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**BBA HONOURS**

**SEMESTER 2**

**SPREADSHEET**

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# **SPREADSHEET MODELLING FOR BUSINESS MODULE 1**

# INTRODUCTION TO SPREADSHEET

A **spreadsheet** is a digital tool used to organize, analyze, and store data in a grid format of rows and columns. It is one of the most versatile tools for working with data and is widely used in fields like accounting, finance, project management, and data analysis.

Here's an introduction to spreadsheets:

## 1. Structure of a Spreadsheet

- **Cells:** A spreadsheet is made up of individual cells, which are the basic units where you enter data. Each cell is identified by a unique address, which is a combination of its column letter and row number. For example, the cell at the intersection of column "A" and row "1" is referred to as **A1**.
- **Rows:** These are horizontal lines of cells, numbered 1, 2, 3, and so on.
- **Columns:** These are vertical lines of cells, labeled with letters (A, B, C, etc.), or more recently, they can go beyond Z (AA, AB, etc.) as the number of columns increases.
- **Sheets:** Spreadsheets may contain multiple sheets or tabs, each containing its own set of rows and columns. Each sheet can be used for different parts of the project or dataset.

## 2. Basic Operations in a Spreadsheet

- **Entering Data:** You can type text, numbers, dates, or even formulas directly into the cells.
- **Formulas and Functions:** A key feature of spreadsheets is the ability to perform calculations using formulas. For example:
  - **SUM:** Adds up numbers in a range of cells.
  - **AVERAGE:** Calculates the average of numbers in a range.
  - **IF:** Performs conditional logic (e.g., "IF A1 is greater than 100, then show 'Yes', else show 'No'").
- **Copy, Paste, Cut:** You can copy or cut data from one part of the sheet and paste it elsewhere.
- **Cell References:** Formulas can refer to other cells by their addresses (e.g.,  $=A1+B1$  adds the values in cells A1 and B1).

## 3. Common Spreadsheet Software

- **Microsoft Excel:** One of the most widely used spreadsheet applications, offering a powerful range of features for data analysis, charting, and automation.
- **Google Sheets:** A cloud-based alternative that allows for real-time collaboration and sharing. It's free and accessible from any device with an internet connection.
- **Apple Numbers:** A spreadsheet program designed for macOS and iOS, with an emphasis on ease of use and visual design.
- **LibreOffice Calc:** A free and open-source spreadsheet program that offers similar functionality to Excel.

#### 4. Common Uses of Spreadsheets

- **Data Analysis:** Spreadsheets can be used to process and analyze large datasets. They support statistical functions, pivot tables, and data visualization tools like charts and graphs.
- **Budgeting and Accounting:** Many businesses use spreadsheets for financial tasks such as creating budgets, managing expenses, and tracking profits and losses.
- **Project Management:** Spreadsheets can help track tasks, deadlines, resources, and progress within a project.
- **Inventory Management:** Keeping track of products, stock levels, and sales is often done using spreadsheets.
- **Personal Finance:** People use spreadsheets to manage their personal budgets, track spending, and monitor investments.

#### 5. Advanced Features

- **Pivot Tables:** A powerful tool for summarizing large datasets, allowing you to quickly group, filter, and analyze data from different perspectives.
- **Charts and Graphs:** You can visually represent data with pie charts, bar graphs, line charts, etc., which make it easier to interpret trends.
- **Data Validation:** Ensures that the data entered into cells meets specific criteria (e.g., numbers only, dates in a certain format).
- **Conditional Formatting:** Lets you format cells based on the data within them (e.g., changing the color of a cell if its value is above a certain threshold).
- **Macros:** Automation of repetitive tasks through simple programming scripts or recorded actions.

#### 6. Tips for Using Spreadsheets Effectively

- **Organize Your Data:** Ensure your data is well-structured and easy to read, with clear headers and appropriate data types (e.g., text, numbers, dates).

- **Use Shortcuts:** Keyboard shortcuts can save you time. For example, Ctrl + C (Copy), Ctrl + V (Paste), Ctrl + Z (Undo), and Ctrl + Shift + L (Add Filter).
- **Use Templates:** Many spreadsheet programs offer pre-made templates for budgeting, invoicing, project management, etc.
- **Save and Backup:** Always save your work regularly. With Google Sheets, your work is saved automatically, but if using Excel, be sure to use cloud storage or backup files.

In conclusion, spreadsheets are indispensable tools that allow users to perform a wide range of data-related tasks, from simple calculations to complex analyses, all within an intuitive interface. Whether for personal use or professional applications, learning how to use spreadsheets effectively can greatly enhance productivity and decision-making.

## **FUNCTIONS OF SPREADSHEET**

Spreadsheets, such as Microsoft Excel, Google Sheets, and other similar programs, offer a wide array of **functions** that help users perform various tasks, ranging from basic arithmetic to complex data analysis and visualization. Functions in spreadsheets are predefined formulas that perform specific calculations or actions. Below are the key **functions of spreadsheets** and their uses:

### **1. Mathematical and Arithmetic Functions**

These functions perform basic and complex mathematical calculations.

- **SUM():** Adds up the values in a range of cells.
  - Example: =SUM(A1:A5) adds the values in cells A1 to A5.
- **AVERAGE():** Calculates the average (mean) of the values in a range.
  - Example: =AVERAGE(B1:B10) computes the average of the values in cells B1 to B10.
- **MIN():** Returns the smallest number in a range. ◦ Example: =MIN(C1:C10) gives the minimum value in cells C1 to C10.
- **MAX():** Returns the largest number in a range.
  - Example: =MAX(D1:D10) gives the maximum value in cells D1 to D10.
- **COUNT():** Counts the number of cells that contain numbers in a range.
  - Example: =COUNT(E1:E10) counts how many cells in E1 to E10 contain numeric values.
- **COUNTA():** Counts the number of cells that are not empty (works with numbers, text, dates, etc.).

- Example: =COUNTA(F1:F10) counts all non-empty cells in the range F1 to F10.
- **ROUND():** Rounds a number to a specified number of decimal places.
  - Example: =ROUND(G1, 2) rounds the value in G1 to two decimal places.
- **INT():** Rounds a number down to the nearest integer. ○ Example: =INT(H1) rounds the value in H1 down to the nearest whole number.
- **MOD():** Returns the remainder of a division operation.
  - Example: =MOD(I1, 3) returns the remainder when the value in I1 is divided by 3.

## 2. Text Functions

These functions manipulate and analyze text strings within cells.

- **CONCATENATE() or CONCAT():** Joins two or more text strings into one.
  - Example: =CONCATENATE("Hello", " ", "World") results in "Hello World".
- **TEXT():** Converts a number to text in a specified format.
  - Example: =TEXT(J1, "dd/mm/yyyy") converts the date in J1 into the format "dd/mm/yyyy".
- **LEFT():** Extracts a specified number of characters from the left side of a text string. ○ Example: =LEFT(K1, 4) extracts the first 4 characters from the string in K1.
- **RIGHT():** Extracts a specified number of characters from the right side of a text string.
  - Example: =RIGHT(L1, 3) extracts the last 3 characters from the string in L1.
- **LEN():** Returns the length (number of characters) of a text string.
  - Example: =LEN(M1) returns the number of characters in the text string in M1.
- **SEARCH():** Finds the position of a substring within a text string (case-insensitive).
  - Example: =SEARCH("apple", "I have an apple") returns 10 (the starting position of "apple").
- **UPPER():** Converts text to uppercase. ○ Example: =UPPER(N1) converts the text in N1 to uppercase.
- **LOWER():** Converts text to lowercase.
  - Example: =LOWER(O1) converts the text in O1 to lowercase.
- **TRIM():** Removes extra spaces from text except for single spaces between words.



- Example: =TRIM(P1) removes extra spaces from the text in P1.

### 3. Logical Functions

Logical functions help you make decisions and perform conditional

tests. • **IF():** Checks a condition and returns one value if true, another if false.

- Example: =IF(Q1 > 100, "Yes", "No") returns "Yes" if Q1 is greater than 100, otherwise "No".
- **AND():** Returns TRUE if all conditions are TRUE. ○ Example: =AND(R1 > 50, S1 < 20) returns TRUE if both conditions are true.
- **OR():** Returns TRUE if at least one condition is TRUE. ○ Example: =OR(T1 > 10, U1 < 5) returns TRUE if either condition is true.
- **NOT():** Reverses the logical value of its argument.
  - Example: =NOT(V1 = "Apple") returns TRUE if V1 does not equal "Apple".
- **IFERROR():** Returns a specified value if a formula results in an error.
  - Example: =IFERROR(W1 / X1, 0) returns 0 if there's an error dividing W1 by X1.

### 4. Lookup and Reference Functions

These functions are used to look up and retrieve data from a range based on a specific criterion.

- **VLOOKUP():** Searches for a value in the first column of a range and returns a value in the same row from another column.
  - Example: =VLOOKUP(Y1, A1:B10, 2, FALSE) looks for the value in Y1 in the range A1:A10, and returns the corresponding value from column B.
- **HLOOKUP():** Similar to VLOOKUP but searches horizontally across rows.
  - Example: =HLOOKUP(Z1, A1:F2, 2, FALSE) searches for the value in Z1 in the first row, then returns the corresponding value from the second row.
- **INDEX():** Returns the value of a cell in a specific row and column within a range.
  - Example: =INDEX(A1:C10, 2, 3) returns the value in the second row and third column of the range A1:C10.
- **MATCH():** Returns the position of a value within a range.



- Example: =MATCH("Apple", A1:A5, 0) returns the position of "Apple" in the range A1:A5.
- **OFFSET():** Returns a reference to a range that is offset from a starting cell.
  - Example: =OFFSET(A1, 2, 3) returns the value that is two rows down and three columns to the right of cell A1.

## 5. Date and Time Functions

These functions help you manipulate and calculate with dates and times.

- **TODAY():** Returns the current date.
  - Example: =TODAY() returns the current date.
- **NOW():** Returns the current date and time.
  - Example: =NOW() returns the current date and time.
- **DATE():** Creates a date value from year, month, and day.
  - Example: =DATE(2024, 12, 25) creates the date December 25, 2024.
- **DAY():** Extracts the day from a date.
  - Example: =DAY(A1) returns the day of the month from the date in cell A1.
- **MONTH():** Extracts the month from a date. ○ Example: =MONTH(B1) returns the month of the date in cell B1.
- **YEAR():** Extracts the year from a date.
  - Example: =YEAR(C1) returns the year of the date in cell C1.
- **DATEDIF():** Calculates the difference between two dates.
  - Example: =DATEDIF(D1, E1, "Y") calculates the difference in years between the dates in D1 and E1.

## 6. Financial Functions

These functions are used for financial calculations.

- **PMT():** Calculates the payment for a loan based on constant payments and a constant interest rate.
  - Example: =PMT(0.05/12, 60, -10000) calculates the monthly payment for a \$10,000 loan at 5% interest over 60 months.
- **FV():** Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

- Example: =FV(0.05/12, 60, -200, 0) calculates the future value of monthly \$200 deposits at 5% interest over 60 months.

## 7. Statistical Functions

These functions help you analyze and summarize data statistically.

- **MEDIAN():** Returns the median of a set of numbers.
  - Example: =MEDIAN(F1:F10) returns the median value from the range F1 to F10.
- **STDEV():** Calculates the standard deviation of a set of numbers.
  - Example: =STDEV(G1:G10) calculates the standard deviation of the values in G1 to G10.
- **VAR():** Calculates the variance of a set of numbers.

# SPREADSHEET USES AND LIMITATIONS

## Uses of Spreadsheets

Spreadsheets are widely used in various fields due to their flexibility, ease of use, and powerful features. Here are some of the most common uses:

### 1. Data Entry and Management

- **Organizing Data:** Spreadsheets are often used for collecting, storing, and managing data in an organized format. Users can store large amounts of data in rows and columns, making it easier to input, edit, and track information.
  - **Example:** Managing a contact list, inventory records, or project timelines.

### 2. Data Analysis and Reporting

- **Analyzing Data:** Spreadsheets offer numerous functions and tools (like SUM, AVERAGE, COUNT, etc.) to perform statistical analysis. You can filter, sort, and summarize data quickly.
  - **Example:** Analyzing sales data, customer feedback, or financial performance reports.
- **Pivot Tables:** These help summarize large datasets, enabling users to analyze and draw insights from complex data.
  - **Example:** Summarizing sales data by region, product, or time period.

### 3. Financial Management

- **Budgeting and Forecasting:** Spreadsheets are often used for personal and organizational budgeting. They are also used for forecasting future expenses and revenues.
  - **Example:** Household budgets, company financial projections, or monthly expense tracking.
- **Accounting:** Spreadsheets help with keeping track of income, expenses, accounts payable, and accounts receivable.
  - **Example:** Preparing financial statements, balance sheets, and profit & loss reports.
- **Investment Tracking:** Individuals and firms use spreadsheets to track investments, stock prices, and portfolio performance.
  - **Example:** Tracking stock market portfolios, mutual funds, and asset allocation.

#### 4. Project Management

- **Task Lists and Timelines:** Project managers use spreadsheets to track tasks, deadlines, and resources required for project completion.
  - **Example:** Gantt charts, project schedules, and task dependencies.
- **Resource Management:** Spreadsheets can be used to monitor team member workloads, resource allocation, and project milestones.
  - **Example:** Tracking the progress of tasks or monitoring the hours worked by each team member.

#### 5. Inventory Management

- **Tracking Stock Levels:** Spreadsheets are used to monitor inventory in real-time, keeping track of stock quantities, reorder levels, and suppliers.
  - **Example:** Managing inventory for small businesses or warehouses.

#### 6. Data Visualization

- **Charts and Graphs:** Spreadsheets can convert raw data into visual representations, such as bar charts, pie charts, and line graphs, making it easier to understand trends, comparisons, and distributions.
  - **Example:** Creating a visual report of sales performance over time or showing market share distribution.

#### 7. Scheduling and Planning

- **Event Scheduling:** Spreadsheets are used for scheduling appointments, meetings, and events.

- **Example:** Scheduling employee shifts, meeting schedules, or class timetables.
- **Time Tracking:** Many use spreadsheets to track time spent on various tasks or projects.
  - **Example:** Employee timesheets, billable hours for freelance work.

## 8. Customer Relationship Management (CRM)

- **Tracking Leads and Contacts:** Small businesses use spreadsheets to manage customer data, track sales leads, and manage relationships.
  - **Example:** Maintaining a contact list, recording customer interactions, or tracking sales leads.

## 9. Formulas and Automations

- **Complex Calculations:** Spreadsheets allow users to perform sophisticated calculations, including financial analysis, engineering computations, and scientific calculations.
  - **Example:** Calculating loan payments, interest rates, or return on investment (ROI).

## 10. Collaboration and Sharing

- **Cloud-based Collaboration:** Spreadsheets like Google Sheets allow multiple users to work on the same document simultaneously. This is useful for team collaboration, especially in realtime.
  - **Example:** Team-based budgeting, project planning, or data analysis.

## Limitations of Spreadsheets

While spreadsheets are incredibly versatile, they have certain limitations that can impact their effectiveness in specific situations. Below are some common limitations:

### 1. Scalability Issues

- **Handling Large Data Sets:** Spreadsheets can slow down or become unresponsive when dealing with large datasets (e.g., thousands of rows or complex formulas). While Excel and Google Sheets can handle large amounts of data, performance degrades as the size of the dataset increases.
  - **Example:** Analyzing a database with millions of records might be better suited to a dedicated database management system (DBMS) like SQL.

### 2. Error-prone

- **Human Errors:** Spreadsheets are highly prone to human errors, especially when large amounts of data are manually entered or formulas are incorrectly set up. A small error in one cell can result in inaccurate outputs across multiple rows and columns.
  - **Example:** A wrong formula in a single cell might propagate through a series of calculations, leading to incorrect financial reports.

### 3. Limited Security

- **Lack of Advanced Security Features:** While spreadsheets allow for password protection, they don't offer the same level of security as specialized software. Sensitive data can be compromised if not properly handled, especially in shared environments.
  - **Example:** Confidential financial data in an Excel sheet can be accessed or edited by anyone who knows the password or has access to the file.

### 4. Complexity for Non-Experts

- **Steep Learning Curve:** Advanced functions, formulas, and features (e.g., pivot tables, macros, complex data analysis) can be overwhelming for new users. While basic functions like SUM or AVERAGE are easy, mastering spreadsheet capabilities often requires training and experience.
  - **Example:** A business owner without a technical background may struggle to use advanced functions like VLOOKUP or pivot tables for data analysis.

### 5. Limited Database Functionality

- **Not a Full Database Solution:** While spreadsheets can store data, they are not a full-fledged database solution. They lack features such as relational data integrity, multi-user access control, and advanced query capabilities.
  - **Example:** Spreadsheets are not ideal for managing large-scale relational data, where a database like MySQL or PostgreSQL would be more appropriate.

### 6. Version Control and Collaboration Issues

- **Versioning Conflicts:** In shared environments (especially with desktop-based spreadsheets like Excel), multiple users working on the same file simultaneously can lead to versioning issues and data loss if changes are not properly tracked.
  - **Example:** If two team members edit the same file independently, their changes may conflict, and important edits could be overwritten.

### 7. Limited Visualization and Reporting Tools

- **Basic Visualization:** While spreadsheets offer basic charting tools (e.g., bar charts, line graphs), they fall short when it comes to advanced data visualization (like interactive dashboards, geospatial mapping, or dynamic reports).

- **Example:** For complex data analysis and high-quality reporting, specialized tools like Power BI or Tableau may be more appropriate.

## 8. Lack of Automation

- **Limited Automation Capabilities:** Spreadsheets have basic automation features (like simple macros in Excel or Google Sheets scripts), but they are not as powerful as dedicated automation tools or business process management (BPM) software.
  - **Example:** For automating large-scale data collection, reporting, or workflow management, you may need tools like Zapier or more sophisticated CRM software.

## 9. Difficulty in Handling Unstructured Data

- **Unstructured Data:** Spreadsheets are not well-suited for managing unstructured data, such as large volumes of text, images, or multimedia files. They are better suited for structured, tabular data.
  - **Example:** Managing large volumes of text-based customer feedback or social media content would be better suited for text mining or natural language processing tools.

## 10. Limited Data Integrity Features

- **No Built-in Data Validation:** While you can use data validation rules in spreadsheets, they are not as robust as those found in relational databases. It's easier to accidentally introduce incorrect or inconsistent data into a spreadsheet.
  - **Example:** Without data validation, a user may mistakenly enter text in a column that should only contain numbers, leading to errors in calculations.

# UNDERSTANDING MICROSOFT EXCEL

Microsoft Excel is one of the most widely used spreadsheet applications. It is part of the **Microsoft Office Suite** and is essential for tasks related to data analysis, financial modeling, reporting, and more. Excel allows users to organize, analyze, and visualize data in a user-friendly environment. Below is an overview of key features and functionalities that make Excel an indispensable tool:

## 1. Excel Interface Overview

When you first open Microsoft Excel, you'll encounter several elements in the interface:

- **Workbook:** A file in Excel is called a workbook, which can contain one or more **worksheets** (or sheets). A workbook typically has a .xlsx or .xls file extension.



- **Worksheet:** Each workbook consists of one or more worksheets, and each worksheet is a grid made up of rows and columns.
- **Cells:** The individual boxes where data is entered. Each cell is identified by a combination of a **column letter** and a **row number** (e.g., **A1** refers to the cell in column A, row 1).
- **Ribbon:** The top portion of the interface, organized into tabs like **Home**, **Insert**, **Page Layout**, **Formulas**, **Data**, **Review**, and **View**. Each tab contains different groups of tools or commands.
- **Formula Bar:** Located above the worksheet, where you can see or edit the content of the active cell, including formulas and text.
- **Status Bar:** Found at the bottom of the Excel window, showing summary information like the sum, average, and count of selected cells, or the mode (e.g., ready, edit).

## 2. Basic Excel Concepts

- **Cells, Rows, and Columns:**
  - **Cell:** The basic unit in a worksheet where you can enter data (text, numbers, formulas).
  - **Row:** Horizontal collection of cells, numbered 1, 2, 3, etc. ○ **Column:** Vertical collection of cells, labeled A, B, C, etc.
- **Cell References:**
  - **Relative Reference** (e.g., A1): Adjusts when copied to another location.
  - **Absolute Reference** (e.g., \$A\$1): Does not change when the formula is copied to another location.
  - **Mixed Reference** (e.g., A\$1 or \$A1): Locks either the row or column.

### 3. Key Features of Microsoft Excel

#### a. Data Entry and Formatting

- **Entering Data:** Excel allows users to enter data such as numbers, text, dates, and times into cells.
- **Formatting Cells:** You can format cells to make the data easier to read. This includes changing font styles, colors, alignment, borders, and number formats (currency, percentages, dates, etc.).
  - Example: You can format a column of numbers as **Currency** to display monetary values with a dollar sign.



- **Text Wrapping:** For longer text strings, Excel can wrap the text within the cell, so it displays neatly across multiple lines.
  - **Cell Merging:** You can combine multiple cells into one large cell (often used for headings).
- b. Formulas and Functions**
- **Formulas:** These are expressions that perform calculations. All formulas in Excel begin with an equal sign (=).
    - Example: =A1 + B1 adds the values in cells A1 and B1.
  - **Functions:** Predefined formulas that perform specific calculations. Excel includes hundreds of built-in functions, such as:
    - **SUM():** Adds up numbers in a range of cells.
      - ▢ Example: =SUM(A1:A10) adds the values in cells A1 to A10.
    - **AVERAGE():** Calculates the average of a set of numbers.
      - ▢ Example: =AVERAGE(B1:B10) gives the average of the values in B1 to B10.
    - **COUNT():** Counts how many numbers are in a range of cells.
      - ▢ Example: =COUNT(C1:C10) counts how many cells in C1 to C10 contain numbers.
    - **IF():** Logical function to check if a condition is true or false.
      - ▢ Example: =IF(D1>50, "Pass", "Fail") checks if the value in D1 is greater than 50, and returns "Pass" if true, otherwise "Fail".

### c. Sorting and Filtering

- **Sorting:** Excel allows you to sort data alphabetically or numerically in ascending or descending order.
  - Example: Sorting a list of names from A to Z or a column of numbers from smallest to largest.
- **Filtering:** You can filter data to display only rows that meet certain criteria. For example, you might filter a list of sales transactions to show only those over \$500.
  - Example: Filtering a list of employees to show only those who work in the "Sales" department.

### d. Charts and Graphs

- **Charts:** Excel offers a variety of chart types to help visualize data, including bar charts, line charts, pie charts, scatter plots, and more.

- Example: You can create a bar chart to show monthly sales figures or a pie chart to illustrate market share.
- **Creating Charts:** Select your data, and then choose **Insert > Chart** to create a visual representation of your data.
- **Chart Formatting:** Customize charts by adding titles, legends, data labels, changing colors, and adjusting axis labels.

#### e. Data Validation

- **Data Validation:** This feature ensures that the data entered into a cell meets specific criteria (such as whole numbers, dates, text length, etc.).
  - Example: You can use data validation to allow only numbers between 1 and 100 in a cell.

#### f. Conditional Formatting

- **Conditional Formatting:** Allows you to apply formatting (like color changes) to cells based on their values.
  - Example: You can highlight cells with values greater than 1000 in green and those less than 500 in red.
  - This helps in visually distinguishing trends or critical values.
- **Pivot Tables**
  - **Pivot Tables:** A powerful tool for summarizing and analyzing large amounts of data quickly. They allow you to group and aggregate data dynamically.
    - Example: You can create a pivot table to analyze sales data by product and region.
    - Pivot tables can automatically calculate totals, averages, counts, and percentages for complex datasets.

#### h. Collaborating and Sharing

- **Multiple Users:** In Excel 365 or Excel Online, multiple users can collaborate on the same workbook in real time.
- **Sharing:** You can share workbooks by saving them to OneDrive or SharePoint, allowing others to view or edit them.

#### i. Automation (Macros)

- **Macros:** These are automated sequences of actions recorded in Excel, enabling you to perform repetitive tasks quickly.
  - Example: You can create a macro to automatically format a report each time you open a workbook or process a data entry task.

- Macros are typically written using VBA (Visual Basic for Applications) scripting, which allows for even more advanced automation.

#### 4. Excel Keyboard Shortcuts

Excel offers numerous keyboard shortcuts to help speed up your workflow:

- **Ctrl + C:** Copy
- **Ctrl + V:** Paste
- **Ctrl + X:** Cut
- **Ctrl + Z:** Undo
- **Ctrl + Y:** Redo
- **Ctrl + Arrow Keys:** Navigate quickly to the edges of data regions
- **Alt + E, S, V:** Paste Special
- **F2:** Edit the active cell
- **Ctrl + Shift + L:** Add or remove filters
- **Ctrl + T:** Create a table

#### 5. Excel Tips for Beginners

- **Use Templates:** Excel offers pre-built templates for budgeting, invoicing, and project management that you can customize for your needs.
- **Freeze Panes:** Freeze rows or columns to keep headings visible while scrolling through large datasets.
- **Group Data:** Use grouping to collapse and expand data sections for better organization in large spreadsheets.
- **Use Excel Tables:** Tables automatically adjust for new data, and allow for easier sorting and filtering.
- **Name Ranges:** Assign names to ranges of data so you can refer to them more easily in formulas.

#### 6. Advanced Excel Features

Once you're comfortable with basic Excel functionality, you can explore more advanced features:

- **Power Query:** This tool allows for importing, cleaning, and transforming data before bringing it into Excel.

- **Power Pivot:** For advanced data modeling and creating complex relationships between datasets, Power Pivot provides an enhanced version of pivot tables.
- **Solver:** A tool used for optimization problems (e.g., determining the best values for specific constraints).
- **Data Models:** Excel can handle multiple data tables that are related to one another, making it easier to perform complex analysis without manually combining data.

## **EXCEL WORKBOOK WINDOWS**

The **Excel Workbook Window** is the main interface where you interact with your Excel files. It contains various components that allow you to organize, enter, format, and analyze your data. Here's a breakdown of the key parts of the Excel workbook window:

### **1. Title Bar**

- **Location:** At the very top of the Excel window.
- **What it Shows:** The title bar displays the name of the active workbook (the file you are currently working on). If the workbook hasn't been saved yet, it will show something like "Book1" or "Untitled." ○

**Example:** "SalesData.xlsx" or "Book1."

### **2. Ribbon**

- **Location:** Directly below the title bar.
- **What it Shows:** The Ribbon is a toolbar that organizes Excel's commands into tabs. Each tab contains groups of related tools and features.
  - **Key Tabs on the Ribbon:**
    - **Home:** Includes most common commands like Copy, Paste, Format, Font, and Alignment tools.
    - **Insert:** Used for adding tables, charts, images, shapes, and more.
    - **Page Layout:** Controls page setup options like margins, orientation, and themes.
    - **Formulas:** Contains Excel functions, including financial, statistical, and mathematical functions.
    - **Data:** Includes options for sorting, filtering, importing data, and working with external data.
    - **Review:** Includes features for checking spelling, adding comments, protecting workbooks, and collaboration tools.

- **View:** Controls the view settings, including zoom, window arrangement, and showing/hiding elements.

### 3. Workbook Tabs

- **Location:** Directly below the Ribbon (often on the bottom of the screen).
- **What it Shows:** Each open workbook is represented by a tab. A workbook can contain one or more worksheets (tabs) within it. By default, a new Excel file starts with one sheet (Sheet1), but you can add, rename, or delete sheets.
  - **Key Actions:**
    - Click a tab to switch between worksheets in the workbook.
    - Right-click a tab to rename, move, copy, or delete the sheet.
    - Click the "+" button (if available) to add a new worksheet.

### 4. Formula Bar

- **Location:** Directly below the Ribbon and above the worksheet grid.
- **What it Shows:** The Formula Bar shows the contents of the currently selected cell. If the cell contains a formula, it will display the formula; otherwise, it will display the data (text, number, or date) entered into the cell.
  - **Example:** If you click on a cell with the formula =SUM(A1:A5), the Formula Bar will display that formula. If you click on a cell with the number 100, the Formula Bar will show "100."

### 5. Worksheet Grid

- **Location:** In the center of the window (below the Formula Bar and above the Status Bar).
- **What it Shows:** This is the main area where data is entered. It consists of:
  - **Cells:** The basic building blocks of Excel, identified by a **column letter** (A, B, C, etc.) and a **row number** (1, 2, 3, etc.), creating a unique reference for each cell (e.g., A1, B5, C10).
  - **Columns:** Vertical groups of cells labeled with letters (A, B, C...).
  - **Rows:** Horizontal groups of cells labeled with numbers (1, 2, 3...).

### 6. Active Cell

- **Location:** The currently selected cell in the worksheet.
- **What it Shows:** The active cell is the one you're working with, and it's highlighted with a thicker border. Any data you enter is placed in this cell. The active cell reference is shown in the **Name Box** (see below).

## 7. Name Box

- **Location:** Located to the left of the Formula Bar.
- **What it Shows:** The Name Box displays the reference of the currently selected cell (e.g., A1, B3, etc.). If a cell range is selected, it will show the range (e.g., A1:B10).
  - You can also use the Name Box to quickly navigate to a specific cell by typing its reference (e.g., "B10").

## 8. Status Bar

- **Location:** At the bottom of the Excel window.
- **What it Shows:** The Status Bar provides information about the current worksheet and displays certain statistics about selected data.
  - **Examples of Status Bar Information:**
    - **Zoom Level:** You can adjust the zoom level using the zoom slider on the right side of the Status Bar.
    - **Sum, Average, Count:** When you select a range of cells with numbers, the status bar shows the sum, average, and count of the selected numbers.
    - **Ready:** Shows that Excel is ready for action.
    - **Caps Lock:** Indicates whether Caps Lock is on.
    - **Language and Input Mode:** Sometimes displays language settings or input modes (such as "Edit," "Insert," etc.).

## 9. Scroll Bars

- **Location:** Found on the right side (vertical) and at the bottom (horizontal) of the worksheet.
- **What it Shows:** The scroll bars allow you to navigate through large worksheets. You can click and drag the scroll box or use the arrow buttons to scroll, or you can click anywhere on the scrollbar to move quickly.

## 10. Zoom Slider

- **Location:** On the bottom-right corner of the window, near the Status Bar.
- **What it Shows:** The zoom slider allows you to zoom in or out on the worksheet to make the content appear larger or smaller. You can also adjust the zoom level by clicking the percentage value (e.g., "100%").

## 11. Quick Access Toolbar



- **Location:** At the very top-left of the Excel window, next to the **File** tab.
- **What it Shows:** The Quick Access Toolbar provides easy access to commonly used commands, such as **Save**, **Undo**, **Redo**, and **Print Preview**. You can customize the Quick Access Toolbar to add or remove commands for quicker access.

## 12. File Tab (Backstage View)

- **Location:** In the upper-left corner, replacing the Ribbon when clicked.
- **What it Shows:** The File tab opens **Backstage View**, where you can manage your workbooks and settings. Key options include:
  - **New:** Create a new workbook.
  - **Open:** Open an existing workbook.
  - **Save / Save As:** Save your workbook or save it under a new name or location.
  - **Print:** Print the workbook.
  - **Share:** Share the workbook via email or cloud storage (e.g., OneDrive).
  - **Options:** Access Excel settings and preferences.

## Key Features of the Excel Workbook Window

- **Multiple Worksheets:** A workbook can contain multiple worksheets, allowing you to organize different datasets in one file.
- **Tabs and Navigation:** Easily switch between sheets using tabs at the bottom of the screen.
- **File Management:** Through the **File Tab** or Backstage View, you can manage saving, opening, and sharing files.
- **Working with Data:** The **worksheet grid** is where you input data, and the **Formula Bar** allows you to see and edit the contents of the selected cell, including formulas.
- **Visual Feedback:** The **Status Bar** provides real-time updates, like the sum or average of selected data.

## BASIC SPREADSHEET SKILLS

Spreadsheets, like Microsoft Excel, Google Sheets, and similar programs, are powerful tools for organizing, analyzing, and visualizing data. Whether you're using spreadsheets for personal or professional purposes, mastering the basics will make your tasks more efficient and productive. Here are some key **basic spreadsheet skills** you should develop:

### 1. Data Entry and Formatting

#### a. Entering Data

- **Type in Data:** Click on a cell and start typing to enter text, numbers, or dates.



- **Example:** In cell A1, type "January" or "500" or "01/01/2024" to input text, numbers, or dates respectively.
- **Use Tab and Enter Keys:** After entering data in one cell, press the **Tab** key to move to the next cell horizontally or **Enter** to move to the next cell vertically.

## b. Basic Formatting

- **Font Styles:** Change the font, size, and color to make data more readable.
  - **Example:** Highlight a column and change the font size to 14 to make text easier to read.
- **Bold, Italic, Underline:** Use these for emphasis.
  - **Example:** Bold the headers in row 1 to make them stand out.
- **Number Formatting:** Format numbers as currency, percentages, or decimals.
  - **Example:** Select a range of cells and choose the **Currency** format to display monetary values (e.g., \$500.00).
- **Date Formatting:** Format cells with dates to match your preferred style (e.g., "MM/DD/YYYY" or "DD-MMM-YYYY").

## 2. Cell Referencing

### a. Cell References

- **Relative Reference:** A cell reference like **A1** is relative; when you copy a formula across cells, it changes according to the new position.
  - **Example:** If you copy =A1+B1 from row 1 to row 2, it will automatically change to =A2+B2.
- **Absolute Reference:** A reference like **\$A\$1** locks both the row and column, so it doesn't change when copied.
  - **Example:** If you use =\$A\$1+B1 and copy it, the \$A\$1 part will remain fixed while B1 will adjust.

**Mixed Reference:** A reference like **\$A1** (column fixed) or **A\$1** (row fixed) only locks one part.

### b. Copying and Pasting

- **Copy** (Ctrl + C) and **Paste** (Ctrl + V) to replicate data.
- **Paste Special:** Paste values, formats, or formulas only.
  - **Example:** Right-click on a cell and select **Paste Special > Values** to paste only the values, not the formulas.

### 3. Simple Formulas and Functions

#### a. Formulas

- **Basic Arithmetic:** Use formulas to perform calculations, starting with an equal sign (=).
  - **Example:** In cell **C1**, type =A1+B1 to add the values in cells **A1** and **B1**.
- **SUM Function:** Add up a range of numbers.
  - **Example:** =SUM(A1:A5) adds up the numbers in cells A1 through A5.
- **AVERAGE Function:** Find the average of a range of numbers.
  - **Example:** =AVERAGE(B1:B5) calculates the average of the values in cells B1 to B5.

#### b. Autofill

- **Drag to Autofill:** Use the fill handle (the small square at the bottom-right corner of a selected cell) to copy formulas or fill a series of data (e.g., numbers, dates, or text).
  - **Example:** Drag the fill handle down to fill cells with a series of numbers or dates.
- **AutoSum:** Quickly sum a range of numbers by selecting an empty cell and clicking the **AutoSum** button ( $\Sigma$ ) on the toolbar.

### 4. Sorting and Filtering Data

#### a. Sorting

- **Sort Data:** Sort numbers or text alphabetically (A-Z or Z-A) or numerically (smallest to largest or largest to smallest).
  - **Example:** Highlight a range of cells and use **Sort** in the **Data** tab to sort the list of names or numbers.

#### b. Filtering

- **Apply Filters:** Filters allow you to display only the rows that meet certain criteria (e.g., showing only data from a specific month or category).
  - **Example:** Select a column, click on the **Filter** button (in the **Data** tab), and use the drop-down arrow to select specific data to display.

**Multiple Filters:** You can apply filters to multiple columns to narrow down your results based on several conditions.

### 5. Basic Data Visualization (Charts)

### a. Creating Charts

- **Select Data and Insert Chart:** Highlight a range of data and then use the **Insert** tab to choose from various chart types (e.g., column, line, pie, etc.).
  - **Example:** Select sales data for different months and insert a **Bar Chart** to visually represent the information.

### b. Chart Customization

- **Chart Title:** Give your chart a meaningful title to describe the data.
  - **Example:** "Quarterly Sales Report."
- **Legends:** Use a legend to distinguish between different data series in a chart.
- **Axis Labels:** Label the X and Y axes to clarify what data they represent.

## 6. Basic Data Organization (Tables and Ranges)

### a. Creating Tables

- **Format as Table:** Select a range of data and use **Format as Table** to automatically organize and apply formatting to your data. Tables allow you to sort, filter, and reference data more easily.
  - **Example:** Select your range, go to the **Home** tab, and choose **Format as Table** for better data management.

### b. Named Ranges

- **Name Your Data Range:** Naming a range of cells helps you reference it in formulas more easily.
  - **Example:** Select a range (e.g., **A1:A10**), then name it "**SalesData**" in the **Name Box**.

You can now refer to this range by its name in your formulas, like =SUM(SalesData).

## 7. Basic Data Management (Rows and Columns)

### a. Inserting and Deleting Rows/Columns

- **Insert Rows/Columns:** Right-click a row number or column letter, and choose **Insert** to add a new row or column.
  - **Example:** Right-click row 3 and select **Insert** to add a new row above row 3.

**Delete Rows/Columns:** Select the row or column you want to remove, right-click, and choose **Delete**.

### b. Adjusting Row Height and Column Width

- **Adjust Column Width:** Move the cursor between column headers (e.g., between A and B) and double-click to auto-adjust or drag to manually resize.
- **Adjust Row Height:** Similar to columns, you can adjust row height by dragging the row borders up or down.

## 8. Freezing Panes and Splitting Windows

### a. Freezing Panes

- **Freeze Top Row/First Column:** Use **Freeze Panes** to keep certain rows or columns visible as you scroll through the data.
  - **Example:** If you have headers in the first row, go to the **View** tab, click **Freeze Panes**, and choose **Freeze Top Row** to keep the headers visible while scrolling.
- **Split View:** You can split your window into multiple panes to view different parts of your worksheet simultaneously.
  - **Example:** Use the **Split** button in the **View** tab to divide your window into two or four panes.

## 9. Basic Printing Options

### a. Page Setup

- **Set Print Area:** Select the range you want to print, and use the **Set Print Area** option to ensure only that part of the sheet prints.
- **Print Preview:** Before printing, use **Print Preview** to see how your worksheet will look on paper.
  - **Example:** Go to **File > Print** to check the layout and adjust margins or orientation.

### b. Page Breaks

- **Insert Page Breaks:** You can manually insert page breaks to control where a new page starts when printing.
  - **Example:** Select a row or column, then use **Insert > Page Break**.

## 10. Saving and Sharing Workbooks

### a. Saving a Workbook

**Save:** Use **Ctrl + S** to save your workbook. If it's a new file, you'll be prompted to choose a location and file name.

- **Save As:** Use **File > Save As** to save the workbook with a new name or location.

### Sharing Workbooks

- **Share via Email:** You can save your file to cloud services like OneDrive or Google Drive and share a link with others to access or collaborate on the file.

## **EXCEL HELP SYSTEM**

The **Excel Help System** is an essential tool for users to find solutions to problems, learn new features, and access detailed information about Excel functions, features, and commands. Excel's Help System is designed to provide quick assistance, step-by-step guides, and tutorials, whether you're a beginner or an advanced user.

Here's a detailed guide on how to effectively use the **Excel Help System**:

### **1. Accessing the Help System**

There are several ways to access Excel's Help System, depending on the version of Excel you're using:

#### **a. Using the "Tell Me" Search Bar (Excel 2016 and later)**

- **Location:** The "Tell Me" bar is located at the top of the Excel window, just below the Ribbon.
- **What It Does:** This feature allows you to quickly search for commands, functions, or tasks without navigating through the Ribbon manually. It is an efficient way to find features, commands, and instructions.

**How to use it:**

1. Click on the **Tell Me** search box.
2. Type what you need help with (e.g., "create chart," "SUM function," "filter data").
3. Excel will show suggestions, including commands, help articles, or options for your search.
4. You can click on any suggestion to go directly to the command or open related help content.

#### **b. Using F1 (Keyboard Shortcut)**

- **Location:** Press **F1** on your keyboard (works in all versions of Excel).
- **What It Does:** Pressing **F1** opens the **Excel Help pane** or the **Microsoft Office Support** page in a web browser, where you can search for help topics, tutorials, and articles.

**How to use it:**

1. Press **F1** to open the Help pane.

2. Type your query (e.g., "how to use VLOOKUP") in the search box that appears.
3. Excel will display relevant articles, videos, and troubleshooting steps.

### c. Help Tab (Excel 2013 and earlier)

- **Location:** In older versions of Excel (2013 and earlier), the **Help** option is available directly on the **Ribbon** under the **File** tab.
- **What It Does:** Clicking the **Help** tab opens the help system where you can search for topics or browse through the help content organized by categories.

#### How to use it:

1. Click on the **File** tab in Excel.
2. Select **Help** from the options on the left-hand sidebar.
3. Use the search bar or browse the categories to find help topics.

## 2. Searching for Help Topics

Once you've accessed the Help System, you can search for a wide range of topics to find solutions to your Excel-related questions. Here's how you can perform an effective search:

### a. Search by Keywords

- Type a keyword or phrase related to your issue or task in the search box (e.g., "pivot table," "add a chart," "SUM function").
- Excel will return a list of relevant help articles, tips, and tutorials.

### b. Search by Function Name

- If you want to understand a specific Excel function, type its name (e.g., VLOOKUP, SUM, IF, COUNTIF) into the search box.
- Excel will display the function's syntax, examples, and explanations.

### c. Use Natural Language Queries

- Excel's help system allows for natural language queries, so you can type questions in a conversational way (e.g., "How do I filter data in a table?" or "How do I create a pie chart?").
- This feature is particularly useful for beginners.

## 3. Using Excel's Built-in Documentation

### a. Function Descriptions and Syntax

- **Formula Help:** When entering a formula in Excel, you can access detailed function help by clicking the **fx** button next to the formula bar. This will open the **Insert**



**Function** dialog box, where you can search for functions, read their descriptions, and view examples.

- **Example:** If you're typing =VLOOKUP(, click the **fx** button to open the help pane that explains the VLOOKUP function's syntax and parameters.

#### **b. Tooltips and ScreenTips**

- **Tooltips:** When you hover over a button or option in the Ribbon or other menus, a small tooltip will appear with a brief description of what the button does.
  - **Example:** Hovering over the **Bold** button in the **Home** tab will display the tooltip "Bold (Ctrl + B)."
- **ScreenTips:** These are additional tips that may appear when you hover over a formula or function in the Formula Bar or a chart element, providing additional context.

### **4. Microsoft Office Online Help and Support**

Excel integrates with the broader **Microsoft Office Help and Support** system, which is available through the **Office Support Website**. This is particularly useful for accessing troubleshooting guides, system requirements, and detailed tutorials.

#### **a. Office Support Website**

- Visit the **Microsoft Office Support** website at <https://support.microsoft.com> for detailed documentation and tutorials for all Excel versions.
- The website includes articles, videos, community forums, and other resources that can help you with advanced tasks, such as creating complex formulas, using Excel VBA, or troubleshooting issues.

#### **b. Online Help for Excel for Office 365**

- Excel for Office 365 comes with built-in **cloud-based** help, meaning that the help topics and features are updated frequently.
- **Using the Online Help:** In addition to the built-in Help system, you can access **cloud-based help** by visiting the Help tab (via **File > Help**) or using the **Tell Me** search box.

### **5. Troubleshooting and Advanced Support**

If you're facing specific issues or need troubleshooting support, Excel's Help System also provides access to advanced tools and resources:

#### **a. Excel Community and Forums**



- **Microsoft Community:** For more complex issues or questions not directly answered by the Help System, you can visit the **Microsoft Excel Community Forum** where you can ask questions or browse discussions.
  - Visit [Microsoft Community: Excel](#).
- **Stack Overflow:** For more technical queries, you can explore or ask questions on forums like **Stack Overflow**, where experienced Excel users and developers share solutions to programming-related issues, such as VBA or advanced formulas.

#### b. Excel Troubleshooter

- If Excel isn't working properly, you can access the **Excel Troubleshooter** from the **Microsoft Office Support** page. It helps to diagnose and fix common issues like slow performance, crashes, or errors.
  - Visit the Office support page and search for "**Troubleshoot Excel problems.**"

### 6. Excel Training and Tutorials

#### a. In-App Training (Excel 365)

- **Training Tab:** Excel 365 provides a built-in training tab that gives you access to **interactive learning materials** directly within the app. This includes tutorials, videos, and step-by-step guides for various Excel tasks.

#### b. Online Tutorials

- **Excel for Beginners:** Websites like **Excel Easy** and **Excel Jet** offer free tutorials for beginners and advanced users.
- **YouTube:** YouTube channels such as **ExcelsFun**, **MyExcelOnline**, and **Leila Gharani** provide hundreds of free Excel tutorial videos for all skill levels.

### 7. Excel Support for Mac and Mobile Versions

#### a. Excel for Mac

- The Help System for Excel on Mac is similar to that on Windows. You can access help by pressing **F1** or using the **Help** menu at the top of the screen.

#### b. Excel Mobile (iOS/Android)

- Excel on mobile devices also offers access to the Help system through the **Help** menu, which you can find in the app's **settings** or **File** menu.

### 8. Using Excel's Accessibility Features

For users with disabilities or accessibility needs, Excel provides a variety of support tools:

- **Screen Reader Support:** Excel supports screen readers and other accessibility tools, making it easier for users with visual impairments to navigate and use the application.
- **Keyboard Shortcuts:** Excel has a vast array of keyboard shortcuts that make it easier for users to navigate the interface without a mouse.

## **OPENING AND CLOSING AND SAVING WORKBOOK**

Understanding how to **open**, **close**, and **save** workbooks is a fundamental skill in Excel. Here's a comprehensive guide on these tasks:

### **1. Opening a Workbook**

To work on an existing Excel file, you first need to **open** it. You can open a workbook in several ways:

#### **a. Open a Workbook from the File Tab (Excel 2013 and later)**

1. **Click the File Tab:** On the Ribbon, click the **File** tab (in older versions, this would be the "Office Button").
2. **Select Open:** In the menu that appears, click **Open**.
3. **Choose a Location:** You will be given options to open files from:
  - **Recent:** Recent workbooks you've opened.
  - **OneDrive or SharePoint:** If your workbook is saved in cloud storage (OneDrive, SharePoint, etc.), you can access it from here.
  - **This PC:** Browse your computer to locate and open the file from a specific folder.
4. **Browse and Open:** Navigate to the folder where the workbook is saved, select the workbook file, and click **Open**.

#### **b. Open a Workbook with the Keyboard Shortcut**

- **Ctrl + O:** Press **Ctrl + O** (Windows) or **Cmd + O** (Mac) to open the file dialog box, where you can choose a workbook to open.

#### **c. Open a Workbook from File Explorer (Windows)**

1. **Navigate to the File:** Open **File Explorer** (Windows) and locate the workbook you want to open.
2. **Double-Click the File:** Double-click on the Excel file (.xlsx or .xls) to open it directly in Excel.

#### **d. Open a Workbook from Finder (Mac)**

1. **Navigate to the File:** Open **Finder** and go to the folder where your workbook is saved.
2. **Double-Click the File:** Double-click on the file to open it in Excel.

## 2. Closing a Workbook

Once you're done working on a workbook, you can **close** it. Closing the workbook doesn't close Excel itself, so you can still open and work on other files.

### a. Close a Workbook Using the Close Button

**Click the Close Button (X):** At the top-right corner of the Excel window, click the **X** button. If multiple workbooks are open, this will close the current workbook while leaving other workbooks open.

- If you have unsaved changes, Excel will prompt you to **save** your work before closing.

### b. Close a Workbook from the File Tab (Excel 2013 and later)

1. **Click the File Tab:** In the Ribbon, click the **File** tab.
2. **Select Close:** From the menu, choose **Close**. This will close the currently open workbook.
3. If you have unsaved changes, Excel will prompt you to save the workbook before closing it.

### c. Close a Workbook with the Keyboard Shortcut

- **Ctrl + W:** Press **Ctrl + W** (Windows) or **Cmd + W** (Mac) to close the current workbook.
  - If you have multiple workbooks open, **Ctrl + W** will close the active workbook but leave other workbooks open.

### d. Close All Workbooks

If you have multiple workbooks open and want to close them all at once, click **File > Close All** (Excel 365/2019). Alternatively, you can manually close each workbook with the **Close** button or the shortcut **Ctrl + W**.

## 3. Saving a Workbook

It's essential to **save** your work regularly to avoid losing data. There are several methods to save your Excel workbook:

### a. Save a New Workbook

If you're creating a new workbook or want to save an existing workbook under a new name or location, use the **Save As** option.

1. **Click the File Tab:** In the Ribbon, click the **File** tab.

2. **Choose Save As:** From the menu, select **Save As**.
3. **Choose a Location:**
  - **This PC:** Save to a specific folder on your computer.
  - **OneDrive:** Save to the cloud for easy access from anywhere.
  - **Browse:** To select a specific folder or drive on your computer.
4. **Enter a File Name:** In the "File Name" box, enter the name you want for the workbook.
5. **Click Save:** Click the **Save** button to save the workbook.

#### b. Save an Existing Workbook

To save changes to an already existing workbook:

1. **Click the Save Icon:** Click the **Save** icon in the Quick Access Toolbar (the floppy disk icon).
2. **Use the Keyboard Shortcut:** Press **Ctrl + S** (Windows) or **Cmd + S** (Mac) to save your work quickly.
3. **Save Automatically** (Excel 365/2019): If you're working on a file saved to **OneDrive** or **SharePoint**, Excel will automatically save your changes as you work, with no need for manual saving. This is called **AutoSave**.

#### c. Save As a Different Format

To save your workbook in a different file format, such as an older Excel version or PDF, follow these steps:

1. **Click File Tab:** Click the **File** tab in the Ribbon.
2. **Select Save As:** Choose **Save As** from the menu.
3. **Choose the Format:** Under **Save as type**, select a different format from the dropdown list (e.g., Excel 97-2003 Workbook, PDF, CSV, etc.).
4. **Click Save:** Choose a location and click **Save**.

### 4. Autosave and Versions

Excel has **AutoSave** and **Version History** features that help ensure your work is never completely lost, even if you forget to save manually.

#### a. AutoSave (Excel 365/2019)

- **What it Does:** If you're using **Excel 365** or **Excel 2019**, **AutoSave** will automatically save your work every few seconds if the workbook is stored on **OneDrive** or **SharePoint**.

- **Turn On/Off AutoSave:** In the top-left corner, just below the Ribbon, you'll see the **AutoSave** toggle. Turn it on to enable automatic saving or off if you prefer to save manually.
- **b. Version History**
- **Access Version History:** If you're working on a file stored on **OneDrive** or **SharePoint**, you can access previous versions of the file by selecting **File > Info > Version History**. This allows you to view, compare, and restore older versions of your workbook.
- **Restore Previous Versions:** You can restore a previous version of the workbook if you make a mistake or need to revert to an earlier state.

## 5. File Formats in Excel

Excel supports several file formats for saving your workbook, and it's important to choose the right format based on your needs:

### a. Excel Workbook (.xlsx)

- The default file format in recent versions of Excel (Excel 2007 and later).
- Most compatible** for sharing with others and allows for all features, including formulas, formatting, and macros (if saved as .xlsm).

### b. Excel Macro-Enabled Workbook (.xlsm)

- Used for workbooks that contain **macros** (VBA code).
- Allows you to save Excel workbooks with embedded macros.

### c. Excel 97-2003 Workbook (.xls)

- The older Excel file format used by versions of Excel prior to 2007.
  - Use this format if you need to share a workbook with users who have older versions of Excel.
- ### d. Comma Separated Values (.csv)
- A text-based format used to store data in tabular form, with each value separated by commas.
  - Does not support Excel-specific features like formatting, formulas, or multiple sheets.

### e. PDF (.pdf)

- Save your workbook as a **PDF** if you want to share it in a non-editable format (e.g., for printing or sharing reports).

## UNDERSTANDING WORKBOOK FILE FORMATS

When working with Excel, it's important to understand the different **file formats** available for saving your workbooks. Excel supports various formats that determine how data,

formulas, formatting, and other workbook components are stored. The format you choose depends on how you plan to use or share the file, as well as the version of Excel being used by others.

Here's a breakdown of the most common **Excel file formats** and when to use them:

## 1. Excel Workbook (.xlsx)

### a. Overview:

- **File Extension:** .xlsx
- **Default Format:** This is the default file format used by Excel 2007 and later versions.
- **Compatibility:** Most modern versions of Excel (Excel 2007 and later) support this format. It's widely accepted and can be opened in Excel, as well as other spreadsheet applications that support this format (e.g., Google Sheets, LibreOffice Calc).

#### Features:

- **Stores data:** Includes values, formulas, formatting, and data validation.
- **Does not support macros:** If you have macros (VBA code) in your workbook, they won't be saved in this format.
- **Uses Open XML:** The .xlsx format is based on Open XML standards, which means the file is a compressed archive that stores the workbook's data in a set of individual XML files. This makes the format more efficient in terms of file size and stability.

### c. When to Use:

- **General Use:** When you want to store a regular workbook with formulas, charts, and formatting, but without macros.
- **Sharing Files:** If you want to share your workbook with others and they are using Excel 2007 or newer, or any application that supports the .xlsx format.

## 2. Excel Macro-Enabled Workbook (.xlsm)

### a. Overview:

- **File Extension:** .xlsm
- **Purpose:** This file format is specifically designed for workbooks that contain **macros** (VBA code). It's similar to .xlsx, but it can store Excel macros.

### b. Features:

- **Macros Supported:** Unlike .xlsx, .xlsm allows you to save VBA macros (Visual Basic for Applications), which are used to automate tasks and create custom functions in Excel.

**Data and Formatting:** Just like .xlsx, it can store data, formulas, formatting, charts,

and more. **c. When to Use:**



- **Workbooks with Macros:** If your workbook contains macros or VBA code, save it as .xlsm to ensure the macros are preserved and functional.
- **Automation:** If you create automated workflows using macros in your workbook, choose .xlsm as the format for saving.

**d. Warning:**

- **Macro Security:** Be cautious when opening .xlsm files from unknown sources, as they could contain harmful macros. Always ensure the source is trustworthy.

### **3. Excel 97-2003 Workbook (.xls)**

**a. Overview:**

- **File Extension:** .xls
- **Legacy Format:** This is the file format used by Excel versions before Excel 2007.
- **Compatibility:** It's still supported in modern versions of Excel, but it has limitations compared to the newer .xlsx and .xlsm formats.

**b. Features:**

- **Limited Features:** The .xls format doesn't support many features introduced in newer Excel versions, such as larger worksheets, advanced functions, and improved formatting options.
- **File Size:** .xls files are typically larger than .xlsx files for the same content, as they don't use the more efficient Open XML format.
- **Macro Support:** Macros are supported in .xls files, but the VBA capabilities are less advanced than in .xlsm

**c. When to Use:**

- **Sharing with Older Excel Versions:** If you need to share a workbook with someone who uses an older version of Excel (Excel 2003 or earlier), save it as .xls.
- **Compatibility Issues:** If your workbook contains data that needs to be opened in legacy Excel applications, use .xls.

**d. Limitations:**

- **File Size and Performance:** The .xls format is less efficient and slower with large datasets.
- **Missing Features:** Many modern Excel features are not available in .xls.

### **4. Comma Separated Values (.csv)**



#### a. Overview:

**File Extension:** .xlsm

- **Purpose:** A plain text format where each cell value is separated by a comma (or another delimiter such as a semicolon). It's used to store tabular data.

#### b. Features:

- **Data-Only:** .csv files contain only the raw data and cannot store formatting, formulas, charts, or multiple worksheets.
- **Plain Text:** The data is saved as plain text, which makes it easy to import into other applications or databases.
- **Limited to One Sheet:** Unlike Excel workbooks, a .csv file can only store data for a single worksheet. If your workbook contains multiple sheets, only the active sheet is saved in the .csv format.

#### c. When to Use:

- **Interchangeable Data:** Use .csv when you need to share or export data between different programs or systems that might not support Excel's native file formats.
- **Database Imports/Exports:** When exporting data to import into databases, accounting systems, or other software that requires plain-text data.

#### d. Limitations:

- **Loss of Excel Features:** Any formulas, formatting, or charts in your workbook are lost when saving as .csv.
- **Regional Settings:** The default delimiter might vary by region (comma or semicolon), so be mindful of how your CSV file is opened in different locales.

### 5. Portable Document Format (.pdf)

#### a. Overview:

- **File Extension:** .pdf
- **Purpose:** A **non-editable** format that's used for sharing and printing Excel workbooks as static documents.

#### b. Features:

- **Fixed Layout:** .pdf files preserve the exact formatting of the workbook, making them ideal for reports or printing.
- **No Data Editing:** Data in the .pdf format cannot be edited in Excel or other spreadsheet software.

- **Multiple Page Support:** If your workbook contains multiple sheets, you can save them all as separate pages in a PDF document.

**c. When to Use:**

**Printing or Sharing:** Use .pdf if you want to share your Excel data in a **read-only** format, such as for reports, invoices, or presentations.

- **Cross-Platform Sharing:** PDFs are universally compatible and can be opened on any device, ensuring that the document looks the same everywhere.

**d. Limitations:**

- **No Data Editing:** You cannot modify the data or structure of the workbook after it's saved as a PDF.
- **Not Interactive:** If you need others to interact with the data (e.g., input new values or change formulas), PDF is not suitable.

## 6. Excel Template (.xltx and .xltm)

**a. Overview:**

- **File Extensions:** .xltx (template without macros), .xltm (template with macros)
- **Purpose:** Template files are pre-designed workbooks that you can use as a starting point for new workbooks.

**b. Features:**

- **Pre-set Design:** Templates often contain predefined formatting, styles, functions, and sometimes VBA code to help users quickly create standardized documents (e.g., invoices, reports, budgets).
- **Can't be Edited Directly:** When you open a template, Excel creates a new workbook based on that template, leaving the template file itself unchanged.

**c. When to Use:**

- **Reusable Documents:** Use templates when you regularly create similar types of documents (e.g., monthly reports, financial statements) and want to ensure consistency.
- **With or Without Macros:** Choose .xltm if you need to include macros in the template, and .xltx for templates without macros.

## 7. Text File (.txt)

**a. Overview:**

- **File Extension:** .txt

- **Purpose:** Like CSV, a .txt file contains plain text but with customizable delimiters (tabs, spaces, commas).

**b. Features:**

- **No Formatting:** Data in .txt files is stored without any formatting, formulas, or structure. It's used to store simple text or numbers.

**Custom Delimiters:** Unlike CSV files, you can specify delimiters other than commas, such as tab-separated values (TSV) or space-separated values.

**c. When to Use:**

- **Simple Data Export:** If you need to export data in a very basic text format or need to specify a custom delimiter for an external program.
- **Plain Text Data:** When sharing raw data without the need for any Excel-specific features.

## **CREATING A NEW WORKBOOK**

Here's a step-by-step guide to creating a new workbook:

Microsoft Excel

1. Open Microsoft Excel: Double-click on the Excel icon or search for "Excel" in your computer's search bar.
2. Click on "File": Located in the top-left corner of the Excel window.
3. Select "New": A dialog box will appear.
4. Choose a template: Select "Blank Workbook" or choose a template that suits your needs.
5. Click "Create": Your new workbook will be created.

## **SELECTING CELLS**

Selecting cells in Excel can be done in various ways depending on what you need to accomplish. Here's a detailed guide:

### **1. Selecting a Single Cell**

- Click on the cell you want to select.
- Alternatively, use the arrow keys to navigate to the desired cell.

### **2. Selecting a Range of Cells**

**Using Mouse:**

1. Click and hold the left mouse button on the first cell of the range.
2. Drag to the last cell of the range and release the mouse button.

#### **Using Keyboard:**

1. Navigate to the starting cell.
2. Hold **Shift** and use the arrow keys to extend the selection.

#### **Selecting a Large Range:**

1. Click the first cell.
2. Hold **Shift** and click the last cell of the desired range.

### **3. Selecting Entire Rows or Columns**

#### **Entire Row:**

- Click the row number on the left side of the spreadsheet.
- Or, use **Shift + Spacebar** to select the row where the active cell is.

#### **Entire Column:**

- Click the column letter at the top of the spreadsheet.
- Or, use **Ctrl + Spacebar** to select the column where the active cell is.

### **4. Selecting Non-Adjacent Cells or Ranges**

1. Hold **Ctrl** (Windows) or **Command** (Mac).
2. Click on each cell or drag to select additional ranges.

### **5. Selecting All Cells**

- Use the **Select All** button: Click the triangle at the top-left corner of the spreadsheet (where the row and column headers meet).
- Or, press **Ctrl + A** (Windows) or **Command + A** (Mac).

### **6. Selecting Cells with Specific Data**

#### **Go To Special:**

1. Press **Ctrl + G** or **F5** to open the **Go To** dialog box.
2. Click **Special**.
3. Choose options like blank cells, formulas, or conditional formatting, and click **OK**.

# **AUTOSUM AND AUTOFILL FUNCTION**

The **AutoSum** and **AutoFill** functions in Excel are powerful tools for performing calculations and quickly copying values or formulas to adjacent cells. Here's how to use them:

## **1. AutoSum**

The **AutoSum** function adds up a range of numbers automatically.

### **How to Use AutoSum:**

1. **Select a Cell:** ○ Click the cell where you want the sum to appear.
2. **Activate AutoSum:**
  - Go to the **Home** tab, and in the **Editing** group, click the **AutoSum (Σ)** button.
  - Alternatively, press **Alt + =** (Windows) or **Command + Shift + T** (Mac).
3. **Select a Range (if needed):**
  - Excel usually selects the range of numbers automatically. If not, drag to highlight the desired range.
4. **Press Enter:**
  - The sum of the selected range will appear in the cell.

### **Example:**

- If you have numbers in cells A1 to A5, select cell A6 and press **Alt + =**. Excel will display `=SUM(A1:A5)` in A6.

## **2. AutoFill**

The **AutoFill** function allows you to copy content or continue a pattern into adjacent cells.

### **How to Use AutoFill:**

1. **Enter Data in a Cell:** ○ For example, type 1 in A1.
2. **Drag the Fill Handle:**
  - Select the cell. Hover over the small square at the bottom-right corner of the cell (the **fill handle**).
  - Click and drag down or across to fill adjacent cells.
3. **Patterns and Formulas:**
  - If you enter a series (e.g., 1, 2 in A1 and A2), drag the fill handle, and Excel will continue the pattern.

- If the cell contains a formula, dragging the fill handle will copy the formula to the new cells and adjust cell references accordingly.

### **AutoFill Options:**

After releasing the mouse button, a small **AutoFill Options** box appears:

- **Copy Cells:** Duplicates the original content.
- **Fill Series:** Continues a pattern or sequence.
- **Fill Without Formatting:** Copies the data but not the formatting.
- **Flash Fill (for patterns):** Automatically fills based on detected patterns in adjacent data (available in Excel 2013 and later).

### **Using Both Together**

You can combine **AutoSum** with **AutoFill**:

1. Use AutoSum to calculate a total for a row or column.
2. Drag the fill handle to copy the formula across multiple rows or columns.

## **CELL REFERENCING AND REQUEST**

### **Cell Referencing in Excel**

Cell referencing is a way to refer to the contents of a specific cell or range in formulas. It allows you to dynamically use and update data in calculations.

### **Types of Cell Referencing**

1. **Relative Referencing** ○ References adjust when a formula is copied to another cell.
  - Example:
    - Formula in cell B1: =A1.
    - Copy the formula to B2; it changes to =A2.
2. **Absolute Referencing** ○ References remain fixed regardless of where the formula is copied. ○ Use the \$ symbol before the column letter and row number.
  - Example: =\$A\$1 always points to cell A1.
3. **Mixed Referencing** ○ Keeps either the row or column fixed. ○ Example:



- \$A1: Fixes column A; row adjusts.
- A\$1: Fixes row 1; column adjusts.

## Named Ranges for Cell Referencing

### 1. Define a Name:

- Select the cell or range.
- Go to **Formulas > Define Name** and assign a name.

### 2. Use in Formulas:

- Instead of =A1 + B1, use =Sales + Tax if you've named A1 as Sales and B1 as Tax.

## Dynamic Cell Referencing (INDIRECT Function)

The INDIRECT function creates references dynamically.

- Example:
  - In A1, type B1. ○ In B1, type 100.
  - In C1, type =INDIRECT(A1). The result will be 100.

If you'd like assistance with:

- A specific formula using cell references.
- Guidance on absolute, relative, or mixed references.
- Automating cell referencing with macros or scripts.

## FORMATTING CELLS

Formatting cells allows you to customize the appearance of data to make it more readable and visually appealing. Here's a breakdown of various cell formatting options:

### 1. Accessing Cell Formatting

1. Select the cells you want to format.
2. Right-click and choose **Format Cells** or go to the **Home** tab and use the tools in the **Font**, **Alignment**, and **Number** groups.

### 2. Types of Formatting

#### a. Number Formatting

Customize how numbers, dates, and text appear in a cell:

- **General:** Default format.
- **Number:** Adds decimal places and thousands separators.
- **Currency:** Displays numbers with currency symbols (e.g., \$).
- **Accounting:** Aligns currency symbols and decimal points in a column.
- **Date/Time:** Formats dates and times (e.g., MM/DD/YYYY or HH:MM).
- **Percentage:** Multiplies the number by 100 and adds a % symbol.
- **Custom:** Create custom formats (e.g., #,##0.00 for thousands with two decimals).

#### b. Text Formatting

- **Font Style:** Change font, size, bold, italic, underline, etc.
- **Font Color:** Change the color of text.
- **Fill Color:** Add a background color to cells.
- **Borders:** Add borders around cells.

#### c. Alignment

- **Horizontal Alignment:** Align text left, center, or right.
- **Vertical Alignment:** Align text top, middle, or bottom.
- **Wrap Text:** Make text appear on multiple lines within a cell.
- **Merge Cells:** Combine multiple cells into one larger cell.

#### d. Conditional Formatting

Apply rules to format cells based on their content:

1. Go to the **Home** tab > **Conditional Formatting**.
2. Choose a rule (e.g., highlight cells greater than a certain value).
3. Customize the formatting.

#### e. Cell Styles

- Use pre-designed styles from the **Home** tab > **Cell Styles** to quickly apply consistent formatting.

### 3. Advanced Formatting Options

## Custom Number Formats

Create specific display formats:

- **Phone Numbers:** (###) ###-#### for phone number formatting.
- **Leading Zeros:** 0000 to ensure numbers like 5 appear as 0005.

## Data Bars, Color Scales, and Icons

1. Select cells.
2. Go to **Conditional Formatting** > Choose **Data Bars**, **Color Scales**, or **Icon Sets**.

## Format Painter

Copy formatting from one cell or range to another:

1. Select a formatted cell.
2. Click the **Format Painter** (Home tab).
3. Apply it to another cell or range.

## 4. Shortcuts for Formatting

- **Bold:** Ctrl + B (Windows) or Command + B (Mac).
- **Italic:** Ctrl + I (Windows) or Command + I (Mac).
- **Underline:** Ctrl + U (Windows) or Command + U (Mac).
- **Open Format Cells Dialog:** Ctrl + 1 (Windows) or Command + 1 (Mac).

# FORMATTING NUMBERS

Formatting numbers helps present numerical data in a way that is easy to read and understand. Excel provides several built-in formats and allows for custom number formatting.

## 1. Accessing Number Formatting

1. **Select Cells:** Highlight the cells you want to format.
2. **Format Options:**
  - Use the **Number** group on the **Home** tab.
  - Right-click and choose **Format Cells** > **Number** tab.

## 2. Built-in Number Formats

You can quickly apply pre-defined formats: **a. General**

- Default format for numbers.
- Displays numbers as entered, with no special formatting.

### **b. Number**

- Allows customization of decimal places and use of a thousands separator.
- Example: 1,234.56.

### **c. Currency**

- Displays numbers with a currency symbol.
- Example: \$1,234.56.

### **d. Accounting**

- Similar to Currency but aligns the symbols and numbers neatly in a column.
- Example:

\$ 1,234.56

\$ 567.89

### **e. Date/Time**

- Formats numbers as dates or times.
- Example: 12/26/2024 or 14:30.

### **f. Percentage**

- Multiplies the number by 100 and appends a % symbol.
- Example: 0.85 becomes 85%.

### **g. Fraction**

- Displays numbers as fractions.
- Example: 0.5 becomes 1/2.

### **h. Scientific (Exponential)**

- Displays numbers in scientific notation.

- Example: 123456 becomes 1.23E+05.

### 3. Custom Number Formatting

You can create custom formats for specific needs. Use the **Format Cells** dialog box:

1. Right-click selected cells > **Format Cells** > **Number** tab > **Custom**.
2. Enter a format code.

#### Common Custom Formats

- **Thousands Separator:** #,##0 (displays 1234 as 1,234).
- **Fixed Decimal Places:** #,##0.00 (displays 1234 as 1,234.00).
- **Currency with Symbol:** \$#,##0.00.
- **Positive/Negative Numbers:** #,##0;(#,##0) shows negatives in parentheses.
  - o Example: 1234 as 1,234 and -1234 as (1,234).

#### Special Formats

- **Phone Numbers:** (###) ###-####.
- **ZIP Codes:** 00000 (preserves leading zeros).
- **Time (Hours:Minutes):** hh:mm.

### 4. Quick Keyboard Shortcuts for Number Formatting

- **Apply Currency Format:** Ctrl + Shift + \$ (Windows).
- **Apply Percentage Format:** Ctrl + Shift + % (Windows).
- **Apply Number Format with Two Decimal Places:** Ctrl + Shift + ! (Windows).

### 5. Conditional Formatting for Numbers Apply rules to highlight numbers:

1. Go to **Home** > **Conditional Formatting**.
2. Example Rules:
  - o Highlight numbers greater than 100.
  - o Apply color scales for data visualization.

### PLACING CELL ALIGNMENT

Cell alignment refers to how content is positioned within a cell. You can align text or numbers horizontally, vertically, or at an angle.

## 1. Accessing Alignment Options

1. **Select the Cells:** Highlight the cells you want to format.
2. **Alignment Tools:**
  - o Use the **Alignment** group on the **Home** tab.
  - o Right-click, select **Format Cells**, and go to the **Alignment** tab.

## 2. Types of Alignment

### a. Horizontal Alignment

- Determines how content is aligned across the width of the cell.
- Options:
  - o **Left Align:** Aligns content to the left (default for text).
  - o **Center:** Aligns content in the middle horizontally.
  - o **Right Align:** Aligns content to the right (default for numbers).
  - o **Fill:** Repeats the content to fill the cell if adjacent cells are empty.
  - o **Justify:** Aligns text evenly across the cell when the content wraps to multiple lines.
  - o **Center Across Selection:** Centers text across a selected range without merging cells.

### b. Vertical Alignment

- Determines how content is aligned across the height of the cell.
- Options:
  - o **Top:** Aligns content to the top.
  - o **Middle:** Centers content vertically.
  - o **Bottom:** Aligns content to the bottom (default).

## 3. Wrapping Text

- **Purpose:** Ensures long text fits within the cell by wrapping it onto multiple lines.
- **How to Apply:**
  - o Select the cells.
  - o Click **Wrap Text** in the **Alignment** group (Home tab).

## 4. Merging Cells

- **Purpose:** Combines multiple cells into one large cell.
- **How to Apply:**



- Select the cells to merge. ○ Click **Merge & Center** in the **Alignment** group (Home tab).
- Options:
  - **Merge & Center**: Merges cells and centers the content.
  - **Merge Across**: Merges selected rows but keeps them as separate rows.
  - **Merge Cells**: Merges cells without centering.

#### 5. Rotating Text (Angle Alignment) • Purpose: Aligns text at an angle.

- **How to Apply:**
  1. Select the cells.
  2. Go to **Format Cells > Alignment** tab.
  3. Adjust the **Orientation** by dragging the dial or entering an angle.

#### 6. Applying Alignment with Shortcuts

- **Horizontal Alignment:**
  - **Left Align**: Ctrl + L (Windows). ○ **Center Align**: Ctrl + E (Windows). ○ **Right Align**: Ctrl + R (Windows).
- **Vertical Alignment:**
  - No default shortcuts, but you can access via the **Format Cells** dialog.

#### 7. Conditional Formatting for Alignment

- Automatically adjust alignment based on cell content using rules in **Conditional Formatting**.
- Rotating axis labels: Rotate text for headers in charts or tables.

## UNDERSTANDING CELLS, ROWS AND COLOUMNS IN EXCEL

Excel is organized in a grid layout made up of **cells**, which are arranged into **rows** and **columns**. Here's a detailed explanation:

### 1. Cells

A **cell** is the basic unit of Excel where data is entered.

### Characteristics:

- **Cell Reference:** Identified by a column letter and row number (e.g., A1).
- **Active Cell:** The cell currently selected and ready for data entry.
- **Content Types:** Cells can hold text, numbers, formulas, or special characters.
- **Cell Size:** Adjustable in terms of width and height.

### Common Actions:

- **Select a Cell:** Click on it or use arrow keys.
- **Edit a Cell:** Double-click or press F2 to modify content.
- **Move Between Cells:** Use arrow keys or Tab/Shift+Tab.

## 2. Rows

Rows run horizontally across the Excel worksheet.

### Characteristics:

- **Row Identification:** Identified by numbers (e.g., Row 1, Row 2).
- **Row Limit:**
  - Excel supports over 1 million rows (up to 1,048,576 rows in newer versions).
- **Row Height:** Default height is 15 points but can be adjusted.

### Common Actions:

- **Select a Row:** Click on the row number on the left.
- **Insert a Row:**
  - Right-click a row number > Select **Insert**.
  - Shortcut: Ctrl + Shift + + (Windows).
- **Delete a Row:** Right-click the row number > Select **Delete**.
- **Hide a Row:** Right-click the row number > Select **Hide**.

## 3. Columns

Columns run vertically down the Excel worksheet.

### Characteristics:

- **Column Identification:** Identified by letters (e.g., Column A, Column B).

- **Column Limit:**
  - Excel supports up to 16,384 columns (ending at column XFD in newer versions).
- **Column Width:** Default width is 8.43 characters but can be adjusted.

#### Common Actions:

- **Select a Column:** Click on the column letter at the top.
- **Insert a Column:**
  - Right-click the column letter > Select **Insert**.
  - Shortcut: Ctrl + Shift + + (Windows).
- **Delete a Column:** Right-click the column letter > Select **Delete**.
- **Hide a Column:** Right-click the column letter > Select **Hide**.

#### 4. Working with Cells, Rows, and Columns Together

##### Inserting Multiple Rows or Columns

1. Select the desired number of rows/columns.
2. Right-click > Choose **Insert**.

##### Merging Cells

- Combine adjacent cells into one:
  - Select the cells.
  - Click **Merge & Center** on the **Home** tab.

##### Adjusting Size

- **AutoFit Column Width:** Double-click the boundary between column letters.
- **AutoFit Row Height:** Double-click the boundary between row numbers.
- **Manual Adjustment:**
  - Drag the boundary between row/column headers.

##### Freeze Panes

Keep rows or columns visible while scrolling:

1. Select the cell below the row(s) and to the right of the column(s) you want to freeze.

2. Go to **View > Freeze Panes**.

## 5. Shortcuts

- **Select Entire Row:** Shift + Space.
- **Select Entire Column:** Ctrl + Space.
- **Move to First Row or Column:** Ctrl + Home (Windows).

## PAGE LAYOUT IN EXCEL

The **Page Layout** feature in Excel helps you format your worksheet for printing or visual presentation. It provides tools to control margins, orientation, scaling, headers, footers, and more.

### Accessing Page Layout

1. **Page Layout Tab:** Found on the Ribbon.
2. **Page Layout View:**
  - o Go to **View > Page Layout** to see how the worksheet will appear when printed.

### 1. Page Setup Options

#### a. Orientation

- Controls whether the page prints in:
  - o **Portrait:** Taller than it is wide.
  - o **Landscape:** Wider than it is tall.
- **How to Set:** Go to **Page Layout > Orientation**.

#### b. Paper Size

- Sets the size of the paper for printing.
- Common options: Letter, Legal, A4.
- **How to Set:** Go to **Page Layout > Size**.

#### c. Margins

- Adjusts the space between the content and the edge of the page.
- Predefined options:
  - o **Normal:** Default margins.
  - o **Wide:** Extra spacing.

**Narrow:** Minimal margins.

- **Custom Margins:** Adjust manually in **Page Layout > Margins > Custom Margins**.

#### d. Scaling

- Shrinks or enlarges the content to fit on a specific number of pages.
- Options:
  - **Fit Sheet on One Page.**
  - **Fit All Columns on One Page.**
  - **Custom Scaling Options** under **Page Setup**.

#### 2. Headers and Footers

- Add information at the top (header) or bottom (footer) of each printed page.

##### How to Add:

1. Go to **Insert > Header & Footer**.
2. Choose built-in options or customize with:
  - Page numbers. ○ Date and time. ○ File path or name.

#### 3. Gridlines and Headings

- **Gridlines:**
  - By default, gridlines are visible in the worksheet but not in print.

To print gridlines: Go to **Page Layout > Check Print** under **Gridlines**.

- **Headings:**
  - Includes row numbers and column letters in the printout. ○ Enable: **Page Layout > Check Print** under **Headings**.

#### 4. Page Breaks

- Control where pages start and end during printing.
- **Insert a Page Break:**
  - Select the cell where you want to break.
  - Go to **Page Layout > Breaks > Insert Page Break**.
- **Remove Page Breaks:**
  - Select the break or go to **Page Layout > Breaks > Reset All Page Breaks**.

#### 5. Print Titles

- Repeat specific rows or columns on each printed page (e.g., headers for tables).
- **Set Print Titles:**

1. Go to **Page Layout > Print Titles**.
2. Specify rows to repeat at the top or columns to repeat on the left.

## 6. Backgrounds

- Add a background image to your worksheet:
  - Go to **Page Layout > Background > Choose an image**.

Note: Backgrounds are visible on-screen but do not print.

## 7. Themes

- Apply a consistent style with fonts, colors, and effects:
  - Go to **Page Layout > Themes**.
  - Choose a predefined theme or customize.

## 8. Viewing Page Layout Settings

- **Normal View:** Default grid view.
- **Page Layout View:** Displays headers, footers, and margins.
- **Page Break Preview:** Shows where page breaks occur.



# UNDERSTANDING WORKSHEETS IN EXCEL

A **worksheet** in Excel is a single page within a workbook where you enter, organize, and analyze data. Multiple worksheets are grouped within a workbook, making it easy to manage and categorize related data.

## **1. Components of a Worksheet**

### **a. Cells**

- **Definition:** Basic unit where data is entered.
- Identified by a **cell reference** (e.g., A1, B2).
- Can hold text, numbers, formulas, or formatting.

### **b. Rows and Columns**

- **Rows:** Horizontal lines, identified by numbers (e.g., 1, 2, 3).
- **Columns:** Vertical lines, identified by letters (e.g., A, B, C).
- Intersection of a row and column forms a cell.

### **c. Worksheet Tabs**

- Located at the bottom of the workbook.
- Each tab represents a worksheet.
- Default names: Sheet1, Sheet2, etc.
- Rename by double-clicking the tab.

### **d. Gridlines**

- Light gray lines separate cells.
- Visible on-screen but optional in printing.

### **e. Sheet Area**

- **Active Worksheet:** The sheet currently displayed.
- **Navigation Buttons:** Allow scrolling through worksheets when many are present.

## **2. Adding, Deleting, and Managing Worksheets**

### **a. Add a Worksheet**

- Click the + icon next to the sheet tabs.

- Shortcut: Shift + F11 (Windows).

#### **b. Delete a Worksheet**

- Right-click the sheet tab > Select **Delete**.
- Note: Deleted sheets cannot be recovered unless the file is saved beforehand.

#### **c. Rename a Worksheet**

- Double-click the sheet tab and type a new name.
- Or, right-click the tab > **Rename**.

#### **d. Move or Copy Worksheets**

- Drag the sheet tab to reorder.
- Right-click the tab > **Move or Copy** > Choose destination.

### **3. Navigating Between Worksheets**

- **Mouse Click:** Click the desired sheet tab.
- **Keyboard Shortcuts:**
  - o Ctrl + PgDn: Move to the next worksheet.
  - o Ctrl + PgUp: Move to the previous worksheet.

### **4. Formatting Worksheets**

#### **a. Change Tab Color**

- Right-click the tab > **Tab Color** > Choose a color.

#### **b. Hide/Unhide Worksheets**

- **Hide:**
  - o Right-click the tab > **Hide**.
- **Unhide:**
  - o Right-click any tab > **Unhide** > Select sheet to unhide.

#### **c. Adjust Sheet Gridlines**

- Go to **View** > Check/Uncheck **Gridlines**.
- For printing: Go to **Page Layout** > **Gridlines** > Check **Print**.

### **5. Linking and Referencing Across Worksheets**

### a. Cross-Sheet Cell Reference

- To reference a cell from another sheet:
  - Syntax: =SheetName!CellReference.
  - Example: =Sheet2!A1 references cell A1 from Sheet2.

### b. Link Data Between Sheets

- Create formulas referencing data from other sheets.
- Use the **Ctrl key** to switch sheets while creating references.

## 6. Protecting Worksheets

### a. Protect a Worksheet

- Prevent accidental changes:
  - Go to **Review > Protect Sheet**.
  - Set a password and select allowed actions (e.g., selecting cells).

### b. Unprotect a Worksheet

- Go to **Review > Unprotect Sheet**.
- Enter the password if required.

## 7. Importing and Exporting Worksheets

### a. Import Data

- Use **File > Open** or copy-paste data into the worksheet.

### b. Export a Worksheet

- Save a worksheet as a new workbook:

Right-click the sheet tab > **Move or Copy** > Choose **(new book)**.

- Save the new workbook.

## 8. Printing Worksheets

### a. Print a Single Worksheet

- Go to **File > Print** > Ensure the desired worksheet is selected.

### b. Print Multiple Worksheets

- Hold **Ctrl** and click the tabs of the sheets you want to print.

## Examples

- Create a workbook with separate sheets for sales data by month.
- Link monthly totals to a summary sheet using cross-sheet references.
- Hide unused worksheets for a cleaner interface.

# **ADDING, MOVING AND COPYING WORKSHEETS**

Managing worksheets is essential for organizing and handling data effectively in Excel. Here's a step-by-step guide on how to add, move, and copy worksheets.

## **1. Adding Worksheets**

### **Method 1: Using the + Icon**

Click the **+** icon at the bottom of the workbook next to the sheet tabs.

A new sheet (e.g., Sheet2, Sheet3) is added.

### **Method 2: Keyboard Shortcut**

Press Shift + F11 (Windows) or Fn + Shift + F11 (Mac) to add a new worksheet instantly. **Method 3: Ribbon Menu** Go to the **Home** tab.

In the **Cells** group, click **Insert**.

Select **Insert Sheet**.

## **2. Moving Worksheets**

### **Method 1: Drag-and-Drop**

Click and hold the sheet tab you want to move.

Drag it to the desired location among the sheet tabs.

Release the mouse button to place the sheet.

**Method 2: Using the Right-Click Menu** Right-click the sheet tab you want to move.

Select **Move or Copy**.

Under **To book**, choose the workbook where you want to move the sheet.

Under **Before sheet**, specify where to insert the sheet.

Click **OK**.

## **3. Copying Worksheets**

### **Method 1: Using Drag-and-Drop with Ctrl Key**

Hold the Ctrl key (Windows) or Option key (Mac).

Click and hold the sheet tab you want to copy.

Drag it to the desired location.

Release the mouse button, and a duplicate sheet appears.

### **Method 2: Using the Right-Click Menu**

Right-click the sheet tab you want to copy.

Select **Move or Copy**.

In the dialog box:

Check **Create a copy**.

Under **To book**, choose the workbook where you want the copy.

Under **Before sheet**, specify where to place the copied sheet.

Click **OK**.

### **Method 3: Copy to a New Workbook**

Right-click the sheet tab.

Select **Move or Copy**.

In the dialog box:

Under **To book**, select **(new book)**.

Check **Create a copy**.

Click **OK** to create a new workbook with the copied sheet.

### **Tips and Best Practices Rename New**

#### **Sheets:**

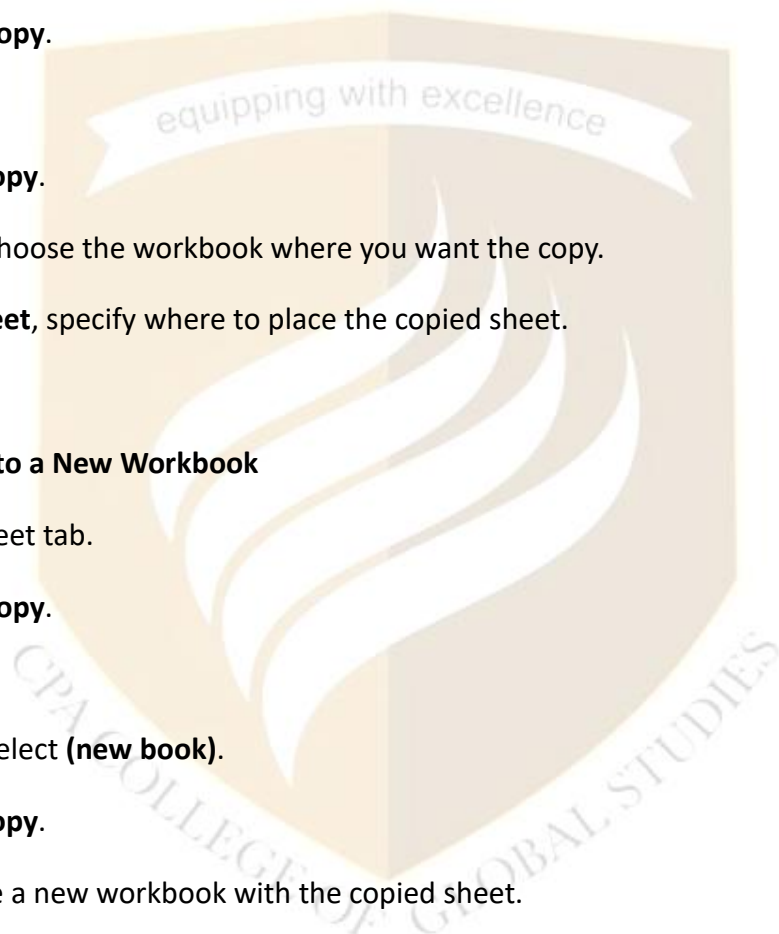
Double-click the sheet tab and type a descriptive name.

Use names relevant to the sheet's content (e.g., "January Sales" or "Summary").

#### **Avoid Duplication Confusion:**

When copying, ensure unique sheet names to prevent errors in references or formulas.

#### **Shortcut for Multiple Copies:**



Copy sheets multiple times using the Move or Copy dialog and repeatedly check **Create a copy**.

### **Copy Across Workbooks:**

Open both workbooks side by side.

Drag a sheet from one workbook to another while holding

## **EDITING, COPYING AND MOVING CELLS**

Working with cells is a fundamental part of Excel. Here's a detailed guide to help you **edit**, **copy**, and **move cells** efficiently.

### **1.Editing Cells**

#### **Method 1: Double-Click**

1. Double-click the cell you want to edit.
2. Modify the content directly.
3. Press Enter to save changes or Esc to cancel.

#### **Method 2: Using the Formula Bar**

1. Select the cell.
2. Edit the content in the **formula bar** above the worksheet.

Press Enter to save changes.

#### **Method 3: Keyboard Shortcut**

- Select the cell and press F2 (Windows) or Control + U (Mac) to enter edit mode.

#### **Tips for Editing:**

- To clear content: Select the cell and press Delete.
- To replace all content: Start typing after selecting the cell (no need to double-click).

### **2. Copying Cells**

#### **Method 1: Using Copy and Paste**

1. Select the cell(s) to copy.



2. Right-click and select **Copy** (or press Ctrl + C / Cmd + C).
3. Select the destination cell(s).
4. Right-click and select **Paste** (or press Ctrl + V / Cmd + V).

#### **Method 2: Drag-and-Drop with Ctrl Key**

1. Select the cell(s).
2. Hold the Ctrl key (Windows) or Option key (Mac).
3. Drag the selection to the destination and release.

#### **Method 3: Copy Using Fill Handle**

1. Select the cell.
2. Hover over the bottom-right corner (Fill Handle) until the cursor changes to a +.
3. Drag the Fill Handle to copy the content to adjacent cells.

### **3. Moving Cells**

#### **Method 1: Cut and Paste**

1. Select the cell(s) to move.
2. Right-click and select **Cut** (or press Ctrl + X / Cmd + X).
3. Select the destination cell(s).
4. Right-click and select **Paste** (or press Ctrl + V / Cmd + V).

#### **Method 2: Drag-and-Drop**

1. Select the cell(s).
2. Hover over the edge of the selection until the cursor changes to a four-sided arrow.
3. Click and drag the selection to the destination.
4. Release the mouse button to drop the content.

#### **Tips for Moving:**

- Hold Shift while dragging to insert the content between existing cells.
- Moving cells will adjust formulas referencing those cells automatically.

### **4. Copying and Moving Formulas**

- When copying formulas, Excel adjusts the cell references automatically:
  - o **Relative References** (default): Adjust based on the new location.
  - o **Absolute References** (\$A\$1): Remain fixed regardless of the new location.

#### To Keep Absolute References:

1. Use \$ before column/row references in the formula (e.g., \$A\$1).
2. Press F4 while typing the formula to toggle reference types.

#### 5. Special Paste Options

- Access these by right-clicking and selecting **Paste Special**:
  - o **Values Only**: Paste results of formulas, not the formulas themselves.
  - o **Formats**: Paste only the formatting.
  - o **Formulas**: Paste formulas without altering the format.
  - o **Transpose**: Switch rows to columns and vice versa.

#### 6. Undo/Redo Changes

- **Undo**: Press Ctrl + Z (Windows) or Cmd + Z (Mac).
- **Redo**: Press Ctrl + Y (Windows) or Cmd + Y (Mac).

#### Examples

- **Editing**: Correct a typo in cell A1 by pressing F2, modifying it, and pressing Enter.
- **Copying**: Copy data from B1:B5 to D1:D5 using Ctrl + C and Ctrl + V.
- **Moving**: Drag content from C1:C3 to E1:E3 while holding Shift to insert.

## UNDERSTANDING RIBBONS AND TOOLBARS

Excel's **Ribbon** and **Toolbar** are central components of its user interface, providing access to a wide range of tools and commands for working with data.

### 1. The Ribbon

The **Ribbon** is the large toolbar at the top of the Excel window, organized into **tabs** and **groups** of commands. It is designed to simplify access to Excel's features.

#### a. Components of the Ribbon

1. **Tabs**: Broad categories of commands (e.g., **Home**, **Insert**, **Page Layout**, etc.).
2. **Groups**: Related commands are grouped under each tab (e.g., Font group in the Home tab).

3. **Commands:** Specific tools or functions (e.g., Bold, Align, Insert Table).

#### b. Key Tabs in the Ribbon

- **Home:** Common tasks like formatting, cutting, copying, pasting, and cell alignment.
- **Insert:** Adding charts, tables, pictures, shapes, or other objects.
- **Page Layout:** Adjusting page setup for printing, themes, and arranging objects.
- **Formulas:** Tools for creating and managing formulas.
- **Data:** Data-related tasks such as sorting, filtering, importing, and data analysis.
- **Review:** Tools for comments, spell check, and sheet protection.
- **View:** Options for viewing and customizing the worksheet interface.

#### c. Customizing the Ribbon

1. Right-click anywhere on the Ribbon and select **Customize the Ribbon**.
2. Add, remove, or rearrange tabs and commands.
3. Create custom tabs or groups for frequently used commands.

#### 2 Show or Hide the Ribbon

1. To minimize or expand the Ribbon: Click the **arrow** in the lower-right corner of the Ribbon or press Ctrl + F1.

#### 2. The Quick Access Toolbar

The **Quick Access Toolbar (QAT)** is a smaller toolbar located above or below the Ribbon, offering quick access to frequently used commands.

#### 3 Default Commands

- **Save, Undo, and Redo** are commonly included by default.

#### b. Customizing the QAT

1. Click the **down arrow** on the QAT.
2. Select commands to add from the list or choose **More Commands**.
3. Drag commands to reorder them.

#### c. Moving the QAT

- Right-click on the QAT and select **Show Below the Ribbon** or **Show Above the Ribbon**.

### 3. Contextual Tabs

- **Definition:** Tabs that appear only when specific objects are selected (e.g., a chart, table, or image).
- **Example:** When you select a chart, the **Chart Tools** tab appears with options for formatting and design.

### 4. Shortcut Menus

- Access by right-clicking anywhere in the worksheet or on an object.
- Provides context-specific options like formatting, inserting, or deleting.

### 5. Using the Ribbon Efficiently

- **Keyboard Shortcuts:**
  - o Press Alt to display shortcut keys for Ribbon commands.
  - o Letters appear over each tab and command for quick access.
- **Search Box:** Use the search bar at the top of Excel to quickly locate commands.

### 6. Tooltips

- Hover over a command to see a description and shortcut (if available).
- Tooltips provide helpful hints about the functionality of a command.

### 7. Differences Between Ribbon and Toolbar

Feature	Ribbon	Quick Access Toolbar
Location	Top of the Excel window Ribbon.	Above or below the below the title bar.
Customization	Can add/remove tabs/commands	Can add/remove frequently commands
Purpose	Organizes all Excel commands by category	Provides quick access to specific commands

#### Examples

- **Task:** You frequently save your work and adjust text alignment.
  - o Add **Save** and **Center Align** to the QAT for faster access.

- **Task:** You use formatting tools often.
- Pin the Home tab to keep its commands readily available.



The logo of the CPA College of Global Studies is a shield-shaped emblem. It features a stylized white flame or wave design in the center. A white banner at the top of the shield contains the text "equipping with excellence". The bottom of the shield is bordered by the text "CPA COLLEGE OF GLOBAL STUDIES".

# ENTERING FORMULAS INTO EXCEL

## MODULE 2

# ENTERING FORMULAS INTO EXCEL

Formulas in Excel are essential for performing calculations, analyzing data, and automating tasks. Here's how to effectively enter and use formulas in Excel.

## 1. What is a Formula?

A **formula** in Excel is an expression that performs calculations or operations on data in your worksheet. Formulas always start with an **equals sign (=)**.

## 2. Steps to Enter a Formula Step 1: Select a Cell

- Click on the cell where you want the result of your formula to appear.

### Step 2: Begin with an Equals Sign (=)

- Type = to indicate you're entering a formula.

### Step 3: Input Your Formula

- Use numbers, cell references, operators, or built-in functions.
- Examples:
  - Simple formula: =A1 + B1 adds the values in cells A1 and B1.
  - Function formula: =SUM(A1:A10) calculates the total of cells A1 to A10.

### Step 4: Press Enter

- Excel calculates the formula and displays the result in the cell.

## 3. Formula Components

Component	Description	Example
<b>Equals Sign (=)</b>	Indicates the start of a formula.	=A1+B1
<b>Cell References</b>	References to data in other cells.	=A1*C1
<b>Operators</b>	Symbols for arithmetic or logical operations.	+, -, *, /



<b>Functions</b>	Predefined operations like SUM or AVERAGE.	=SUM(A1:A5)
------------------	--	-------------

#### 4. Using Cell References in Formulas

##### Relative References

- Adjust automatically when copied to another cell.
- Example: =A1 + B1 becomes =A2 + B2 when copied to the next row.

##### Absolute References

- Fixed reference using \$ (e.g., \$A\$1).
- Example: =\$A\$1 + B1 always refers to A1, even when copied.

##### Mixed References

- Partly relative, partly absolute.
- Example: =\$A1 + B\$1.

#### 5. Arithmetic Operators

Operator Description		Example Result
+	Addition	=A1+B1 Sum
-	Subtraction	=A1-B1 Difference
*	Multiplication	=A1*B1 Product
/	Division	=A1/B1 Quotient
^	Exponentiation (Power)	=A1^2 A1 squared

#### 6. Common Functions

Function	Description	Example
SUM	Adds values in a range.	=SUM(A1:A5)
AVERAGE	Calculates the average of a range	=AVERAGE(A1:A5)

IF	Performs a logical test and return a result	=IF(A1>10, "Yes", "No")
VLOOKUP	Searches for a value in a	=VLOOKUP(10, A1:B10, 2,table.FALSE)
NOW	Returns the current date and time	=NOW()

## 7. Entering Formulas for Multiple Cells

### Using AutoFill

1. Enter the formula in one cell.
2. Drag the **fill handle** (small square at the cell's bottom-right corner) to copy the formula to adjacent cells.
3. Excel adjusts relative references automatically.

### Using Copy and Paste

1. Copy the cell with the formula (Ctrl + C or Cmd + C).
2. Select the target cells.
3. Paste (Ctrl + V or Cmd + V).

## 8. Editing Formulas

- To edit, double-click the cell or select the cell and press F2.
- Modify the formula in the cell or **Formula Bar**, then press Enter.

## 9. Viewing All Formulas

- Press Ctrl + ` (grave accent) to toggle between viewing results and formulas.

## 10. Troubleshooting Formulas

- **Common Errors:**
  - o #DIV/0!: Division by zero.
  - o #REF!: Invalid cell reference.
  - o #NAME?: Misspelled function or name.
- **Fix Errors:**
  - o Review the formula in the **Formula Bar**.
  - o Use **Error Checking** from the **Formulas** tab.

## Examples

### Example 1: Adding Two Cells

excel Copy

code

```
=A1 + B1
```

### Example 2: Calculating a Total excel

Copy code =SUM(A1:A10)

### Example 3: Logical Test excel

Copy code

```
=IF(A1 > 100, "Above Target", "Below Target")
```

CONTROL-FLOW STATEMENTS-CHARTS IN EXCEL-

## DASHBOARDS-SENSITIVITY ANALYSIS

### 1. Control-Flow Statements in Excel

Although Excel doesn't support traditional programming control-flow statements directly (like if, for, and while loops found in programming languages), it provides similar functionality through formulas and **VBA (Visual Basic for Applications)**.

#### a. Using Formulas for Logic-Based Control Flow

- **IF Function:** Implements conditional logic. excel

Copy code

```
=IF(A1>50, "Pass", "Fail")
```

- o Returns "Pass" if the value in A1 is greater than 50, otherwise "Fail."

- **Nested IF:** Handle multiple conditions. excel

Copy code

```
=IF(A1>90, "A", IF(A1>80, "B", "C"))
```

- **IFS Function:** Simplifies multiple conditions. excel

Copy code

```
=IFS(A1>90, "A", A1>80, "B", TRUE, "C")
```

- **CHOOSE Function:** Selects a value from a list.

=CHOOSE(A1, "One", "Two", "Three")

#### **b. VBA for Complex Control Flow**

- **For Loop:** Iterates over a range of cells. vba Copy code

```
For i = 1 To 10
```

```
    Cells(i, 1).Value = i * 2
```

```
Next i
```

- **If-Then-Else:** Handles branching logic. vba Copy code

```
If Range("A1").Value > 50 Then
```

```
    MsgBox "Pass"
```

```
Else
```

```
    MsgBox "Fail"
```

```
End If
```

## **2. Charts in Excel**

Excel charts help visualize data effectively. **a. Types of**

### **Charts**

- **Column/Bar Chart:** Compare categories.
- **Line Chart:** Display trends over time.
- **Pie Chart:** Show proportions.
- **Scatter Chart:** Visualize relationships.
- **Combo Chart:** Combine different chart types.

#### **b. Creating a Chart**

1. Select the data range.
2. Go to the **Insert** tab.
3. Choose the desired chart type.
4. Customize using **Chart Design** and **Format** tabs.

#### **c. Advanced Features**

- **Dynamic Charts:** Link charts to dynamic named ranges using the **OFFSET** and **Defined Names**.

- **Interactive Elements:** Use slicers and dropdown menus for filtering data displayed in charts.

### 3. Dashboards in Excel

Dashboards are interactive, visual summaries of data, combining charts, tables, and slicers.

#### a. Steps to Create a Dashboard

1. **Plan:** Identify key metrics and data sources.
2. **Prepare Data:**
  - Clean and organize data in tables.
  - Use formulas or PivotTables for summarization.
3. **Add Visuals:**
  - Insert charts, PivotCharts, and tables.
  - Use **Conditional Formatting** for emphasis.
4. **Add Interactivity:** ○ Use slicers, timelines, and dropdown menus.
5. **Design for Clarity:**
  - Arrange visuals neatly.
  - Use colors and labels strategically.

#### b. Best Practices

- Keep it simple and focused.
- Test the dashboard for responsiveness and accuracy.
- Optimize for performance by minimizing volatile formulas.

### 4. Sensitivity Analysis in Excel

Sensitivity analysis evaluates how changes in input values affect the outcome of a model or calculation.

#### a. Manual Sensitivity Analysis

- Change input values in the worksheet manually and observe the impact on the results.
- Example: Adjusting interest rates in a loan calculator.

#### b. Data Tables for Sensitivity Analysis

- Create **one-variable** or **two-variable data tables** to automate the process.

### 1. One-Variable Data Table:

- Use when changing one input.
- Example:
  - Row/Column Input: Interest rate.
  - Formula: Loan payment ( $=\text{PMT}(\text{A1}/12, 60, -10000)$ ).
- Steps:
  - Select the range.
  - Go to **Data > What-If Analysis > Data Table**.
  - Input the reference cell for the variable.

### 2. Two-Variable Data Table:

Use when changing two inputs.

- Example:
  - Row Input: Loan amount.
  - Column Input: Interest rate.
- Similar steps as above.

### C. Goal Seek

- Adjust a single input to achieve a desired result.
- Example:
  - Find the interest rate needed for a specific loan payment.
  - Go to **Data > What-If Analysis > Goal Seek**.

### d. Scenario Manager

- Compare multiple scenarios by varying input values.
- Example: Best case, worst case, and most likely case.
  - Go to **Data > What-If Analysis > Scenario Manager**.

## Example

### Dynamic Sensitivity Analysis with Data Table

1. Calculate loan payments for interest rates from 3% to 8%:
  - Enter the formula `=PMT(A1/12, 60, -10000)` in B1.
  - List interest rates (3%, 4%, ...) in column A.
  - Use a one-variable data table to compute payments.

### Creating a Dashboard

1. Sales data for different regions:
  - Summarize data with a PivotTable. o Visualize with bar and line charts.

Add slicers to filter by product or region.

## Creating Tornado Diagrams, Pivot Tables, and Charts in Excel

### 1. Tornado Diagrams

A **Tornado Diagram** is a visual representation used in sensitivity analysis to display the impact of varying inputs on an outcome. It is typically structured as a horizontal bar chart where bars are sorted by size.

#### Steps to Create a Tornado Diagram

1. **Prepare Your Data:**
  - Create a table with the following:
    - Input factors (e.g., "Cost," "Time," "Risk").
    - Base case result.
    - High and low case results for each factor.

Example:

Factor	Low Case	Base Case	High Case
Cost	80	100	120
Time	50	75	100



Risk	20	50	80
------	----	----	----

## 2. Calculate Deviations:

- Compute the deviations of the low and high cases from the base case.
- Add columns for negative and positive deviations.

Example:

	Factor	Negative Deviation	Positive Deviation
Cost		-20	20
Time		-25	25
Risk		-30	30

## 3. Insert a Bar Chart:

- Highlight the "Factor," "Negative Deviation," and "Positive Deviation" columns.
- Go to **Insert > Bar Chart > Stacked Bar Chart**.

## 4. Customize the Chart:

- Reverse the axis order to align factors correctly:
  - Right-click the vertical axis > **Format Axis** > Check **Categories in Reverse Order**.
- Add data labels to show deviation values.
- Adjust colors to distinguish negative and positive deviations.

## 2. Pivot Tables

A **Pivot Table** is a powerful tool to summarize, analyze, and visualize data interactively.

### Steps to Create a Pivot Table

#### 1. Prepare Your Data:

- Ensure the data is organized as a table with headers and no blank rows or columns.

#### 2. Insert a Pivot Table:

- Select your data range.

- Go to **Insert > PivotTable**. ○ Choose where to place the PivotTable (new or existing worksheet).

### 3. Build the Pivot Table:

- Drag fields to the following areas in the **PivotTable Fields** pane:
  - ▢ **Rows:** Categories for rows (e.g., Region, Product).
  - ▢ **Columns:** Categories for columns (e.g., Year, Month).
  - ▢ **Values:** Numeric values to summarize (e.g., Sales, Quantity).
  - ▢ **Filters:** Criteria to filter the data.

### 4. Customize the Pivot Table:

- Use options like sorting, filtering, and grouping. ○ Change summary functions (e.g., Sum, Average) by clicking the value field > **Value Field Settings**.

## 3. Pivot Charts

A **Pivot Chart** provides a visual representation of the data in a Pivot Table.

### Steps to Create a Pivot Chart

1. **Create a Pivot Table** (as described above).
2. **Insert a Pivot Chart:**
  - Select the Pivot Table. ○ Go to **Insert > Pivot Chart** and choose the desired chart type (e.g., Column, Line, Pie).
3. **Interact with the Chart:**
  - Use filters and slicers from the Pivot Table to dynamically update the chart.

## Examples and Use Cases

### Tornado Diagram Example:

Visualize the impact of cost, time, and risk variations on project outcomes.

- Negative deviations: Costs less time but lower output.
- Positive deviations: Costs more time but higher output.

### Pivot Table Example:

Analyze sales data:

- **Rows:** Product categories.
- **Columns:** Months.
- **Values:** Total revenue.

#### Pivot Chart Example:

Create a bar chart from the sales Pivot Table:

- Compare monthly revenue across product categories.

## MODELLING WITH IFPS AND VBA

### 1. Modelling with IFPS (Interactive Financial Planning System)

The **Interactive Financial Planning System (IFPS)** is a software tool designed for financial modeling, forecasting, and decisionmaking. While Excel is widely used for financial modeling today, IFPS provided an early platform for structured, scenario-based planning.

#### a. Core Features of IFPS

- **Input Variables:** Define assumptions like costs, revenues, and interest rates.
- **Model Logic:** Use structured formulas to compute financial metrics.
- **Scenario Management:** Compare multiple cases (e.g., worstcase, best-case).
- **Output Reports:** Generate summaries, charts, and tables.

#### b. Implementing IFPS-like Modeling in Excel

While IFPS is a standalone tool, its features can be replicated in Excel using built-in functionalities like formulas, **What-If Analysis**, and VBA.

##### 1. Define Inputs:

- Use a dedicated section for model assumptions (e.g., interest rates, costs).
- Example:

Parameter	Value
-----------	-------

Interest Rate	5%
---------------	----

Loan Amount	100,000
-------------	---------

##### 2. Set Up Formulas:

- Create calculation sections using references to the input values. ○ Example:  $\text{=PMT}(\text{InterestRate}/12, 60, -\text{LoanAmount})$  to calculate monthly loan payments.

### 3. Scenario Analysis:

- Use **Data Tables**, **Goal Seek**, or **Scenario Manager** to explore how changes in inputs affect outputs.

## 2. Modelling with VBA (Visual Basic for Applications)

Excel's **VBA** allows for advanced modeling by automating calculations, creating user interfaces, and implementing custom logic. **a. Benefits of VBA in Modeling**

- Automate repetitive tasks (e.g., recalculating scenarios).
- Handle large datasets efficiently.
- Customize financial models with user-defined inputs and outputs.
- Integrate advanced control structures (e.g., loops, conditional statements).

### b. VBA Modeling Example: Loan Calculator

#### Step 1: Open the VBA Editor

- Press Alt + F11 to open the VBA editor.
- Insert a new module: Insert > Module.

#### Step 2: Write the Code

```
Sub LoanCalculator()
```

```
    Dim LoanAmount As Double
```

```
    Dim InterestRate As Double
```

```
    Dim NumPayments As Integer
```

```
    Dim MonthlyPayment As Double
```

```
    ' Input values
```

```
    LoanAmount = InputBox("Enter Loan Amount:")
```

```
    InterestRate = InputBox("Enter Annual Interest Rate (in %):") / 100 / 12
```

```
    NumPayments = InputBox("Enter Number of Payments:")
```

```
    ' Calculate monthly payment
```

```
    MonthlyPayment =
```

```
Application.WorksheetFunction.Pmt(InterestRate, NumPayments, LoanAmount)
```

```
' Display the result
```

```
MsgBox "Your monthly payment is: " & Format(MonthlyPayment,  
"Currency")
```

```
End Sub
```

### Step 3: Run the Macro

- Close the VBA editor (Alt + Q).
- Run the macro: Alt + F8, select LoanCalculator, and click **Run**.

### 3. Combining IFPS and VBA

#### a. Scenario-Based Modeling

##### 1. Define Scenarios:

- Use VBA to automate the calculation of multiple scenarios (e.g., low, base, high).

##### 2. Dynamic Inputs: ○ Create an input form with VBA to gather user inputs.

##### 3. Output Results:

- Display outputs in Excel using VBA-generated tables or charts.

#### b. VBA Code for Sensitivity Analysis vba Copy code

```
Sub SensitivityAnalysis()
```

```
Dim InterestRate As Double
```

```
Dim LoanAmount As Double
```

```
Dim NumPayments As Integer
```

```
Dim MonthlyPayment As Double
```

```
Dim i As Integer
```

```
LoanAmount = 100000
```

```
NumPayments = 60
```

```
' Output table headers
```

```
Range("A1").Value = "Interest Rate"
```

```
Range("B1").Value = "Monthly Payment"
```

```
' Loop through interest rates   For i = 1 To 10
```

```
    InterestRate = i / 100 / 12
```

```
    MonthlyPayment =
```

```
Application.WorksheetFunction.Pmt(InterestRate, NumPayments, LoanAmount)
```

```
' Write results to the sheet
```

```
Cells(i + 1, 1).Value = i & "%"
```

```
Cells(i + 1, 2).Value = MonthlyPayment
```

```
Next i
```

```
MsgBox "Sensitivity analysis completed!"
```

End Sub **Output:**

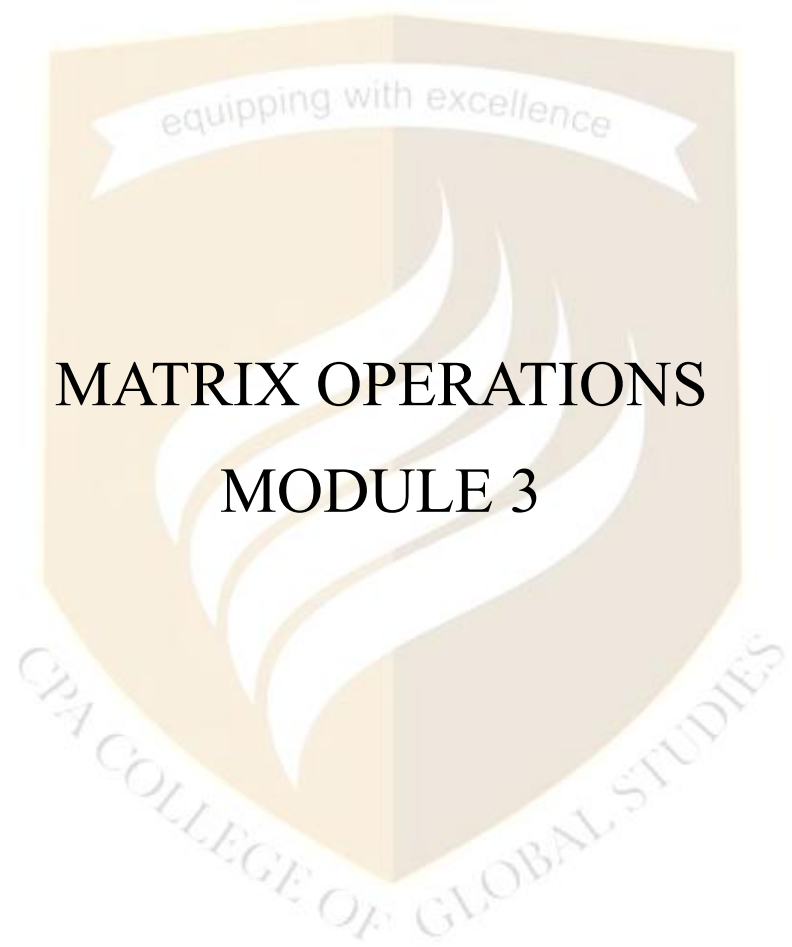
- A table displaying monthly payments for interest rates ranging from 1% to 10%.

#### 4. Best Practices for Modeling with VBA

- **Modular Code:** Break complex models into smaller procedures.
- **Error Handling:** Use On Error to manage runtime errors.
- **Input Validation:** Ensure user inputs are within acceptable ranges.
- **Documentation:** Add comments to explain the logic for future reference.

#### 5. Key Takeaways

- **IFPS** provides structured financial modeling and scenario analysis, which can be mimicked in Excel using formulas and tools.
- **VBA** enables customization, automation, and efficient handling of complex models.
- Combining Excel's features with VBA enhances flexibility and user interaction.



# MATRIX OPERATIONS

## MODULE 3



# INTRODUCTION TO MATRIX OPERATIONS

Matrices are fundamental mathematical structures used in various fields such as engineering, physics, computer science, and economics. A **matrix** is a rectangular array of numbers arranged in rows and columns. Matrix operations allow us to manipulate and analyze these arrays efficiently.

## BASIC MATRIX OPERATIONS

### 1. Matrix Addition and Subtraction

- Two matrices can be **added** or **subtracted** only if they have the same dimensions (same number of rows and columns).
- The operation is performed **element-wise**.

**Formula:**

$$(A \pm B)_{ij} = A_{ij} \pm B_{ij}$$

**Example:**

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$
$$A + B = \begin{bmatrix} 1+5 & 2+6 \\ 3+7 & 4+8 \end{bmatrix} = \begin{bmatrix} 6 & 8 \\ 10 & 12 \end{bmatrix}$$

### 2. Scalar Multiplication

- Multiplying a matrix by a scalar (a single number) involves multiplying each element by the scalar.

**Formula:**

$$(cA)_{ij} = c \times A_{ij}$$

**Example:**

$$c = 3, \quad A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$3A = \begin{bmatrix} 3 \times 1 & 3 \times 2 \\ 3 \times 3 & 3 \times 4 \end{bmatrix} = \begin{bmatrix} 3 & 6 \\ 9 & 12 \end{bmatrix}$$

### 3. Matrix Multiplication

- Two matrices **A** and **B** can be multiplied only if the **number of columns of A** matches the **number of rows of B**.
- The result is a new matrix where each element is calculated as the **dot product** of the corresponding row from **A** and column from **B**.

**Formula:**

$$(AB)_{ij} = \sum_k A_{ik} B_{kj}$$

**Example:**

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

$$\begin{aligned} AB &= \begin{bmatrix} (1 \times 5 + 2 \times 7) & (1 \times 6 + 2 \times 8) \\ (3 \times 5 + 4 \times 7) & (3 \times 6 + 4 \times 8) \end{bmatrix} \\ &= \begin{bmatrix} 19 & 22 \\ 43 & 50 \end{bmatrix} \end{aligned}$$

### 4. Transpose of a Matrix

- The transpose of a matrix **A**, denoted  $A^T$ , is obtained by swapping rows and columns.

**Formula:**

$$(A^T)_{ij} = A_{ji}$$

**Example:**

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$$

$$A^T = \begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}$$

## 5. Determinant of a Matrix

- The determinant is a scalar value that gives information about a square matrix (e.g., whether it is invertible).

For a 2×2 matrix:

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, \quad \det(A) = ad - bc$$

Example:

$$A = \begin{bmatrix} 3 & 4 \\ 2 & 5 \end{bmatrix}$$

$$\det(A) = (3 \times 5) - (4 \times 2) = 15 - 8 = 7$$

## 6. Inverse of a Matrix

- The inverse of a square matrix A, denoted  $A^{-1}$ , satisfies:

$$AA^{-1} = A^{-1}A = I$$

where I is the identity matrix.

- The inverse exists only if the determinant  $\det(A) \neq 0$ .

For a 2×2 matrix:

$$A^{-1} = \frac{1}{\det(A)} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

**Example:**

$$A = \begin{bmatrix} 3 & 4 \\ 2 & 5 \end{bmatrix}$$
$$A^{-1} = \frac{1}{7} \begin{bmatrix} 5 & -4 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} \frac{5}{7} & -\frac{4}{7} \\ -\frac{2}{7} & \frac{3}{7} \end{bmatrix}$$

## 7. Identity Matrix

- The identity matrix, denoted  $I$ , is a square matrix with 1s on the diagonal and 0s elsewhere.
- It acts like 1 in multiplication:

$$AI = IA = A$$

- **Example:**

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

## 8. Rank of a Matrix

- The rank of a matrix is the number of linearly independent rows or columns.
- It provides insight into the dimensionality of the data.

## 9. Trace of a Matrix

- The **trace** of a square matrix is the sum of its diagonal elements.

**Formula:**

$$\text{Tr}(A) = \sum_i A_{ii}$$

**Example:**

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

$$\text{Tr}(A) = 1 + 5 + 9 = 15$$

### Applications of Matrix Operations

1. **Computer Graphics** – Transformations (rotation, scaling, translation).
2. **Engineering & Physics** – Solving linear equations, mechanics, circuit analysis.
3. **Machine Learning & AI** – Representing data, neural networks, optimization.
4. **Economics & Business** – Financial modeling, risk analysis, linear programming.
5. **Cryptography** – Encryption and decryption of messages.

## Regression Analysis

Regression analysis is a **statistical technique** used to model and analyze the relationship between a **dependent variable (target/output)** and one or more **independent variables (predictors/input features)**. It helps in understanding patterns, making predictions, and identifying trends.

### Types of Regression Analysis

Regression can be classified into several types based on the nature of the relationship and the type of dependent variable:

#### 1. Linear Regression

- The simplest form of regression, where the relationship between variables is modeled as a straight line.

- **Equation:**

$$Y = \beta_0 + \beta_1 X + \epsilon$$

- where:
  - Y = Dependent variable
  - X = Independent variable

- $\beta_0$  = Intercept (constant)
- $\beta_1$  = Slope (coefficient)
- $\epsilon$  = Error term (random noise)

**Example:** Predicting house prices based on square footage.

## 2. Multiple Linear Regression

- Extension of simple linear regression with multiple independent variables.
- **Equation:**

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \epsilon$$

Used when multiple factors influence the dependent variable.

**Example:** Predicting salary based on education level, years of experience, and skills.

## 3. Polynomial Regression

- Used when data has a non-linear relationship but can be approximated using polynomial terms.
- **Equation:**

$$Y = \beta_0 + \beta_1 X + \beta_2 X^2 + \beta_3 X^3 + \cdots + \beta_n X^n + \epsilon$$

Converts a curved relationship into a linear model by adding polynomial terms.

**Example:** Modeling population growth or stock price movements.

## 4. Logistic Regression

- Used for **binary classification** problems (0 or 1, True or False).
- Instead of predicting a continuous value, it predicts probabilities.
- **Equation:**

$$P(Y = 1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n)}}$$

- The output is a probability between 0 and 1.

**Example:** Predicting whether an email is spam or not.

## 5. Ridge and Lasso Regression (Regularization)

- Used to handle multicollinearity and overfitting in multiple regression models.

#### Ridge Regression (L2 Regularization)

- Adds a penalty term to shrink coefficients, preventing overfitting.

$$\sum (Y - \hat{Y})^2 + \lambda \sum \beta_j^2$$

#### Lasso Regression (L1 Regularization)

- Can shrink some coefficients to zero, effectively selecting important features.

$$\sum (Y - \hat{Y})^2 + \lambda \sum |\beta_j|$$

### 6. Other Types of Regression

☐ Stepwise Regression (Automatic selection of features)

☐ Time Series Regression (Used in forecasting)

☐ Support Vector Regression (SVR) (Uses margin boundaries for predictions)

☐ Quantile Regression (Estimates conditional median or other quantiles)

☐ Bayesian Regression (Uses probability distribution for parameters)

#### How to Perform Regression Analysis

##### Steps:

1. Collect Data – Identify dependent and independent variables.
2. Visualize Data – Check patterns using scatter plots.
3. Split Data – Divide into training and testing sets.
4. Select Model – Choose the appropriate regression type.
5. Train Model – Fit the regression equation.
6. Evaluate Model – Use metrics like  $R^2$ , RMSE, or MAE.
7. Make Predictions – Use the trained model for forecasting.

#### Evaluating Regression Models

To measure the accuracy of a regression model, we use various metrics:

1.  **$R^2$  (Coefficient of Determination)** – Measures how well independent variables explain the variance in the dependent variable.



$$R^2 = 1 - \frac{\sum(Y - \hat{Y})^2}{\sum(Y - \bar{Y})^2}$$

- Closer to 1 = Better model fit.

2. **Mean Absolute Error (MAE)** – Measures average absolute error.

$$MAE = \frac{1}{n} \sum |Y - \hat{Y}|$$

3. **Mean Squared Error (MSE)** – Penalizes larger errors more than MAE.

$$MSE = \frac{1}{n} \sum (Y - \hat{Y})^2$$

4. **Root Mean Squared Error (RMSE)** – Similar to MSE but in original units.

$$RMSE = \sqrt{MSE}$$

### Applications of Regression Analysis

**Finance** – Predicting stock prices and credit risk.

**Healthcare** – Diagnosing diseases based on medical tests.

**Marketing** – Understanding customer behaviour.

**Engineering** – Quality control in manufacturing.

**Economics** – Forecasting GDP, inflation, and demand.

## RECORDING A MACRO IN ECONOMICS

1. Enable the Developer Tab (if not already enabled):
  - Go to File → Options → Customize Ribbon.
  - Check the Developer box and click OK.
2. Start Recording:
  - Go to Developer → Click Record Macro.
  - Name your macro (avoid spaces).
  - Choose where to store it:
    - This Workbook (macro available only in the current file).

- New Workbook (macro available only in a new file).
  - Personal Macro Workbook (macro available in all Excel files).
  - (Optional) Assign a shortcut key (e.g., Ctrl + Shift + M).
  - Click OK to start recording.
3. Perform the Actions You Want to Automate
- Any keystrokes, formatting changes, or cell selections will be recorded.
4. Stop Recording:
- Go back to Developer → Click Stop Recording.

### **RUNNING A MACRO**

- Press the assigned **shortcut key** (if set).
- OR go to **Developer** → **Macros**, select the macro, and click **Run**.

### **EDITING A MACRO (USING VBA EDITOR)**

1. Open the **VBA Editor**:
- Press Alt + F11 OR go to **Developer** → **Visual Basic**.
2. Find your macro:
- In the left panel (**Project Explorer**), open **Modules** → **Module1**.
  - Double-click the macro to view its code.
3. Edit the VBA Code:
- Modify recorded actions, loops, conditions, or add message boxes.
  - Example of a recorded macro:

```
vba Copy  
  
Sub FormatCells()  
    Range("A1:A10").Font.Bold = True  
    Range("A1:A10").Interior.Color = RGB(255, 255, 0) ' Yellow background  
End Sub
```

- You can edit the range, add loops, or improve efficiency.
4. Save Changes:
- Close the VBA Editor and test the macro by running it again.

## **SAVING A MACRO ENABLED WORKBOOK**

- Save the file as **.xlsm** (Macro-Enabled Workbook) to preserve macros.

## **LOOKUP AND REFERENCE FUNCTIONS**

### **1. LOOKUP Functions**

#### **A. VLOOKUP (Vertical Lookup)**

Searches for a value in the first column of a table and returns a value from another column in the same row.

##### **Syntax:**

=VLOOKUP(lookup\_value, table\_array, col\_index\_num, [range\_lookup])

- **lookup\_value** → The value to search for.
- **table\_array** → The range of data (first column must contain lookup values).
- **col\_index\_num** → The column number from which to return data.
- **range\_lookup** → TRUE (approximate match) or FALSE (exact match).

##### **Example:**

=VLOOKUP(101, A2:C10, 2, FALSE)

Finds **101** in column **A** and returns the corresponding value from column **B**.

#### **B. HLOOKUP (Horizontal Lookup)**

Similar to **VLOOKUP**, but searches in rows instead of columns.

##### **Syntax:**

excel

=HLOOKUP(lookup\_value, table\_array, row\_index\_num, [range\_lookup])

- **row\_index\_num** → The row number from which to return the value.

##### **Example:**

=HLOOKUP(50, A1:D2, 2, FALSE)

Searches for **50** in row **1** and returns the value from row **2**.

#### **C. XLOOKUP (Advanced Lookup, Available in Excel 365 & 2019+)**

More powerful than **VLOOKUP** and **HLOOKUP**, allowing searches both **vertically and horizontally**.

**Syntax:**

=XLOOKUP(lookup\_value, lookup\_array, return\_array, [if\_not\_found], [match\_mode], [search\_mode])

- **lookup\_array** → The range to search in.
- **return\_array** → The range from which to return the value.
- **[if\_not\_found]** → Custom message if no match is found.

**Example:**

=XLOOKUP(101, A2:A10, B2:B10, "Not Found")

Finds **101** in **A2:A10** and returns the value from **B2:B10**.

**D. INDEX & MATCH (Powerful Alternative to VLOOKUP)**

More flexible than **VLOOKUP**, allowing lookups in any column.

**Step 1: INDEX (Find Value at a Position)**

=INDEX(range, row\_num, [column\_num])

- Returns the value from a specified row and column.

**Example:**

=INDEX(A2:C5, 2, 3)

Returns the value from row **2**, column **3**.

**Step 2: MATCH (Find Position of a Value)**

=MATCH(lookup\_value, lookup\_array, match\_type)

- **match\_type**: 0 (exact match), 1 (approximate, sorted ascending), -1 (approximate, sorted descending).

**Example:**

=MATCH(101, A2:A10, 0)

Finds **101** in **A2:A10** and returns its row number.

**Combining INDEX & MATCH**

=INDEX(B2:B10, MATCH(101, A2:A10, 0))

Finds **101** in **A2:A10** and returns the corresponding value from **B2:B10**.

## **2. REFERENCE FUNCTIONS**

### **A. OFFSET (Dynamic Cell Referencing)**

Returns a reference to a range that is offset from a starting cell.

#### **Syntax:**

=OFFSET(reference, rows, cols, [height], [width])

- Moves a specified number of **rows** and **columns** from a starting cell.

#### **Example:**

=OFFSET(A1, 2, 1)

Moves **2 rows down** and **1 column right**, returning **B3**.

### **B. INDIRECT (Convert Text to Cell Reference)**

Allows dynamic referencing of cells using text.

#### **Syntax:**

=INDIRECT(reference\_text, [a1])

- **reference\_text** → A text string representing a cell reference.

#### **Example:**

=INDIRECT("A" & 5)

Returns the value from **A5** dynamically.

### **C. ADDRESS (Get Cell Address)**

Returns the cell address of a given row and column number.

#### **Syntax:**

=ADDRESS(row\_num, column\_num, [abs\_num], [a1], [sheet\_text])

#### **Example:**

=ADDRESS(3, 2)

Returns "\$B\$3".

### **D. ROW & COLUMN (Find Position of a Cell)**

- =ROW(A5) → Returns **5** (row number of A5).

- =COLUMN(B3) → Returns **2** (column number of B3).

### 3. CHOOSING THE RIGHT FUNCTION

Task	Best Function
Find a value in a table (column-wise)	VLOOKUP
Find a value in a table (row-wise)	HLOOKUP
Look up values dynamically	XLOOKUP
Find a value anywhere in a table	INDEX & MATCH
Get a dynamic reference	OFFSET, INDIRECT
Get row/column number	ROW, COLUMN
Get a cell address	ADDRESS

## Discounted Cash Flow (DCF)

Discounted Cash Flow (DCF) is a valuation method used to estimate the present value of expected future cash flows by discounting them using a required rate of return.

**Formula:**

$$DCF = \sum \frac{C_t}{(1 + r)^t}$$

where:

- $C_t$  = Cash flow at time  $t$
- $r$  = Discount rate (cost of capital or required rate of return)
- $t$  = Time period

**Example:**

=NPV(discount\_rate, future\_cash\_flows)

**Application of DCF**

- **Investment Valuation:** Used to determine the intrinsic value of a company or project.
- **Mergers & Acquisitions:** Helps in making buy/sell decisions.
- **Real Estate:** Evaluates the value of property investments.

- **Stock Valuation:** Determines if a stock is overvalued or undervalued.

## Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is the discount rate at which the Net Present Value (NPV) of cash flows becomes zero. It represents the expected annual return of an investment.

**Formula:**

$$0 = \sum \frac{C_t}{(1 + IRR)^t}$$

where:

- $C_t$  = Cash flow at time  $t$
- $t$  = Time period
- $IRR$  = Internal Rate of Return (the discount rate that makes  $NPV = 0$ )

Since IRR doesn't have a direct formula for calculation, it is usually found using an **iterative approach**, such as the Newton-Raphson method.

**Example:**

=IRR(A1:A6)

**Interpreting IRR**

- If  $IRR > \text{Required Rate of Return}$  → Accept the investment.
- If  $IRR < \text{Required Rate of Return}$  → Reject the investment.
- A higher IRR means a more profitable investment.

**Applications of IRR**

- **Capital Budgeting:** Evaluating investment projects.
- **Real Estate:** Assessing property investments.
- **Startup Valuation:** Determining potential ROI for investors.
- **Private Equity & M&A:** Analysing buyout opportunities.



# Net Present Value (NPV)

**Net Present Value (NPV)** is a financial metric that calculates the present value of future cash flows, discounted at a given rate, minus the initial investment. It helps determine whether an investment is profitable.

**Formula:**

$$NPV = \sum \frac{C_t}{(1 + r)^t} - C_0$$

where:

- $C_t$  = Cash inflow at time  $t$
- $C_0$  = Initial investment (cash outflow at  $t = 0$ )
- $r$  = Discount rate (cost of capital)
- $t$  = Time period

**Example:**

=NPV(discount\_rate, future\_cash\_flows) + initial\_investment

**NPV Decision Rule**

- **If NPV > 0** → Accept the investment (profitable)
- **If NPV < 0** → Reject the investment (not profitable)
- **If NPV = 0** → Indifferent (breakeven point)

**Applications of NPV**

- **Investment Decisions:** Evaluating whether a project is worth pursuing.
- **Capital Budgeting:** Comparing multiple projects.
- **Real Estate:** Valuing rental properties.
- **Stock Valuation:** Determining fair value of a company.

**Summary**

- **NPV:** Net present value of future cash flows adjusted for time value of money.
- **IRR:** Discount rate at which NPV = 0.
- **DCF:** Present value of future cash flows.

# Data Tables in Excel

Excel supports **one-variable** and **two-variable** data tables.

## **One-Variable Data Table (Changing Discount Rate)**

A One-Variable Data Table is used to analyze how changing a single input affects an output. It's commonly used in financial modeling to observe how changes in a discount rate, investment amount, or sales growth impact NPV, IRR, or profit.

**Example:** Calculate NPV for different discount rates.

1. List discount rates in one column.
2. In the adjacent column, reference the NPV formula.
3. Select the table range.
4. Go to **Data → What-If Analysis → Data Table**.
5. In **Column Input Cell**, select the discount rate cell.
6. Click OK.

## **Use Cases of One-Variable Data Tables**

- ✓ **NPV Analysis** – Impact of different discount rates.
- ✓ **Loan Analysis** – Impact of interest rate on monthly payments.
- ✓ **Sales Growth Impact** – Effect on revenue projections.

## **Two-Variable Data Table (Changing Discount Rate & Initial Investment)**

A Two-Variable Data Table analyzes how two different inputs affect an output. In finance, it's used to see how changes in discount rate and initial investment impact NPV, or how price and sales volume affect profit.

**Example:** Analyze NPV based on varying discount rates and initial investments.

1. Enter discount rates **horizontally** and investments **vertically**.
2. In the top-left cell, reference the **NPV formula**.
3. Select the table range.
4. Go to **Data → What-If Analysis → Data Table**.
5. In **Row Input Cell**, select the discount rate cell.
6. In **Column Input Cell**, select the initial investment cell.
7. Click OK.

## Use Cases of Two-Variable Data Tables

- ✓ Investment Valuation – NPV changes with different discount rates & investment amounts.
- ✓ Loan Analysis – How interest rate and loan amount affect monthly payments.
- ✓ Pricing Strategy – How price and units sold impact total revenue.

## Database Manipulation in Excel & Python

Database manipulation refers to inserting, updating, deleting, and retrieving data from structured data sources like **Excel tables, SQL databases, or CSV files**.

### 1. Database Manipulation in Excel

Excel can handle databases using **Tables, Power Query, and VBA**.

#### A. Using Excel Tables for Database-Like Operations

##### Creating a Table in Excel

1. Select your data.
2. Press **Ctrl + T** or go to **Insert → Table**.
3. Check "**My table has headers**" and click OK.

##### Sorting & Filtering Data

- **Sort:** Click on the header, then use **Sort A-Z** or **Sort Z-A**.
- **Filter:** Use the dropdown menu in column headers.

##### Using Formulas for Data Manipulation

- **VLOOKUP / XLOOKUP** – Find values in a dataset.
- **INDEX & MATCH** – More flexible lookup.
- **SUMIF / COUNTIF** – Aggregate data based on conditions.

#### B. Power Query for Data Cleaning & Transformation

Power Query is a powerful tool for **importing, transforming, and cleaning data**.

##### Steps to Use Power Query

1. Go to **Data → Get Data → From Excel / CSV / Database**.
2. Use the **Transform Data** option to clean and modify the dataset.
3. Click **Close & Load** to refresh the main table.

## C. Automating Database Manipulation with VBA

```
Sub DeleteRowsWithZero()  
    Dim ws As Worksheet  
    Set ws = ThisWorkbook.Sheets("Sheet1")  
  
    Dim rng As Range  
    Set rng = ws.Range("A1:A100") ' Define range  
  
    Dim cell As Range  
    For Each cell In rng  
        If cell.Value = 0 Then  
            cell.EntireRow.Delete  
        End If  
    Next cell  
End Sub
```

- ◆ **Use case:** This script removes rows where column **A** has a value of **0**.

### Use Cases of Database Manipulation

- ✓ **Business Reports** – Extract, clean, and analyze sales data.
- ✓ **Data Cleaning** – Remove duplicates, correct errors.
- ✓ **Automation** – Automate repetitive tasks in databases.
- ✓ **Merging Data** – Combine multiple datasets.

## Workbook Sharing and Merging, and Customizing Toolbars & Menus in Excel

### 1. Workbook Sharing & Merging

#### A. Sharing a Workbook in Excel

Sharing a workbook allows multiple users to **collaborate** on the same file simultaneously.

#### Steps to Share a Workbook (Excel 365 & Excel 2019)

1. **Open the workbook** you want to share.
2. Click on **File → Share**.
3. Select **OneDrive** (if not already saved to the cloud).
4. Click **Share with People**.
5. Enter email addresses and set permissions (**Can Edit** or **Can View**).
6. Click **Send**.

#### B. Merging Shared Workbooks

When multiple users edit separate copies of the same workbook, **merging** helps combine the changes.

### Steps to Merge Workbooks

1. **Enable Sharing:**
  - Go to **Review → Share Workbook**.
  - Ensure "Allow changes by more than one user" is checked.
2. **Track Changes:**
  - Enable tracking via **Review → Track Changes → Highlight Changes**.
3. **Merge Workbooks:**
  - Click **Compare and Merge Workbooks** (under Review).
  - Select the modified workbook to merge changes.
  - Click **OK**.

## 2. Customizing Toolbars & Menus

You can **customize** Excel's interface by modifying the **Quick Access Toolbar** and the **Ribbon**.

### A. Customizing the Quick Access Toolbar

1. Click the **dropdown arrow** on the **Quick Access Toolbar** (top-left).
2. Select **More Commands**.
3. Choose from:
  - **Popular Commands**
  - **All Commands**
  - **Macros**
4. Click **Add** to move them to the toolbar.
5. Click **OK**.

### B. Customizing the Ribbon (Menu Tabs)

1. Go to **File → Options → Customize Ribbon**.
2. Under **Customize the Ribbon**, click **New Tab** or select an existing one.
3. Add or remove commands using the **Add >>** button.
4. Click **OK**.

### C. Resetting Toolbars & Menus

- **Quick Access Toolbar** → File → Options → Quick Access Toolbar → Reset.
- **Ribbon Customizations** → File → Options → Customize Ribbon → Reset.

## User-Defined Functions, Matrix Operations in Excel, and Auditing Tools

### 1. User-Defined Functions (UDFs) in Excel

UDFs allow users to create **custom functions** using **VBA (Visual Basic for Applications)** when built-in functions are not sufficient.

### A. Creating a User-Defined Function in VBA

1. Open Excel and press **Alt + F11** to open the **VBA Editor**.
2. Click **Insert → Module**.
3. Enter your function code.
4. Save and use it like a built-in function.

### Example: Custom Function to Calculate Compound Interest

```
Function CompoundInterest(P As Double, r As Double, n As Integer) As Double
    CompoundInterest = P * (1 + r) ^ n
End Function
```

#### Usage in Excel:

=CompoundInterest(1000, 0.05, 5) → Returns the future value of an investment.

## 2. Matrix Operations in Excel

Excel supports **matrix calculations** using **array formulas** and the **MMULT** function.

### A. Multiplication of Two Matrices

Given:

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

To multiply matrices **A × B**:

1. Select a **2×2 range**.
2. Type =MMULT(A1:B2, D1:E2).
3. Press **Ctrl + Shift + Enter** (for older Excel) or **Enter** (for Excel 365).

### B. Other Matrix Functions in Excel

Function	Description
MMULT(A, B)	Matrix multiplication
MINVERSE(A)	Matrix inverse
MDETERM(A)	Matrix determinant
TRANSPOSE(A)	Matrix transpose

### 3. Auditing Tools in Excel

Excel provides built-in tools to **trace formulas, check errors, and debug spreadsheets.**

#### A. Formula Auditing Tools (Located in the Formulas Tab)

Tool	Description
<b>Trace Precedents</b>	Shows which cells affect the selected formula.
<b>Trace Dependents</b>	Shows which cells are affected by the selected formula.
<b>Error Checking</b>	Detects formula errors in the worksheet.
<b>Evaluate Formula</b>	Steps through a formula to understand calculations.
<b>Watch Window</b>	Monitors important cells while working in other areas.

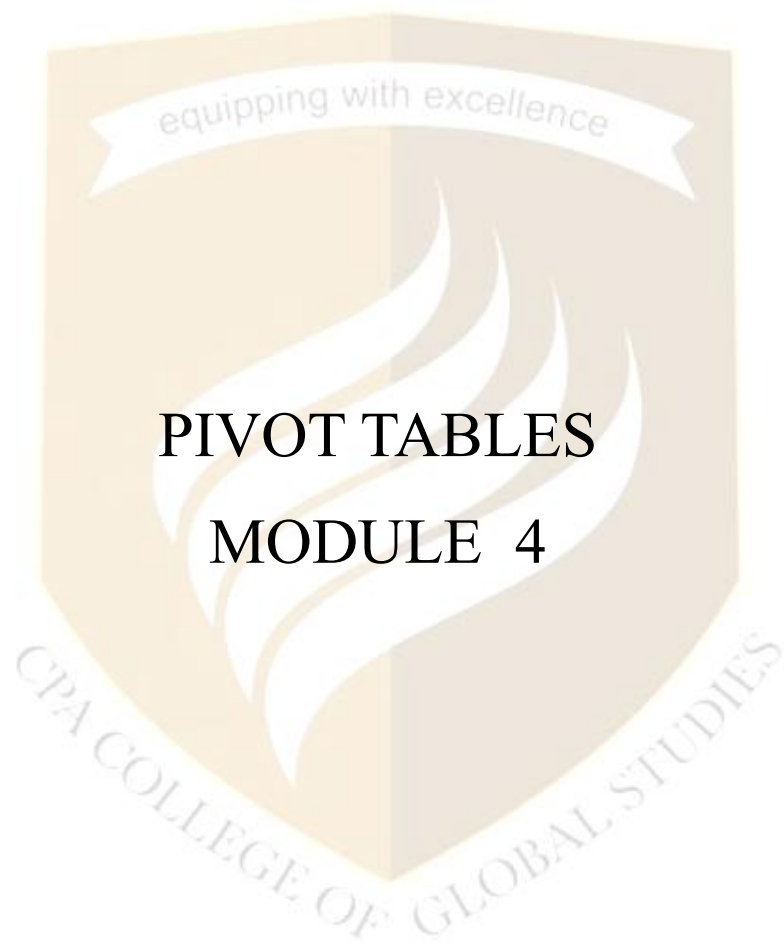
#### B. Example: Using Formula Auditing

1. Click on a cell with a formula.
2. Go to **Formulas → Trace Precedents** to see input cells.
3. Use **Trace Dependents** to see which formulas use this cell.
4. Click **Evaluate Formula** to see step-by-step calculations.

#### Use Cases

- ✅ **UDFs** – Custom financial models, advanced calculations.
- ✅ **Matrix Operations** – Engineering, economics, and data analysis.
- ✅ **Auditing Tools** – Debugging complex spreadsheets.





# PIVOT TABLES

## MODULE 4

# **Pivot tables**

- Pivot tables are powerful data analysis tools used in spreadsheet modeling to summarize, analyze, and visualize large datasets efficiently
- They help businesses make informed decisions by extracting meaningful insights from raw data.

## **Key Features of Pivot Tables in Business Modeling:**

1. **Data Summarization:** Pivot tables can group, filter, and summarize data using functions like sum, average, count, and percentage.
2. **Dynamic Reporting:** Users can easily change views, rearrange fields, and drill down into details without modifying the original dataset.
3. **Comparative Analysis:** Businesses can compare sales performance, financial trends, and customer behaviors across different periods or categories.
4. **Decision-Making Support:** By identifying patterns and trends, pivot tables assist in forecasting and strategic planning.
5. **Customization & Visualization:** Users can create charts and graphs directly from pivot tables for better data presentation.

## **Common Business Applications:**

- **Sales Analysis:** Comparing revenue by region, product, or salesperson.
- **Financial Reporting:** Summarizing expenses and profits over different time frames.
- **Inventory Management:** Tracking stock levels and identifying fast-moving products.
- **Customer Segmentation:** Analyzing purchasing behavior based on demographics.

## **Slicers and Report Filters in Spreadsheet Modeling for Business**

Slicers and report filters in Excel are essential tools for refining and analyzing data in spreadsheet modeling. They enhance basic analytics, contact management, and marketing strategies by allowing users to interact with data dynamically.

### **1. Slicers for Basic Analytics & Business Insights**

Slicers provide an intuitive way to filter data visually, especially when working with pivot tables and charts. They help businesses analyze trends and performance metrics efficiently.

- **Quick Filtering:** Users can click on buttons to filter data instantly.
- **Multi-Level Analysis:** Multiple slicers can be used to filter data across different categories (e.g., sales by region, product, or salesperson).

- **Improved Data Visualization:** Slicers make reports more interactive and easier to interpret.

## 2. Report Filters for Contact Management

In business contact management, Excel's report filters allow users to segment and organize customer data effectively.

- **Customer Segmentation:** Filter contacts based on location, purchase history, or engagement level.
- **Data Customization:** Adjust views to display only relevant contacts for specific campaigns or follow-ups.
- **Streamlined Communication:** Use filtered lists for targeted emails or customer outreach.

## 3. Marketing Analytics with Slicers & Filters

Slicers and report filters play a crucial role in marketing decision-making by refining data insights.

- **Campaign Performance Analysis:** Filter marketing data based on region, channel, or campaign type.
- **Customer Behavior Insights:** Identify top-performing products, customer preferences, and seasonal trends.
- **Targeted Marketing Strategies:** Use segmented data to optimize promotions and customer engagement.

# Using Pivot Tables for Managing Customers, Vendors, and Employees & Gaining Product and Service Insights

Pivot tables in Excel are essential tools in spreadsheet modeling for businesses, helping to organize and analyze large datasets efficiently. They are particularly useful in managing customer relationships, vendor transactions, employee data, and gaining insights into products and services.

## 1. Managing Customers

- **Customer Segmentation:** Analyze customer demographics, purchase history, and preferences.

- **Sales Performance Tracking:** Identify top buyers, repeat customers, and high-value transactions.
- **Customer Support Insights:** Track complaint resolution times and customer satisfaction trends.

## 2. Managing Vendors

- **Vendor Performance Analysis:** Monitor order fulfilment times, product quality, and consistency.
- **Cost Optimization:** Compare pricing trends across different vendors.
- **Purchase Order Tracking:** Summarize expenses, order frequency, and supply chain efficiency.

## 3. Managing Employees

- **HR Analytics:** Analyze attendance, performance ratings, and payroll distribution.
  - **Productivity Tracking:** Identify high-performing employees and areas needing improvement.
  - **Training & Development Insights:** Assess training needs based on performance trends.
- ## 4. Gaining Product & Service Insights
- **Sales Trends & Profitability:** Analyze product-wise revenue, profit margins, and demand fluctuations.
  - **Inventory Management:** Identify fast-moving and slow-moving products.
  - **Customer Preferences:** Understand which services or products are most popular among different customer segments.

## Pivot Tables for Sales Reports in Excel

Pivot tables in Excel are powerful tools for creating dynamic and insightful sales reports as part of spreadsheet modeling for business. They help businesses analyze large sales datasets efficiently, track performance, and make data-driven decisions.

### Key Uses of Pivot Tables in Sales Reporting:

1. **Sales Performance Analysis:**
  - Summarize total sales by product, region, or salesperson.
  - Identify top-performing products and services.
2. **Trend Analysis & Forecasting:**

- Compare sales over different time periods (daily, monthly, yearly).
- Identify seasonal trends and demand patterns.
- 3. Customer & Market Insights:**
  - Segment customers based on purchase history and buying behavior.
  - Analyze revenue contributions from different customer categories.
- 4. Profitability & Revenue Tracking:**
  - Calculate profit margins and total revenue across different products.
  - Identify underperforming areas to optimize pricing strategies.
- 5. Customizable & Interactive Reports:**
  - Use filters and slicers to refine data views.
  - Generate visual charts and graphs for better decision-making.

### **Pivot Tables for Supervising Sales & Preparing Invoices in Excel**

Pivot tables in Excel are essential for supervising sales performance and streamlining invoice preparation as part of spreadsheet modeling for business. They help businesses track, analyze, and manage sales data efficiently.

#### **1. Supervising Sales with Pivot Tables**

- **Sales Performance Monitoring:** Analyze total sales by region, product, or salesperson.
- **Revenue Trends & Forecasting:** Track sales growth, seasonal trends, and demand fluctuations.
- **Customer Insights:** Identify top customers, buying patterns, and purchase frequency.
- **Inventory & Order Tracking:** Monitor stock levels and ensure timely order fulfillment.

#### **2. Preparing Invoices Using Excel Pivot Tables**

- **Automating Invoice Details:** Extract and summarize customer purchase data for quick invoicing.
- **Sales Tax & Discounts Calculation:** Generate accurate totals, including taxes, discounts, and final prices.
- **Filtering & Sorting Data:** Easily retrieve customer-specific invoice details using filters.
- **Invoice Summary Reports:** Create reports on pending, paid, or overdue invoices for better financial tracking.

