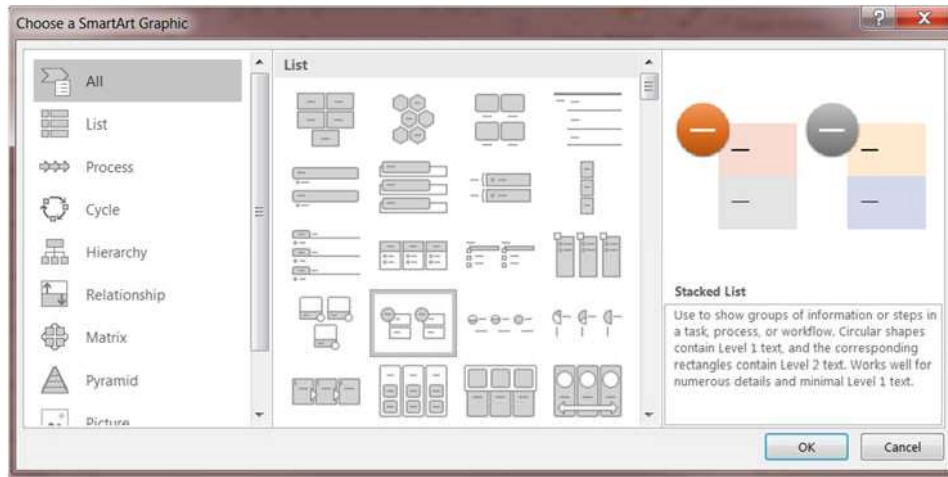
Charts

Select the type of chart you want and click OK. Once inserted into the slide, you can click on the chart to activate the **Chart Tools** contextual tab, where you'll find tools for editing chart data and changing layouts and styles.



SmartArt Graphics

SmartArt graphics are shapes that are designed to represent the relationship between things or people. You might use SmartArt for an organizational chart or a timeline. SmartArt styles and layouts can be formatted in the **SmartArt Tools** contextual tab.



Pictures

Rather than using too much text on your slides, consider using **pictures along with text** as a more interesting way to communicate your ideas. You can put lots of text into the **Notes Section** and refer to that as you're speaking.

When browsing for images, keep in mind that pictures imported from web sites can be low resolution, and are typically used for on-screen presentations and web pages. If you're going to print handouts, be sure to use images that are at least 180 dpi (dots per inch).

Teamwork

- We work together
- We share ideas
- We support each other

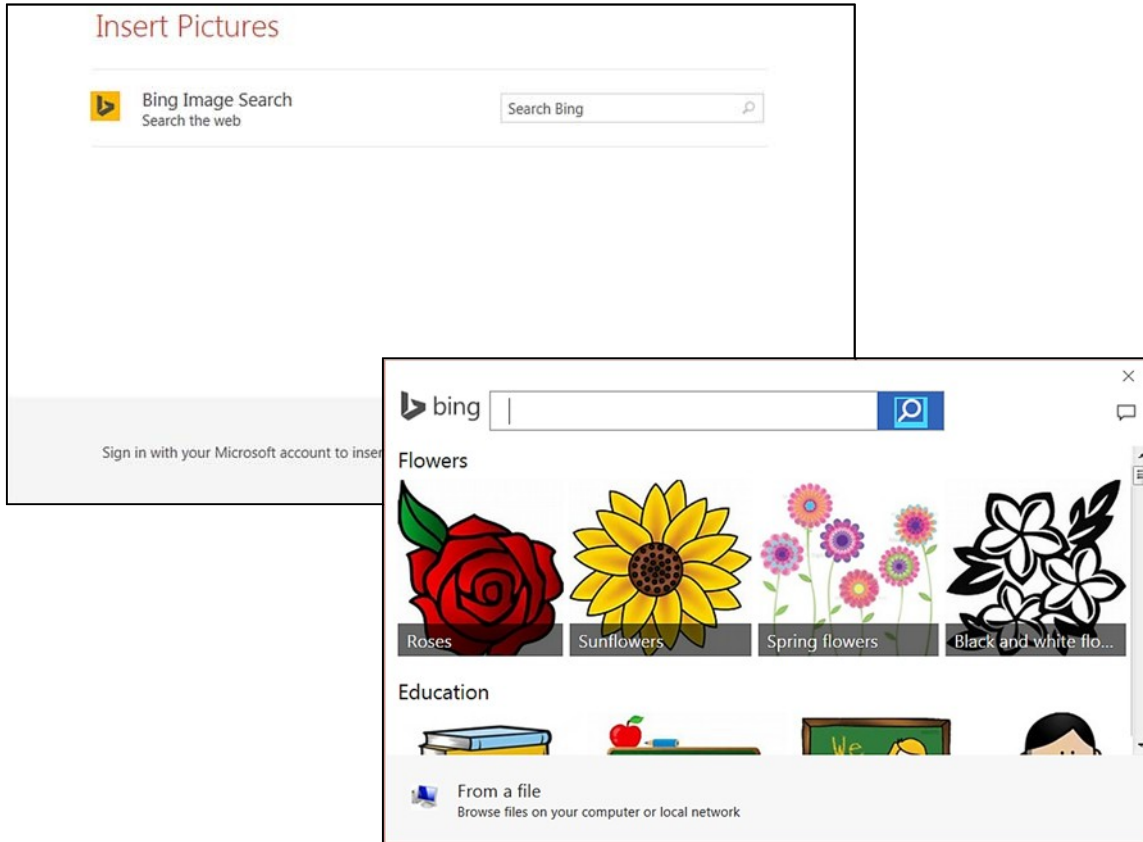
How do we Succeed as a Team?

- Team building is creating a work culture that values collaboration
- In a *teamwork* environment, people understand and believe that thinking, planning are better done cooperatively
- We're open and receptive to ideas and input from others on the team.
- At *Whatever Corporation*, we believe that we're only as strong as our team
- "None of us is as good as all of us"

Notes Section →

Online Pictures

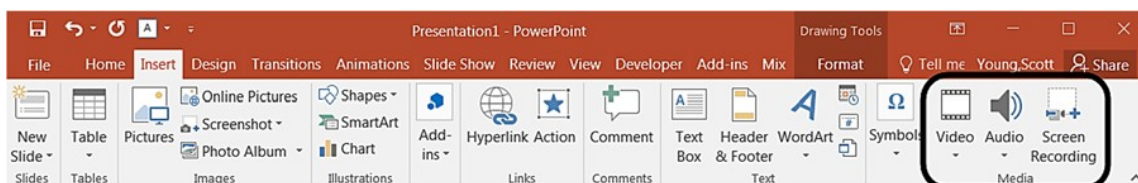
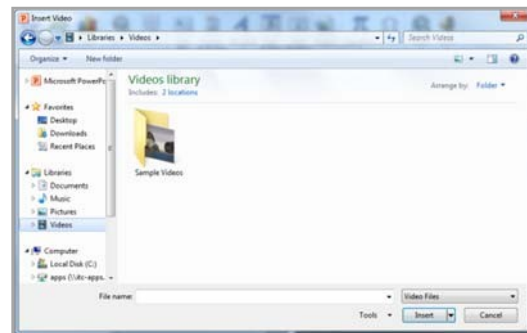
Online pictures have replaced the old Clip Art. When you click on the Online Pictures button you get a search box. You can type in a word and press enter to search for a specific image or you can click on the Bing Image Search icon to browse categories.



Videos / Media

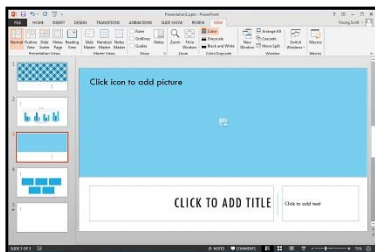
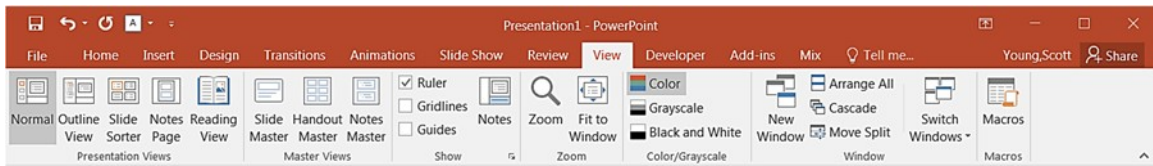
You can embed a video or link to a video from your presentation. If you want to limit the size of your file, you can link to a video file on your local drive or to a video file that you uploaded to a web site, such as YouTube or Hulu.

All options to insert video or audio are located on the **Insert** tab, in the **Media** group.

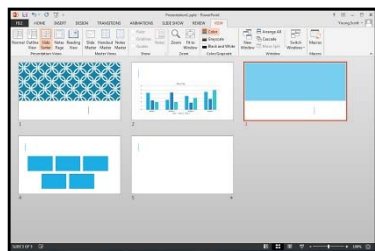


Viewing Presentations

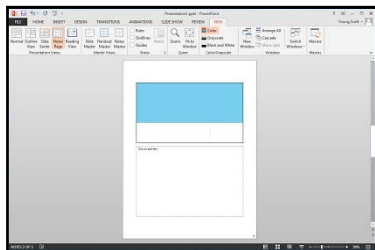
There are four different ways to view your presentation in PowerPoint. The views can be accessed using the buttons in the status bar, or by using the **View Tab** on the Ribbon.



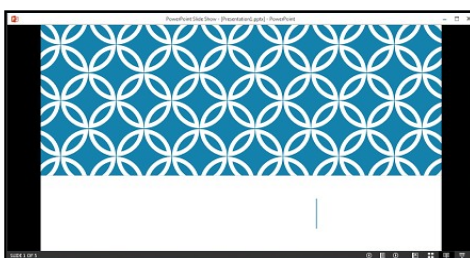
Normal View displays a single slide as it appears in the presentation, as well as thumbnails and an outline tab, where you can organize the structure. Speaker notes can be added in the bottom section of this window. This view is used to create and edit slides.



Slide Sorter View shows thumbnails of your slides. From this view you can reorder slides by dragging and dropping them, or you can set the timing for the slide show. You can also hide slides in this view. Hiding a slide will keep it in the file, but it will not show when you view the presentation.



Notes Page View allows the speaker to create notes to use during a presentation. Each page corresponds to one slide. These can be printed to assist the presenter during the presentation. Use this view when you're composing speaking topics.



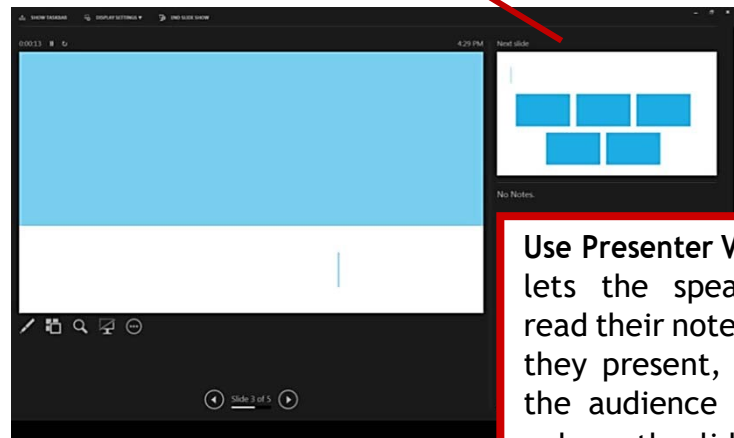
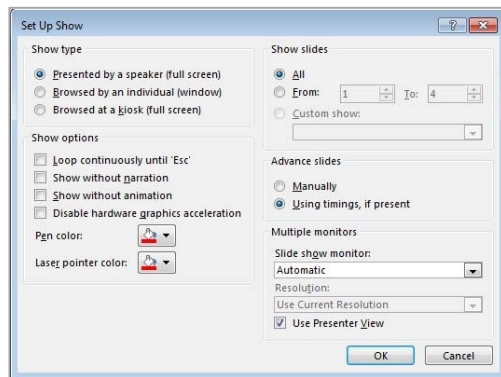
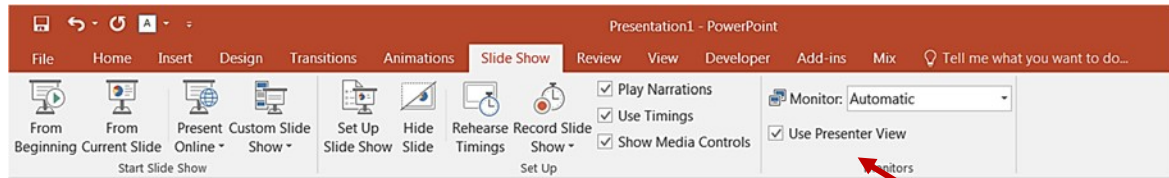
Reading View/Slide Show View displays the slides as an audience will see them. Use the arrows and icons on the lower right side of the **Status Bar** to advance slides or switch views.

Use the **Esc** key to return to Normal View.

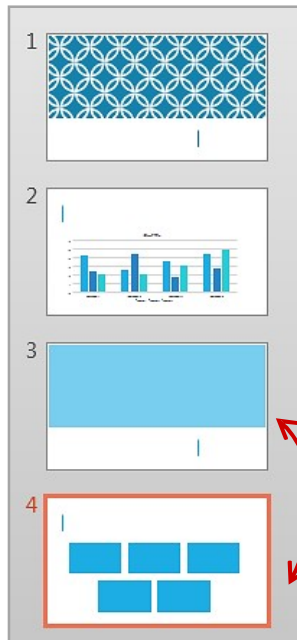


Slide Show Tab

The **Slide Show Tab** allows you to review the slide show from beginning to end or from the current (active) slide. You can also control how the show will be presented and rehearse timings in the **Set Up Slide Show** drop down box.



Use Presenter View lets the speaker read their notes as they present, but the audience will only see the slides.



Changing the Order of Slides in a Presentation

In the slide sorter view, click and hold down the left mouse button and drag the slide to a new location. You'll see a line where the slide will be placed when you release the mouse button. This can also be done in the Thumbnail pane area of the Navigation bar.

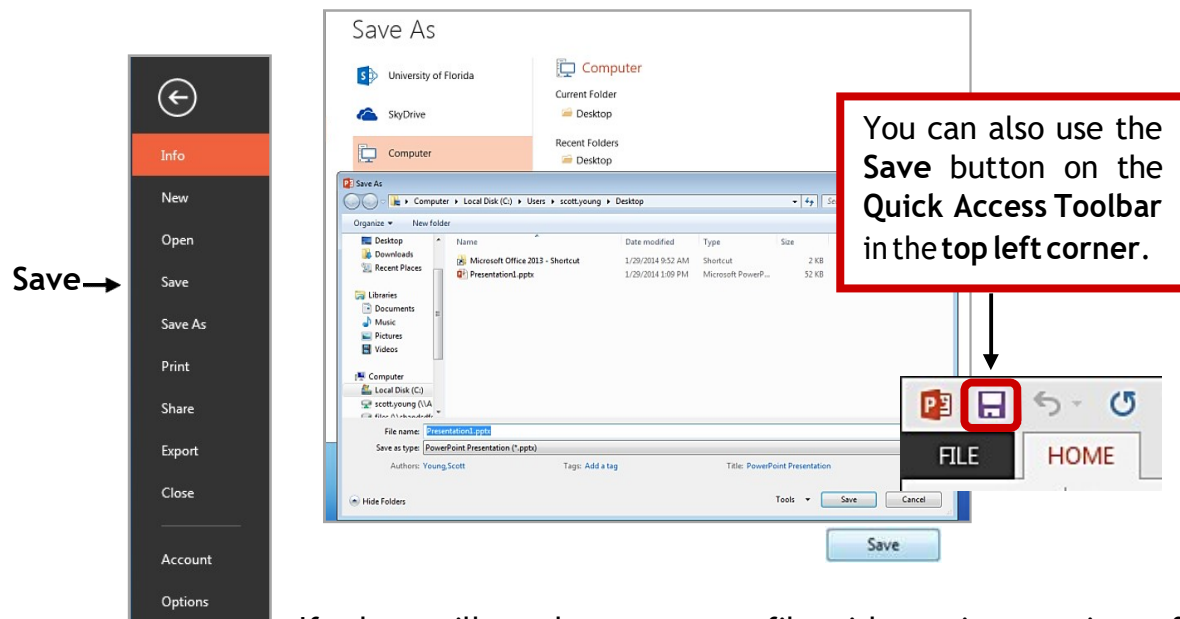
Select slide 4 and drag it above slide 3.

PowerPoint Help

If you need help at any point while you're creating or presenting a PowerPoint slide show, you can press the F1 key on your keyboard to get content-specific help.

Saving a Presentation

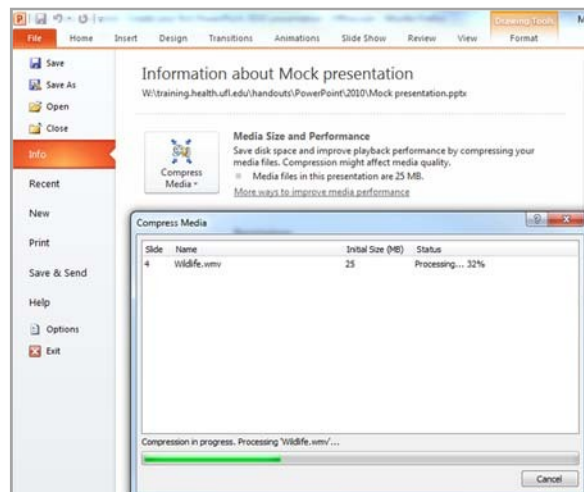
You can save a file by clicking the **File** tab, choosing **Save**, typing a descriptive name into the **File Name** window, and then clicking the **Save** button.



If others will need to open your file with previous versions of PowerPoint, use the **Save As** option and select **PowerPoint 97 - 2003 Presentation** from the **Save as type** menu.

Save and Send to Others

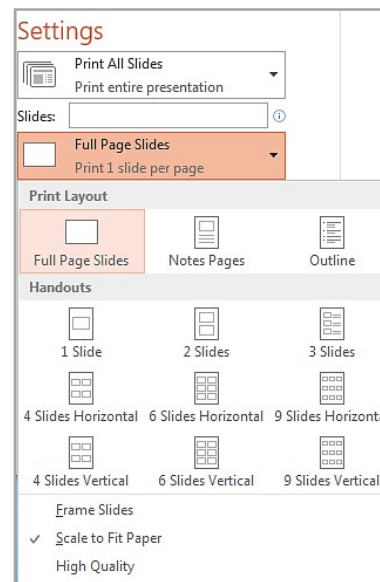
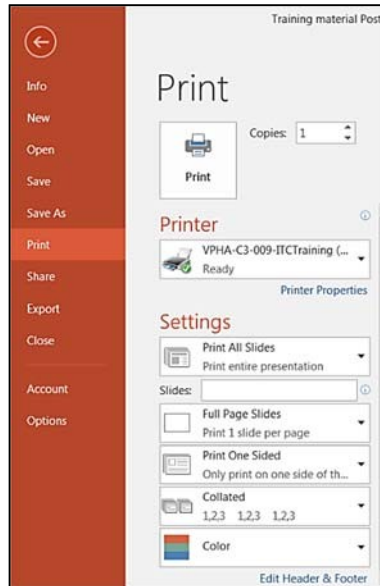
If you need to send your presentation to someone else, the best way to is to use the **Save & Send** option. You can send an attachment of your file using **Send Using E-mail**, but if you have large media files, such as videos, you'll need to compress those first to make a smaller file. On the **Home** Select the **Info** tab and click the **Compress Media** button and choose **Presentation Quality**. *Note: Only available if you have inserted media.*



You also have the option to **Package Presentation for CD**. This allows you to add other files or to add a PowerPoint Viewer so that the presentation can be run on a computer that does not have the PowerPoint program. You can also add any linked files such as video or audio.

Printing your Presentation

PowerPoint offers several print options to help you prepare your presentation. You can print slides, handouts, and/or notes to support your presentation.



Types of Print Layouts

- **Print All Slides** prints out the entire presentation, one slide per page, usually landscape. If you have color graphics on your slides and a large number of pages to print, you may want to print in Grayscale or Pure Black and White.
- **Notes Pages** will print one slide per page and have room for your presentation notes (if you type them in).
- You can print a text outline of your slides with the **Outline** option.
- **Handouts** can be printed with one, two, three, four, six or nine slides per page. When printing handouts with multiple slides per page, you also have the option to print the pages horizontally or vertically.

Exiting PowerPoint

There are several ways to close your file and exit PowerPoint. From the **File Button**, click **Close**, if you have not saved your presentation, PowerPoint will prompt you to save. Click **Yes** to save your presentation and your changes, click **No** to discard your changes and close the file.

To close the presentation and exit the program, choose **Exit** or use the **X** in the upper right corner of the PowerPoint window. You'll be prompted to save the presentation if any changes have not been saved..

Microsoft EXCEL Basic Training

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1. Opening Excel

Using Windows 7

1. Click on the Start Button.
2. In the Search Program and Files box type Excel.
3. Click on Excel 2013 from the Program results.
4. The Microsoft Excel 2013 program will open.

Using Windows 8

1. Press the Windows key on the keyboard.
2. Type Excel.
3. Click on Excel 2013 under the Apps results.

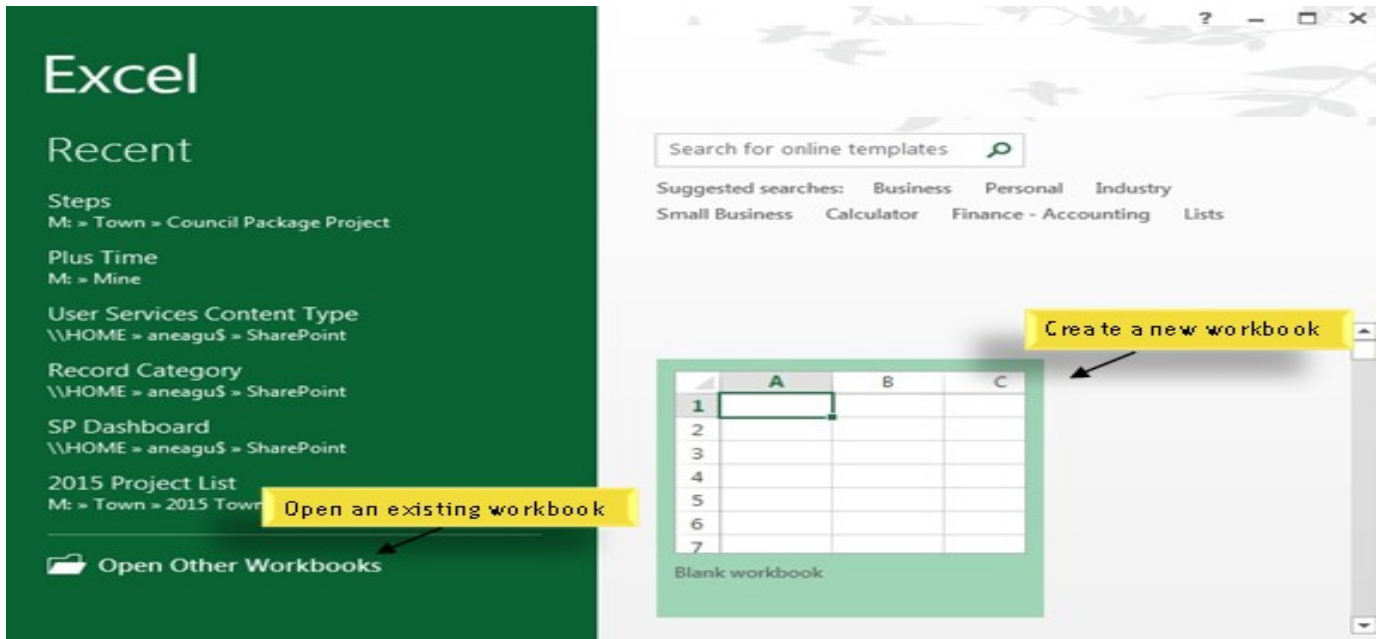
Using iOS 7

1. Click on Launchpad.
2. Select Microsoft Excel.

2. Getting Started

When you open Excel 2013 for the first time, the Excel Start Screen will appear. From here, you'll be able to create a new workbook, choose a template, and access your recently edited workbooks.

1. From the Excel Start Screen, locate and select Blank workbook to access the Excel interface.
2. Click Open Other Workbooks to work on an existing workbook.



To set up Excel so it automatically opens a new workbook

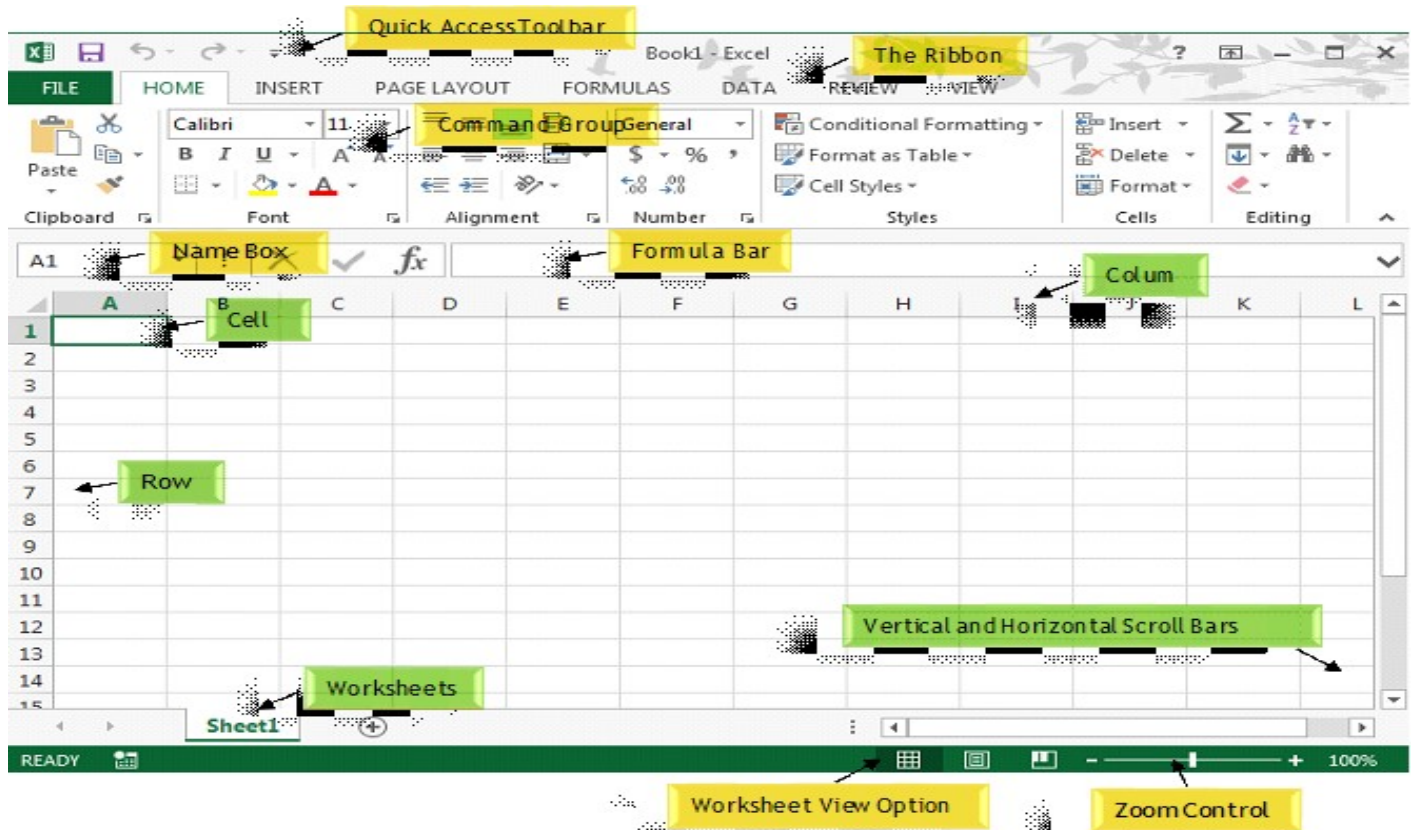
1. Click File then Options.
2. On the General tab, under Start up options, uncheck the Show the Start screen when this application starts box.
3. The next time you start Excel, it opens a blank workbook automatically similar to older versions of Excel.

The Excel Interface

After starting Excel, you will see two windows - one within the other. The outer window is the Application Window and the inner window is the Workbook Window. When maximized, the Excel Workbook Window blends in with the Application Window.

After completing this module, you should be able to:

- Identify the components of the Application Window.
- Identify the components of the Workbook Window.



The Application Window

The Application Window provides the space for your worksheets and workbook elements such as charts. The components of the Application Window are described below.

❑ The Quick Access Toolbar

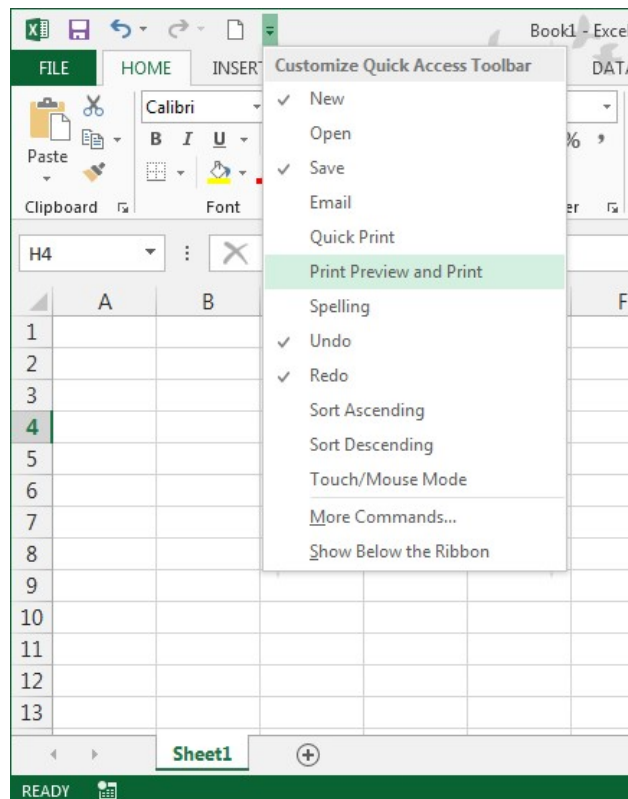
The Quick Access Toolbar lets you access common commands no matter which tab is selected.

By default, it includes the Save, Undo, and Repeat commands. You can add other commands depending on your preference.

To add commands to the Quick Access toolbar

1. Click the drop-down arrow to the right of the Quick Access toolbar.

-
2. Select the command you wish to add from the drop-down menu. To choose from more commands, select More Commands.

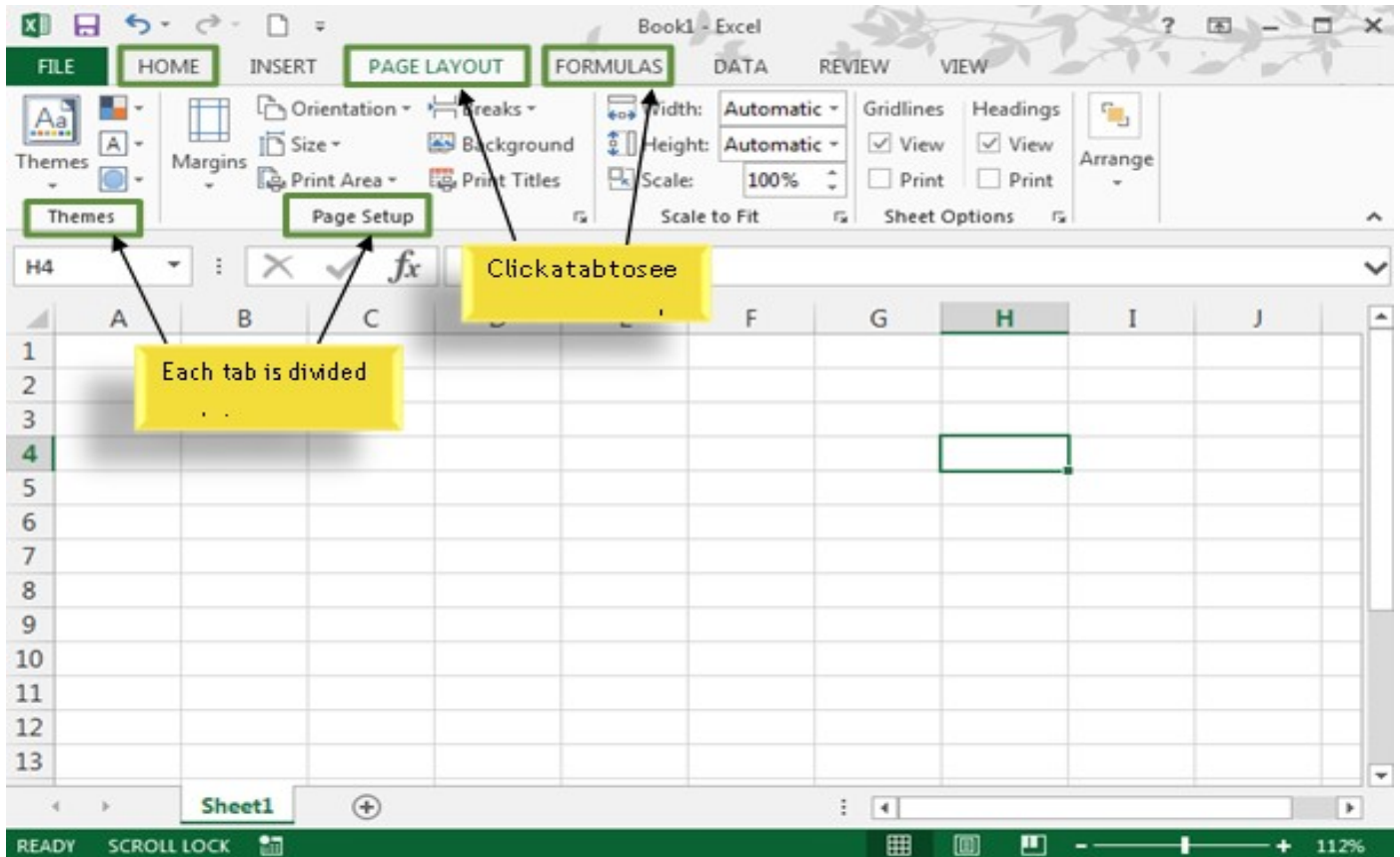


3. The command will be added to the Quick Access toolbar.



❑ The Ribbon

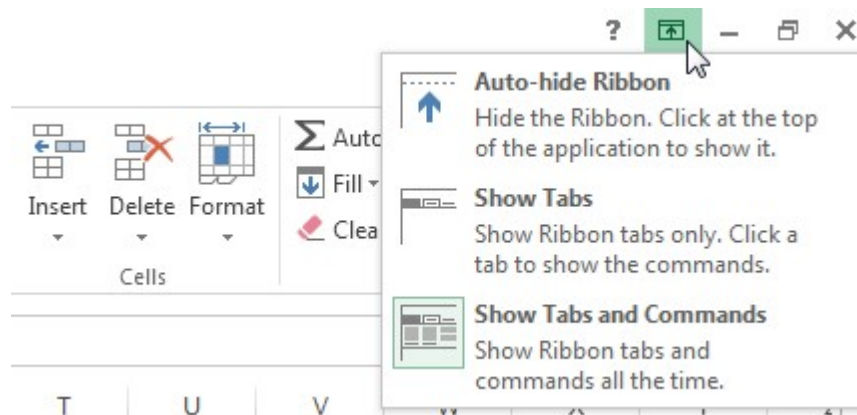
Excel 2013 uses a tabbed Ribbon system instead of traditional menus. The Ribbon contains multiple tabs, each with several groups of commands. You will use these tabs to perform the most common tasks in Excel.



To minimize and maximize the Ribbon

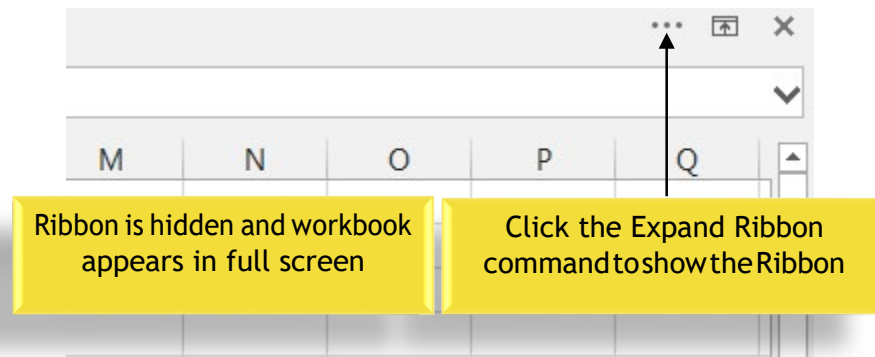
The Ribbon is designed to respond to your current task, but you can choose to minimize it if you find that it takes up too much screen space.

1. Click the Ribbon Display Options arrow in the upper-right corner of the Ribbon.



2. Select the desired minimizing option from the drop-down menu:

- Auto-hide Ribbon: Auto-hide displays your workbook in full-screen mode and completely hides the Ribbon. To show the Ribbon, click the Expand Ribbon command at the top of screen.

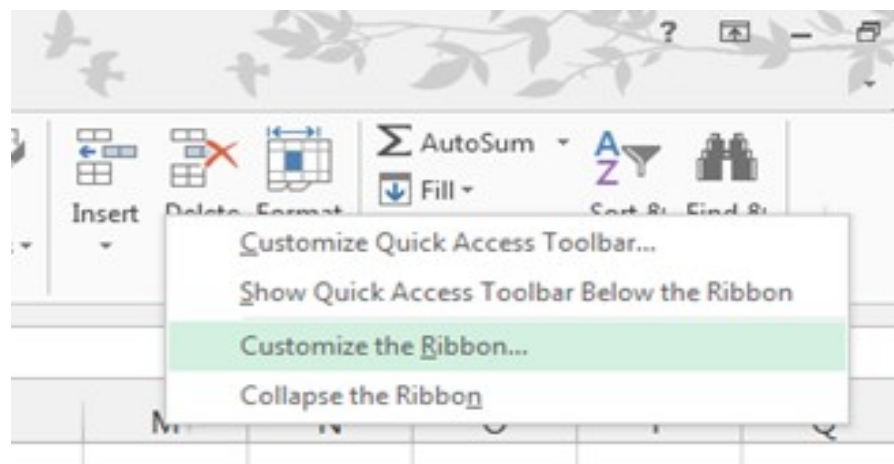


- Show Tabs: This option hides all command groups when not in use, but tabs will remain visible. To show the Ribbon, simply click a tab.
- Show Tabs and Commands: This option maximizes the Ribbon. All of the tabs and commands will be visible. This option is selected by default when you open Excel for the first time.

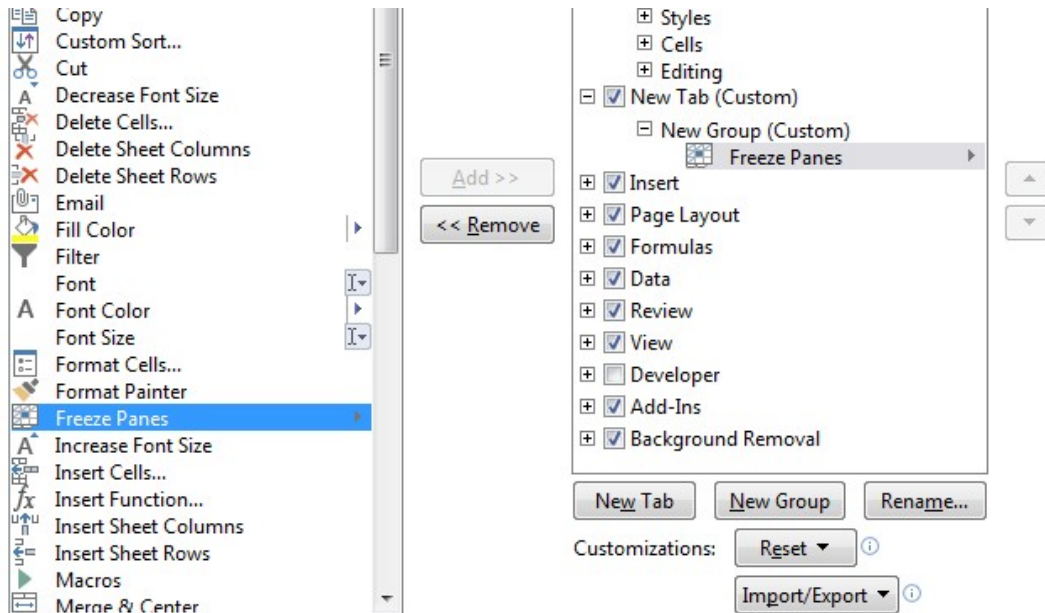
To Customize the Ribbon in Excel 2013

You can customize the Ribbon by creating your own tabs with whichever commands you want. Commands are always housed within a group, and you can create as many groups as you want in order to keep your tab organized. If you want, you can even add commands to any of the default tabs, as long as you create a custom group in the tab.

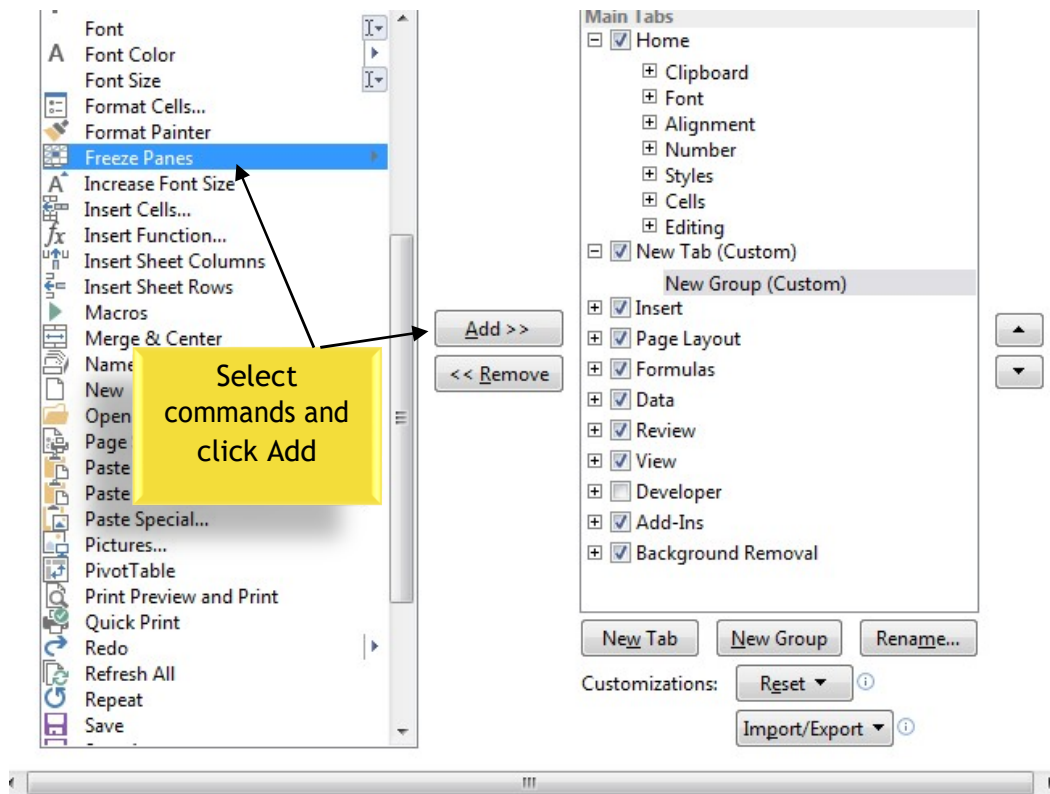
1. Right-click the Ribbon and then select customize the Ribbon... from the drop-down menu.



2. The Excel Options dialog box will appear. ²⁴Locate and select New Tab.



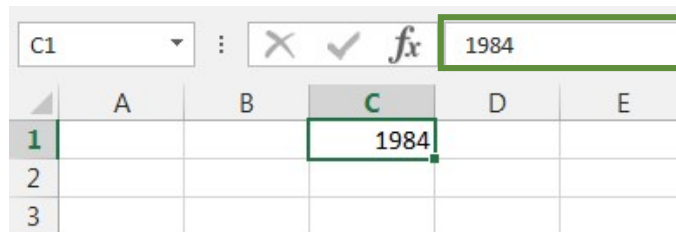
3. Make sure the New Group is selected, select a command, and then click Add. You can also drag commands directly into a group.
4. When you are done adding commands, click OK. The commands will be added to the Ribbon.



❑ The Formula Bar

In the formula bar, you can enter or edit data, a formula, or a function that will appear in a specific cell.

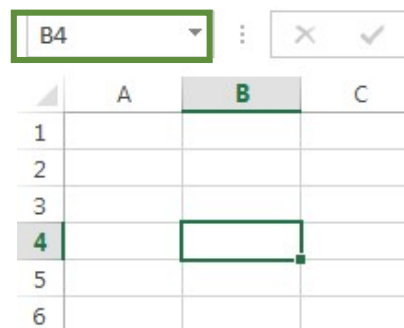
In the image below, cell C1 is selected and 1984 is entered into the formula bar. Note how the data appears in both the formula bar and in cell C1.



❑ The Name Box

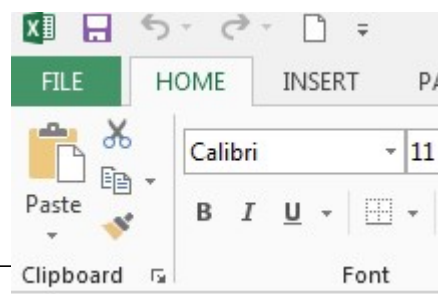
The Name box displays the location, or "name" of a selected cell.

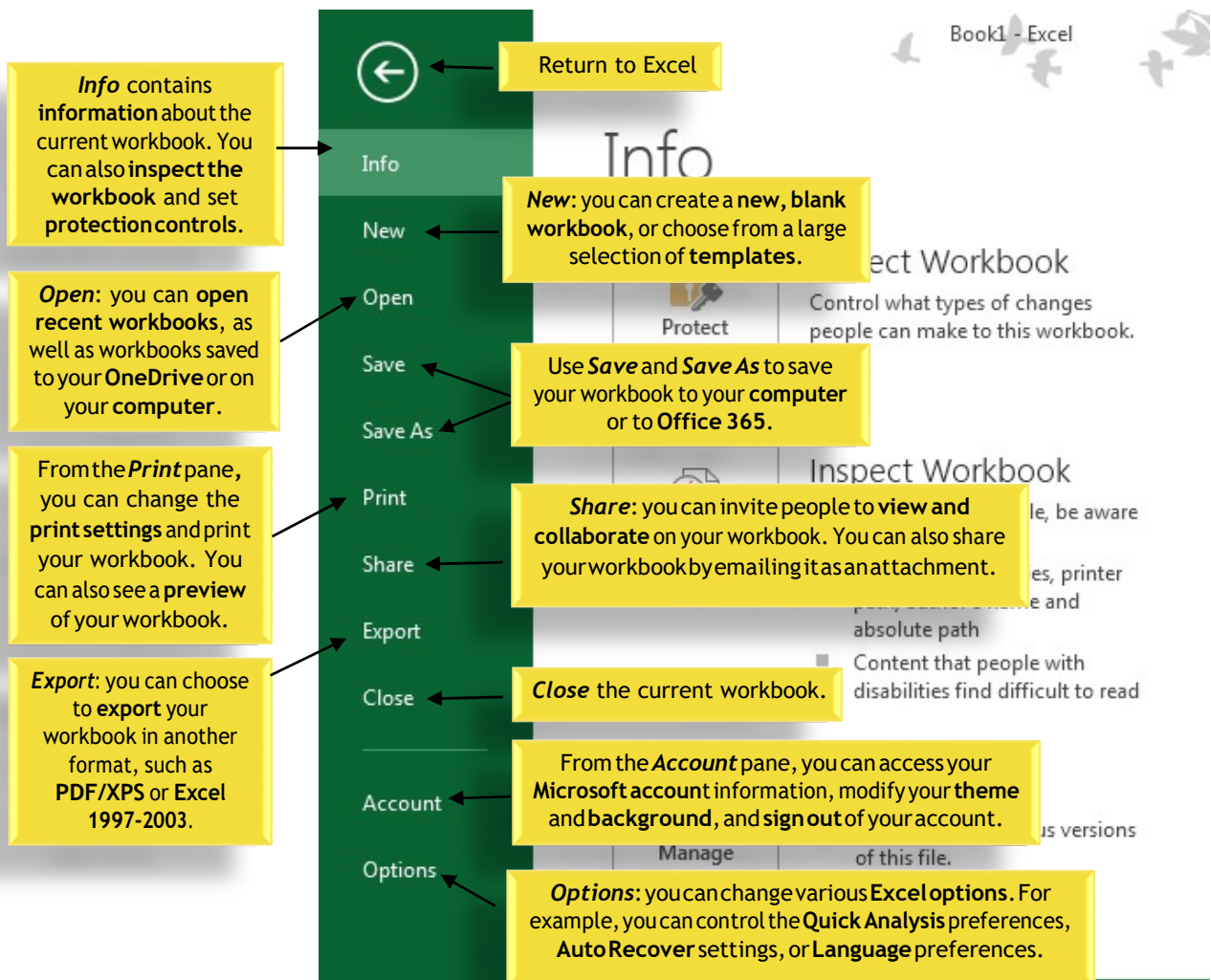
In the image below, cell B4 is selected. Note that cell B4 is where column B and row 4 intersect.



❑ The Backstage View (The File Menu)

Click the File tab on the Ribbon. Backstage view will appear.

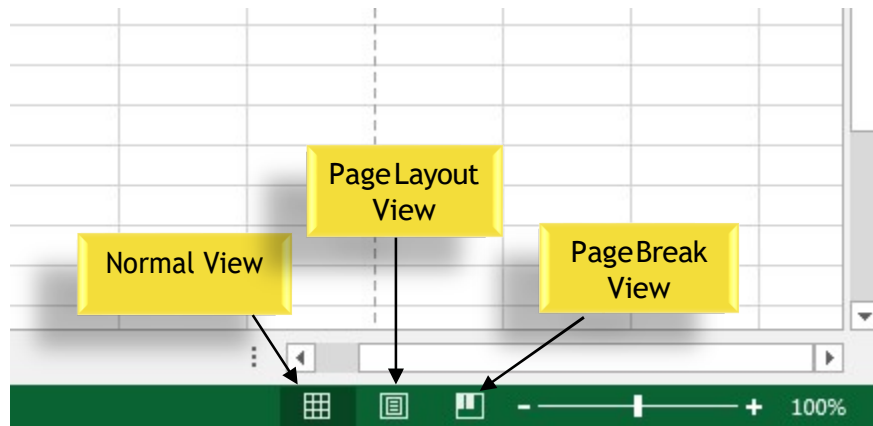




❑ The Worksheet Views

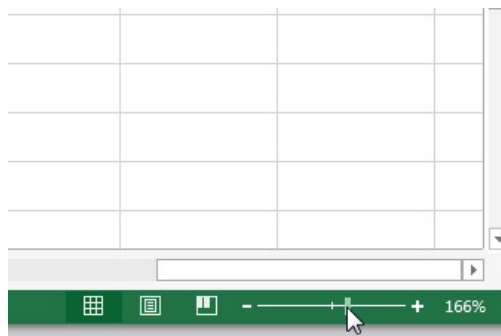
Excel 2013 has a variety of viewing options that change how your workbook is displayed. You can choose to view any workbook in Normal view, Page Layout view, or Page Break view. These views can be useful for various tasks, especially if you're planning to print the spreadsheet.

To change worksheet views, locate and select the desired worksheet view command in the bottom-right corner of the Excel window.



□ Zoom Control

To use the Zoom control, click and drag the slider. The number to the right of the slider reflects the zoom percentage.



Challenge!

1. Open Excel 2013.
2. Click through all of the tabs, and review the commands on the Ribbon.
3. Try minimizing and maximizing the Ribbon.
4. Add a command to the Quick Access toolbar.
5. Navigate to Backstage view, and open your Account settings.
6. Try switching worksheet views.
7. Close Excel (you do not have to save the workbook).

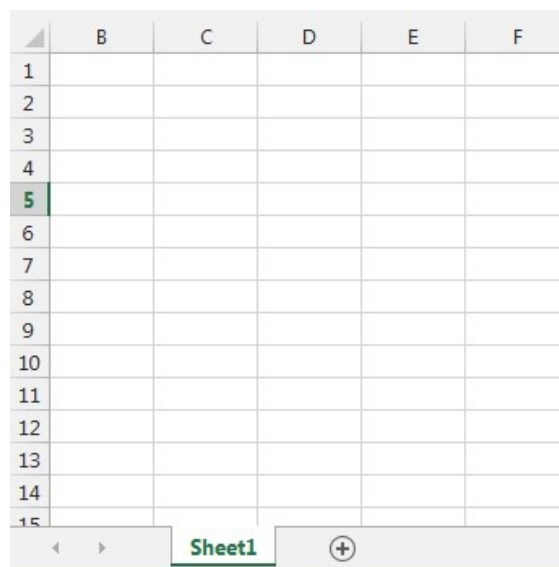
The Workbook Window

In Excel 2013, when you open up a new workbook it now contains only 1 worksheet. There can be a max of 1,048,576 rows and 16,384 columns in an excel work sheet.

❑ The Worksheet

Excel files are called workbooks. Each workbook holds one or more worksheets (also known as "spreadsheets").

Whenever you create a new Excel workbook, it will contain one worksheet named Sheet1. A worksheet is a grid of columns and rows where columns are designated by letters running across the top of the worksheet and rows are designated by numbers running down the left side of the worksheet.

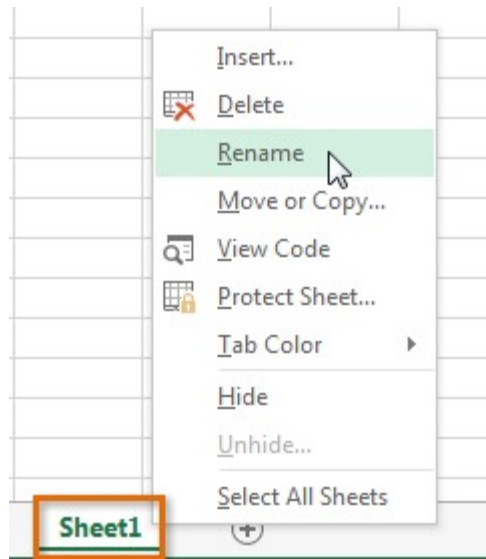


When working with a large amount of data, you can create multiple worksheets to help organize your workbook and make it easier to find content. You can also group worksheets to quickly add information to multiple worksheets at the same time.

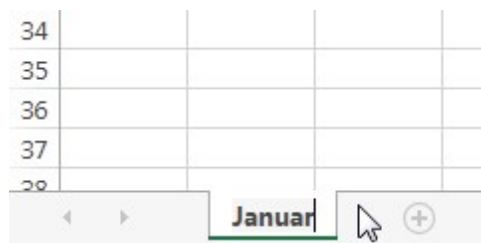
To rename a worksheet

Whenever you create a new Excel workbook, it will contain one worksheet named Sheet1. You can rename a worksheet to better reflect its content. In our example, we will create a training log organized by month.

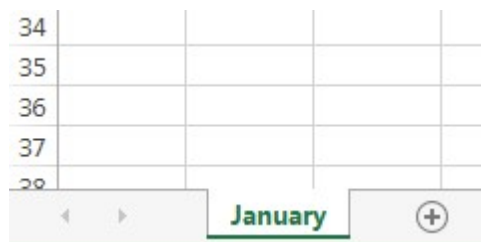
1. Right-click the worksheet you wish to rename, then select Rename from the worksheet menu.



2. Type the desired name for the worksheet.

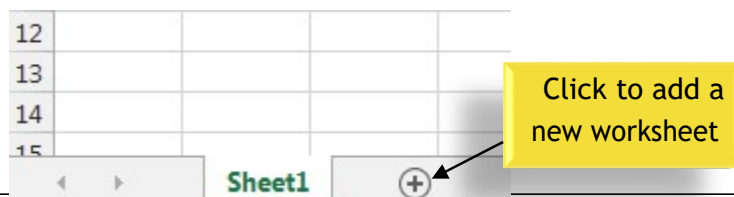


3. Click anywhere outside of the worksheet, or press Enter on your keyboard. The worksheet will be renamed.




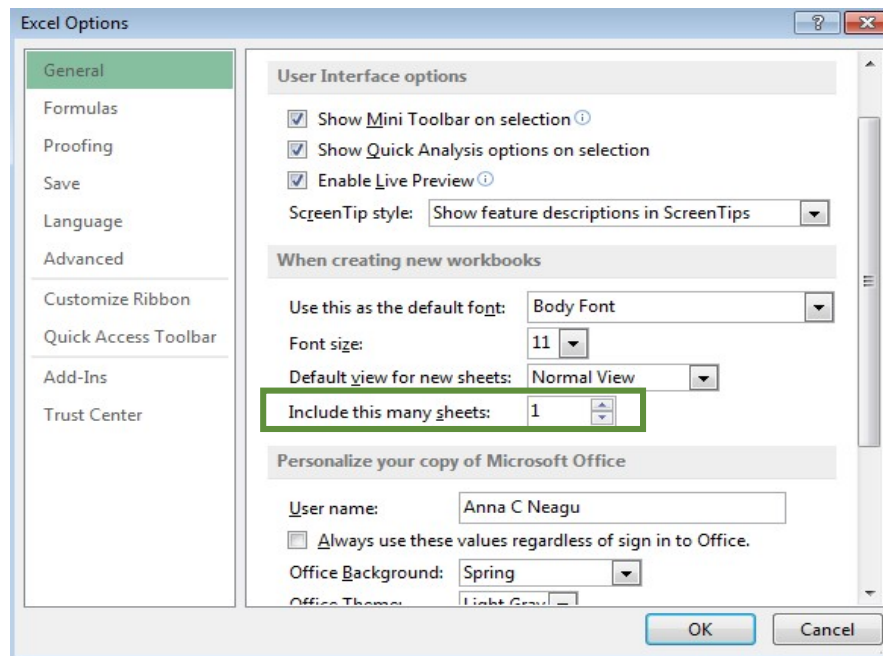
To insert a new worksheet

1. Locate and select the New sheet button.



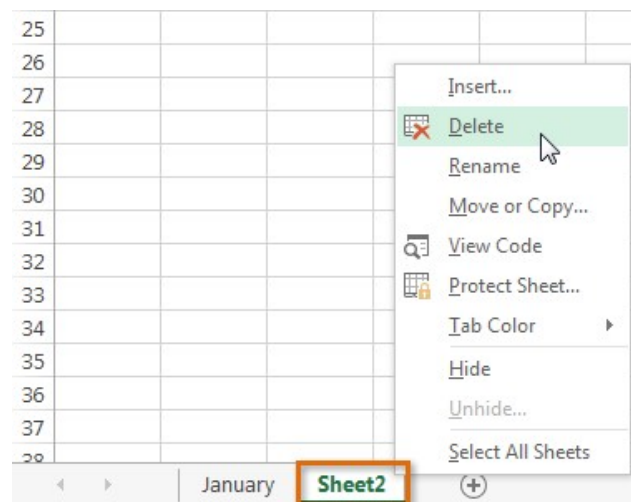
2. A new, blank worksheet will appear.

 **TIP:** To change the default number of worksheets, navigate to Backstage view, click Options, then choose the desired number of worksheets to include in each new workbook.

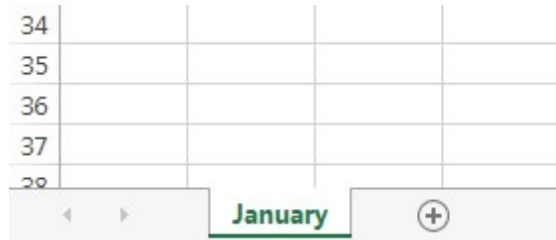


To delete a worksheet

1. Right-click the worksheet you wish to delete, then select Delete from the worksheet menu.



2. The worksheet will be deleted from your workbook.

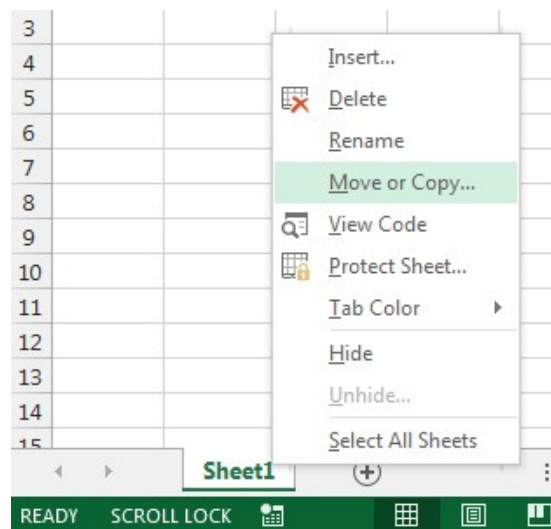


Alternatively, from the Home Tab in the Cells Group click on Delete and select Delete Sheet. Warning: The Undo button will not undo the deletion of a worksheet.

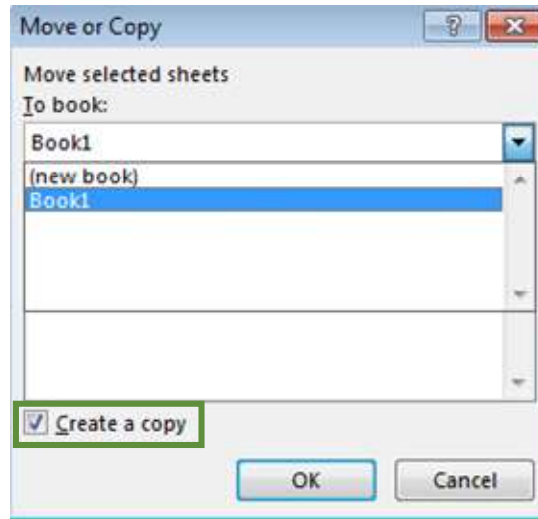
To copy a worksheet

If you need to duplicate the content of one worksheet to another, Excel allows you to copy an existing worksheet.

1. Right-click the worksheet you want to copy, then select Move or Copy from the worksheet menu.

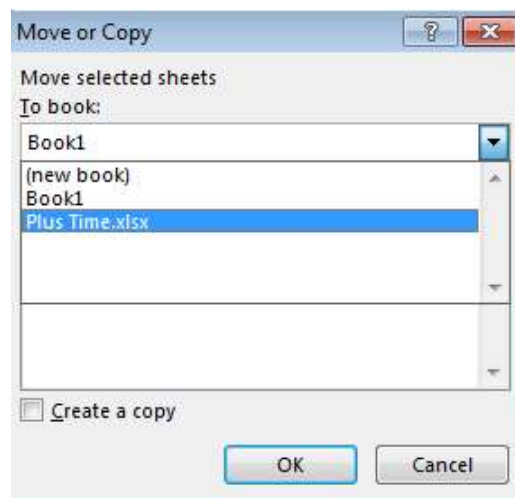


2. The Move or Copy dialog box will appear. Choose where the sheet will appear in the Before sheet: field. In our example, we'll choose (move to end) to place the worksheet to the right of the existing worksheet.
3. Check the box next to Create a copy, then click OK.





4. The worksheet will be copied. It will have the same title as the original worksheet, as well as a version number.

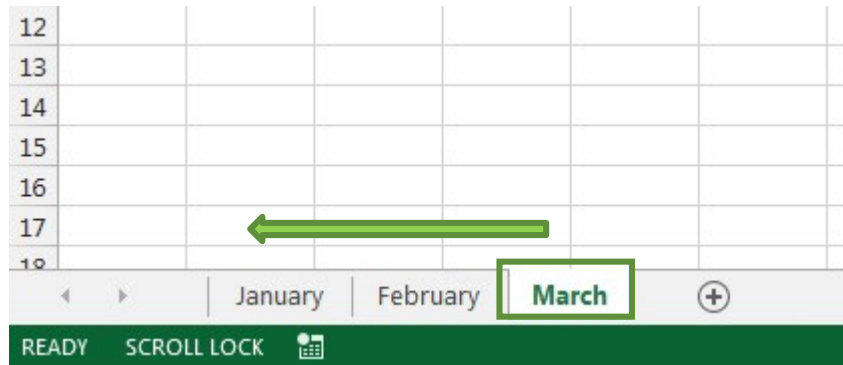
TIP: You can also copy a worksheet to an entirely different workbook. You can select any workbook that is currently open from the To book: drop-down menu.



To move a worksheet

Sometimes you may want to move a worksheet to rearrange your workbook.

1. Select the worksheet you wish to move. The cursor will become a small worksheet icon .
2. Hold and drag the mouse until a small black arrow  appears above the desired location.

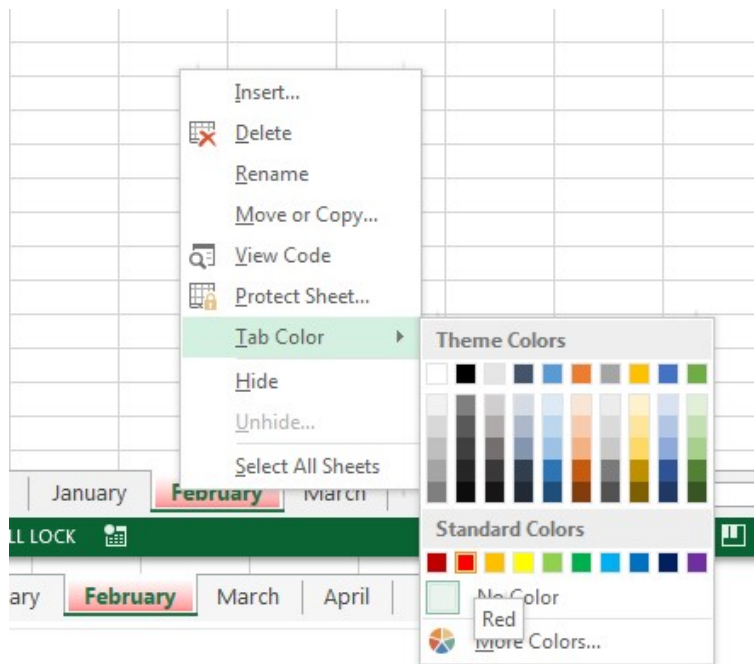


3. Release the mouse. The worksheet will be moved.

To change the worksheet color

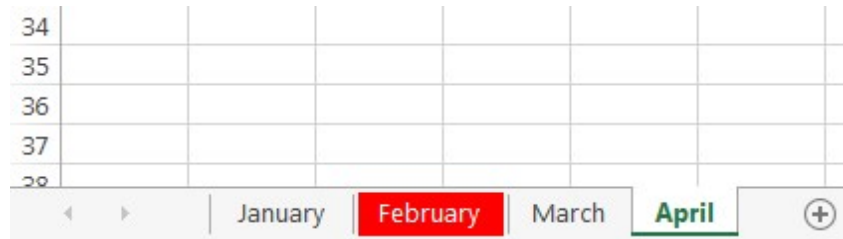
You can change a worksheet's color to help organize your worksheets and make your workbook easier to navigate.

1. Right-click the desired worksheet, and hover the mouse over Tab Color. The Color menu will appear.
2. Select the desired color. A live preview of the new worksheet color will appear as you hover the mouse over different options. In our example, we'll choose Red.



3. The worksheet color will be changed.

The worksheet color is considerably less noticeable when the worksheet is selected. Select another worksheet to see how the color will appear when the worksheet is not selected.

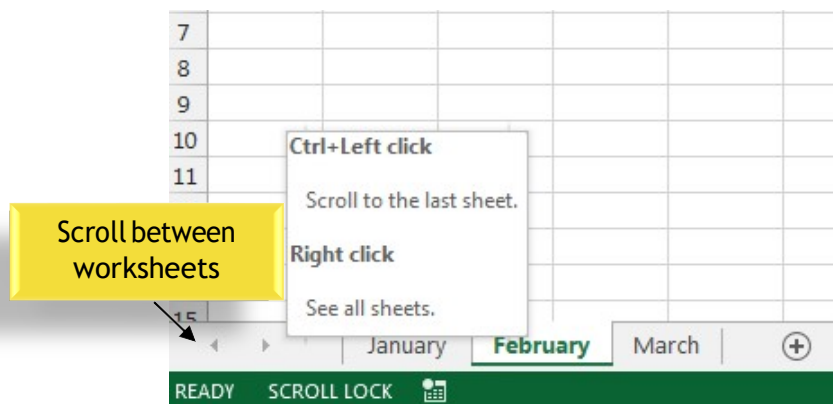


Challenge!

1. Open an existing Excel workbook.
2. Insert a new worksheet and rename it.
3. Delete a worksheet.
4. Move a worksheet.
5. Copy a worksheet.

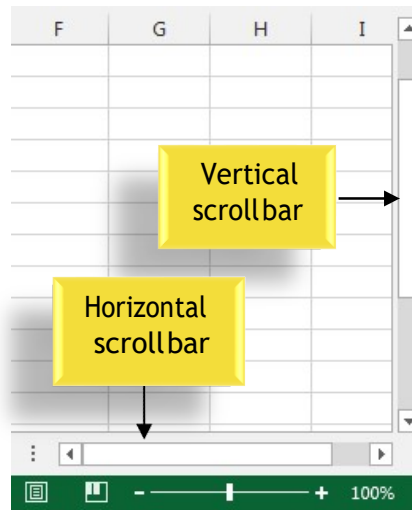
❑ The Scrolling Buttons

These buttons scroll the display of sheet tabs one at a time or to display the first and last grouping of sheet tabs and are located to the left of the sheet tabs.



❑ The Scroll Bars

Your spreadsheet may frequently have more data than you can see on the screen at once. Click, hold and drag the vertical or horizontal scroll bar depending on what part of the page you want to see.

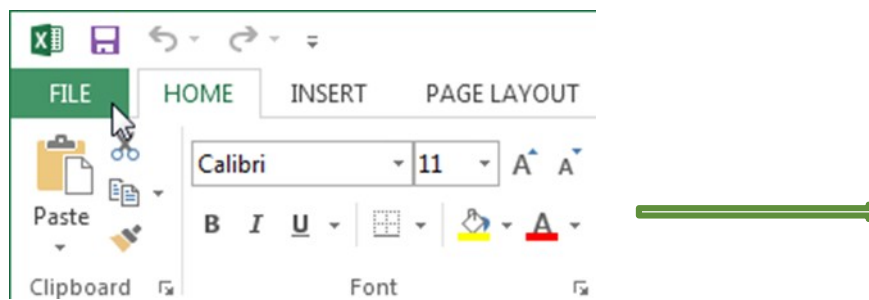


Creating and Opening Workbooks

Excel files are called workbooks. Whenever you start a new project in Excel, you'll need to create a new workbook. There are several ways to start working with a workbook in Excel 2013. You can choose to create a new workbook—either with a blank workbook or a predesigned template—or open an existing workbook.

Create a new blank workbook

1. Select the File tab. Backstage view will appear.

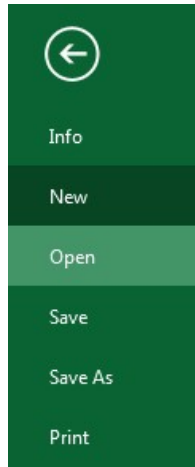


2. Select New, then click Blank workbook.
3. A new blank workbook will appear.

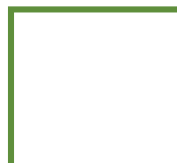
Open an existing workbook

In addition to creating new workbooks, you'll often need to open a workbook that was previously saved.

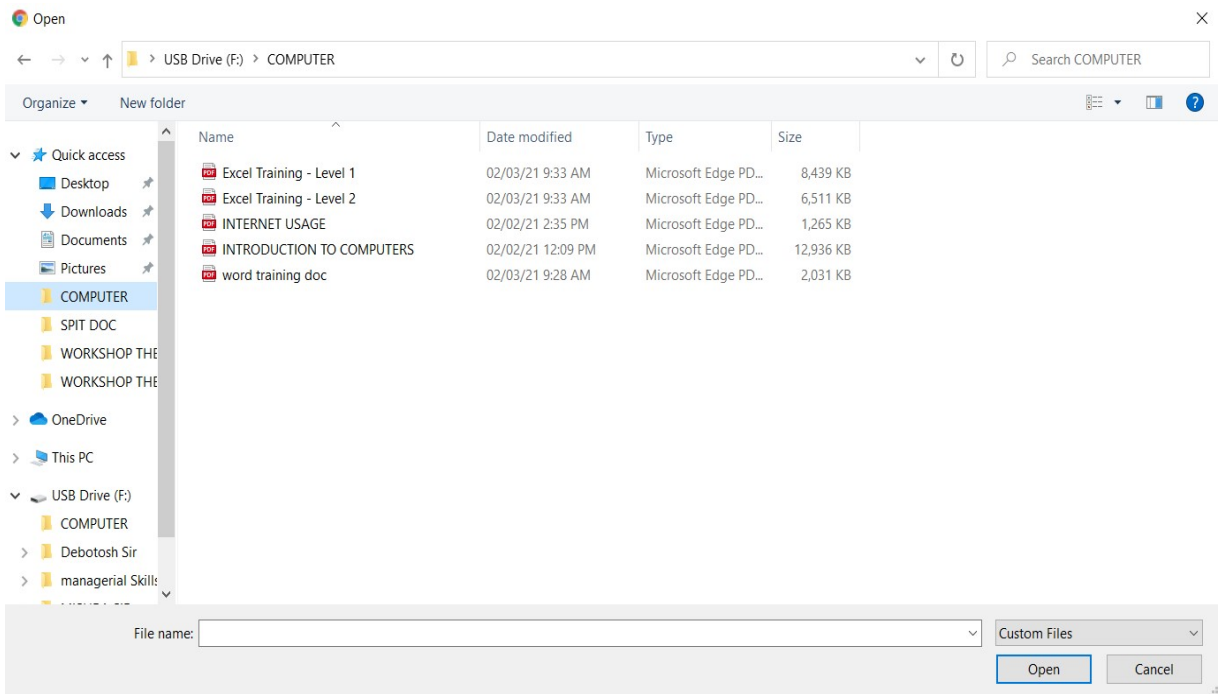
1. Navigate to Backstage view, then click Open.




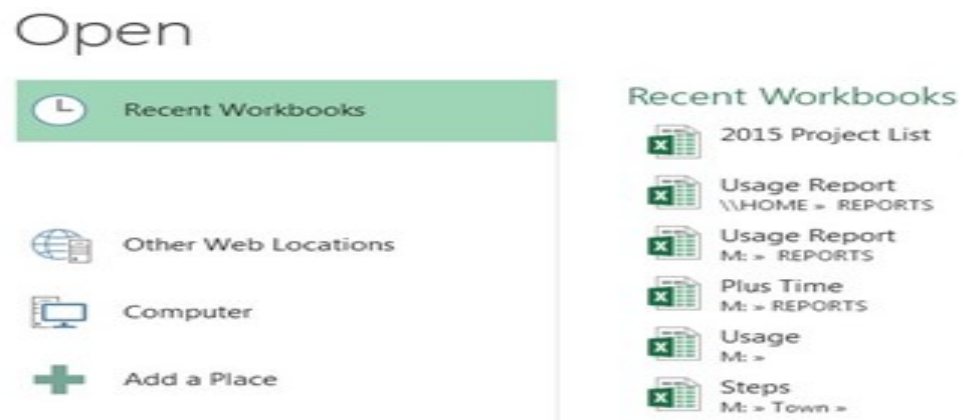
2. Select Computer, and then click Browse.



3. The Open dialog box will appear. Locate and select your workbook, then click Open.



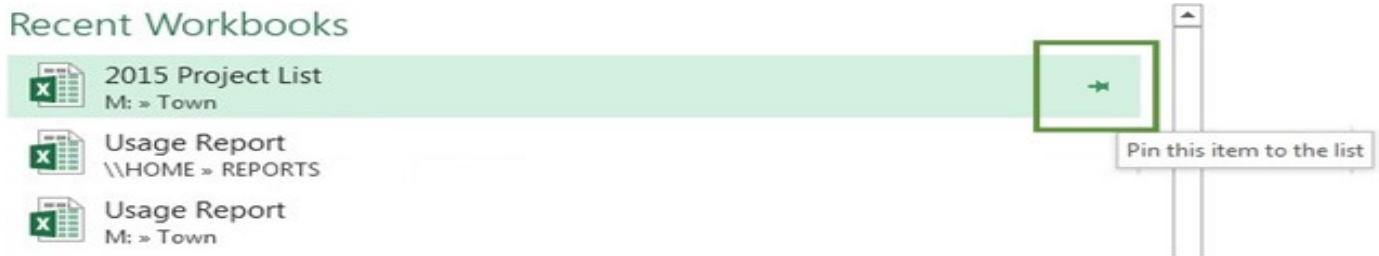
 **TIP:** If you've opened the desired workbook recently, you can browse your RecentWork book rather than searching for the file.




To pin a workbook

If you frequently work with the same workbook, you can pin it to Backstage view for quick access.

1. Navigate to Backstage view and then click Open. Your recently edited workbooks will appear.
2. Hover the mouse over the workbook you wish to pin. A pushpin icon ➦ will appear next to the workbook. Click the pushpin icon.



3. The workbook will stay in Recent Workbooks. To unpin a workbook, simply click the pushpin icon again.

 **TIP:** You can also pin folders to Backstage view for quick access. From Backstage view, click open, then locate the folder you wish to pin and click the pushpin icon.

Compatibility mode

Sometimes you may need to work with workbooks that were created in earlier versions of Microsoft Excel, such as Excel 2003 or Excel 2000. When you open these kinds of workbooks, they will appear in Compatibility mode.



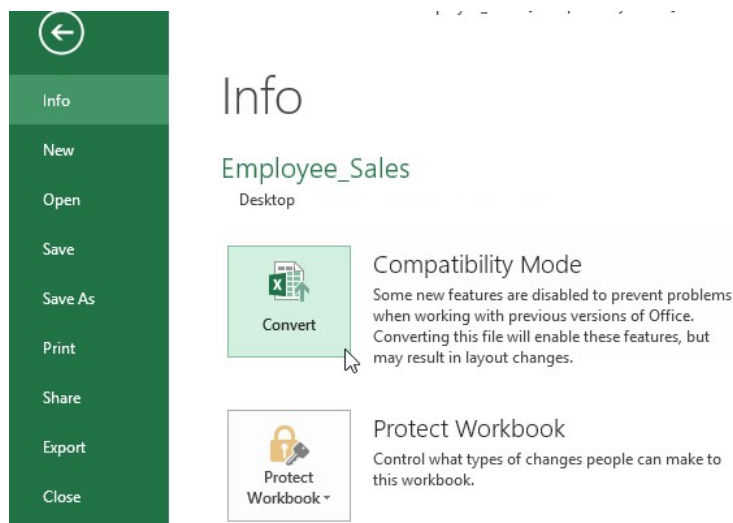
Compatibility mode disables certain features, so you'll only be able to access commands found in the program that was used to create the workbook. For example, if you open a workbook created in Excel 2003, you can only use tabs and commands found in Excel 2003.

In order to exit Compatibility mode, you'll need to convert the workbook to the current version type. However, if you're collaborating with others who only have access to an earlier version of Excel, it's best to leave the workbook in Compatibility mode so the format will not change.

To convert a workbook

If you want access to all of the Excel 2013 features, you can convert the workbook to the 2013 file format. Note that converting a file may cause some changes to the original layout of the workbook.

1. Click the File tab to access Backstage view.
2. Locate and select Convert command.



3. The Save As dialog box will appear. Select the location where you wish to save the workbook, enter a file name for the presentation, and click Save.
4. The workbook will be converted to the newest file type.

Challenge!

1. Create a new blank workbook.
2. ~~Open an existing workbook from your computer.~~
3. Pin a folder to Backstage view.

Saving and Sharing Workbooks

Whenever you create a new workbook in Excel, you'll need to know how to save it in order to access and edit it later. As with previous versions of Excel, you can save files locally to your computer. But unlike older versions, Excel 2013 also lets you save a workbook to the cloud using OneDrive. You can also export and share workbooks with others directly from Excel.

Save and Save As

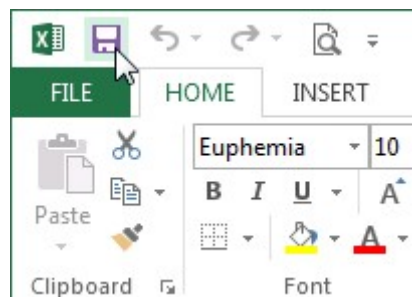
Excel offers two ways to save a file: Save and Save As. These options work in similar ways, with a few important differences:

- ☑ **Save:** When you create or edit a workbook, you'll use the Save command to save your changes. You'll use this command most of the time. When you save a file, you'll only need to choose a file name and location the first time. After that, you can just click the Save command to save it with the same name and location.
- ☑ **Save As:** You'll use this command to create a copy of a workbook while keeping the original. When you use Save As, you'll need to choose a different name and/or location for the copied version.

To save a workbook

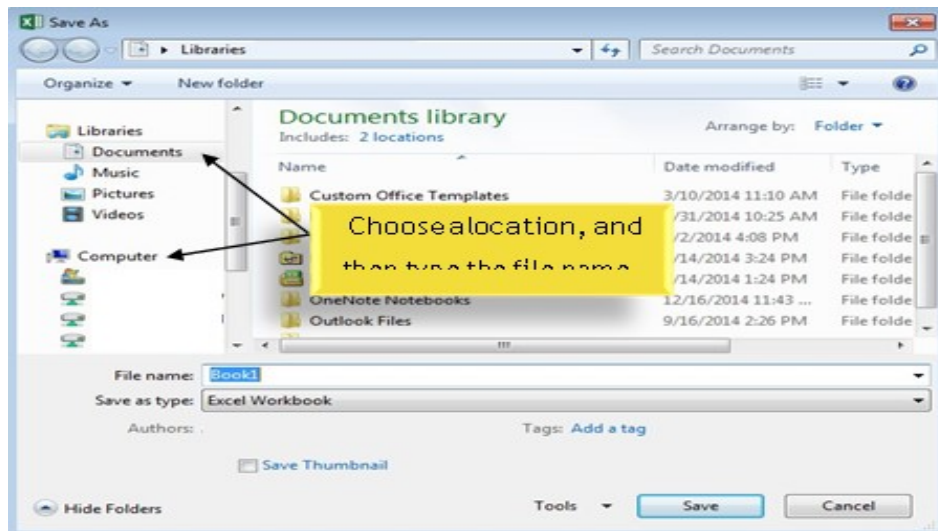
It's important to save your workbook whenever you start a new project or make changes to an existing one. Saving early and often can prevent your work from being lost. You'll also need to pay close attention to where you save the workbook so it will be easy to find later.

1. Locate and select the Save command on the Quick Access Toolbar.



2. If you're saving the file for the first time, the Save As pane will appear in Backstage view.
3. You'll then need to choose where to save the file and give it a file name. To save the workbook to your computer, select Computer, then click Browse. Alternatively, you can click OneDrive to save the file to your OneDrive.
4. The Save As dialog box will appear. Select the location where you wish to save the workbook.

-
5. Enter a file name for the workbook, then click Save.



6. The workbook will be saved. You can click the Save command again to save your changes as you modify the workbook.

Using Save As to make a copy

If you want to save a different version of a workbook while keeping the original, you can create a copy. For example, if you have a file named "Sales Data" you could save it as "Sales Data 2" so you'll be able to edit the new file and still refer back to the original version.

To do this, you'll click the Save As command in Backstage view. Just like when saving a file for the first time, you'll need to choose where to save the file and give it a new file name.

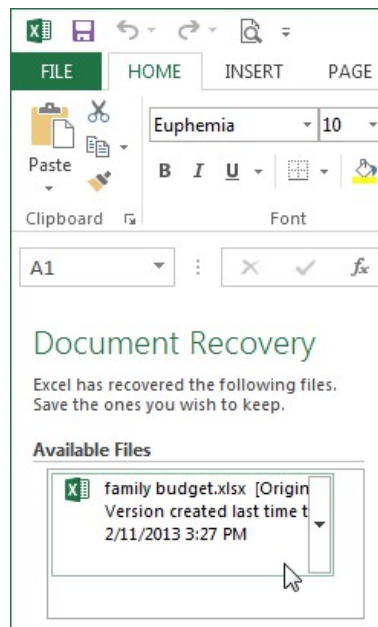
AutoRecover


Excel automatically saves your workbooks to a temporary folder while you are working on them. If you forget to save your changes, or if Excel crashes, you can restore the file using AutoRecover.

To use AutoRecover

1. Open Excel 2013. If auto-saved versions of a file are found, the Document Recovery pane will appear.

2. Click to open an available file. The workbook will be recovered.



 **TIP:** By default, Excel autosaves every 10 minutes. If you are editing a workbook for less than 10 minutes, Excel may not create an autosaved version.

If you don't see the file you need, you can browse all autosaved files from Backstage view. Just select the File tab, click Manage Versions, and then choose Recover Unsaved Workbooks.

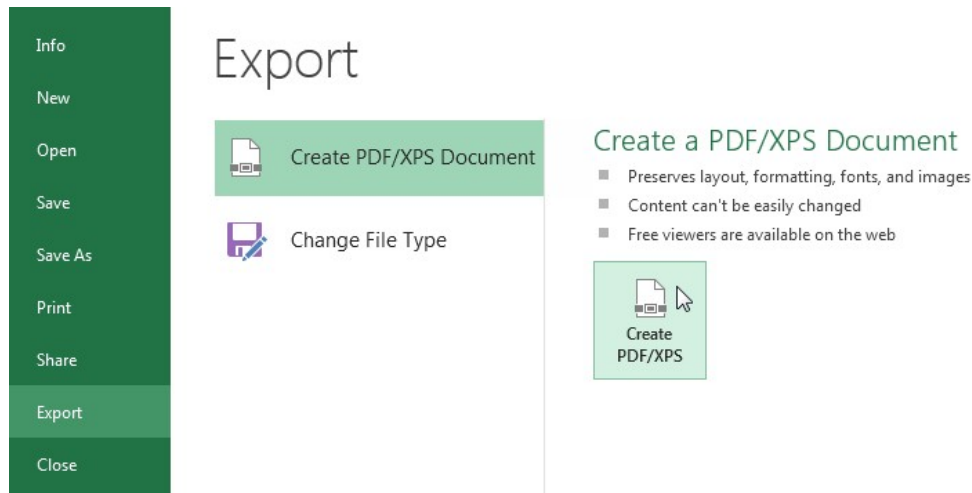
Exporting workbooks

By default, Excel workbooks are saved in the .xlsx file type. However, there may be times when you need to use another file type, such as a PDF or Excel 97-2003 workbook. It's easy to export your workbook from Excel in a variety of file types.


To export a workbook as a PDF file

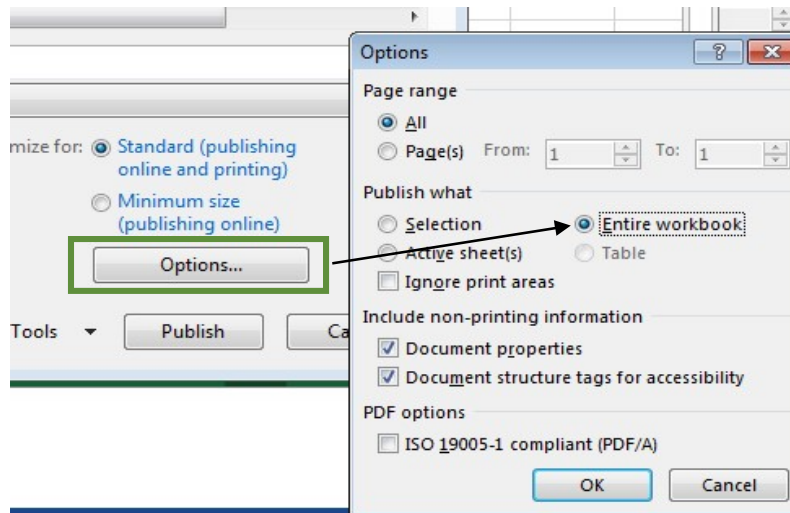
Exporting your workbook as an Adobe Acrobat document, commonly known as a PDF file, can be especially useful if sharing a workbook with someone who does not have Excel. A PDF will make it possible for recipients to view, but not edit, the content of your workbook.

1. Click the File tab to access Backstage view.
2. Click Export, then select Create PDF/XPS.



3. The Save As dialog box will appear. Select the location where you wish to export the workbook, enter a file name, and then click Publish.

 **TIP:** By default, Excel will only export the active worksheet. If you have multiple worksheets and want to save all of them in the same PDF file, click Options in the Save as dialog box. The Options dialog box will appear. Select Entire workbook, then click OK.



To export a workbook in other file types

You may also find it helpful to export your workbook in other file types, such as an Excel 97-2003 Workbook if you need to share with people using an older version of Excel, or a .CSV file if you need a plain-text version of your workbook.

1. Click the File tab to access Backstage view.
2. Click Export, then select Change File Type.
3. Select a common file type, then click Save As.
4. The Save As dialog box will appear. Select the location where you wish to export the workbook, enter a file name, and then click Save.

Challenge!

5. Create a new blank workbook.
6. Use the Save command to save the workbook to your desktop.
7. Save the workbook to OneDrive and invite someone else to view it.
8. Export the workbook as a PDF file.

3. Cell Basics

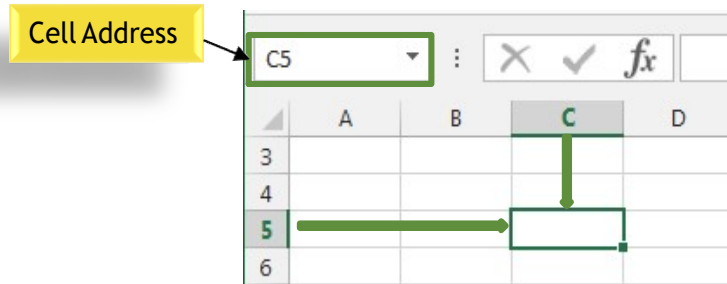
Whenever you work with Excel, you'll enter information, or content, into cells. Cells are the basic building blocks of a worksheet. You'll need to learn the basics of cells and cell content to calculate, analyze, and organize data in Excel.

Understanding Cells

Every worksheet is made up of thousands of rectangles, which are called cells. A cell is the intersection of a row and a column. Columns are identified by letters (A, B, C), while rows are identified by numbers (1, 2, 3).



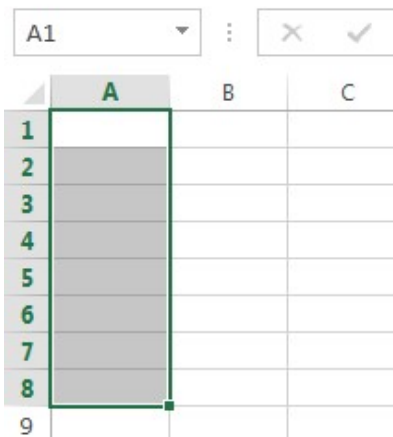
Each cell has its own name, or cell address, based on its column and row. In this example, the selected cell intersects column C and row 5, so the cell address is C5. The cell address will also appear in the Name box. Note that a cell's column and row headings are highlighted when the cell is selected.



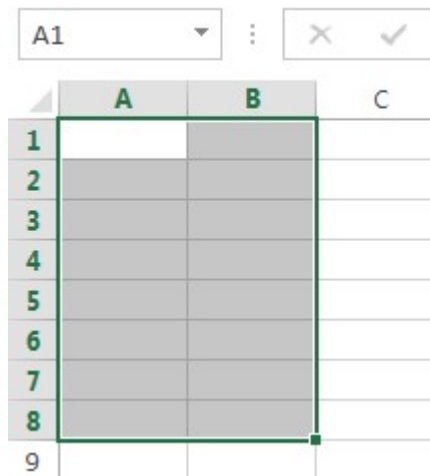
You can also select multiple cells at the same time. A group of cells is known as a cell range. Rather than a single cell address, you will refer to a cell range using the cell addresses of the first and last cells in the cell range, separated by a colon. For example, a cell range that included cells A1, A2, A3, A4, and A5 would be written as A1:A5.

In the images below, two different cell ranges are selected:

- Cell range A1:A8



- Cell range A1:B8



To select a cell range

Sometimes you may want to select a larger group of cells, or a cell range.

1. Click, hold, and drag the mouse until all of the adjoining cells you wish to select are highlighted.
2. Release the mouse to select the desired cell range. The cells will remain selected until you click another cell in the worksheet.

Cell Content

Any information you enter into a spreadsheet will be stored in a cell. Each cell can contain several different kinds of content, including text, formatting, formulas, and functions.

Text

Cells can contain text, such as letters, numbers, and dates.

	A	B	C
1	Date	Sales	% of Total
2	21.02.2015	68	0.89
3	21.02.2016	55	0.63
4	21.02.2017	84	0.57
5	21.02.2018	96	0.66
6	21.02.2019	63	0.42
7	21.02.2020	14	0.56

❑ Formatting Attributes

Cells can contain formatting attributes that change the way letters, numbers, and dates are displayed. For example, percentages can appear as 0.15 or 15%. You can even change a cell's background color.

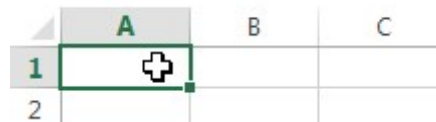
❑ Formulas and Functions

Cells can contain formulas and functions that calculate cell values. In our example, SUM(B4:B7) adds the value of each cell in cell range B4:B7 and displays the total in cell B8.

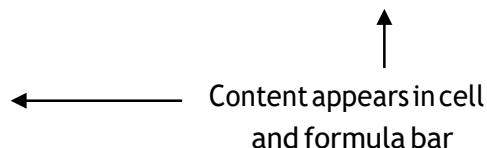
A	B	C
Date	Sales	% of Total
21.02.2015	68	0.89
21.02.2016	55	0.63
21.02.2017	84	0.57
21.02.2018	96	0.66
21.02.2019	63	0.42
21.02.2020	14	0.56

To insert content

1. Click a cell to select it.



2. Type content into the selected cell, then press Enter on your keyboard. The content will appear in the cell and the formula bar. You can also input and edit cell content in the formula bar.



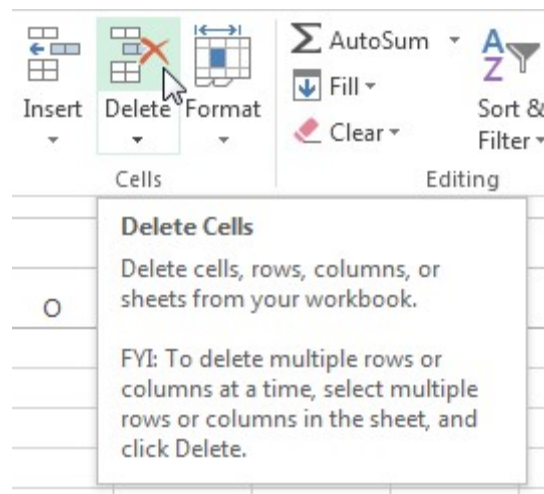
To delete cell content

1. Select the cell with content you wish to delete.
2. Press the Delete or Backspace key on your keyboard. The cell's contents will be deleted.

To delete cells

There is an important difference between deleting the content of a cell and deleting the cell itself. If you delete the entire cell, the cells below it will shift up and replace the deleted cells.

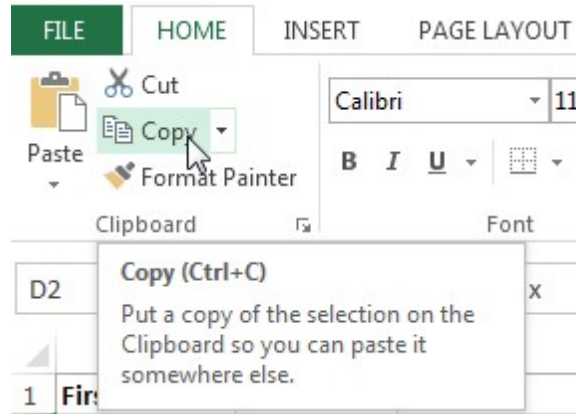
1. Select the cell(s) you wish to delete.
2. Select the Delete command from the Home tab on the Ribbon.
3. The cells below will shift up.



To copy and paste cell content

Excel allows you to copy content that is already entered into your spreadsheet and paste that content to other cells, which can save you time and effort.

1. Select the cell(s) you wish to copy.
2. Click the Copy command on the Home tab, or press Ctrl+C on your keyboard.

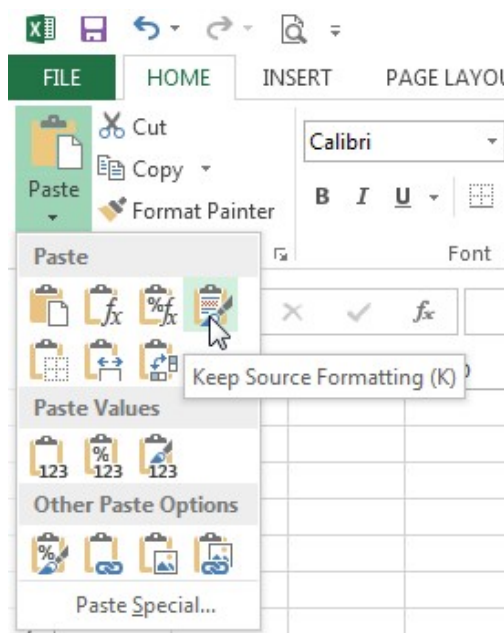



3. Select the cell(s) where you wish to paste the content. The copied cells will now have a dashed box around them.
4. Click the Paste command on the Home tab, or press Ctrl+V on your keyboard.
5. The content will be pasted into the selected cells.

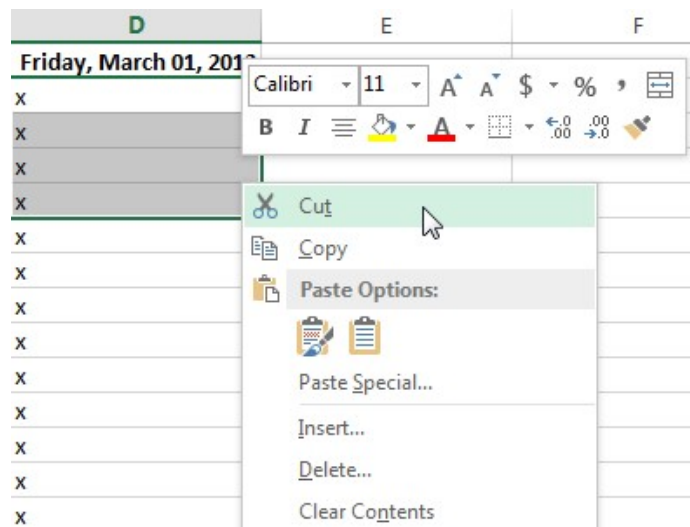
To access more paste options

You can also access additional paste options, which are especially convenient when working with cells that contain formulas or formatting.

- ☑ To access more paste options, click the drop-down arrow on the Paste command.



 **TIP:** Rather than choosing commands from the Ribbon, you can access commands quickly by right-clicking. Simply select the cell(s) you wish to format, then right-click the mouse. A drop-down menu will appear, where you'll find several commands that are also located on the Ribbon.



To drag and drop cells

Rather than cutting, copying, and pasting, you can drag and drop cells to move their contents.

1. Select the cell(s) you wish to move.
2. Hover the mouse over the border of the selected cell(s) until the cursor changes from a white cross to a black cross with four arrows.
3. Click, hold, and drag the cells to the desired location.
4. Release the mouse, and the cells will be dropped in the selected location.

To use the fill handle

There may be times when you need to copy the content of one cell to several other cells in your worksheet. You could copy and paste the content into each cell, but this method would be very time consuming. Instead, you can use the fill handle to quickly copy and paste content to adjacent cells in the same row or column.

1. Select the cell(s) containing the content you wish to use. The fill handle will appear as a small square in the bottom-right corner of the selected cell(s).

↑
The fill handle

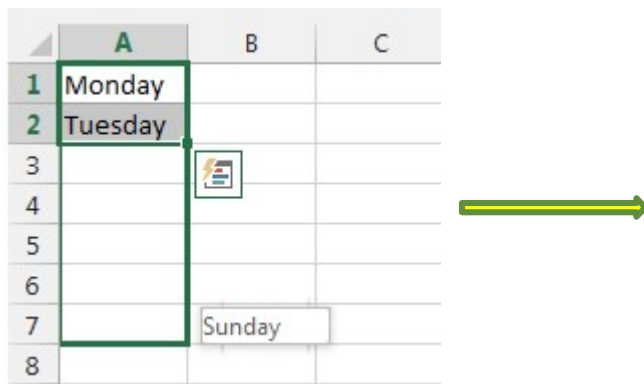
2. Click, hold, and drag the fill handle until all of the cells you wish to fill are selected.

	A	B	C
1	x	x	
2	x	x	
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			x
13			

3. Release the mouse to fill the selected cells.

To continue a series with the fill handle

The fill handle can also be used to continue a series. Whenever the content of a row or column follows a sequential order, like numbers (1, 2, 3) or days (Monday, Tuesday, Wednesday), the fill handle can guess what should come next in the series. In many cases, you may need to select multiple cells before using the fill handle to help Excel determine the series order. In our example below, the fill handle is used to extend a series of dates in a column.

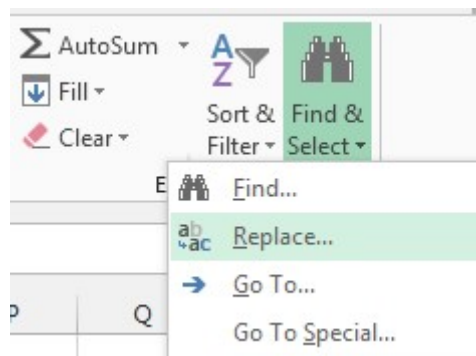


Find and Replace

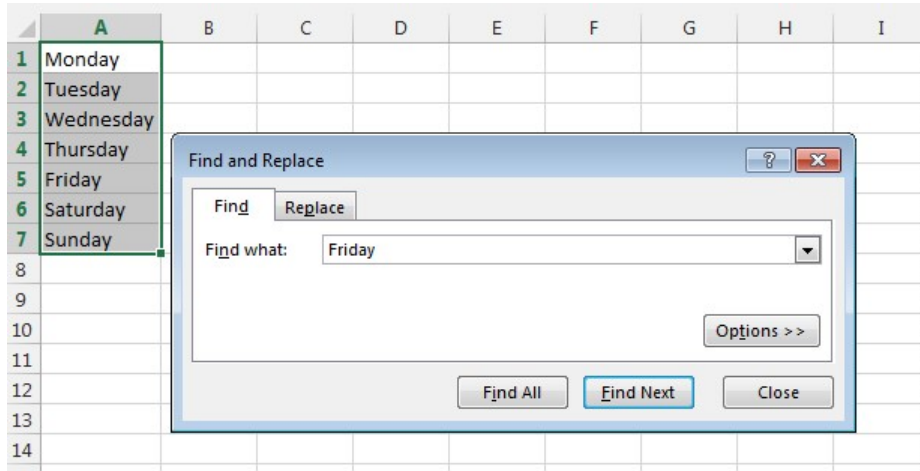
When working with a lot of data in Excel, it can be difficult and time consuming to locate specific information. You can easily search your workbook using the Find feature, which also allows you to modify content using the Replace feature.

To find content

1. From the Home tab, click the Find and Select command, then select Find... from the drop-down menu.



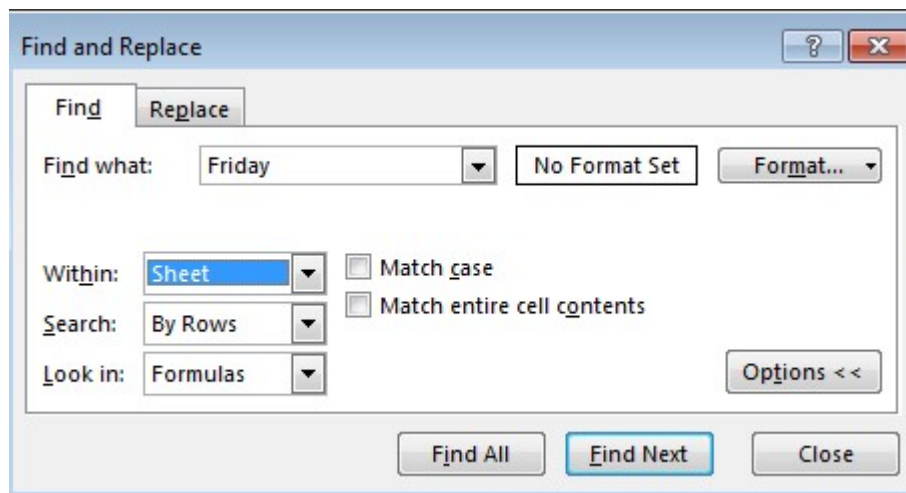
2. The Find and Replace dialog box will appear. Enter the content you wish to find.
3. Click Find Next. If the content is found, the cell containing that content will be selected.



4. Click Find Next to find further instances or Find All to see every instance of the search term.
5. When you are finished, click Close to exit the Find and Replace dialog box.

 **TIP:** You can also access the Find command by pressing Ctrl+F on your keyboard.

 **TIP:** Click Options to see advanced search criteria in the Find and Replace dialog box.



To replace cell content

At times, you may discover that you've repeatedly made a mistake throughout your workbook (such as misspelling someone's name), or that you need to exchange a particular word or phrase for another. You can use Excel's Find and Replace feature to make quick revisions.

1. From the Home tab, click the Find and Select command, then select Replace... from the drop- down menu.
2. The Find and Replace dialog box will appear. Type the text you wish to find in the Find what: field.
3. Type the text you wish to replace it with in the Replace with: field, then click Find Next.
4. If the content is found, the cell containing that content will be selected.
5. Review the text to make sure you want to replace it.
6. If you wish to replace it, select one of the replace options:
 - Replace will replace individual instances.
 - Replace All will replace every instance of the text throughout the workbook. In our example, we'll choose this option to save time.
7. A dialog box will appear, confirming the number of replacements made. Click OK to continue.
8. When you are finished, click Close to exit the Find and Replace dialog box.

Challenge!

1. Open an existing Excel 2013 workbook.
2. Select cell D3. Notice how the cell address appears in the Name box and its content appears in both the cell and the Formula bar.
3. Select a cell, and try inserting text and numbers.
4. Delete a cell, and note how the cells below shift up to fill in its place.
5. Cut cells and paste them into a different location.
6. Try dragging and dropping some cells to other parts of the worksheet.
7. Use the fill handle to fill in data to adjoining cells both vertically and horizontally.
8. Use the Find feature to locate content in your workbook.

4. Formatting Cells

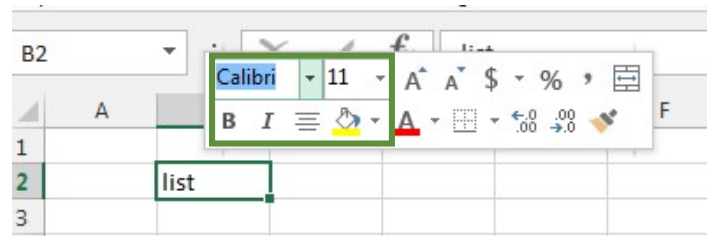
All cell content uses the same formatting by default, which can make it difficult to read a workbook with a lot of information. Basic formatting can customize the look and feel of your workbook, allowing you to draw attention to specific sections and making your content easier to view and understand. You can also apply number formatting to tell Excel exactly what type of data you're using in the workbook, such as percentages (%), currency (\$), and so on.

Font Formatting


To change the font

By default, the font of each new workbook is set to Calibri. However, Excel provides a variety of other fonts you can use to customize your cell text. In the example below, we'll format our title cell to help distinguish it from the rest of the worksheet.

1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the Font command on the Home tab. The Font drop-down menu will appear.
3. Select the desired font. A live preview of the new font will appear as you hover the mouse over different options.




4. The text will change to the selected font.

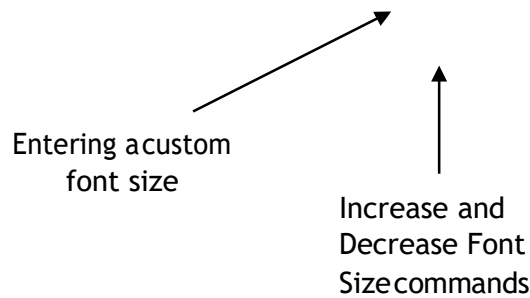
 **TIP:** When creating a workbook in the workplace, you'll want to select a font that is easy to read.

Along with Calibri, standard reading fonts include Cambria, Times New Roman, and Arial.

To change the font size

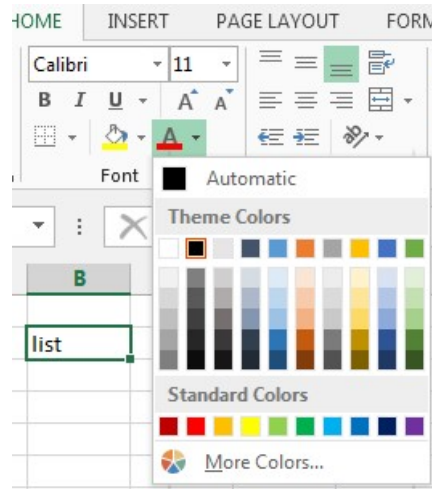
1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the Font Size command on the Home tab. The Font Size drop-down menu will appear.
3. Select the desired font size. A live preview of the new font size will appear as you hover the mouse over different options.
4. The text will change to the selected font size.

 **TIP:** You can also use the Increase Font Size and Decrease Font Size commands or enter a font size using your keyboard.



To change the font color

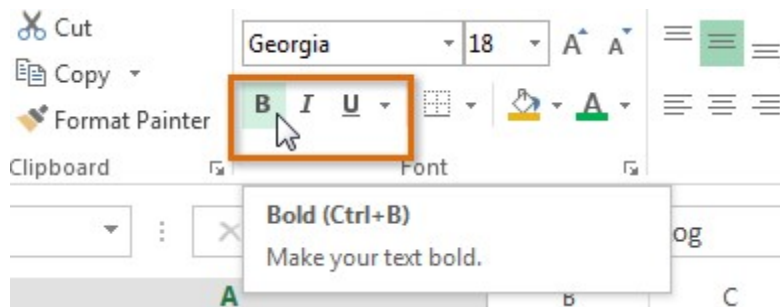
1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the Font Color command on the Home tab. The Color menu will appear.
3. Select the desired font color. A live preview of the new font color will appear as you hover the mouse over different options.




4. The text will change to the selected font color.

To use the Bold, Italic, and Underline commands

1. Select the cell(s) you wish to modify.
2. Click the Bold (B), Italic (I), or Underline (U) command on the Home tab. In our example, we'll make the selected cells bold.



3. The selected style will be applied to the text.

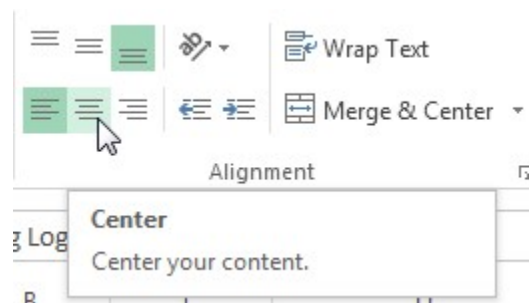
 **TIP:** You can also press **Ctrl+B** on your keyboard to make selected text bold, **Ctrl+I** to apply ~~its~~ and **Ctrl+U** to apply an underline.

Text Alignment

By default, any text entered into your worksheet will be aligned to the bottom-left of a cell. Any numbers will be aligned to the bottom-right of a cell. Changing the alignment of your cell content allows you to choose how the content is displayed in any cell, which can make your cell content easier to read.

To change horizontal text alignment

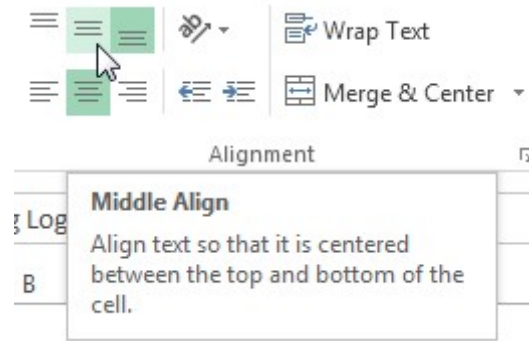
1. Select the cell(s) you wish to modify.
2. Select one of the three horizontal alignment commands on the Home tab. In our example, we'll choose Center Align.



3. The text will realign.

To change vertical text alignment

1. Select the cell(s) you wish to modify.
2. Select one of the three vertical alignment commands on the Home tab. In our example, we'll choose Middle Align.



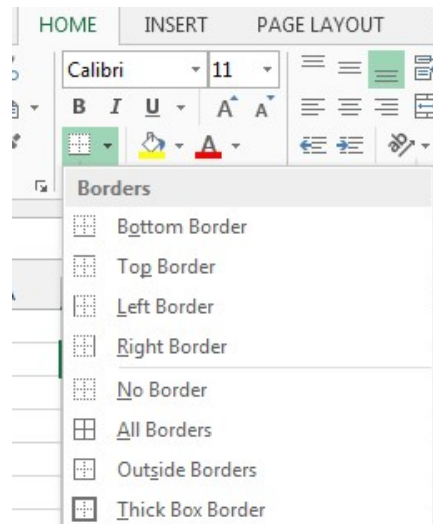
3. The text will realign.

Cell borders and fill colors


Cell borders and fill colors allow you to create clear and defined boundaries for different sections of your worksheet.

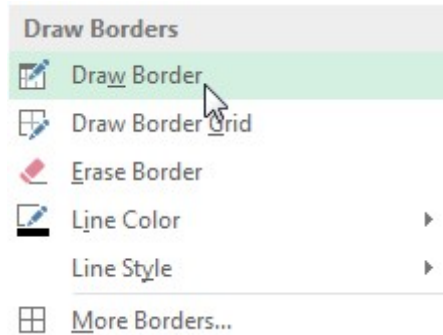
To add a border

1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the Borders command on the Home tab. The Borders drop-down menu will appear.



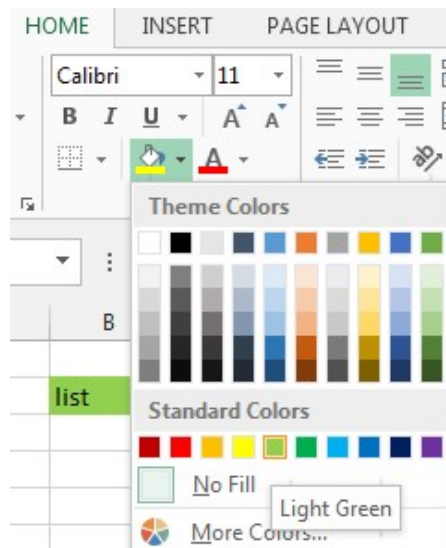
3. Select the border style you want to use.
4. The selected border style will appear.

 **TIP:** You can draw borders and change the line style and color of borders with the Draw Borders tools at the bottom of the Borders drop-down menu.



To add a fill color

1. Select the cell(s) you wish to modify.
2. Click the drop-down arrow next to the Fill Color command on the Home tab. The Fill Color menu will appear.
3. Select the fill color you want to use. A live preview of the new fill color will appear as you hover the mouse over different options. In our example, we'll choose Light Green.



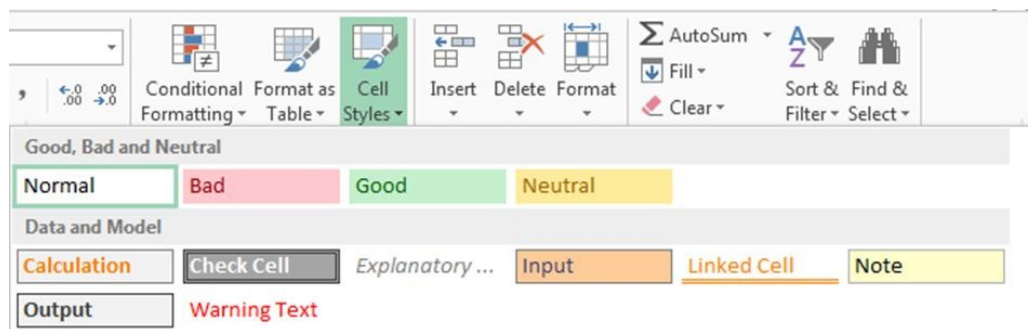
4. The selected fill color will appear in the selected cells.

Cell styles


Rather than formatting cells manually, you can use Excel's predesigned cell styles. Cell styles are a quick way to include professional formatting for different parts of your workbook, such as titles and headers.

To apply a cell style

1. Select the cell(s) you wish to modify.
2. Click the Cell Styles command on the Home tab, then choose the desired style from the drop-down menu.



3. The selected cell style will appear.

 **TIP:** Applying a cell style will replace any existing cell formatting except for text alignment. You may not want to use cell styles if you've already added a lot of formatting to your workbook.

Formatting text and numbers

One of the most powerful tools in Excel is the ability to apply specific formatting for text and numbers. Instead of displaying all cell content in exactly the same way, you can use formatting to change the appearance of dates, times, decimals, percentages (%), currency (\$), and much more.

To apply number formatting

1. Select the cells(s) you wish to modify.
2. Click the drop-down arrow next to the Number Format command on the Home tab. The Number Formatting drop-down menu will appear.
3. Select the desired formatting option.
4. The selected cells will change to the new formatting style.

The image shows the Excel Number Format dropdown menu with the following items and callouts:

- General** (list: No specific format): Callout: "General is the default format for any cell. When you enter a number into the cell, Excel will guess the number format that is most appropriate." Example: ABC, 123
- Number** (list: list): Callout: "Number formats numbers with decimal places." Example: 12
- Currency** (list: list): Callout: "Currency formats numbers as currency with a currency symbol." Example: \$12.34
- Accounting** (list: list): Callout: "Accounting formats numbers as monetary values like the Currency format, but it also aligns currency symbols and decimal places within columns." Example: \$12.34
- Short Date** (list: list): Callout: "Short Date formats numbers as M/D/YYYY." Example: 12/31/2012
- Long Date** (list: list): Callout: "Long Date formats numbers as Weekday, Month DD, YYYY." Example: Monday, 12/31/2012
- Time** (list: list): Callout: "Time formats numbers as HH/MM/SS and notes AM or PM." Example: 12:31:00 PM
- Percentage** (list: list): Callout: "Percentage formats numbers with decimal places and the percent sign." Example: 12.34%
- Fraction** (list: list): Callout: "Fraction formats numbers as fractions separated by the forward slash." Example: 1/2
- Scientific** (list: list): Callout: "Scientific formats numbers in scientific notation." Example: 10²
- Text** (list: list): Callout: "Text formats numbers as text, meaning that what you enter into the cell will appear exactly as it was entered." Example: ABC
- More Number Formats...**: Callout: "You can easily customize any format in More Number Formats."



Challenge!

1. Open an existing Excel 2013 workbook.
2. Select a cell and change the font style, size, and color of the text.
3. Apply bold, italics, or underline to a cell.
4. Try changing the vertical and horizontal text alignment for some cells.
5. Add a border to a cell range.
6. Change the fill color of a cell range.
7. Try changing the formatting of a number.

5. Modifying Columns, Rows and Cells

By default, every row and column of a new workbook is always set to the same height and width. Excel allows you to modify column width and row height in different ways, including wrapping text and merging cells.


To modify column width

1. Position the mouse over the column line in the column heading so the white cross  becomes a double arrow .





	A	B	C
1	First Name	Last Name	
2			
3			
4			
5			
6			
7			


2. Click, hold, and drag the mouse to increase or decrease the column width.
3. Release the mouse. The column width will be changed.

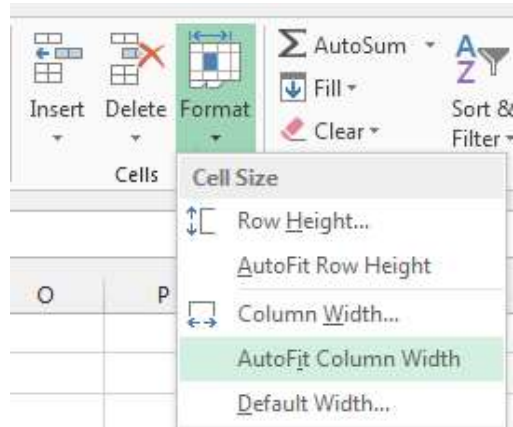
 **TIP:** If you see pound signs (#####) in a cell, it means that the column is not wide enough to display the cell content. Simply increase the column width to show the cell content.

To AutoFit column width



The AutoFit feature will allow you to set a column's width to fit its content automatically.

1. Position the mouse over the column line in the column heading so the white cross  becomes a double arrow .
2. Double-click the mouse. The column width will be changed automatically to fit the content.

 **TIP:** You can also AutoFit the width for several columns at the same time. Simply select the columns you would like to AutoFit, then select the AutoFit Column Width command from the Format drop-down menu on the Home tab. This method can also be used for Row height.




To modify row height



1. Position the cursor over the row line so the white cross  becomes a double arrow .
2. Click, hold, and drag the mouse to increase or decrease the row height.
3. Release the mouse. The height of the selected row will be changed.

To modify all rows or columns

Rather than resizing rows and columns individually, you can modify the height and width of every row and column at the same time. This method allows you to set a uniform size for every row and column in your worksheet.

1. Locate and click the Select All button  just below the formula bar to select every cell in the worksheet.



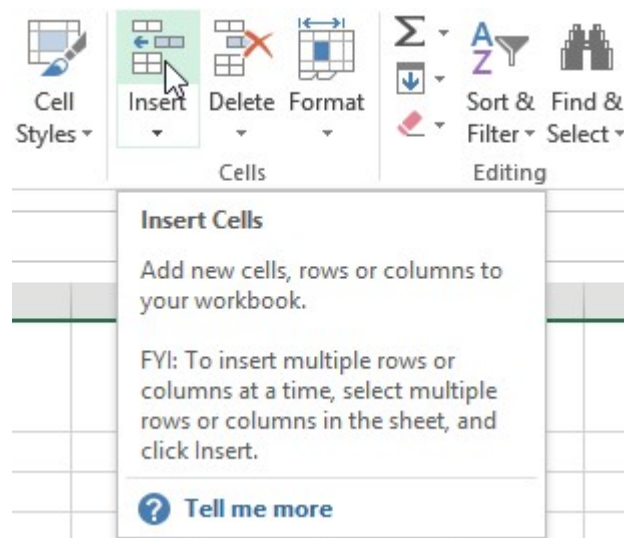
2. Position the mouse over a row line so the white cross  becomes a double arrow .
3. Click, hold, and drag the mouse to increase or decrease the row height.
4. Release the mouse when you are satisfied with the new row height for the worksheet.

Inserting, deleting, moving, and hiding rows and columns



After you've been working with a workbook for a while, you may find that you want to insert new columns or rows, delete certain rows or columns, move them to a different location in the worksheet, or even hide them.

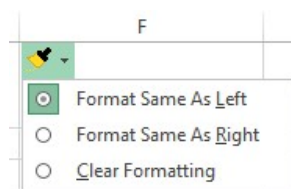
To insert rows

1. Select the row heading below where you want the new row to appear.
2. Click the Insert command on the Home tab.



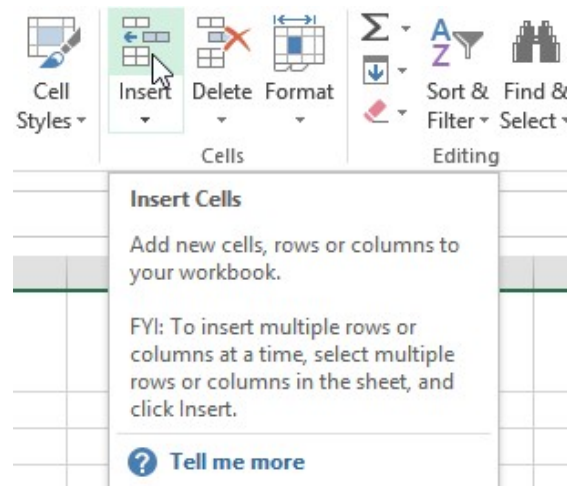
3. The new row will appear above the selected row.

 **TIP:** When inserting new rows, columns, or cells, you will see the Insert Options button  next to the inserted cells. This button allows you to choose how Excel formats these cells. By default, Excel formats inserted rows with the same formatting as the cells in the row above. To access more options, hover your mouse over the Insert Options button, then click the drop-down arrow.




To insert columns

1. Select the column heading to the right of where you want the new column to appear.
2. Click the Insert command on the Home tab.



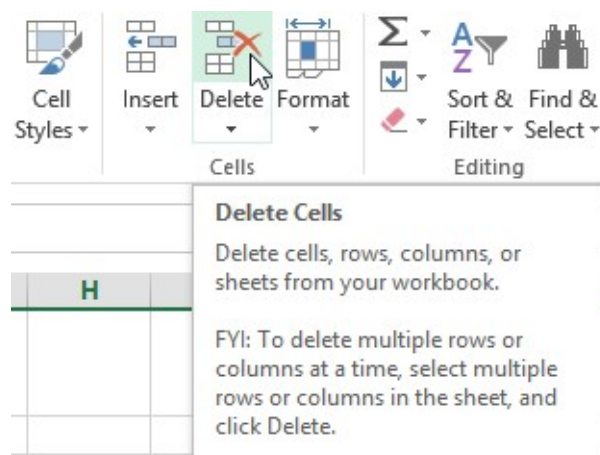
3. The new column will appear to the left of the selected column.

 **TIP:** When inserting rows and columns, make sure you select the entire row or column by clicking the heading. If you select only a cell in the row or column, the Insert command will only insert a new cell.

To delete rows

It's easy to delete any row that you no longer need in your workbook.

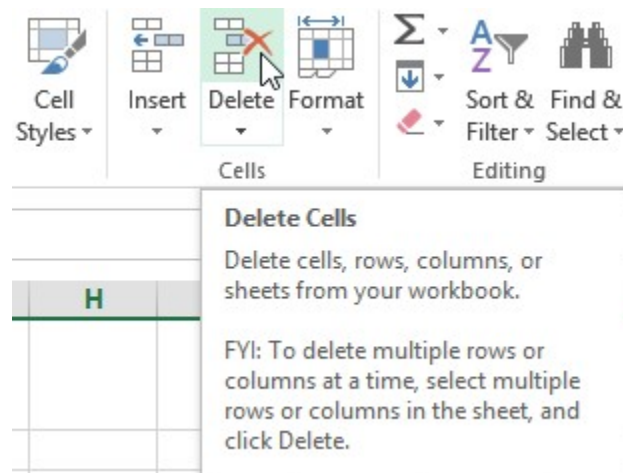
1. Select the row(s) you want to delete.
2. Click the Delete command on the Home tab.




3. The selected row(s) will be deleted, and the rows below will shift up.

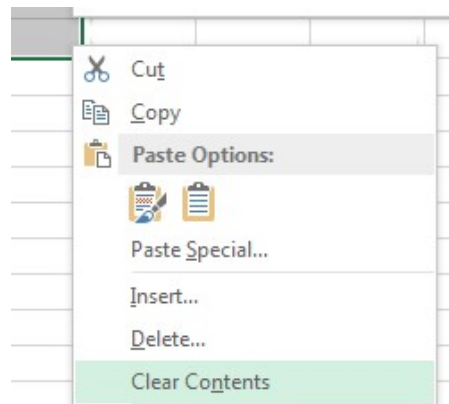
To delete columns

1. Select the column(s) you want to delete.
2. Click the Delete command on the Home tab.



3. The selected column(s) will be deleted, and the columns to the right will shift left.

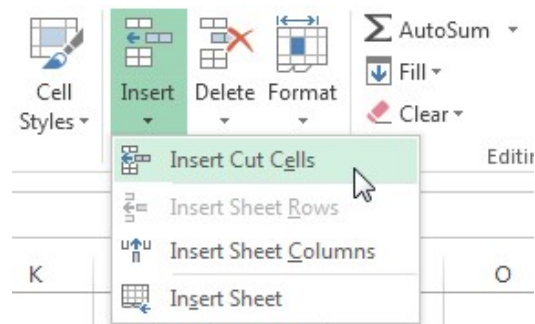
 **TIP:** It's important to understand the difference between deleting a row or column and ~~only~~ clearing its contents. If you want to remove the content of a row or column without causing others to shift, right-click a heading, then select Clear Contents from the drop-down menu.




To move a row or column

Sometimes you may want to move a column or row to rearrange the content of your worksheet.

1. Select the desired column heading for the column you wish to move, then click the Cut command on the Home tab or press Ctrl+X on your keyboard.
2. Select the column heading to the right of where you want to move the column. For example, if you want to move a column between columns B and C, select column C.
3. Click the Insert command on the Home tab, then select Insert Cut Cells from the drop-down menu.



4. The column will be moved to the selected location, and the columns to the right will shift right.

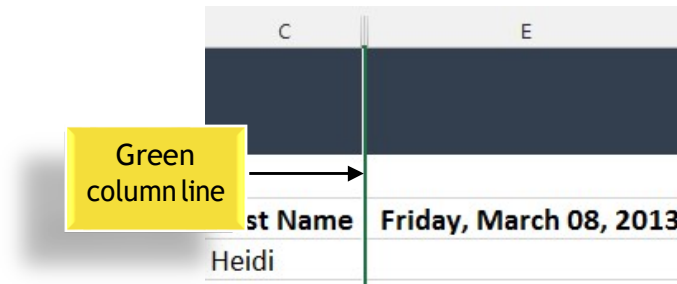
 **TIP:** You can also access the Cut and Insert commands by right-clicking the mouse and selecting the desired commands from the drop-down menu.

To hide and unhide a row or column

At times, you may want to compare certain rows or columns without changing the organization of your worksheet. Excel allows you to hide rows and columns as needed.

1. Select the column(s) you wish to hide, right-click the mouse, then select Hide from the formatting menu.

2. The columns will be hidden. The green column line indicates the location of the hidden columns.



3. To unhide the columns, select the columns to the left and right of the hidden columns (in other words, the columns on both sides of the hidden columns).
4. Right-click the mouse, then select Unhide from the formatting menu. The hidden columns will reappear.

Wrapping text and merging cells

Whenever you have too much cell content to be displayed in a single cell, you may decide to wrap the text or merge the cell rather than resizing a column. Wrapping the text will automatically modify a cell's row height, allowing cell contents to be displayed on multiple lines. Merging allows you to combine a cell with adjacent, empty cells to create one large cell.

1. Select the cells you wish to wrap.
2. Select the Wrap Text command on the Home tab.



-
3. The text in the selected cells will be wrapped.

 **TIP:** Click the Wrap Text command again to unwrap the text.

To merge cells using the Merge & Center command

1. Select the cell range you want to merge together.
2. Select the Merge & Center command on the Home tab.

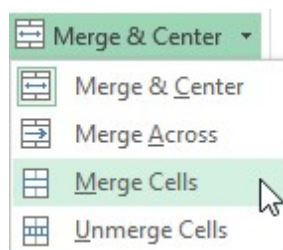


3. The selected cells will be merged, and the text will be centered.

To access more merge options

Click the drop-down arrow next to the Merge & Center command on the Home tab. The Merge drop-down menu will appear. From here, you can choose to:

- Merge & Center: Merges the selected cells into one cell and centers the text
- Merge Across: Merges the selected cells into larger cells while keeping each row separate
- Merge Cells: Merges the selected cells into one cell, but does not center the text
- Unmerge Cells: Unmerges selected cells



Challenge!

1. Open an existing Excel 2013 workbook.
2. Modify the width of a column.
3. Insert a column between column A and column B, then insert a row between row 3 and row 4.
4. Delete a column or a row.
5. Move a column or row.
6. Try using the Text Wrap command on a cell range.
7. Try merging some cells together.

6. Formulas and Functions

One of the most powerful features in Excel is the ability to calculate numerical information using formulas.

Simple Formulas

Just like a calculator, Excel can add, subtract, multiply, and divide. In this lesson, we'll show you how to use cell references to create simple formulas.

Mathematical operators

Excel uses standard operators for formulas, such as a plus sign for addition (+), a minus sign for subtraction (-), an asterisk for multiplication (*), a forward slash for division (/), and a caret (^) for exponents.

Addition	+
Subtraction	-
Multiplication	*
Division	/
Exponents	^

All formulas in Excel must begin with an equals sign (=). This is because the cell contains, or is equal to, the formula and the value it calculates.

Understanding cell references

While you can create simple formulas in Excel manually (for example, $=2+2$ or $=5*5$), most of the time you will use cell addresses to create a formula. This is known as making a cell reference. Using cell references will ensure that your formulas are always accurate because you can change the value of referenced cells without having to rewrite the formula.

The first screenshot shows an Excel spreadsheet with columns A and B and rows 1, 2, and 3. Cell A1 contains the number 10, and cell A2 contains the number 5. Cell A3 contains the formula $=A1+A2$. A yellow callout box with an arrow pointing to cell A3 contains the text: "The formula in cell A3 refers to the value in cell A1 plus the value in cell A2".

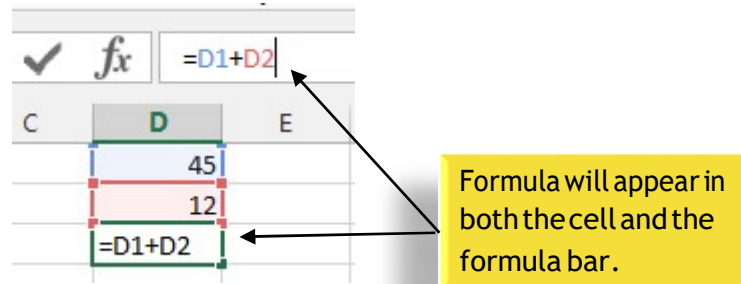
The second screenshot shows the same spreadsheet, but now cell A3 displays the number 15. A yellow callout box with an arrow pointing to cell A3 contains the text: "The formula calculates and displays the answer to the equation A1 plus A2".

By combining a mathematical operator with cell references, you can create a variety of simple formulas in Excel. Formulas can also include a combination of cell references and numbers, as in the examples below:


$=A1+A2$	Adds cells A1 and A2
$=C4-3$	Subtracts 3 from cell C4
$=E7/J4$	Divides cell E7 by J4
$=N10*1.05$	Multiplies cell N10 by 1.05
$=R5^2$	Finds the square of cell R5

To create a formula

1. Select the cell that will contain the formula.
2. Type the equals sign (=). Notice how it appears in both the cell and the formula bar.




1. Type the cell address of the cell you wish to reference first in the formula: cell D1 in our example. A blue border will appear around the referenced cell.
2. Type the mathematical operator you wish to use. In our example, we'll type the addition sign (+).
3. Type the cell address of the cell you wish to reference second in the formula: cell D2 in our example. A red border will appear around the referenced cell.
4. Press Enter on your keyboard. The formula will be calculated, and the value will be displayed in the cell.

 **TIP:** If the result of a formula is too large to be displayed in a cell, it may appear as ~~###~~ signs (#####) instead of a value. This means that the column is not wide enough to display the cell content. Simply increase the column width to show the cell content.

Modifying values with cell references

The true advantage of cell references is that they allow you to update data in your worksheet without having to rewrite formulas.

 **TIP:** Excel will not always tell you if your formula contains an error, so it's up to you to check ~~all~~ your formulas.

To create a formula using the point-and-click method

Rather than typing cell addresses manually, you can point and click on the cells you wish to include in your formula. This method can save a lot of time and effort when creating formulas. In our example below, we'll create a formula to calculate the cost of ordering several boxes of plastic silverware.

1. Select the cell that will contain the formula. In our example, we'll select cell D3.

The screenshot shows an Excel spreadsheet with the following data:

Paper Supply Inventory Orders			
Item	Quantity	Price Per Unit	Total Cost
Plastic Silverware (box of 100)	9	\$8.75	
Napkins (box of 250)	12	\$2.59	
Plates (box of 50)	6	\$14.25	
Cups (box of 75)	10	\$11.99	
Total			

The formula bar at the top shows 'D3' and is currently empty.

2. Type the equals sign (=).
3. Select the cell you wish to reference first in the formula: cell B3 in our example. The cell address will appear in the formula, and a dashed blue line will appear around the referenced cell.

The screenshot shows the same Excel spreadsheet as above. Cell B3 is now selected, and the formula bar shows '=B3'.

4. Type the mathematical operator you wish to use. In our example, we'll type the multiplication sign (*).
5. Select the cell you wish to reference second in the formula: cell C3 in our example. The cell address will appear in the formula, and a dashed red line will appear around the referenced cell.

Paper Supply Inventory Orders			
Item	Quantity	Price Per Unit	Total Cost
Plastic Silverware (box of 100)	9	\$8.75	=B3*C3
Napkins (box of 250)	12	\$2.59	
Plates (box of 50)	6	\$14.25	
Cups (box of 75)	10	\$11.99	
Total			


- Press Enter on your keyboard. The formula will be calculated, and the value will be displayed in the cell.




Paper Supply Inventory Orders			
Item	Quantity	Price Per Unit	Total Cost
Plastic Silverware (box of 100)	9	\$8.75	\$78.75
Napkins (box of 250)	12	\$2.59	
Plates (box of 50)	6	\$14.25	
Cups (box of 75)	10	\$11.99	
Total			


Formulas can also be copied to adjacent cells with the fill handle, which can save a lot of time and effort if you need to perform the same calculation multiple times in a worksheet.

To edit a formula

Sometimes you may want to modify an existing formula. In the example below, we've entered an incorrect cell address in our formula, so we'll need to correct it.

- Select the cell containing the formula you wish to edit.
- Click the formula bar to edit the formula. You can also double-click the cell to view and edit the formula directly within the cell.
- A border will appear around any referenced cells.
- When finished, press Enter on your keyboard or select the Enter command  in the formula bar.
- The formula will be updated, and the new value will be displayed in the cell.

 **TIP:** If you change your mind, you can press the Esc key on your keyboard or click the  command  in the formula bar to avoid accidentally making changes to your formula.

 **TIP:** To show all of the formulas in a spreadsheet, you can hold the Ctrl key and press ` (grave accent). The grave accent key is usually located in the upper-left corner of the keyboard. You can press Ctrl+ ` again to switch back to the normal view.

Challenge!

1. Open an existing Excel workbook.
2. Create a simple addition formula using cell references.
3. Try modifying the value of a cell referenced in a formula.
4. Try using the point-and-click method to create a formula.
5. Edit a formula using the formula bar.

Complex Formulas

A simple formula is a mathematical expression with one operator, such as $7+9$. A complex formula has more than one mathematical operator, such as $5+2*8$. When there is more than one operation in a formula, the order of operations tells Excel which operation to calculate first. In order to use Excel to calculate complex formulas, you will need to understand the order of operations.

Order of operations


Excel calculates formulas based on the following order of operations:

1. Operations enclosed in parentheses
2. Exponential calculations (3^2 , for example)
3. Multiplication and division, whichever comes first
4. Addition and subtraction, whichever comes first

Creating complex formulas

In the example below, we will demonstrate how Excel solves a complex formula using the order of operations. Here, we want to calculate the cost of sales tax for an invoice. To do this, we'll write our formula as $=(D2+D3)*0.075$ in cell D4. This formula will add the prices of our items together and then multiply that value by the 7.5% tax rate (which is written as 0.075) to calculate the cost of sales tax.

SUM				:(X ✓ fx	=(D2+D3)*0.075
	A	B	C	D	
1	Menu Item	Price	Quantity	Total	
2	Item 1	\$2.29	20	\$45.80	
3	Item 2	\$2.29	30	\$68.70	
4	Tax			=(D2+D3)*0.075	
5	Total				

 **TIP:** It is especially important to enter complex formulas with the correct order of operations. Otherwise, Excel will not calculate the results accurately. In our example, if the parentheses are not included, the multiplication is calculated first and the result is incorrect. Parentheses are the best way to define which calculations will be performed first in Excel.

Challenge!

1. Open an existing Excel workbook.
2. Create a complex formula that will perform addition before multiplication.

Relative and Absolute Cell References

There are two types of cell references: relative and absolute. Relative and absolute references behave differently when copied and filled to other cells. Relative references change when a formula is copied to another cell. Absolute references, on the other hand, remain constant, no matter where they are copied.

Relative cell references

By default, all cell references are relative references. *When copied across multiple cells, they change based on the relative position of rows and columns.* For example, if you copy the formula =A1+B1 from row 1 to row 2, the formula will become =A2+B2. Relative references are especially convenient whenever you need to repeat the same calculation across multiple rows or columns.

To create and copy a formula using relative references

In the following example, we want to create a formula that will multiply each item's price by the quantity. Rather than creating a new formula for each row, we can create a single formula in cell D2

and then copy

it to the other rows. We'll use relative references so the formula correctly calculates the total for each item.

1. Select the cell that will contain the formula. In our example, we'll select cell D2.
2. Enter the formula to calculate the desired value. In our example, we'll type =B2*C2.

	A	B	C	D
1	Item	Price	Quantity	Total
2	Item 1	\$2.00	4	=B2*C2
3	Item 2	\$4.00	2	
4	Item 3	\$6.00	1	
5	Item 4	\$3.00		
6	Item 5	\$2.00	5	
7	Item 6	\$8.00	3	
8	Item 7	\$2.00	3	
9	Item 8	\$1.00	6	
10	Item 9	\$9.00	2	
11	Item 10	\$7.00	5	
12		Total		

3. Press Enter on your keyboard. The formula will be calculated, and the result will be displayed in the cell.
4. Locate the fill handle in the lower-right corner of the desired cell. In our example, we'll locate the fill handle for cell D2.


The fill handle

- Click, hold, and drag the fill handle over the cells you wish to fill.

Click, hold and drag the fill handle to copy the formula to adjacent cells

1	Item	Price	Quantity	Total
2	Item 1	\$2.00	4	\$8.00
3	Item 2	\$4.00	2	
4	Item 3	\$6.00	1	
5	Item 4	\$3.00		
6	Item 5	\$2.00	5	
7	Item 6	\$8.00	3	
8	Item 7	\$2.00	3	
9	Item 8	\$1.00	6	
10	Item 9	\$9.00	2	
11	Item 10	\$7.00	5	
12	Total			

- Release the mouse. The formula will be copied to the selected cells with relative references, and the values will be calculated in each cell.

 **TIP:** You can double-click the filled cells to check their formulas for accuracy. The relative references should be different for each cell, depending on their rows.

	A	B	C	D
1	Item	Price	Quantity	Total
2	Item 1	\$2.00	4	\$8.00
3	Item 2	\$4.00	2	\$8.00
4	Item 3	\$6.00	1	\$6.00
5	Item 4	\$3.00		\$0.00
6	Item 5	\$2.00	5	=B6*C6
7	Item 6	\$8.00	3	\$24.00
8	Item 7	\$2.00	3	
9	Item 8	\$1.00	6	
10	Item 9	\$9.00	2	
11	Item 10	\$7.00	5	
12	Total			


Absolute cell references

There may be times when you do not want a cell reference to change when filling cells. Unlike relative references, *absolute references do not change when copied or filled*. You can use an absolute reference to keep a row and/or column constant.

An absolute reference is designated in a formula by the addition of a dollar sign (\$). It can precede the column reference, the row reference, or both.

\$A\$2	The column and the row do not change when copied
A\$2	The row does not change when copied
\$A2	The column does not change when copied

You will generally use the \$A\$2 format when creating formulas that contain absolute references. The other two formats are used much less frequently.

 **TIP:** When writing a formula, you can press the F4 key on your keyboard to switch between ~~relative~~ and absolute cell references. This is an easy way to quickly insert an absolute reference.

To create and copy a formula using absolute references

In our example, we'll use the 7.5% sales tax rate in cell E1 to calculate the sales tax for all items in column D. We'll need to use the absolute cell reference \$E\$1 in our formula. Since each formula is using the same tax rate, we want that reference to remain constant when the formula is copied and filled to other cells in column D.

1. Select the cell that will contain the formula. In our example, we'll select cell D3.
2. Enter the formula to calculate the desired value. In our example, we'll type $= (B3 * C3) * \$E\1 .
3. Press Enter on your keyboard. The formula will calculate, and the result will display in the cell.

	A	B	C	D	E
1	Sales Tax				7.50%
2	Item	Price	Quantity	Total	Tax
3	Item 1	\$2.00	4	\$8.00	=(B3*C3)*\$E\$1
4	Item 2	\$4.00	2	\$8.00	
5	Item 3	\$6.00	1	\$6.00	
6	Item 4	\$3.00		\$0.00	
7	Item 5	\$2.00	5	\$10.00	
8	Item 6	\$8.00	3	\$24.00	
9	Item 7	\$2.00	3	\$6.00	
10	Item 8	\$1.00	6	\$6.00	
11	Item 9	\$9.00	2	\$18.00	
12	Item 10	\$7.00	5	\$35.00	
13	Total				

4. Locate the fill handle in the lower-right corner of the desired cell.
5. Release the mouse. The formula will be copied to the selected cells with an absolute reference, and the values will be calculated in each cell.

Challenge!

1. Open an existing Excel workbook.
2. Create a formula that uses a relative reference. Double-click a cell to see the copied formula and the relative cell references.
3. Create a formula that uses an absolute reference.

Functions

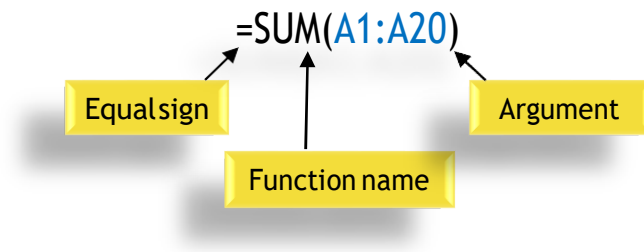
A function is a predefined formula that performs calculations using specific values in a particular order. Excel includes many common functions that can be useful for quickly finding the sum, average, count, maximum value, and minimum value for a range of cells. In order to use functions correctly, you'll need to understand the different parts of a function and how to create arguments to calculate values and cell references.

Formula =A1+A2+A3+A4+A5+A6+A7+A8

Function =SUM(A1:A8)

The parts of a function

In order to work correctly, a function must be written a specific way, which is called the syntax. The basic syntax for a function is an equals sign (=), the function name (SUM, for example), and one or more arguments. Arguments contain the information you want to calculate.



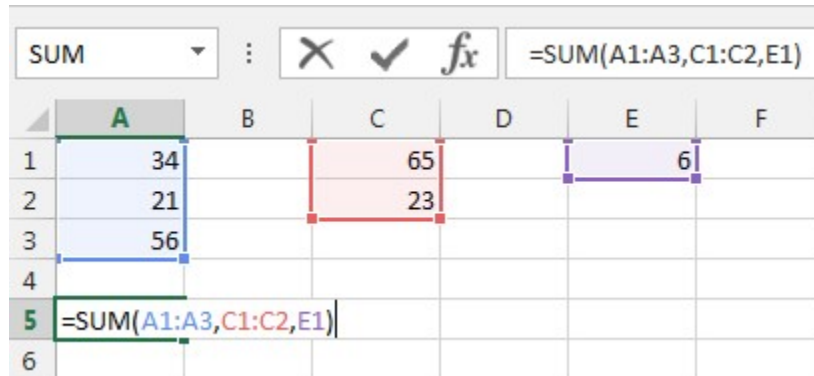
Working with arguments

Arguments can refer to both individual cells and cell ranges and must be enclosed within parentheses. You can include one argument or multiple arguments, depending on the syntax required for the function.

For example, the function `=AVERAGE(B1:B9)` would calculate the average of the values in the cell range B1:B9. This function contains only one argument.

	A	B	C
1		5	
2		8	
3		9	
4		7	
5		5	
6		1	
7		3	
8		2	
9		7	
10		<code>=AVERAGE(B1:B9)</code>	
11			

Multiple arguments must be separated by a comma. For example, the function `=SUM(A1:A3, C1:C2, E2)` will add the values of all the cells in the three arguments.



Creating a function

Excel has a variety of functions available. Here are some of the most common functions you'll use:

- **SUM:** This function adds all of the values of the cells in the argument.
- **AVERAGE:** This function determines the average of the values included in the argument. It calculates the sum of the cells and then divides that value by the number of cells in the argument.
- **COUNT:** This function counts the number of cells with numerical data in the argument. This function is useful for quickly counting items in a cell range.
- **MAX:** This function determines the highest cell value included in the argument.
- **MIN:** This function determines the lowest cell value included in the argument.

To create a basic function

In our example below, we'll create a basic function to calculate the average price per unit for a list of recently ordered items using the **AVERAGE** function.

1. Select the cell that will contain the function.
2. Type the equals sign (=) and enter the desired function name. You can also select the desired function from the list of suggested functions that will appear below the cell as you type. In our example, we'll type `=AVERAGE`.

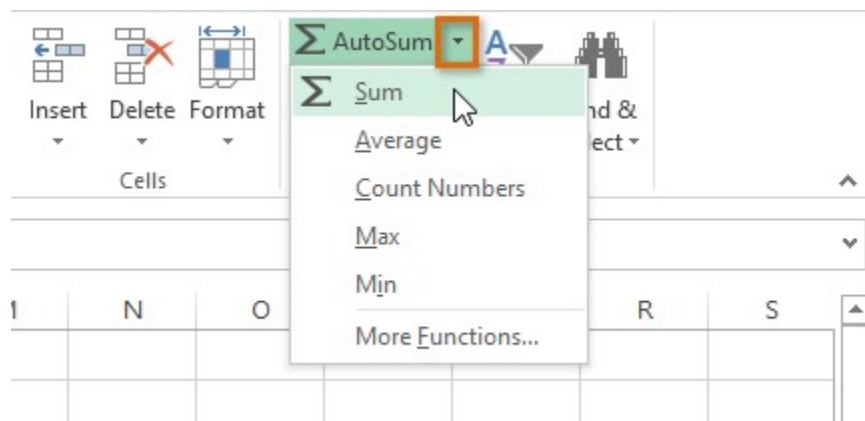
	A	B	C	D
1	Sales Tax			
2	Item	Price	Quantity	Total
3	Item 1	\$2.00	4	\$8.00
4	Item 2	\$4.00	2	\$8.00
5	Item 3	\$6.00	1	\$6.00
6	Item 4	\$3.00		\$0.00
7	Item 5	\$2.00	5	\$10.00
8	Item 6	\$8.00	3	\$24.00
9	Item 7	\$2.00	3	\$6.00
10	Item 8	\$1.00	6	\$6.00
11	Item 9	\$9.00	2	\$18.00
12	Item 10	\$7.00	5	\$35.00
13				=AVER
14				AVERAGE
15				AVERAGEA
16				AVERAGEIF
17				AVERAGEIFS

3. Enter the cell range for the argument inside parentheses. In our example, we'll type (D3:D12).
4. Press Enter on your keyboard. The function will be calculated, and the result will appear in the cell.

To create a function using the AutoSum command

The AutoSum command allows you to automatically insert the most common functions into your formula, including SUM, AVERAGE, COUNT, MIN, and MAX. In our example below, we'll create a function to calculate the total cost for a list of recently ordered items using the SUM function.

1. Select the cell that will contain the function.
2. In the Editing group on the Home tab, locate and select the arrow next to the AutoSum command and then choose the desired function from the drop-down menu. In our example, we'll select Sum.



- The selected function will appear in the cell. If logically placed, the AutoSum command will automatically select a cell range for the argument. You can also manually enter the desired cell range into the argument.

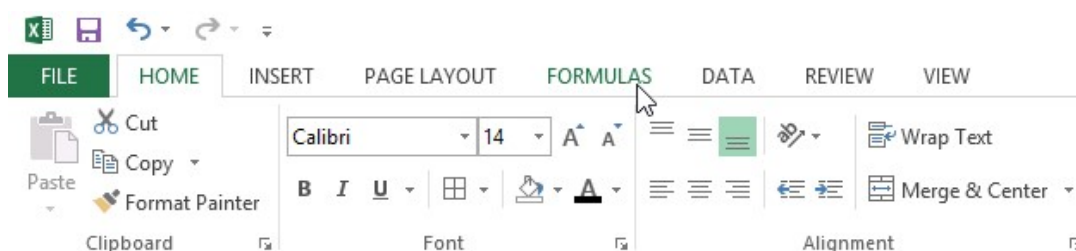
Sales Tax				
Item	Price	Quantity	Total	Tax
Item 1	\$2.00	4	\$8.00	
Item 2	\$4.00	2	\$8.00	
Item 3	\$6.00	1	\$6.00	
Item 4	\$3.00		\$0.00	
Item 5	\$2.00	5	\$10.00	
Item 6	\$8.00	3	\$24.00	
Item 7	\$2.00	3	\$6.00	
Item 8	\$1.00	6	\$6.00	
Item 9	\$9.00	2	\$18.00	
Item 10	\$7.00	5	\$35.00	
			=SUM(D3:D12)	

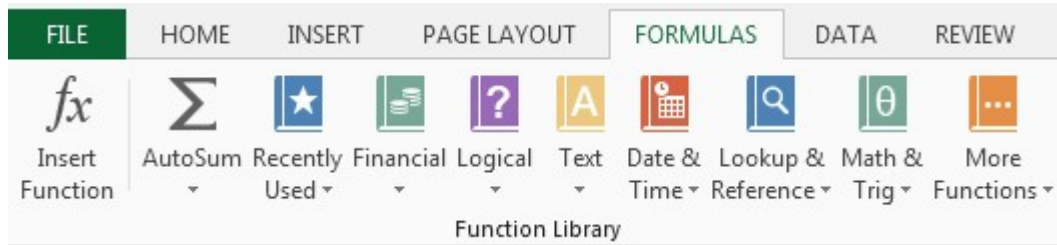
- Press Enter on your keyboard.

The Function Library

While there are hundreds of functions in Excel, the ones you use most frequently will depend on the type of data your workbooks contains. There is no need to learn every single function, but exploring some of the different types of functions will be helpful as you create new projects. You can search for functions by category, such as Financial, Logical, Text, Date & Time, and more from the Function Library on the Formulas tab.

- To access the Function Library, select the Formulas tab on the Ribbon. The Function Library will appear.

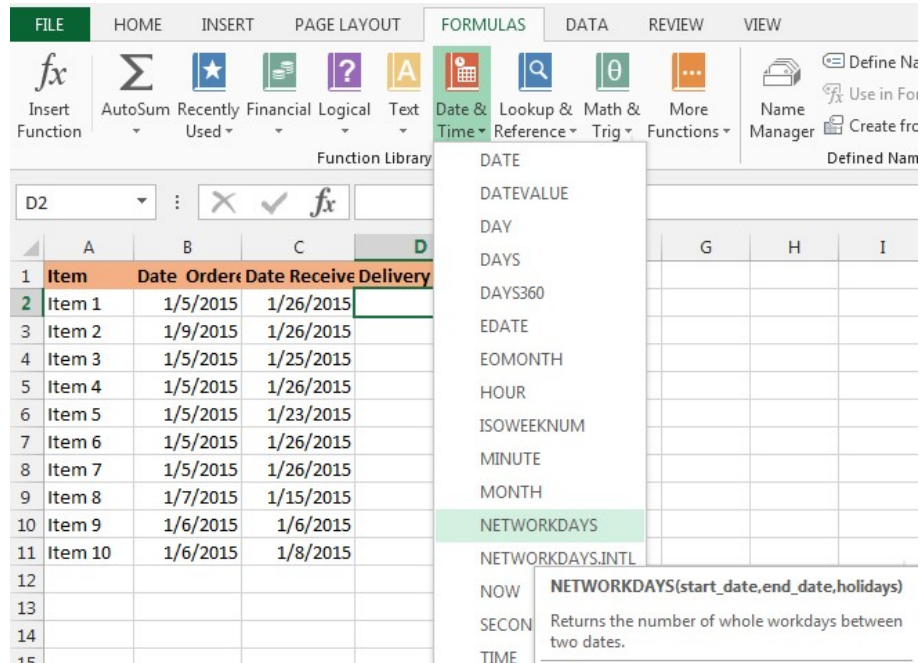




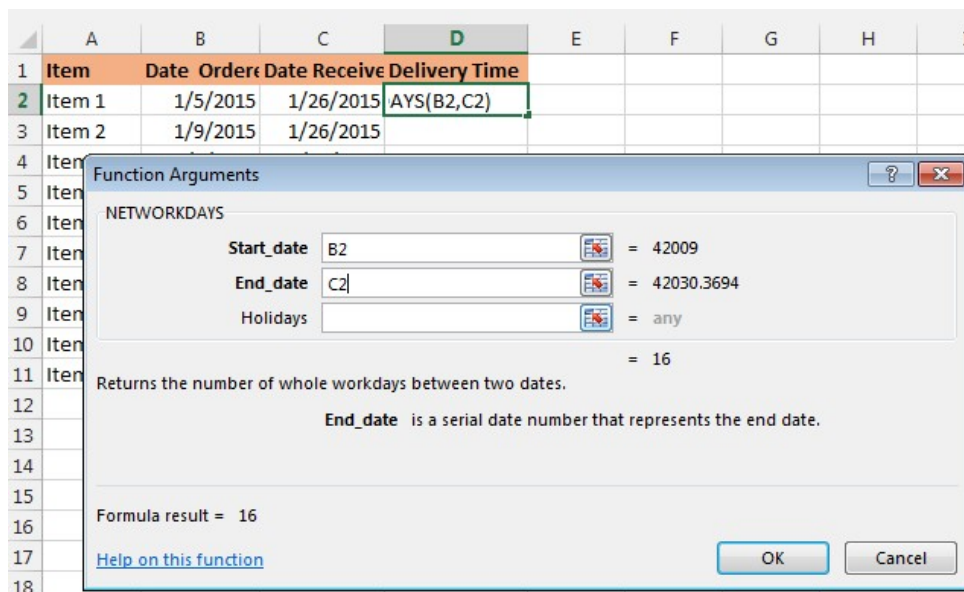
- If you're having trouble finding the right function, the Insert Function command allows you to search for functions using keywords.
- The AutoSum command allows you to automatically return results for common functions, like SUM, AVERAGE, and COUNT.
- The Recently Used command gives you access to functions that you have recently worked with.
- The Financial category contains functions for financial calculations like determining a payment (PMT) or interest rate for a loan (RATE).
- Functions in the Logical category check arguments for a value or condition. For example, if an order is over \$50 add \$4.99 for shipping, but if it is over \$100, do not charge for shipping (IF).
- The Text category contains functions that work with the text in arguments to perform tasks, such as converting text to lowercase (LOWER) or replacing text (REPLACE).
- The Date & Time category contains functions for working with dates and time and will return results like the current date and time (NOW) or the seconds (SECOND).
- The Lookup & Reference category contains functions that will return results for finding and referencing information. For example, you can add a hyperlink (HYPERLINK) to a cell or return the value of a particular row and column intersection (INDEX).
- The Math & Trig category includes functions for numerical arguments. For example, you can round values (ROUND), find the value of Pi (PI) multiply (PRODUCT), subtotal (SUBTOTAL), and much more.
- More Functions contains additional functions under categories for Statistical, Engineering, Cube, Information, and Compatibility.

To insert a function from the Function Library

1. Select the cell that will contain the function.
2. Click the Formulas tab on the Ribbon to access the Function Library.
3. From the Function Library group, select the desired function category.
4. Select the desired function from the drop-down menu.



- The Function Arguments dialog box will appear. From here, you'll be able to enter or select the cells that will make up the arguments in the function.



- When you're satisfied with the arguments, click OK.
- The function will be calculated, and the result will appear in the cell.

Like formulas, functions can be copied to adjacent cells. Hover the mouse over the cell that contains the function, then click, hold, and drag the fill handle over the cells you wish to fill. The function will be copied, and values for those cells will be calculated relative to their rows or columns.

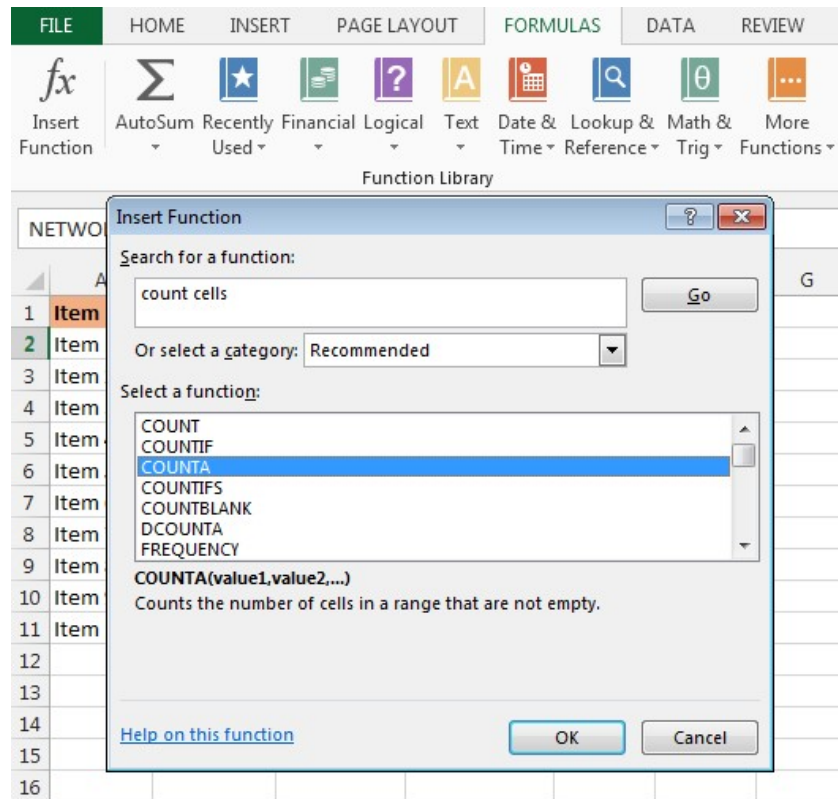
	A	B	C	D	E
1	Item	Date Order	Date Receive	Delivery Time	
2	Item 1	1/5/2015	1/26/2015	16	
3	Item 2	1/9/2015	1/26/2015	12	
4	Item 3	1/5/2015	1/25/2015	15	
5	Item 4	1/5/2015	1/26/2015	16	
6	Item 5	1/5/2015	1/23/2015	15	
7	Item 6	1/5/2015	1/26/2015	16	
8	Item 7	1/5/2015	1/26/2015	16	
9	Item 8	1/7/2015	1/15/2015	7	
10	Item 9	1/6/2015	1/6/2015	1	
11	Item 10	1/6/2015	1/8/2015	3	
12					

The Insert Function command

If you're having trouble finding the right function, the Insert Function command allows you to search for functions using keywords. While it can be extremely useful, this command is sometimes a little difficult to use. If you don't have much experience with functions, you may have more success browsing the Function Library instead. For more advanced users, however, the Insert Function command can be a powerful way to find a function quickly.

To use the Insert Function command

1. Select the cell that will contain the function.
2. Click the Formulas tab on the Ribbon, then select the Insert Function command.
3. The Insert Function dialog box will appear.
4. Type a few keywords describing the calculation you want the function to perform, then click Go.
5. Review the results to find the desired function, then click OK.



6. The Function Arguments dialog box will appear.
7. When you're satisfied, click OK.
8. The function will be calculated, and the result will appear in the cell.

Challenge!

1. Open an existing Excel workbook.
2. Create a function that contains one argument. If you're using the example, use the SUM function in cell B16 to calculate the total quantity of items ordered.
3. Use the AutoSum command to insert a function.
4. Explore the Function Library, and try using the Insert Function command to search for different types of functions.

Excel Formulas You Should Definitely Know

1. SUM

Formula: =SUM(5, 5) or =SUM(A1, B1) or =SUM(A1:B5)

The SUM formula does exactly what you would expect. It allows you to add 2 or more numbers together. You can use cell references as well in this formula.

2. COUNT

Formula: =COUNT(A1:A10)

The count formula counts the number of cells in a range that have numbers in them.

	A	B	C	D
1	1		Formula Result	9
2	2		Formula	=COUNT(A1:A10)
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	doesn't work with text			
10	10			

It only counts the cells where there are numbers.

3. COUNTA

Formula: =COUNTA(A1:A10)

Counts the number of non-empty cells in a range. It will count cells that have numbers and/or any other characters in them.

The COUNTA Formula works with all data types.

	A	B	C	D
1		1	Formula Result	10
2		2	Formula	=COUNTA(A1:A10)
3		3		
4		4		
5		5		
6		6		
7		7		
8		8		
9	This works with text			
10		10		

It counts the number of non-empty cells no matter the data type.

4. LEN

Formula: =LEN(A1)

The LEN formula counts the number of characters in a cell. This includes spaces!

	A	B	C	D
1	I love Excel		Formula Result	12
2	IloveExcel		Formula	=LEN(A1)
3				
4			Formula Result	10
5			Formula	=LEN(A2)

Notice the difference in the formula results: 10 characters without spaces in between the words, 12 with spaces between the words.

5. VLOOKUP

Formula: =VLOOKUP(lookup_value, table_array, col_index_num, range_lookup)

Basically, VLOOKUP lets you search for specific information in your spreadsheet. For example, if you have a list of products with prices, you could search for the price of a specific item.

We're going to use VLOOKUP to find the price of the Photo frame. You can probably already see that the price is \$9.99, but that's because this is a simple example. Once you learn how to use VLOOKUP, you'll be able to use it with larger, more complex spreadsheets, and that's when it will become truly useful.

	A	B	C	D	E	F
1	Item	Price				
2	Spice rack	\$19.99				
3	Stationery	\$5.49				
4	Gift basket	\$25.99				
5	Cutting board	\$24.99				
6	Landscape painting	\$35.99				
7	Greeting card	\$4.99				
8	T-shirt	\$15.49				
9	Scarf	\$29.99				
10	Coffee mug	\$8.99				
11	Tea set	\$16.99				
12	Serving bowl	\$12.99				
13	Wrapping paper	\$3.99				
14	Photo frame	\$9.99				
15	Handmade soap	\$4.49				
16	Gourmet hot cocoa	\$5.99				

As with any formula, you'll start with an equal sign (=). Then, type the formula name.

=VLOOKUP("Photo frame"

The second argument is the cell range that contains the data. In this example, our data is in A2:B16. As with any function, you'll need to use a comma to separate each argument:

=VLOOKUP("Photo frame", A2:B16

Note: It's important to know that VLOOKUP will always search the first column in this range. In this example, it will search column A for "Photo frame". In some cases, you may need to move the columns around so that the first column contains the correct data.

The third argument is the column index number. It's simpler than it sounds: The first column in the range is 1, the second column is 2, etc. In this case, we are trying to find the price of the item, and the prices are contained in the second column. That means our third argument will be 2:

=VLOOKUP("Photo frame", A2:B16, 2

The fourth argument tells VLOOKUP whether to look for approximate matches, and it can be either TRUE or FALSE. If it is TRUE, it will look for approximate matches. Generally, this is only useful if the first column has numerical values that have been sorted. Since we're only looking for exact matches, the fourth argument should be FALSE. This is our last argument, so go ahead and close the parentheses:

=VLOOKUP("Photo frame", A2:B16, 2, FALSE)

And that's it! When you press enter, it should give you the answer, which is 9.99.

fx		=VLOOKUP("Photo frame", A2:B16, 2, FALSE)				
	C	D	E	F	G	
			9.99			

6. IF Statements

Formula: =IF(logical_statement, return this if logical statement is true, return this if logical statement is false).

Example

Let's say a salesperson has a quota to meet. You used VLOOKUP to put the revenue next to the name. Now you can use an IF statement that says: "IF the salesperson met their quota, say "Met quota", if not say "Did not meet quota"

=IF(C3>D3, "Met Quota", "Did Not Meet Quota")

This IF statement will tell us if the first salesperson met their quota or not. We would then copy and paste this formula along all the entries in the list. It would change for each sales person.

	A	B	C	D	E
1	Master List				
2	Sales Person ID	Sales Person Name	Sales Person Revenue	Quota	Met Quota?
3	1	John	\$ 232,103.00	\$ 500,000.00	Did Not Meet Quota
4	2	Joe	\$ 835,477.00	\$ 500,000.00	Met Quota
5	3	Jen	\$ 116,371.00	\$ 500,000.00	Did Not Meet Quota
6	4	Frank	\$ 393,841.00	\$ 500,000.00	Did Not Meet Quota
7	5	Mark	\$ 989,303.00	\$ 500,000.00	Met Quota
8	6	Amanda	\$ 641,883.00	\$ 500,000.00	Met Quota
9	7	Erik	\$ 525,894.00	\$ 500,000.00	Met Quota
10	8	Mike	\$ 732,195.00	\$ 500,000.00	Met Quota
11	9	Matt	\$ 513,372.00	\$ 500,000.00	Met Quota
12	10	Josh	\$ 961,561.00	\$ 500,000.00	Met Quota
13	11	Shea	\$ 235,652.00	\$ 500,000.00	Did Not Meet Quota
14					
15			Formula		
16			=IF(C3>D3, "Met Quota", "Did Not Meet Quota")		

7. Working with Data

Whenever you're working with a lot of data, it can be difficult to compare information in your workbook.

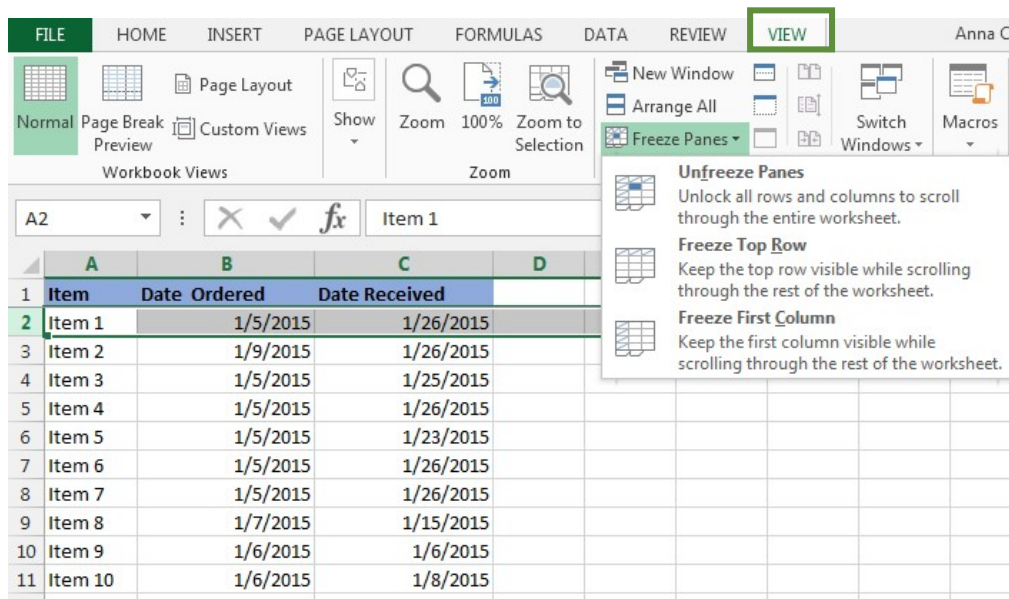
Freezing Panes and View Options

Excel includes several tools that make it easier to view content from different parts of your workbook at the same time, such as the ability to freeze panes and split your worksheet.

To freeze rows

You may want to see certain rows or columns all the time in your worksheet, especially header cells. By freezing rows or columns in place, you'll be able to scroll through your content while continuing to view the frozen cells.

1. Select the row below the row(s) you wish to freeze.
2. Click the View tab on the Ribbon.
3. Select the Freeze Panes command, then choose Freeze Panes from the drop-down menu.



The rows will be frozen in place, as indicated by the gray line. You can scroll down the worksheet while continuing to view the frozen rows at the top.

To freeze columns

1. Select the column to the right of the column(s) you wish to freeze.

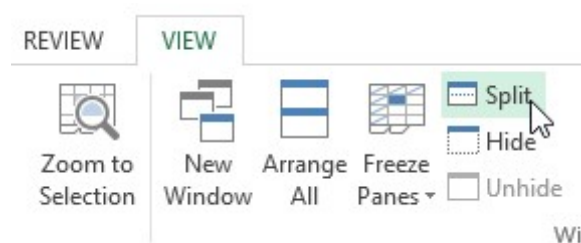
-
2. Click the View tab on the Ribbon.
 3. Select the Freeze Panes command, then choose Freeze Panes from the drop-down menu.
 4. The column will be frozen in place, as indicated by the gray line. You can scroll across the worksheet while continuing to view the frozen column on the left.

To unfreeze rows or columns, click the Freeze Panes command, then select Unfreeze Panes from the drop-down menu.

To split a worksheet

Sometimes you may want to compare different sections of the same workbook without creating a new window. The Split command allows you to divide the worksheet into multiple panes that scroll separately.

1. Select the cell where you wish to split the worksheet.
2. Click the View tab on the Ribbon, then select the Split command.



3. The workbook will be split into different panes. You can scroll through each pane separately using the scroll bars, allowing you to compare different sections of the workbook.

To remove the split, click the Split command again.

Challenge!

1. Open an existing Excel workbook.
2. Try freezing a row or column in place.
3. Use the Split command to split your worksheet into multiple panes.

Sorting Data

As you add more content to a worksheet, organizing that information becomes especially important. You can quickly reorganize a worksheet by sorting your data. For example, you could organize a list of contact information by last name. Content can be sorted alphabetically, numerically, and in many

other ways.

When sorting data, it's important to first decide if you would like the sort to apply to the entire worksheet or just a cell range.

- Sort sheet organizes all of the data in your worksheet by one column.
- Sort range sorts the data in a range of cells, which can be helpful when working with a sheet that contains several tables. Sorting a range will not affect other content on the worksheet.



To sort a sheet

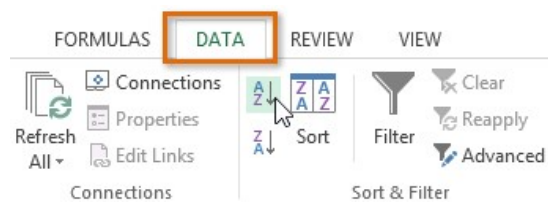
In our example, we'll sort a T-shirt order form alphabetically by Last Name (column C).

1. Select a cell in the column you wish to sort by. In our example, we'll select cell C2.



	A	B	C	D	E	F
1	Homeroom #	First Name	Last Name	T-Shirt Size	Payment Method	
2	105	Christiana	Chen	Medium	Cash	
3	105	Melissa	White	Small	Debit Card	
4	105	Esther	Yaron	Small	Check	
5	135	Anisa	Naser	Small	Check	
6	135	Chantal	Weller	Medium	Cash	
7	220-A	Juan	Flores	X-Large	Pending	
8	220-B	Malik	Reynolds	Small	Cash	
9	220-B	Avery	Kelly	Medium	Debit Card	
10	105	Derek	MacDonald	Large	Cash	

2. Select the Data tab on the Ribbon, then click the Ascending command  to Sort A to Z, or the Descending command  to Sort Z to A. In our example, we'll click the Ascending command.



3. The worksheet will be sorted by the selected column. In our example, the worksheet is now sorted by last name.

1	Homeroom #	First Name	Last Name	T-Shirt Size	Payment Method
2	110	Kris	Ackerman	Large	Money Order
3	105	Nathan	Albee	Medium	Check
4	220-B	Samantha	Bell	Medium	Check
5	110	Matt	Benson	Medium	Money Order
6	105	Christiana	Chen	Medium	Cash
7	110	Gabriel	Del Toro	Medium	Cash
8	220-A	Brigid	Ellison	Small	Cash
9	220-A	Juan	Flores	X-Large	Pending
10	220-B	Tyrese	Hanlon	X-Large	Debit Card


Filtering Data

If your worksheet contains a lot of content, it can be difficult to find information quickly. Filters can be used to narrow down the data in your worksheet, allowing you to view only the information you need.

To filter data

1. In order for filtering to work correctly, your worksheet should include a header row, which is used to identify the name of each column.
2. Select the Data tab, then click the Filter command.

The screenshot shows the Microsoft Excel interface with the 'DATA' tab selected. The 'Filter' button is highlighted in the 'Sort & Filter' group. A tooltip for the 'Filter' button is displayed, stating: 'Filter (Ctrl+Shift+L) Turn on filtering for the selected cells. Then, click the arrow in the column header to narrow down the data.' Below the ribbon, a worksheet is visible with columns labeled 'Item', 'Date Ordered', and 'Date Receive'. A dropdown arrow is visible in the 'Item' header cell.

3. A drop-down arrow  will appear in the header cell for each column.
4. Click the drop-down arrow for the column you wish to filter.

-
5. The Filter menu will appear.
 6. Uncheck the box next to Select All to quickly deselect all data.
 7. Check the boxes next to the data you wish to filter, then click OK.

To remove all filters from your worksheet, click the Filter command on the Data tab.

8. Working with Charts

Creating a chart in Microsoft Office Excel is quick and easy. Excel provides a variety of chart types that you can choose from when you create a chart. Excel offers Pie, Line, Bar, and Column charts to name but a few. Showing data in a chart can make it clearer, more interesting and easier to read. Charts can also help you evaluate your data and make comparisons between different values.

Understanding charts

Excel has several different types of charts, allowing you to choose the one that best fits your data. In order to use charts effectively, you'll need to understand how different charts are used.

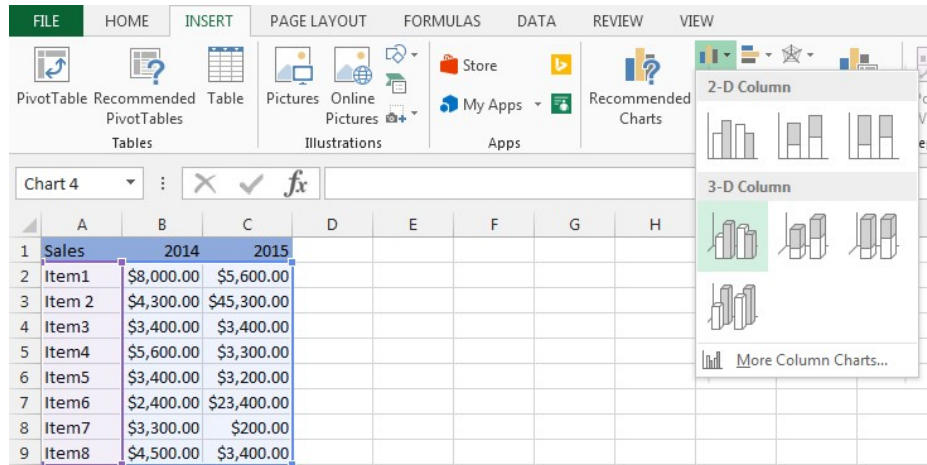
Types of Charts:

- Column charts use vertical bars to represent data. They can work with many different types of data, but they're most frequently used for comparing information.
- Line charts are ideal for showing trends. The data points are connected with lines, making it easy to see whether values are increasing or decreasing over time.
- Pie charts make it easy to compare proportions. Each value is shown as a slice of the pie, so it's easy to see which values make up the percentage of a whole.
- Bar charts work just like Column charts, but they use horizontal bars instead of vertical bars.
- Area charts are similar to line charts, except that the areas under the lines are filled in.
- Surface charts allow you to display data across a 3D landscape. They work best with large data sets, allowing you to see a variety of information at the same time.


To insert a chart

1. Select the cells you want to chart, including the column titles and row labels. These cells will be the source data for the chart.

2. From the Insert tab, click the desired Chart command.
3. Choose the desired chart type from the drop-down menu.



4. The selected chart will be inserted in the worksheet.

 **TIP:** If you're not sure which type of chart to use, the Recommended Charts command will suggest several different charts based on the source data.

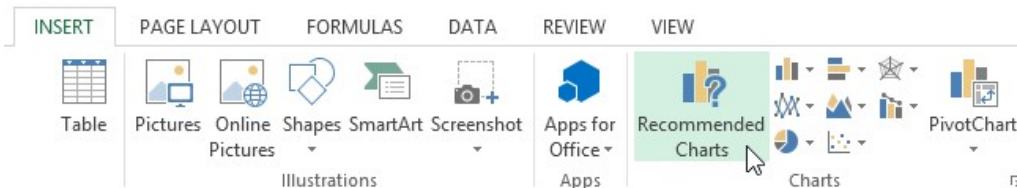
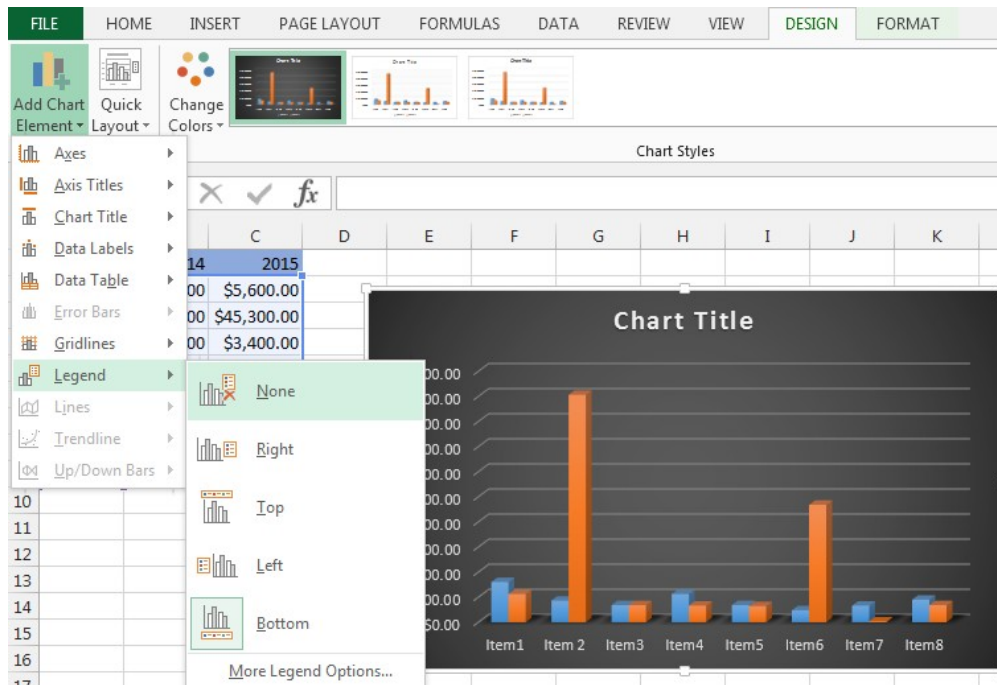


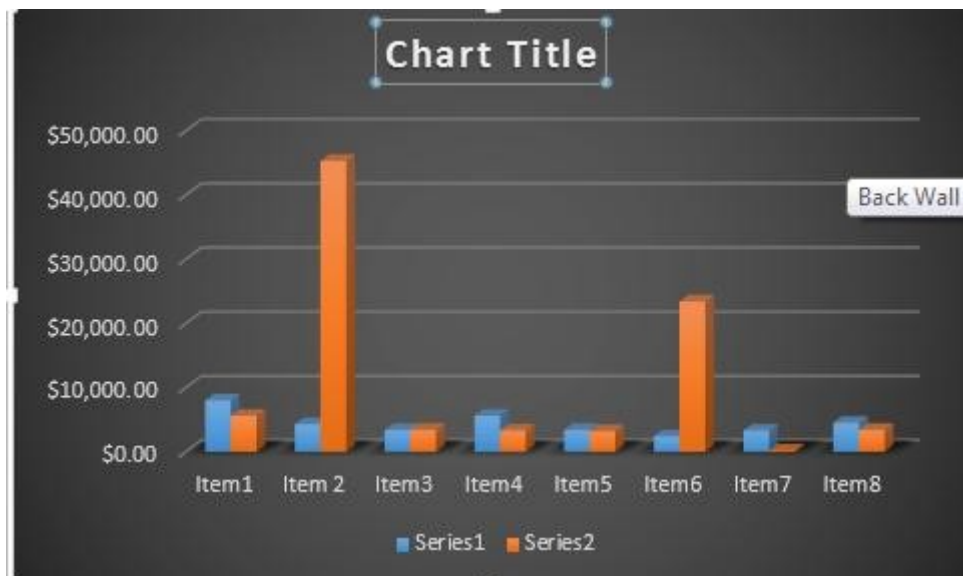
Chart layout and style

After inserting a chart, there are several things you may want to change about the way your data is displayed. It's easy to edit a chart's layout and style from the Design tab.

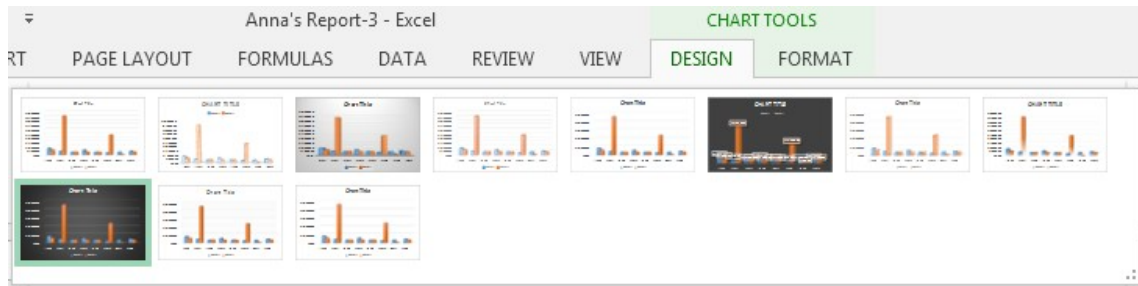
- ☑ Excel allows you to add chart elements—such as chart titles, legends, and data labels—to make your chart easier to read. To add a chart element, click the Add Chart Element command on the Design tab, then choose the desired element from the drop-down menu.




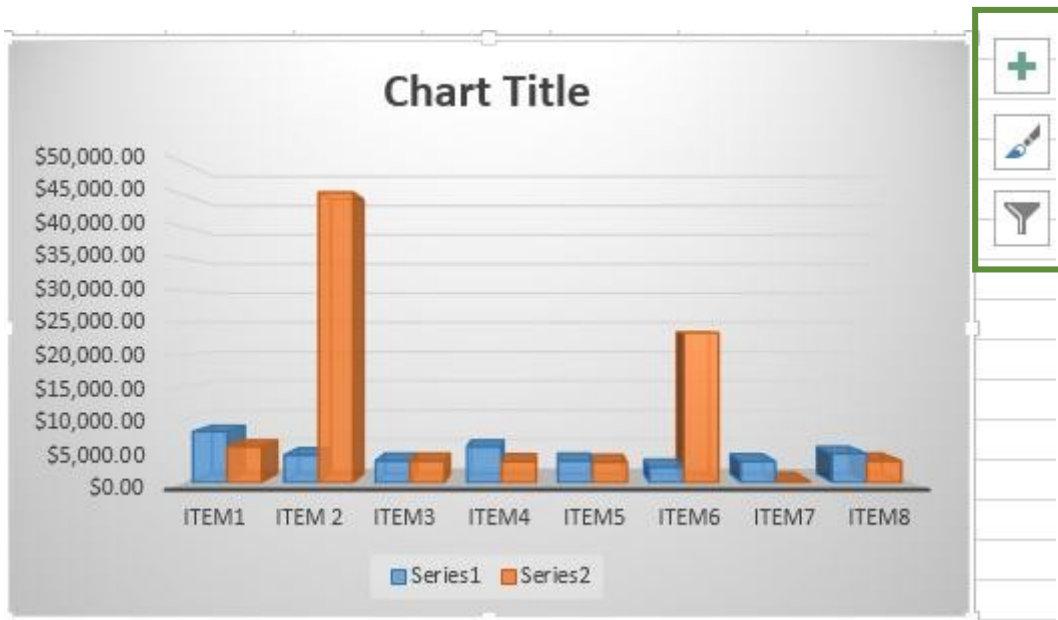
- ☑ To edit a chart element, like a chart title, simply double-click the placeholder and begin typing.



- ☑ If you don't want to add chart elements individually, you can use one of Excel's predefined layouts. Simply click the Quick Layout command, then choose the desired layout from the drop-down menu.
- ☑ Excel also includes several different chart styles, which allow you to quickly modify the look and feel of your chart. To change the chart style, select the desired style from the Chart styles group.



 **TIP:** You can also use the chart formatting shortcut buttons to quickly add chart elements, change the chart style, and filter the chart data.



Other chart options

There are lots of other ways to customize and organize your charts. For example, Excel allows you to rearrange a chart's data, change the chart type, and even move the chart to a different location in the workbook.

To switch row and column data

Sometimes you may want to change the way charts group your data. For example, in the chart below, the Book Sales data are grouped by year, with columns for each genre. However, we could switch the rows and columns so the chart will group the data by genre, with columns for each year. In both cases, the chart contains the same data—it's just organized differently.

1. Select the chart you wish to modify.

2. From the Design tab, select the Switch Row/Column command.



3. The rows and columns will be switched.

To change the chart type

If you find that your data isn't well suited to a certain chart, it's easy to switch to a new chart type. In our example, we'll change our chart from a Column chart to a Line chart.

1. From the Design tab, click the Change Chart Type command.



2. The Change Chart Type dialog box will appear.
3. The selected chart type will appear.

To move a chart

Whenever you insert a new chart, it will appear as an object on the same worksheet that contains its source data. Alternatively, you can move the chart to a new worksheet to help keep your data organized.

1. Select the chart you wish to move.
2. Click the Design tab, then select the Move Chart command.



3. The Move Chart dialog box will appear. Select the desired location for the chart.
4. Click OK.
5. The chart will appear in the selected location.

Challenge!

1. Open an existing Excel workbook.
2. Use worksheet data to create a chart.
3. Change the chart layout.
4. Apply a chart style.
5. Move the chart.

9. Printing Workbooks

There may be times when you want to print a workbook to view and share your data offline. Once you've chosen your page layout settings, it's easy to preview and print a workbook from Excel using the Print pane.

To access the Print pane

1. Select the File tab. Backstage view will appear.



2. Select Print. The Print pane will appear.

The image shows the Excel Print dialog box with several sections and options, each annotated with a yellow callout box:

- Print button:** A callout box states, "When you are ready to print the workbook, click the Print button." It points to the 'Print' button in the top left of the dialog.
- Copies:** A callout box states, "Here you can choose how many copies of the workbook you wish to print." It points to the 'Copies: 1' spinner control.
- Printer selection:** A callout box states, "You may need to select the printer you want to use if your computer is connected to multiple printers." It points to the printer dropdown menu showing 'CSD2851 on PRINTS Ready'.
- Print Active Sheets:** A callout box states, "Here you can choose to print the active sheets, the entire workbook, or a selection of". It points to the 'Print Active Sheets' dropdown menu.
- Pages:** A callout box states, "Here you can choose whether to print on one side or both sides of the paper." It points to the 'Pages: [] to []' spinner controls.
- Print on Both Sides:** A callout box states, "Here you can choose whether to print on one side or both sides of the paper." It points to the 'Print on Both Sides' dropdown menu.
- Collated:** A callout box states, "If you are printing multiple copies, you can choose whether you want the copies collated or uncollated." It points to the 'Collated' dropdown menu.
- Paper Size:** A callout box states, "If your printer uses different paper sizes, you can choose the paper size you wish to use." It points to the 'Letter (8.5" x 11")' dropdown menu.
- Orientation:** A callout box states, "Here you can choose Portrait or Landscape orientation." It points to the 'Portrait Orientation' dropdown menu.
- Margins:** A callout box states, "Here you can adjust the page margins, which can help your data fit more comfortably on the page." It points to the 'Normal Margins' dropdown menu.
- Scaling:** A callout box states, "Here you can choose how to scale your worksheets for the printed page. You can scale worksheets at their actual size, fit the entire worksheet on one page, fit all columns on one page, or fit all rows on one page." It points to the 'No Scaling' dropdown menu.

Choosing a print area

Before you print an Excel workbook, it's important to decide exactly what information you want to print. For example, if you have multiple worksheets in your workbook, you will need to decide if you want to print the entire workbook or only active worksheets. There may also be times when you want to print only a selection of content from your workbook.

To print active sheets

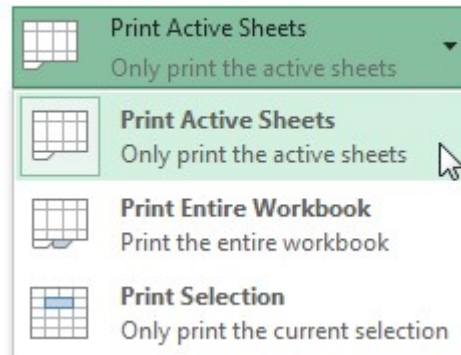
Worksheets are considered active when selected.

1. Select the worksheet you want to print. To print multiple worksheets, click the first worksheet, hold the Ctrl key on your keyboard, then click any other worksheets you want to select.



2. Navigate to the Print pane.
3. Select Print Active Sheets from the Print Range drop-down menu.

Settings



4. Click the Print button.

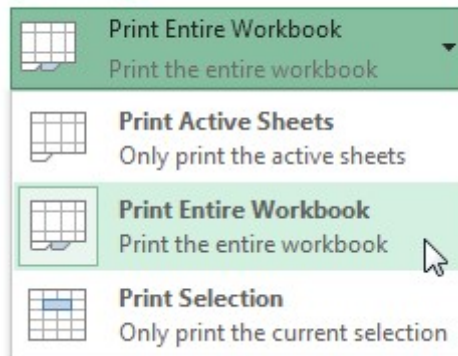
Print



To print the entire workbook

1. Navigate to the Print pane.
2. Select Print Entire Workbook from the Print Range drop-down menu.

Settings



3. Click the Print button.

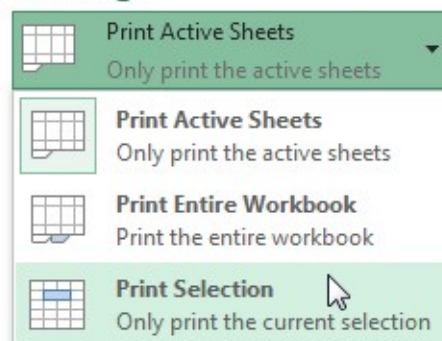
Print



To print a selection

1. Select the cells you wish to print.
2. Navigate to the Print pane.
3. Select Print Selection from the Print Range drop-down menu.


Settings

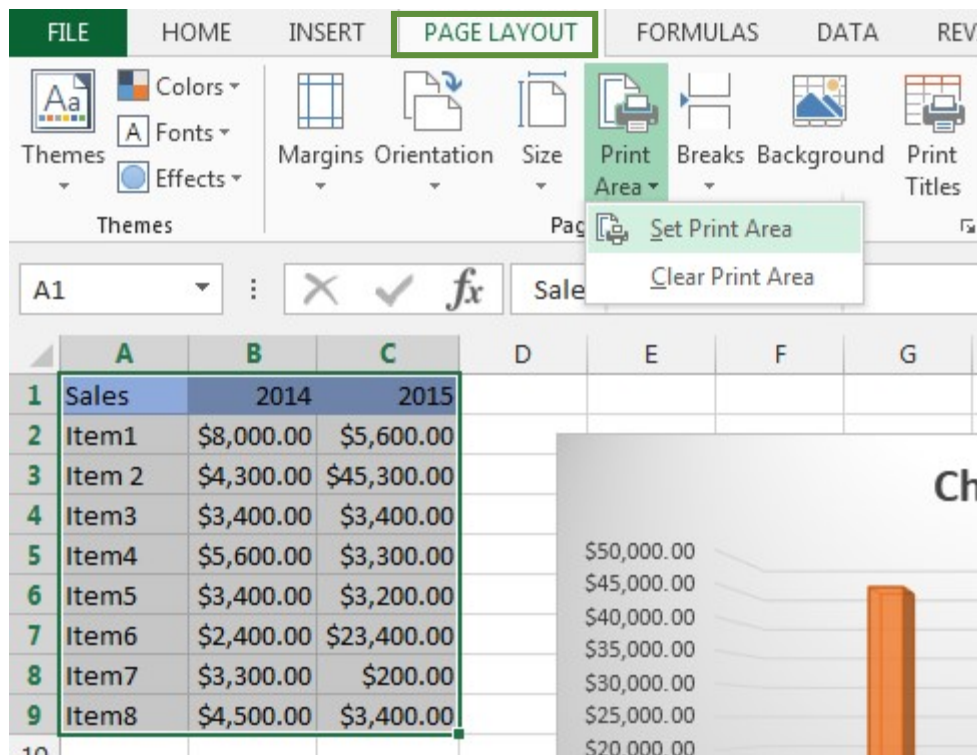


4. A preview of your selection will appear in the Preview pane.
5. Click the Print button to print the selection.

Print



 **TIP:** If you prefer, you can also set the print area in advance so you'll be able to visualize which cells will be printed as you work in Excel. Simply select the cells you want to print, click the Page Layout tab, select the Print Area command, then choose Set Print Area.



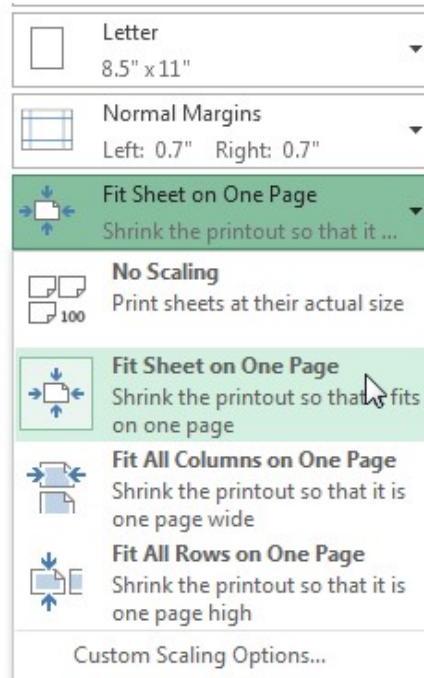
Fitting and scaling content

On occasion, you may need to make small adjustments from the Print pane to fit your workbook content neatly onto a printed page. The Print pane includes several tools to help fit and scale your content, such as scaling and page margins.

To fit content before printing

If some of your content is being cut off by the printer, you can use scaling to fit your workbook to the page automatically.

1. Navigate to the Print pane.
2. Select the desired option from the Scaling drop-down menu. In our example, we'll select Fit Sheet on One Page.

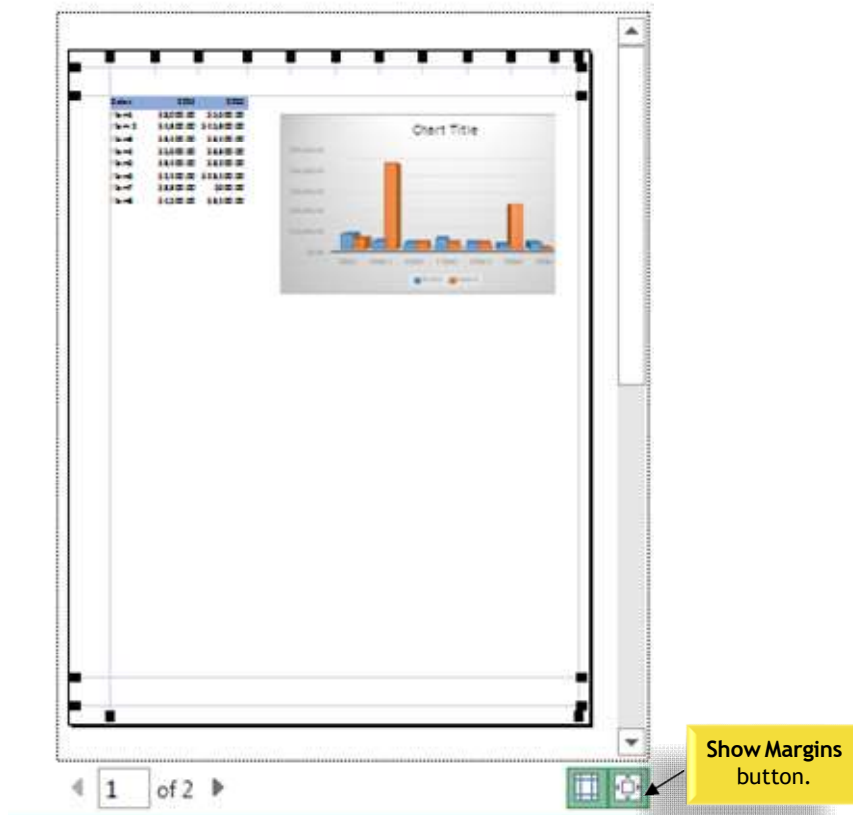


3. The worksheet will be condensed to fit onto a single page.
4. When you're satisfied with the scaling, click Print.

To modify margins in the Preview pane

Sometimes you may only need to adjust a single margin to make your data fit more comfortably. You can modify individual page margins from the Preview pane.

1. Navigate to the Print pane, then click the Show Margins button in the lower-right corner.



2. The page margins will appear in the Preview pane. Hover the mouse over one of the margin markers until the cursor becomes a double arrow \leftrightarrow .
3. Click, hold, and drag the mouse to increase or decrease the margin width.
4. Release the mouse. The margin will be modified. In our example, we were able to fit an additional column on the page.

Challenge!

1. Open an existing Excel workbook.
2. Try printing two active worksheets.
3. Try printing only a selection of cells.
4. Try the scaling feature to condense your workbook content.
5. Adjust the margins from the Preview pane.

Ref.: 1. Microsoft EXCEL Training - Mount Allison University

HAND OUT NOTES ON

COMPUTER

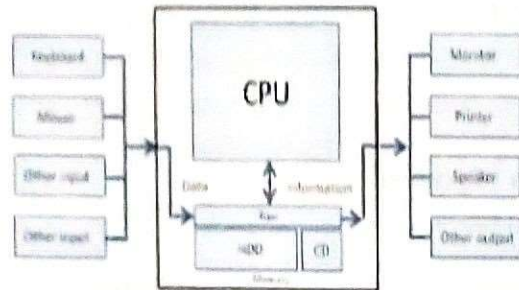
MODULE : MJI & MJP (C,W,D,ELEC)

SUBJECT CODE : MRT-14

WHAT IS COMPUTER?

Computer is an electronic device that is designed to work with Information. *The term computer is derived from the Latin term 'computare', this means to calculate or programmable machine. Computer can not do anything without a Program.* It represents the decimal numbers through a string of binary digits.

A computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It is designed to execute applications and provides a variety of solutions by combining integrated hardware and software components.



Charles Babbage is called the "Grand Father" of the computer. The First mechanical computer designed by Charles Babbage was called **Analytical Engine**. It uses read-only memory in the form of punch cards.

Computer is an advanced electronic device that takes raw data as input from the user and processes these data under the control of set of instructions (called program) and gives the result (output) and saves output for the future use. It can process both numerical and non-

numerical (arithmetic and logical) calculations.

HISTORY OF COMPUTER

The **history of computers** starts out about 2000 years ago in Babylonia (Mesopotamia), at the birth of the abacus, a wooden rack holding two horizontal wires with beads strung on them.

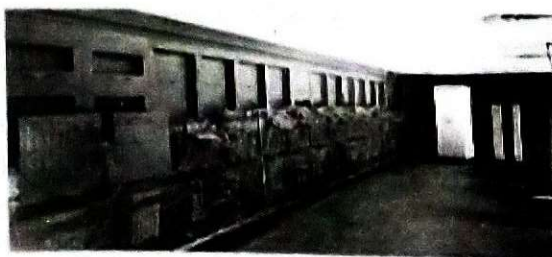
First half of 19th century, The Jacquard loom was a marvel of the Industrial Revolution. A textile-weaving loom, it could also be called the first practical information-processing device. The loom worked by tugging various-coloured threads into patterns by means of an array of rods. By inserting a card punched with holes,

The **computer** as we know it today had its beginning with a 19th century English mathematics professor name Charles Babbage. ... It was called the **Atanasoff-Berry Computer (ABC)**.

GENERATION OF COMPUTER

First Generation of Computers (1942-1955)

The beginning of commercial computer age is from **UNIVAC (Universal Automatic Computer)**. It was developed by two scientists **Mauchly** and **Echert** at the Census Department of United States in 1947. **The first generation computers were used during 1942-1955.** They were based on vacuum tubes. Examples of first generation computers are ENIAC and UNIVAC-1.



Notes on : (I.T) Computer
Module : MJI & MJP (C, W, D, Elect)

The "ENIVAC" was weighing 30 tons, power consume 200KW of electric power and consisting of approx.18000 vacuum tubes, 1500 relays and thousands of resistors, capacitors and inductors, was completed in 1945.

Advantages

- Vacuum tubes were the only electronic component available during those days.
- Vacuum tube technology made possible to make electronic digital computers.
- These computers could calculate data in millisecond.

Disadvantages

- The computers were very large in size.
- They consumed a large amount of energy. (200 Kw of power)
- They heated very soon due to thousands of vacuum tubes.
- They were not very reliable.
- Air conditioning was required.
- Constant maintenance was required.
- Non-portable.
- Costly commercial production.
- Limited commercial use.
- Very slow speed.
- Limited programming capabilities.
- Used machine language only.
- Used magnetic drums which provide very less data storage.
- Used punch cards for input.
- Not versatile and very faulty

Second Generation Computers (1955-1964)



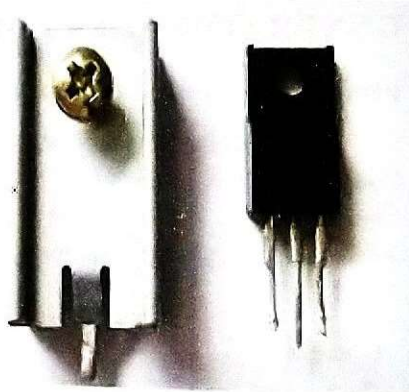
1402 Card Read Punch

1407 Console

1401 CPU

720 Tape Drive

1403 Line Printer



The **second generation computers** used transistors. The scientists at Bell laboratories developed transistor in 1947. These scientists include John Barden, William Brattain and William Shockley. The size of the computers was decreased by replacing vacuum tubes with transistors. The examples of

Notes on : (IT) Computer
Module : MJI & MJP (C, W, D, Elect)

second generation computers are IBM 7094 series, IBM 1400 series and CDC 164 etc.

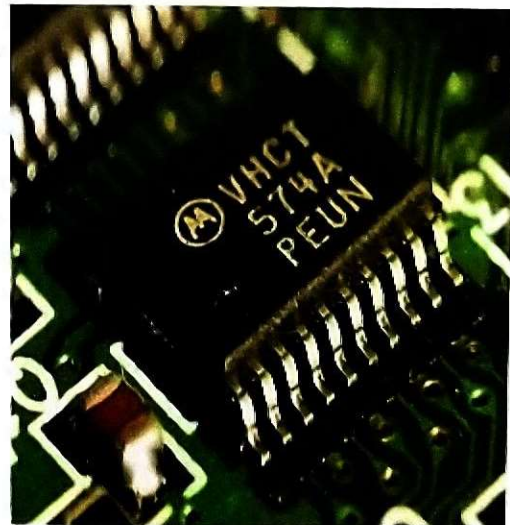
Advantages

- Smaller in size as compared to the first generation computers.
- The 2nd generation Computers were more reliable compare to first generation computers.
- Used less energy and were less heated.
- Better portability as compared to the first generation computers.
- Better speed and could calculate data in microseconds
- Used faster peripherals like tape drives, magnetic disks, printer etc.
- Used Assembly language instead of Machine language.
- Development of high level languages like COBOL, FORTRAN, PASCAL, BASIC & other
- Accuracy improved.

Disadvantages

- Cooling system was required
- Constant maintenance was required
- Commercial production was difficult
- Only used for specific purposes
- Costly and not versatile
- Puch cards were used for input.

Third Generation Computers (1964-1971)



The **Third generation computers** used the integrated circuits (IC). Jack Kilby developed the concept of integrated circuit in 1958. It was an important invention in the computer field. The first IC was invented and used in 1961. The size of an IC is about ¼ square inch. A single IC chip may contain thousands of transistors. The computer became smaller in size, faster, more reliable and less expensive. The examples of third generation computers are **IBM 370, IBM System/360, UNIVAC 1108 and UNIVAC AC 9000** etc.

Advantages

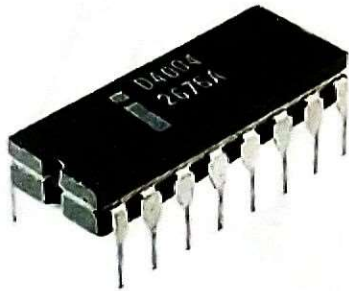
- Smaller in size as compared to previous generations.
- More reliable.
- Used less energy
- Produced less heat as compared to the previous two generations of computers.
- Better speed and could calculate data in nanoseconds.
- Used fan for heat discharge to prevent damage.
- Maintenance cost was low because hardware failure is rare.
- Totally general purpose
- Could be used for high-level languages.
- Good storage
- Versatile to an extent
- Less expensive
- Better accuracy
- Commercial production increased.
- Used mouse and keyboard for input.

Disadvantages

- Air conditioning was required.
- Highly sophisticated technology required for the manufacturing of IC chips.

Fourth Generation Computers (1971-1985)

The fourth generation computers started with the invention of Microprocessor. The Microprocessor contains thousands of ICs. The technology of integrated circuits improved rapidly. The LSI (Large Scale Integration) circuit and VLSI (Very Large Scale Integration) circuit was designed. It greatly reduced the size of computer. The size of modern Microprocessors is usually one square inch. It can contain millions of electronic circuits. The examples of fourth generation computers are **Apple Macintosh & IBM PC**.



Advantages

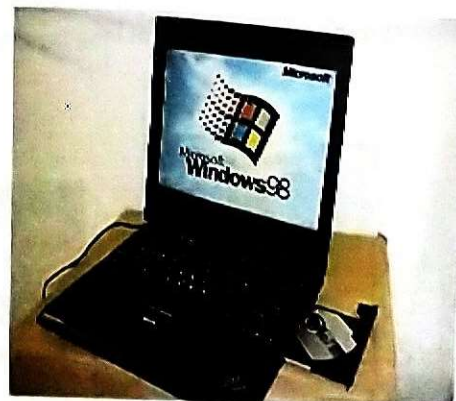
- More powerful and reliable than previous generations.
- Small in size
- Fast processing power with less power consumption
- Fan for heat discharging and thus to keep cold.
- No air conditioning required.
- Totally general purpose
- Commercial production
- Less need of repair.
- Cheapest among all generations
- All types of High level languages can be used in this type of computers

Disadvantages

- The latest technology is required for manufacturing of Microprocessors.

Fifth Generation Computers (1986-1995)

In fifth Generation of computer became more smart than fourth generation computer-





Advantages:

- More powerful and reliable than previous generations.
- Introduced ULSI (Ultra Large scale Integration) technology. Introduced Intel's Pentium and Dual core processors contains billions of transistors on a single IC chip.
- Object oriented language like JAVA suitable for Internet programming has been developed. Cost of data communication decreased,
- Introduced LCD monitor.
- Portable note book computer introduced.
- Storage technology advanced – large main memories and disc storage available.
- Introduction of E-mail, e- commerce, Virtual libraries/ classrooms, multimedia applications etc.
- New operating systems developed – Windows 95/ 98/ XP/ LINUX etc.

Sixth Generation Computers (From 1995 to Present & Beyond)

Artificial intelligence(AI)

In sixth generation, Computer devices with artificial intelligence are still in development, but some of these technologies are beginning to emerge and be used such as voice recognition.

AI is a reality made possible by using parallel processing and superconductors. Looking to the future, computers will be radically transformed again by quantum computation, molecular and nano technology.

The essence of fifth generation will be using these technologies to ultimately create machines which can process and respond to natural language, and have capability to learn and organise themselves.



generations.



Advantages:



More powerful and reliable than previous generations.

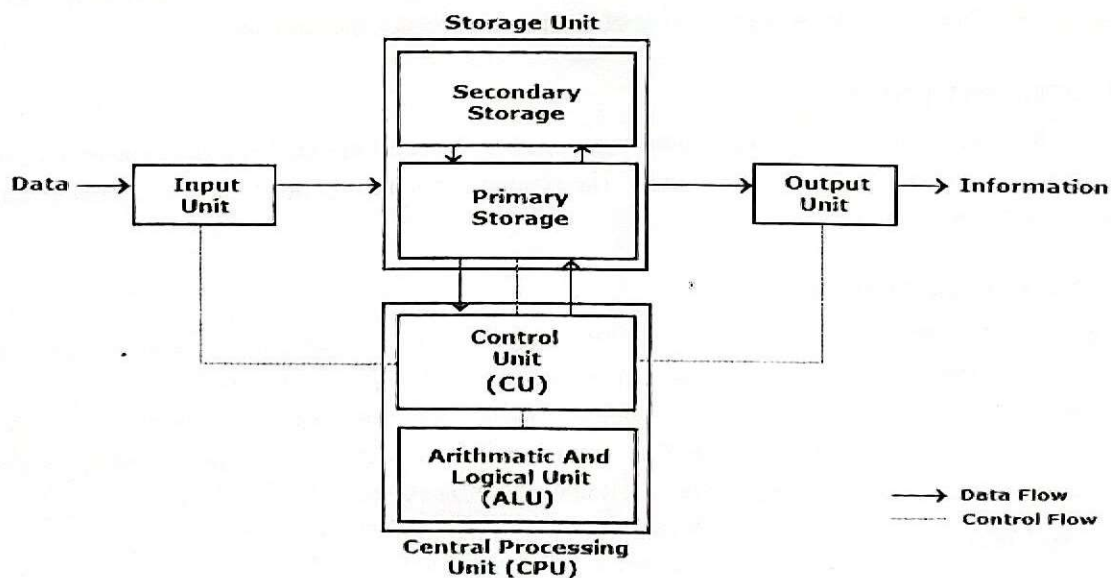
- Computer became too cost effective and absolutely user friendly and more versatile.
- The development of newer LED monitor after CRT and LCD panel monitor was made.
- Introduction of 2nd generation computer Processor from Intel Like i3,i5, i7, i9 etc and new operating system developed by Micosoft like Windows 7, Windows 8, 8.1 and latest Windows10.
- The Hard disk capacity is increased 1,2, 4 Tera byte (TB) and more.
- A revolutionary SSD (Solid State Device) is introduce, it has no moving parts.
- Introduction of Blu-Ray-Disc a high capacity optical disc format for data and high-definition video. It can stored 25 Gb to 100 Gb information where as CD (contain 700 Mb) and DVD (contains 4.7 Gb)

BLOCK DIAGRAM OF COMPUTER

A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer as shown in Fig. performs basically five major computer operations or functions irrespective of their size and make. These are

- 1) it accepts data or instructions by way of input,
- 2) it stores data,
- 3) it can process data as required by the user,
- 4) it gives results in the form of output, and
- 5) it controls all operations inside a computer.

We discuss below each of these Computer operation



1. Input: This is the process of entering data and programs in to the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw

data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. Storage: The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

3. Processing: The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. Output: This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

5. Control: The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step by step processing of all operations inside the computer.

FUNCTIONAL UNITS

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are

Arithmetic Logical Unit (ALU)

Logical Unit : After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. Control Unit is responsible for co-ordinating various operations using time signal. The control unit determines the sequence in which computer programs and

.....
instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output.

Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

Types of computers

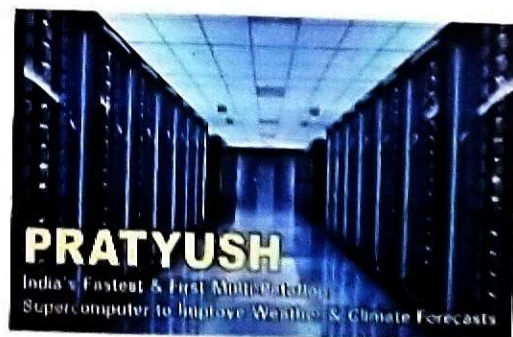
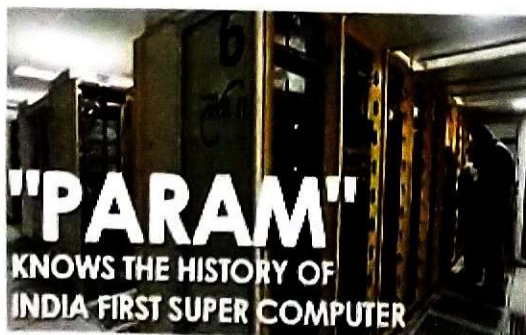
The four basic types of computers are as under:

1. Supercomputer
2. Mainframe Computer
3. Minicomputer
4. Microcomputer

1. Supercomputer

The most powerful computers in terms of performance and data processing are the Supercomputers. These are specialized and task specific computers used by large organizations. These computers are used for research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose.

The supercomputers are very expensive and very large in size. It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.



Seymour Cray designed the first Supercomputer "CDC 6600" in 1964. CDC 6600 is known as the first ever Supercomputer.

Exascale Supercomputer

On 29th July, 2015, President of the United States, Barack Obama, approved the development of an **Exascale Super Computer**. The Exascale Super computer will be 30 times faster and more powerful than today's fastest Super Computers. The need to develop such a high performance Supercomputer comes after China's surge in high performance computing. However, the US still tops the list of Supercomputers with 233 high performance machines. China has 37 Supercomputers but they lead the list of the most powerful and high performance supercomputers since June 2013.

Presently, China's "**Tianhe – 2**" is the world's faster Supercomputer.

The Tianhe – 2 can perform 100 Petaflops, i.e quadrillions of floating point operations per second.

The following table shows list of top five most powerful Supercomputers in the world. you can also view complete list of Top 500 Supercomputers in the world.

Top five Supercomputers

RANK	SITE	SYSTEM
1	National Super computer in Guanzhou, China	Tianhe - 2 (MilkyWay - 2)
2	DOE/SC/Oak Ridge National Laboratory, United States	Titan - Cray XK7, Cray Inc.
3	DOE/NNSA/LLNL, United States	Sequoia - BlueGene/Q, IBM
4	RIKEN Advanced Institute for Computational Science (AICS) Japan	K Computer, Tofu Interconnect Fujitsu.
5	DOE/SC/Argonne National Laboratory, United States	Mira - BlueGene/Q, Custom IBM

Uses of Supercomputers

Space Exploration

Supercomputers are used to study the origin of the universe, the dark-matters. For these studies scientist use IBM's powerful supercomputer "Roadrunner" at National Laboratory Los Alamos.

Earthquake studies

Supercomputers are used to study the Earthquakes phenomenon. Besides that supercomputers are used for natural resources exploration, like natural gas, petroleum, coal, etc.

Weather Forecasting

Supercomputers are used for weather forecasting, and to study the nature and extent of Hurricanes, Rainfalls, windstorms, etc.

Nuclear weapons testing

Supercomputers are used to run weapon simulation that can test the Range, accuracy & impact of Nuclear weapons.

Popular Supercomputers

- IBM's Sequoia, in United States
- Fujitsu's K Computer in Japan
- IBM's Mira in United States
- IBM's SuperMUC in Germany
- NUDT Tianhe-1A in China

2. Mainframe computer

Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations. The Mainframe computers can be accommodated in large air-conditioned rooms because of its size. Super-computers are the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data. Banks educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Application

Used to process large amount of data at very high speed such as in the case of Banks/ Insurance Companies/ Hospital/ Railways...which need online processing of large number of transactions and requires massive data storage and processing capabilities.

Popular Mainframe computers

- Fujitsu's ICL VME
- IBM 3000 series
- Hitachi's Z800

3. Minicomputer

Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

Popular Minicomputers

- K-202
- Texas Instrument TI-990
- SDS-92
- IBM Midrange computers

4. Microcomputer

Desktop computers, laptops, personal digital assistant (PDA), tablets & smartphones are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are HP, Dell, Apple, Samsung, Sony & Toshiba etc.

Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, Notebooks, PDA's, Tablet PC's, Smartphones, Calculators are all type of Microcomputers.

Definition of computer

Hardware is the collection of physical parts of a Computer system that has shape and size and can be feel. The most essential hardware components are Motherboard, CPU, RAM memory, IO system, power supply, video display controller, Bus and hard disk drive. Some of the normal hardware parts you see like a mouse, keyboard, monitor and CPU are the basic components of a computer. But inside the CPU box there is hard disk, motherboard, and RAM, video card, CPU Fan, sound card, server components, CD/DVD drive and many more. The hardware components does change in shape and size as in a desktop computer the CPU integrates all the components that are connected by wires but in laptop computers the components are integrated into a single portable unit. Basically the hardware components in a Computer system are connected through wires in order to function properly. From power supply to network connection all are connected through wires.

Hardware Components:

The most important hardware component is Mother Board that holds all the important components of a Computer including CPU, memory and various connectors for input/output device. Some of the input devices like keyboard, mouse, microphone, modem, joystick, USB devices, joystick and many more are connected for better functioning. Similarly the output devices like the computer monitor, modem, projectors, printers etc are connected to the available connectors of motherboard. It is the main mother board that includes graphic processors for better display screen on your monitor. There is CPU socket, CPU fan memory connector, super IO chip, DIMM memory slots, IDE connector, SATA connector, BIOS flash chip that are the most essential components to run a Computer system. It also integrates audio codec chip for sound and gigabit Ethernet chip for network connection on a computer.

There are several hardware components attached to the CPU or Central Processing Unit which is also called as the brain of Computer. The CPU includes all the processors that interprets and execute program instructions. It includes control unit that instructs, maintains and also control the flow of information, arithmetic logic unit for simple logic operations and a controller. Inside the CPU, memory is an important component that stores all the information or data on your computer. It includes the main memory slot called RAM (Random Access Memory), ROM (Read only Memory), CMOS battery, internal hard disk that is connected to Computer system to store abundant data and applications, and an optical disk drive known as CD/DVD drive that can read and write from CD or

Types of Memory

Mainly computer have two types memory

1. Primary Memory / Volatile Memory.
2. Secondary Memory / Non Volatile Memory.

A. Primary Memory / Volatile Memory– Primary memory is internal memory of the computer. It is also known as main memory and Temporary memory .Primary Memory holds the data and instruction on which computer is currently working. Primary Memory is nature volatile. It means when power is switched off it lost all data.

Types of Primary Memory– Primary memory is generally of two types.

1. RAM
2. ROM

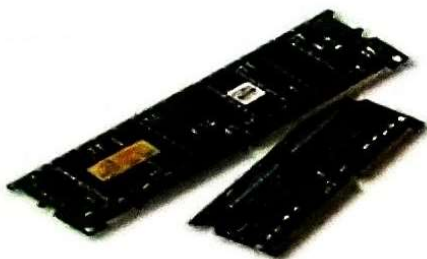
1. RAM (Random Access Memory)– It stands for Random Access Memory.RAM is known as read /writes memory. It generally refereed as main memory of the computer system. It is a temporary memory. The information stored in this memory is lost as the power supply to the computer is switched off. That's why RAM is also called “**Volatile Memory**”

Types of RAM– RAM is also of two types:

a) **Static RAM**- Static RAM also known as SRAM ,retain stored information as long as the power supply is ON. SRAM are of higher coast and consume more power .They have higher speed than Dynamic RAM

b)**Dynamic RAM**– Dynamic RAM also known as DRAM, its stored information in a very short time (a few milliseconds) even though the power supply is ON. The Dynamic RAM are cheaper and moderate speed and also they consume less power.

2. ROM (Read Only Memory) – It stands for Read Only Memory.ROM is a Permanent Type memory. Its content are not lost when power supply is switched off. Content of ROM is decided by the computer manufacturer and permanently stored at the time of manufacturing. ROM cannot be overwritten by the computer. It is also called “**Non-Volatile Memory**”.

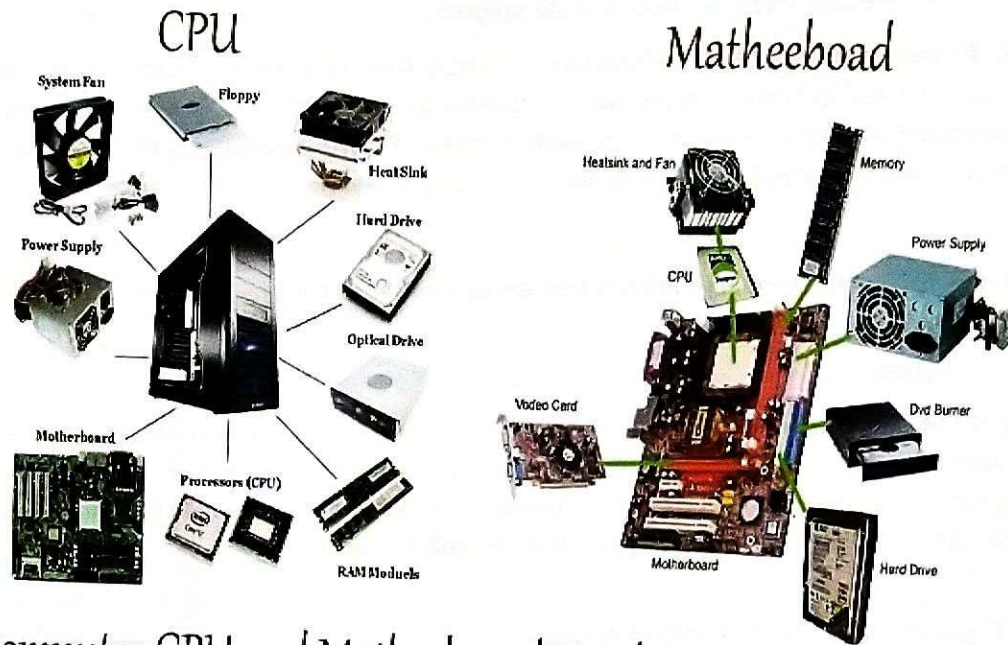


RAM



ROM

DVD's. There are also points for external storage devices like USB, flash drive, external hard disk to be connected for memory storage.



Computer CPU and Motherboard Hardware Components

Computer Memory

Memory is storage part in computer. It is store the data, information, programs during processing in computer. It stores data either temporarily or permanent basis. Memory used to important role in saving and retrieving data.

Computer memory is measured in terms of how many bits it can store. Here is a chart for memory capacity conversion.

- 1 byte (B) = 8 bits
- 1 Kilobytes (KB) = 1024 bytes
- 1 Megabyte (MB) = 1024 KB
- 1 Gigabyte (GB) = 1024 MB
- 1 Terabyte (TB) = 1024 GB
- 1 Exabyte (EB) = 1024 PB
- 1 Zettabyte = 1024 EB
- 1 Yottabyte (YB) = 1024 ZB

Type of ROM: ROM memory is three types names are following-

1. **PROM(Programmable Read Only Memory)**-PROM chip is programmable ROM.it is PROM chips to write data once and read many.once chip has been programmed ,the recorded information cannot be changed. PROM is also nonvolatile memory.
2. **EPROM (Erasable Programmable Read Only Memory)**- EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM exposing the chip for some time ultraviolet light .
3. **EEPROM (Electrically Erasable Programmable Read Only Memory)**-The EEPROM is programmed and erased by special electrical waves in millisecond. A single byte of a data or the entire contents of device can be erased.

B. Secondary Memory / Non Volatile Memory–

Secondary Memory is external memory of the computer. It is also known as Auxiliary memory and permanent memory. It is used to store the different programs and the information permanently. Secondary Memory is nature non volatile. It means data is stored permanently even if power is switched off.

The secondary storage devices are:

1. Floppy Disks
2. Magnetic (Hard) Disk
3. Magnetic Tapes
4. Pen Drive
5. Winchester Disk
6. Optical Disk(CD,DVD)

Differences between Primary and Secondary Memory

S.No.	Primary memory	Secondary memory
1	Primary memory is temporary	Secondary memory is permanent
2	Primary memory is directly accessible by Processor/CPU	Secondary memory is not directly accessible by CPU
3	Nature of Parts of Primary memory varies. RAM-volatile in nature. ROM- Non-volatiler	It's always Non-volatile in nature
4	Primary memory devices are more expensive than secondary storage devices	Secondary memory devices are less expensive when compare to primary memory devices
5	The memory devices used for primary memory are semiconductor memories	The secondary memory devices are magnetic and optical memories
6	Primary memory is also known as Main memory or Internal memory	Secondary memory is also known as External memory or Auxiliary memory
7	Examples: RAM, ROM, Cache memory, PROM, EPROM, Registers etc	Examples: Hard Disk, Floppy Disk, Magnetic Tapes etc

Primary and Secondary Memory in Computer



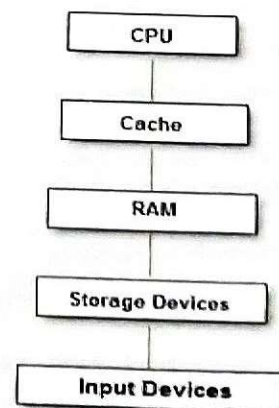
Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

The advantages of cache memory are as follows –

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.



Differences between Primary and Secondary Memory

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive.

Virtual Memory

The concept of virtual memory in computer organisation is allocating memory from the hard disk and making that part of the hard disk as a temporary RAM. In the earlier days, when the concept of virtual memory was not introduced, there was a big troubleshooting that when RAM is already full but program execution needs more space in RAM. The computers became unresponsive in such type of situation since processor forced the program to be in RAM but RAM can't hold them because it is already running out of space. To deal with this type problem the concept of virtual memory was introduced.

The concept of virtual memory in computer organization:

Basically, virtual memory provides an illusion to the users that the PC has enough primary memory left to run the programs. Though the size of programs i.e. to be executed may sometimes very bigger than the size of primary memory left, the user never feels that he needs a bigger primary storage to run that program. When the RAM is full, but program execution needs more space in RAM, then the operating system occupies a portion of the hard disk and uses it as a RAM. In that part of the secondary storage, the part of the program which not currently being executed is stored and all the parts of the program that are eventually executed are first brought into the main memory.

Hard Disc:

The hard drive, which typically provides storage for data and applications within a computer, has four key components inside its casing -- the platter (for storing data), the spindle (for spinning the platters), the read/write arm (for reading and writing data) and the actuator (for controlling the actions of the read/write arm). Only the most technically proficient IT professionals should attempt to work on the components inside a hard drive.



Different component inside Hard Disc:

Platters

The platters are the circular discs inside the hard drive where the 1s and 0s that make up your files are stored. Platters are made out of aluminum, glass or ceramic and have a magnetic surface in order to permanently store data. On larger hard drives, several platters are used to increase the overall capacity of the drive. Data is stored on the the platters in tracks, sectors and cylinders to keep it organized and easier to find.

The Spindle

The spindle keeps the platters in position and rotates them as required. The revolutions-per-minute rating determines how fast data can be written to and read from the hard drive. A typical internal desktop drive runs at 7,200 RPM, though faster and slower speeds are available. The spindle keeps the platters at a fixed distance apart from each other to enable the read/write arm to gain access. (ref 1+3)

The Read/Write Arm

The read/write arm controls the movement of the read/write heads, which do the actual reading and writing on the disk platters by converting the magnetic surface into an electric current. The arm makes sure the heads are in the right position based on the data that needs to be accessed or written; it's also known as the head arm or actuator arm. There is typically one read/write head for every platter side, which floats 3 to 20 millionths of an inch above the platter surface.

Actuator

The actuator or head actuator is a small motor that takes instructions from the drive's circuit board to control the movement of the read/write arm and supervise the transfer of data to and from the platters. It's responsible for ensuring the read/write heads are in exactly the right place at all times.

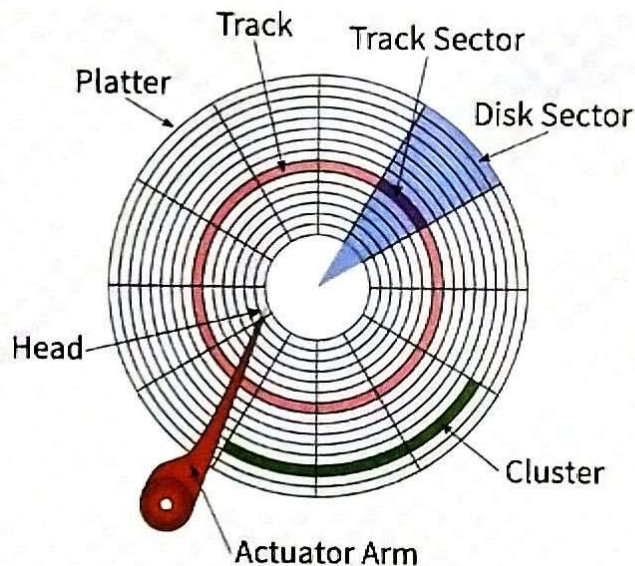
Other Components

As well as the casing on the outside of the hard disk that holds all of the components together, the front-end circuit board controls input and output signals in tandem with the ports at the end of the drive. No matter what the type of drive, it has one port for a power supply and one port for transferring data and instructions to and from the rest of the system.

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Tracks and Sectors of a Hard disc:

Platters are organized into specific structures to enable the organized storage and retrieval of data. Each platter is broken into *tracks*--tens of thousands of them--which are tightly-packed concentric circles. These are similar in structure to the annual rings of a tree (but *not* similar to the grooves in a vinyl record album, which form a connected spiral and not concentric rings).

A track holds too much information to be suitable as the smallest unit of storage on a disk, so each one is further broken down into *sectors*. A sector is normally the smallest individually-addressable unit of information stored on a hard disk, and normally holds 512 bytes of information. The first PC hard disks typically held 17 sectors per track. Today's hard disks can have *thousands* of sectors in a single track, and make use of zoned recording to allow more sectors on the larger outer tracks of the disk.



Hard Drive Types:

Currently, we can group hard drives into four types:

- Parallel Advanced Technology Attachment (PATA)
 - Serial ATA (SATA)
 - Small Computer System Interface (SCSI)
 - Solid State Drives (SSD)
 - External USB HDD
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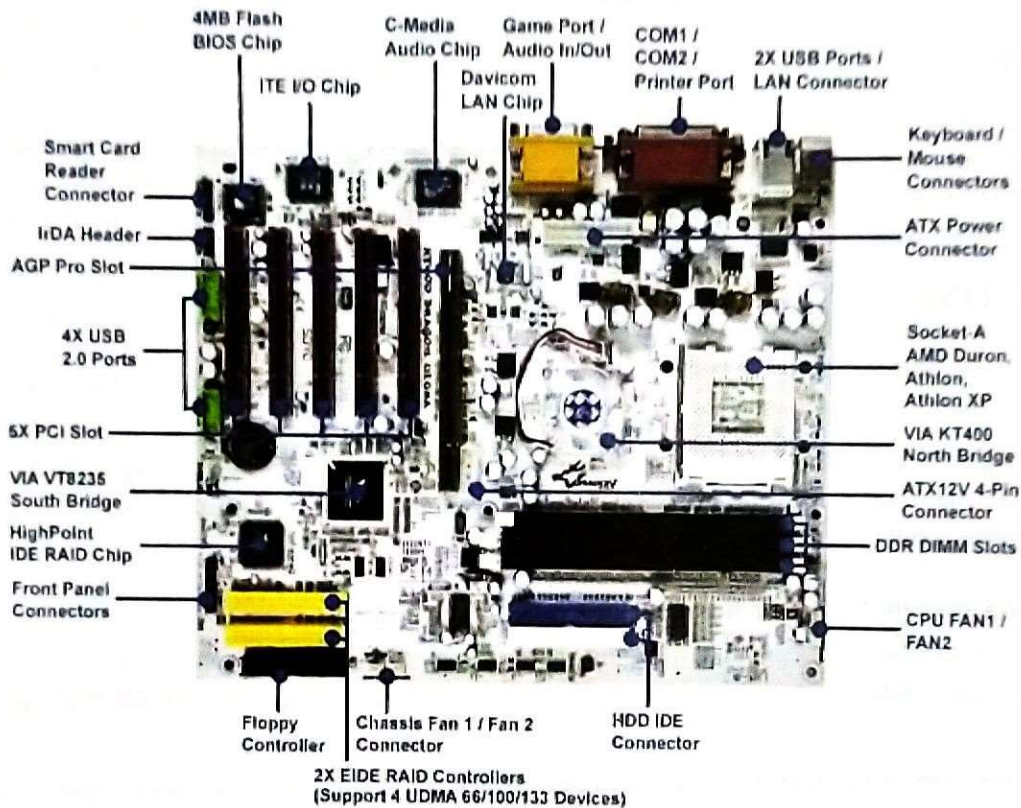
S.S.D

SSD stands for Solid State Drive. It is the current technology this has begun to replace Hard Disk Drives (HDD). The HDD or SDD is the hardware component in a computer that stores data. The operating system (usually Windows on PCs and MacOS on Apple computers) is installed on the drive. It allows the computer to boot into an interface that the user can navigate. When you create a document and save it, it is saved to your storage drive. You can also save files to external devices, such as a flash drive or external hard drive. Without a storage drive, you wouldn't be able to save any files or even boot into the operating system.



Mother board:

A motherboard (sometimes alternatively known as the mainboard, system board, baseboard, planar board or logic board,[1] or colloquially, a mobo) is the main printed circuit board (PCB) found in general purpose microcomputers and other expandable systems. It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.



Optical Disc Drive

An optical drive is a type of computer disk drive that reads and writes data from optical disks through laser beaming technology. This type of drive allows a user to retrieve, edit and delete the content from optical disks such as CDs, DVDs and Blu-ray disks



Basic Terminologies

POST

Stands for "Power On Self Test. POST (or P.O.S.T.) is a series of system checks run by computers and other electronic devices when they are turned on. The results of the test may be displayed on a screen, output through flashing LEDs, or simply recorded internally. On computer systems, the POST operation runs at the beginning of the boot sequence. If all the tests pass, the rest of the startup process continues automatically.

BIOS

BIOS (basic input/output system) are the program a personal computer's microprocessor uses to get the computer system started after you turn it on. It also manages data flow between the computer's operating system and attached devices such as the hard disk, video adapter, keyboard, mouse and printer.

BOOTING

The term boot is used to describe the process taken by the computer when turned on that loads the operating system and prepares the system for use.

Booting, boot up, and start up are all synonymous terms and generally describe the long list of things that happen from the pressing of the power button to a fully-loaded and ready-to-use session of an operating system, like Windows.

What Goes On During the Boot Process?

From the very beginning, when the power button is pressed to turn the computer on, the power supply unit gives power to the motherboard and its components so that they can play their part in the whole system.

The first part of the next step of the boot process is controlled by BIOS and begins after the POST. This is when POST error messages are given if there's a problem with any of the hardware.

Following the display of various information on the monitor, like the BIOS manufacturer and RAM details, BIOS eventually hands the boot process over to the master boot code, that hands it to the volume boot code, and then finally to the boot manager to handle the rest.

This is how BIOS finds the right hard drive that has the operating system. It does this by checking the first sector of the hard drives it identifies. When it finds the right drive that has a boot loader, it loads that into memory so that the boot loader program can then load the operating system into memory, which is how you use the OS that's installed to the drive

Hard (Cold) Booting V/S Soft (Warm) Booting

You may have heard the terms hard/cold booting and soft/warm booting and wondered what was meant. Isn't booting just booting? How can you have two different types?

A cold boot is when the computer starts up from a completely dead state where the components were previously without any power at all. A hard boot is also characterized by the computer performing a power-on self-test, or POST.

However, there are conflicting perspectives on what a cold boot really involves. For example, restarting a computer that's running Windows may make you think that it's performing a cold reboot because the system appears to turn off, but it may not actually shut down the power to the motherboard, in which case it would be applying a soft reboot.

COMPUTER SOFTWARE

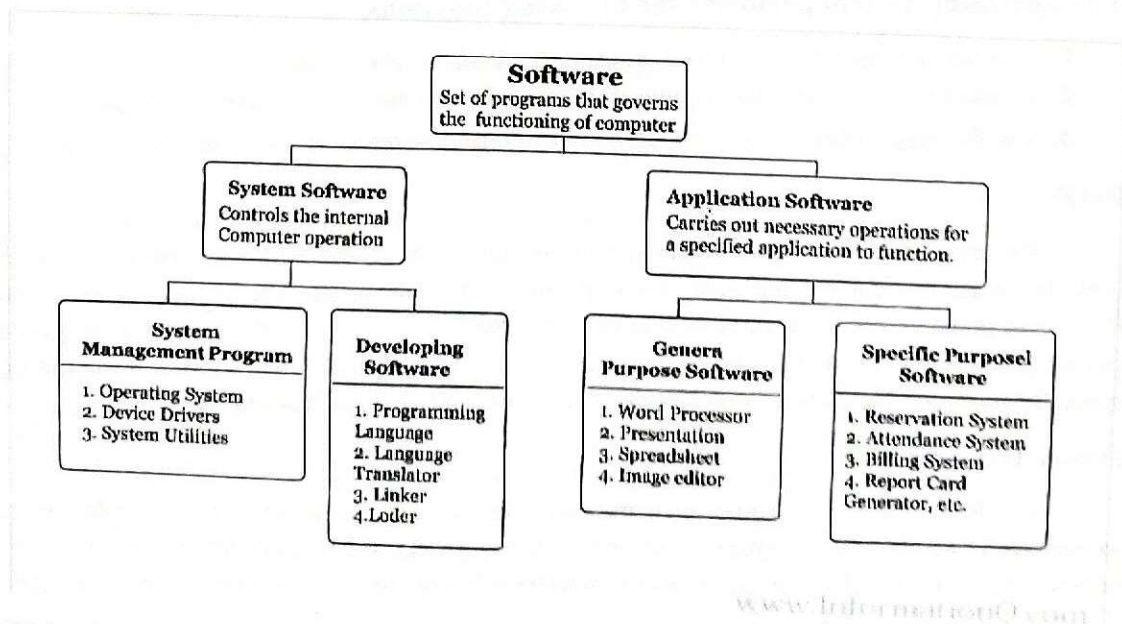
Software

Software is a collection of computer programs and related data that provide the instruction for telling a computer what to do and how to do it. A software is an interface between user and computer. It is a set of instructions, programs that are used to give command to hardware. It is responsible for controlling, integrating and managing the hardware components of a computer system and for accomplishing specific tasks.

Types of Software

Software can be divided into two major categories.

- 1. System Software.
- 2. Application Software.



System Software

System software consists of several programs, which are directly responsible for controlling, integrating and managing the individual hardware components of a computer system.

It also provides the interface between the user and component of the computer.

The purpose of system software is to insulate the applications programmer as much as possible from the detail of the particular complex computer being used.

Depending on the functionality, the system software can be further divided into two major categories; system management program and developing software.

1. System Management Program:

It includes an integrated system of programs, which manages the operations of the processor, controls input/output, manages storage resources and provides various support services. Some common examples of system management programs are operating system, device driver and system utilities.

Operating System:

It consists of programs, which controls, coordinates and supervises the activities of the various components of a computer system. Its function is to provide link between the computer hardware and the user.

It performs all internal management functions (disk access, memory management, task scheduling and user interfacing) and ensures systematic functioning of a computer system. It provides an environment to run the programs. e.g., MS-DOS, windows XP/2000/98, Unix Linux, etc.

The operating system performs the following functions.

1. It recognises input from keyboard, sends output to the display screen.
2. It makes sure that programs running at the same time do not interface with each other.
3. It is also responsible for security, ensuring that unauthorized users do not access the system.

BIOS:

The Basic Input / Output system (BIOS) is commonly known as System Bios. The BIOS controls various electronic components within the main computer system. The initial function of the BIOS is to initialize system devices such as the RAM, hard disk, CD/DVD drive, video display card and other hardwares. The BIOS sets the machine hardware into a known state that helps the operating system to configure the hardware components. This process is known as **Booting Up**.

Device Drivers:

A software, which is written with the objective of making a device functional when it is connected to the computer is called device driver. It is a system software that acts like an interface between the device and the user. Every device, whether it is a printer, monitor, mouse or keyboard has

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a driver program associated with it for its proper functioning.

- *Device drivers are a set of instructions that introduce our PC to a hardware device.*
- Device drivers are not independent programs, they assist and are assisted by the operating system for the proper functioning.
- **System Utilities:**

These programs perform tasks related to the maintenance of the computer system. These are the packages which are loaded into computer during time of installation of operating system. They are used to support, enhance, expand and secure existing programs and data in the computer system.

System utility mainly consists of the following functions.

1. **Disk Compression** It increases the amount of information that can be stored on a hard disk by compressing all information stored on a hard disk. This utility works automatically and the user does not need to be aware of its existence.
2. **Disk Fragmenters** It detects computer files whose contents are broken across several locations on the hard disk and moves the fragments to one location to increase efficiency. It can be used to rearrange files and unused space on your hard disk.
3. **Backup Utilities** It can make a copy of all information stored on a disk and restore either the entire disk or selected files.
4. **Disk Cleaners** It is used to find files that have not been used for a long time. This utility also serves to increase the speed of a slow computer.
5. **Anti-Virus** It is the utility which is used to scan computer for viruses and prevent the computer system files from being corrupt.

2. Developing Software:

It is a software which provides service required for the development and execution of application software. The programming languages, language translator, loader, linker are required for the application software development.

Programming Languages:

A programming language is a primary interface of a programmer with a computer. A programming language is an artificial language to express computation that can be performed by a computer.

Each language has its own syntax i.e., the set of specific rules and expresses the logical steps of an algorithm. programming languages are divided into two categories; Low Level Language (LLL) and High Level Language (HLL).

1. **Low Level Language (LLL)** Low level language is divided into two parts
 1. **Machine Language** It is sometimes, referred to as machine code or object code. It is a collection of binary digits or bits that computer reads and interprets.

2. **Assembly Language** It is used to interface with computer hardware. It uses instructed commands as substitutions for numbers allowing human to read the code more easily than binary. It uses English-like representation to write a program.

Medium Level Language:

It serves as the bridge between raw hardware and programming layer of a computer system. It is designed to improve the translated code before it is executed by the processor.

2. **High Level Language (HLL)** It is machine independent language and uses translator. It is also called source code. Some commonly used high level languages are C, BASIC, FORTRAN, PASCAL, etc.

Language Translator:

A language translator helps in converting programming languages to machine language. The translated program is called the object code. There are three different kinds of language translator

1. **Assembler** It is used to convert the assembly language into machine language (i.e., 0 or 1), This language consists of mnemonic codes which are difficult to learn and is machine dependent.
2. **Compiler** It is used to convert the source code (written in high level language) into machine language. Compiler reads whole source code at a time and trap the errors and inform to programmer. For each high level language, the machine requires a separate compiler.
3. **Interpreter** This language processor converts a high level language program into machine language by converting it line-by-line. If there is any error in any line during execution, it will report it at the same time and cannot resume until the error is rectified.

Linker

A linker is a system program that links together several object modules and libraries to form a single and coherent program (executable). The main purpose of linker is to resolve references among files. Linker is used to determine the memory locations that code from each module will occupy and relates its instruction by adjusting absolute references.

Loader

Loader is a kind of system software, which is responsible for loading and relocation of the executable program in the main memory. It is a part of operating system that brings an executable file residing on disk into memory and starts its execution process.

Application Software

Application software is a computer software designed to help the user to perform singular or multiple tasks. It is a set of instructions or program designed for specific uses or applications, that enable the user to interact with a computer. Application software are also called the end-user programs. These programs do the real work for users.

There are two types of application software.

I. General Purpose Software

General purpose software's are designed to perform general tasks.

I. Word Processing Software

A word processor is a software program capable of creating, storing and printing of documents. Word processors have the ability to create a document and make changes anywhere in the document. This document can also be saved for modification later on or be opened on any other computer using the same word processor.

II. Presentation software

Presentation is the practice of showing and explaining the contents of a topic to an audience or learner visually. People, in a variety of settings and situations, use presentation software to make their presentations more interesting and professional. e.g., marketing managers use presentation graphics to present new marketing strategies to their superiors. Sales people use this software to demonstrate products and encourage customers to make purchases. Students use it to create high quality class presentations. e.g., Microsoft PowerPoint, Corel presentations, Lotus Freelance Graphics etc.

III. Electronic Spreadsheets

Spreadsheet applications (sometimes referred to simply as spreadsheets) are the computer programs that accept data in a tabular form and allow you to create and manipulate spreadsheets electronically. In Spreadsheet Applications, each value exists in a cell. You can define what type of data is in each cell and how different cells depend on one another. The relationships between cells are called Formulas and the names of the cells are called Labels. E.g., Microsoft Excel, Corel Quattro Pro, Lotus 1-2-3 etc.

IV. Database Management System (DBMS)

A DBMS (Database Management System) refers to the software that is responsible for sorting, maintaining and utilizing a database. It enables a user to define, create and maintain the database and provide controlled access on it. A database is a collection of integrated data stored together to serve multiple applications.

e.g., Microsoft Access, Corel Paradox, Lotus Approach etc.

V. Desktop Publishing Software

Desktop publishing software is a tool for graphic designers and non-designers to create visual communications for professional or desktop printing as well as for online or on screen electronic publishing.

Complete Desktop Publishing (DTP) involves the combination of type setting (choosing font and the text layout), graphic design, Page layout (how it all fits on the page) and printing the document. e.g., Quark Express, Adobe Page Maker, 3B2, Corel Draw, Corel Ventura Illustrator etc.

VI. Graphics Software

Graphics Software or image editing software is an application program or collection of programs that enables a person to manipulate visual images on a computer system. Most graphics software have the ability to import and export one or more graphics file formats. Typical graphics software enables data to be plotted as line chart, bar chart and pie chart. e.g., Adobe Photoshop, Pizza, Microsoft Publishes etc.

VII. Multimedia Software

Multimedia includes a combination of text, audio, still images, animation, video or interactivity content forms. The term is used in contrast to media which uses only rudimentary computer display such as text only or traditional forms of printed or hand produced material.

2. Specific Purpose Software

Specific purpose software are designed to perform specific tasks. This type of application software generally has one purpose to execute.

Some of the specific purpose application software's are described below.

I. Inventory Management System and Purchasing System.

It is an attempt to balance inventory needs and requirement to minimize total cost, resulting from obtaining and holding an inventory. Inventory is a list of goods and materials available in a stock. Inventory management system is generally used in departmental stores or in an organization to keep the records of the stock of all the physical resources.

II. Payroll Management System.

Payroll management system is used by all modern organisations to encompass every employee of the organisation who receives a regular wage or other compensation. All different payment methods are calculated by the payroll software and the appropriate Pay checks are issued.

III. Hotel Management System

Hotel management system refers to the management techniques used in the hotel sector. These can include hotel administration, accounts, billing, marketing, housekeeping, front office or front desk.

IV. Reservation System

A reservation system or central reservation system (CRS) is a computerized system used to store and retrieve information and conduct transactions related to air travel, hotels, car rental, or other activities. It is an application software which is commonly seen at railway reservation offices, this software helps the concerned department to automatically check the availability of the seats or berths of any train and any particular data with incomparable speed.

V. Report Card Generator

It is an application software which is commonly used in schools by the examination department to prepare and generate the report cards of the students. It performs all possible mathematical calculations and checks whether a student can be promoted to the next class or not. It can also be used to calculate the class wise ranking of a student.

VI. Accounting software

Accounting software is an application software that records and processes accounting transactions within functional modules such as accounts payable, accounts receivable, payroll and trial balance. It works as an accounting information system.

There are several types of accounting software's as follows

- (a) Accounts payable Software.
- (b) Bank Reconciliation Software.
- (c) Budget Management Software, etc.

VII. HR Management System

It refers to the systems and processes at the intersection between human resource management (HRM) and information technology. The function of HR department is generally administrative and common to all organisations. e.g., Effective Staff, Cezanne HR etc.

VIII. Attendance System

Attendance system is an application software designed to track and optimize the presence of a person/ student in an organisation or school. Now-a-days, attendance system can be integrated with customer's existing time/attendance recording devices like Biometrics/ Access cards. Attendance management can be done in two ways

- (a) Biometric Integration
- (b) Manually Attendance Integration

IX. Billing System

It refers to the software that is used to perform the billing process. It handles the tracking of laded products and services delivered to a customer or set of customers. e.g., Billing Tracker, Killing etc.

Internet

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers). It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANet. The original aim was to create a network that would allow users of a research computer at one university to "talk to" research computers at other universities. A side benefit of ARPANet's design was that, because messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed in the event of a military attack or other disaster.

Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (for Transmission Control Protocol/Internet Protocol). Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol.

The most widely used part of the Internet is the World Wide Web (often abbreviated "WWW" or called "the Web"). Its outstanding feature is hypertext, a method of instant cross-referencing. In most Web sites, certain words or phrases appear in text of a different color than the rest; often this text is also underlined. When you select one of these words or phrases, you will be transferred to the site or page that is relevant to this word or phrase. Sometimes there are buttons, images, or portions of images that are "clickable." If you move the pointer over a spot on a Web site and the pointer changes into a hand, this indicates that you can click and be transferred to another site.

Using the Web, you have access to billions of pages of information. Web browsing is done with a Web browser, the most popular of which are Chrome, Firefox and Internet Explorer. The appearance of a particular Web site may vary slightly depending on the browser you use. Also, later versions of a particular browser are able to render more "bells and whistles" such as animation, virtual reality, sound, and music files, than earlier versions.

The Internet has continued to grow and evolve over the years of its existence. IPv6, for example, was designed to anticipate enormous future expansion in the number of available IP addresses. In a related development, the Internet of Things (IoT) is the burgeoning environment in which almost any entity or object can be provided with a unique identifier and the ability to transfer data automatically over the Internet.

E-mail

Short for **electronic mail**, **e-mail** or **email** is information stored on a computer that is exchanged between two users over telecommunications. More plainly, e-mail is a message that may contain text, files, images, or other attachments sent through a network to a specified individual or group of individuals.

The first e-mail was sent by Ray Tomlinson in 1971. Tomlinson sent the e-mail to himself as a test e-mail message, containing the text "something like QWERTYUIOP." However, despite sending the e-mail to himself, the e-mail message was still transmitted through ARPANET.

By 1996, more electronic mail was being sent than postal mail.

Some early email systems required the author and the recipient to both be online at the same time, in common with instant messaging. Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver, and store messages. Neither the users nor their computers are required to be online simultaneously; they need to connect only briefly, typically to a mail server or a webmail interface, for as long as it takes to send or receive messages.

BROWSER:

Definition - What does Web Browser mean?

A web browser is a software program that allows a user to locate, access, and display web pages. In common usage, a web browser is usually shortened to "browser." Browsers are used primarily for displaying and accessing websites on the internet, as well as other content created using languages such as Hypertext Markup Language (HTML) and Extensible Markup Language (XML).

Browsers translate web pages and websites delivered using Hypertext Transfer Protocol (HTTP) into human-readable content. They also have the ability to display other protocols and prefixes, such as secure HTTP (HTTPS), File Transfer Protocol (FTP), email handling (mailto:), and files (file:). In addition, most browsers also support external plug-ins required to display active content, such as in-page video, audio and game content.

Common browsers include Internet Explorer from Microsoft, Firefox from Mozilla, Google Chrome, Safari from Apple, and Opera. All major browsers have mobile versions that are lightweight versions for accessing the web on mobile devices.

HOW POPULAR WEB BROWSERS WORK



**Mozilla
Firefox**



**Google
Chrome**



**Microsoft
Internet
Explorer**



**Apple
Safari**



Opera

Number system:

The technique to represent and work with numbers is called number system. Decimal number system is the most common number system. Other popular number systems include binary number system, octal number system, hexadecimal number system, etc.

Decimal Number System:

Decimal number system is a **base 10** number system having 10 digits from 0 to 9. This means that any numerical quantity can be represented using these 10 digits. Decimal number system is also a **positional value system**. This means that the value of digits will depend on its position. Let us take an example to understand this.

Say we have three numbers – 734, 971 and 207. The value of 7 in all three numbers is different–

- In 734, value of 7 is 7 hundreds or 700 or 7×100 or 7×10^2
- In 971, value of 7 is 7 tens or 70 or 7×10 or 7×10^1
- In 207, value of 7 is 7 units or 7 or 7×1 or 7×10^0

The weightage of each position can be represented as follows –

10^3	10^4	10^3	10^2	10^1	10^0
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In digital systems, instructions are given through electric signals; variation is done by varying the voltage of the signal. Having 10 different voltages to implement decimal number system in digital equipment is difficult. So, many number systems that are easier to implement digitally have been developed. Let's look at them in detail.

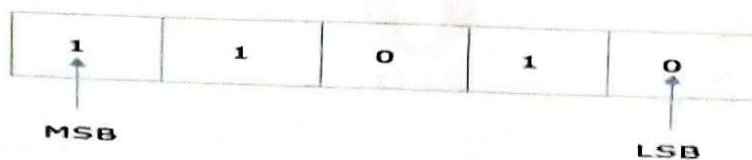
Binary Number System:

The easiest way to vary instructions through electric signals is two-state system – on and off. On is represented as 1 and off as 0, though 0 is not actually no signal but signal at a lower voltage. The number system having just these two digits – 0 and 1 – is called **binary number system**.

Each binary digit is also called a **bit**. Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

2^3	2^4	2^3	2^2	2^1	2^0
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In any binary number, the rightmost digit is called **least significant bit (LSB)** and leftmost digit is called **most significant bit (MSB)**.



And decimal equivalent of this number is sum of product of each digit with its positional value.

$$\begin{aligned}
 110102 &= 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\
 &= 16 + 8 + 0 + 2 + 0 \\
 &= 2610
 \end{aligned}$$

Octal Number System:

Octal number system has eight digits – 0, 1, 2, 3, 4, 5, 6 and 7. Octal number system is also a positional value system with where each digit has its value expressed in powers of 8, as shown here –

8^5	8^4	8^3	8^2	8^1	8^0
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Decimal equivalent of any octal number is sum of product of each digit with its positional value.

$$\begin{aligned}
 7268 &= 7 \times 8^2 + 2 \times 8^1 + 6 \times 8^0 \\
 &= 448 + 16 + 6 \\
 &= 47010
 \end{aligned}$$

Hexadecimal Number System:

Octal number system has 16 symbols – 0 to 9 and A to F where A is equal to 10, B is equal to 11 and so on till F. Hexadecimal number system is also a positional value system with where each digit has its value expressed in powers of 16, as shown here –

16^5	16^4	16^3	16^2	16^1	16^0
--------	--------	--------	--------	--------	--------

Decimal equivalent of any hexadecimal number is sum of product of each digit with its positional value.

$$\begin{aligned}
 27FB16 &= 2 \times 16^3 + 7 \times 16^2 + 15 \times 16^1 + 10 \times 16^0 \\
 &= 8192 + 1792 + 240 + 10 \\
 &= 1023410
 \end{aligned}$$

Number System Relationship:

The following table depicts the relationship between decimal, binary, octal and hexadecimal number systems.

BINARY	DECIMAL	OCTAL	HEXADECIMAL
0000	0	0	0
0001	1	1	1

BINARY DECIMAL OCTAL HEXADECIMAL

0000	0	0	0
0001	1	1	1
0010	2	2	2
0011	3	3	3
0100	4	4	4
0101	5	5	5
0110	6	6	6
0111	7	7	7
1000	8	10	8
1001	9	11	9
1010	10	12	A
1011	11	13	B
1100	12	14	C
1101	13	15	D
1110	14	16	E
1111	15	17	F

As you know decimal, binary, octal and hexadecimal number systems are positional value number systems. To convert binary, octal and hexadecimal to decimal number, we just need to add the product of each digit with its positional value. Here we are going to learn other conversion among these number systems.

Decimal to Binary conversion:

Decimal numbers can be converted to binary by repeated division of the number by 2 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
2	43		
2	21	1	
2	10	1	
2	5	0	
2	2	1	
2	1	0	
2	0	1	

The remainders are to be read from bottom to top to obtain the binary equivalent.

43₁₀ = 101011₂

Decimal to Octal conversion:

Decimal numbers can be converted to octal by repeated division of the number by 8 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
8	473		
8	59	1	MSD ↑ LSD
8	7	3	
	0	7	

Reading the remainders from bottom to top,

$$473_{10} = 731_8$$

Decimal to Hexadecimal conversion:

Decimal numbers can be converted to octal by repeated division of the number by 16 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
16	423		
16	26	7	↑
16	1	A	
	0	1	

Reading the remainders from bottom to top we get,

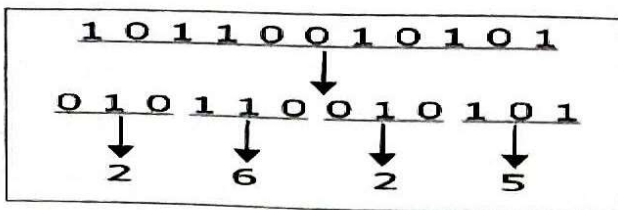
$$423_{10} = 1A7_{16}$$

Binary to Octal conversion and Vice Versa

To convert a binary number to octal number, these steps are followed –

- Starting from the least significant bit, make groups of three bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit
- Convert each group into its equivalent octal number

Let's take an example to understand this.



101100101012 = 26258

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent according to this table.

Octal Digit	0	1	2	3	4	5	6	7
Binary Equivalent	000	001	010	011	100	101	110	111

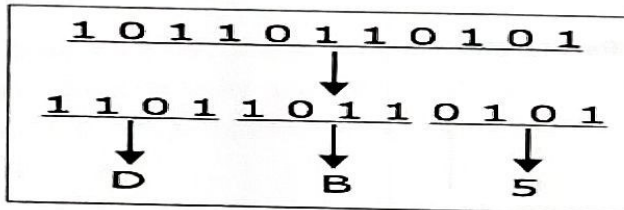
546738 = 1011001101110112

Binary to Hexadecimal conversion:

To convert a binary number to hexadecimal number, these steps are followed –

- Starting from the least significant bit, make groups of four bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit.
- Convert each group into its equivalent octal number.

Let's take an example to understand this.



101101101012 = DB516

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent.

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