

# Practical and Project Work

## LEARNING OUTCOMES

After completion of the unit the students will be able to:

- ❖ Plot the different graphs of functions on Excel.
- ❖ Learn different operations performed on the matrix.
- ❖ Learn how to perform simulation.
- ❖ Comprehend practical applications of demand and supply associated with economics.
- ❖ Understand the meaning of Data Analysis and Data Visualization.
- ❖ Apply Analytical Methods for business decision-making.
- ❖ Analyse different data and develop meaningful inferences for decision-making.

## Practical and Project Work

### Assessment Plan

1. Overall Assessment of the course is out of 100 marks.
2. The assessment plan consists of an External Exam and Internal Assessment.
3. External Exam will be of 03 hour duration Pen/Paper Test consisting of 80 marks.
4. The weightage of the Internal Assessment is 20 marks. Internal Assessment can be a combination of activities spread throughout the semester/academic year. Internal Assessment activities include projects and excel based practicals. Teachers can choose activities from the suggested list of practicals or they can plan activities of a similar nature. For data-based practical, teachers are encouraged to use data from local sources to make it more relevant for students.
5. Weightage for each area of internal assessment may be as under:

Sl. No.	Area and Weightage	Assessment Area	Marks allocated
1.	Project work (10 marks)	Project work and record Year-end Presentation/ Viva of the Project	5 5
2.	Practical work (10 marks)	Performance of practical and record Year-end test of anyone practical	5 5
	Total	20	

## **Practical: Use of spreadsheet**

### **Learning Outcomes**

**Students shall be able to:**

- Draw graph of an exponential function
- Comprehend Demand and supply functions on Excel
- Study the nature of function at various points
- perform Matrix operations using Excel

Suggested practical using the spreadsheet

- Plot the graphs of functions on excel and study the graph to find out the point of maxima/minima
- Probability and dice roll simulation
- Matrix multiplication and the inverse of a matrix
- Stock Market data sheet on excel
- Collect the data on weather, price, inflation or pollution. Analyse the data and make meaningful inferences
- Collect relevant data from newspaper on traffic, sports, stock markets and use excel to study future trends

### **About Project Work**

Some suggested project works are given below (according to the syllabus). For more details, you can refer to the syllabus. The project work would be conducted individually or in a group (3 to 4 students). Students select the topic related to the practical implementation of mathematics in different domains. Project work includes Data analysis, predicting market trends for better decision making, making inferences based on collected data, do simulations, and find out different best solutions to real-time problems. You can collect the data sets of various domains from different platforms like Kaggle, <https://www.kaggle.com> (world's largest data science community), Google Public Datasets, Amazon Web Services (AWS) datasets, and many more for data analysis and make better decision making. Students may also work on various projects based on the prediction of future sales, stock market, air pollution, COVID-19 outbreak etc.

Evaluation of each project should be based on the learning outcomes and practical implementation of its results. The objective of the project should be clear to every student. Different approaches for solving the problem and get the best and optimized solution to it. Teachers should guide the students in making their projects successful.

### **List of Suggested Projects (Class XII)**

1. COVID-19 Data Analysis, pre-process and merge datasets to calculate needed measures and prepare them for an Analysis. In this, you can work with the COVID19 dataset, published by John Hopkins University, which consists of the data related to the cumulative number of confirmed cases, per day, in each Country.
2. Earthquake prediction using past data.
3. The Project Manager uses cost trend analysis to identify project budget under and overruns and to solve many budget issues. One of the responsibilities of a project manager is to manage the project budget. This covers, estimating the initial budget (in most cases or at least reviewing),

creating a monthly budget plan, tracking progress (actual)spend , and then re-forecasting the budget required (known as the estimate to complete – ETC).

The objective of conducting this analysis is to identify where a project will under or overrun the budget. While a project manager should be completing budget reviews and re-forecasts regularly. So the data needed for this is:

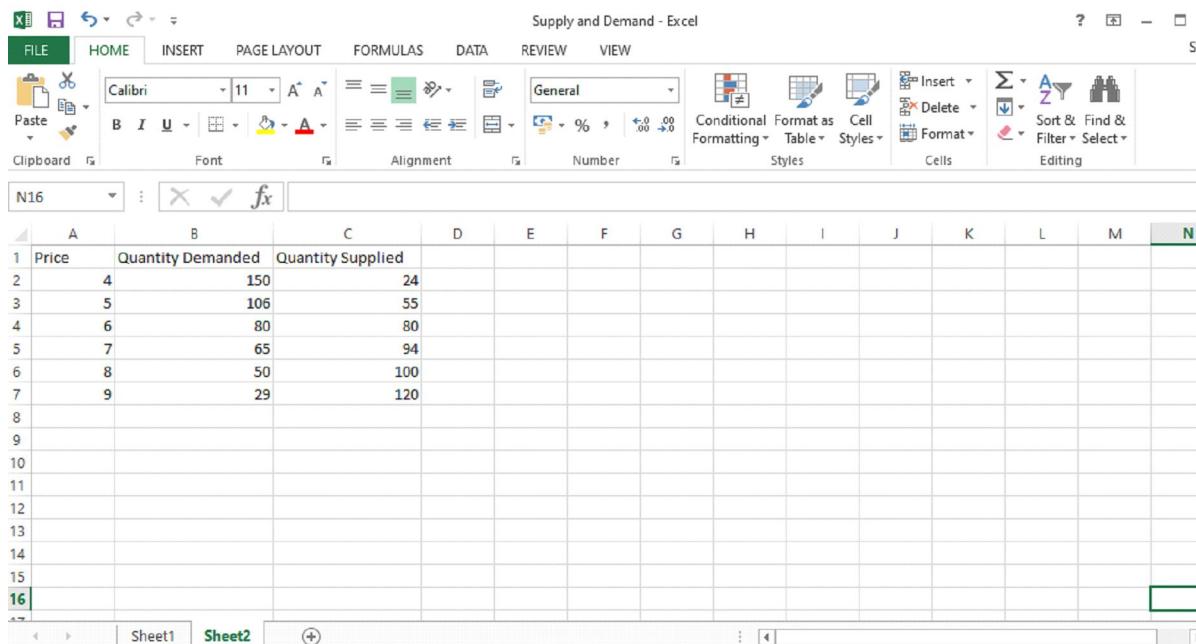
- List of projects
  - Budget for each project
  - Previous months Year to Date (YTD) Actuals for each project
  - Current months YTD Actuals for each project
  - Estimate to Complete (ETC) for each project
  - This data should be produced by the project monthly so hopefully should not present an issue.
4. Another popular one is to obtain product and pricing data from e-commerce sites for Data Analysis and decision making. For instance, extract product information about Bluetooth speakers on Amazon, or collect reviews and prices on various tablets and laptops. This means you can start with a product that has a small number of reviews, and then start analysing with previous feedbacks, reviews on that particular product, and upscale according to the parameters you could choose for better sales.
  5. Global Suicide Rates Analysis by taking the dataset from Kaggle (<https://www.kaggle.com/russellyates88/suicide-rates-overview-1985-to-2016>), it covers suicide rates in various countries, with additional data including year, gender, age, population, GDP, and more. When carrying out your EDA (Exploratory Data Analysis), ask yourself: What patterns can you see? Are suicide rates climbing or falling in various countries? What variables (such as gender or age) can you find that might correlate to suicide rates?
  6. Most Followed on Instagram: Whether you're interested in social media, or celebrity and brand culture, this dataset of most-followed people on Instagram <https://data.world/socialmediadata/most-followed-on-instagram> has great potential for visualization. You could create an interactive bar chart that tracks changes in the most followed accounts over time. Or you could explore whether brand or celebrity accounts are more effective at influencer marketing. Otherwise, why not find another social media dataset to create a visualization?
  7. Superstore Sales Forecasting Data: Areas such as product placement, inventory management, and customization of offers, are sought to improve constantly through the application of data science. Collect the data of various stores and on basis of historical data predict the sales. The goal is to predict the department-wise sales of each store using the historical data spanning across 143 weeks.
  8. Forecasting Uber/ Rapido Demands

## Demand and Supply functions on Excel

A spreadsheet provides various types of charts to display demand and supply information. Different types of charts are available to use but it depends on what kind of analysis you are going to perform. If the data requires finding the equilibrium for supply and demand, a line graph provides the best results as well as visualization but if you want to show the variations between supply and demand, a column chart is more suitable.

For creating different charts on supply and demand, the steps are as follows:

1. Open a new spreadsheet, add the data in the different columns as in the image shown below i.e. price, quantity demanded and quantity supplied.



The screenshot shows a Microsoft Excel spreadsheet titled "Supply and Demand - Excel". The data is organized into three columns: "Price" (A1:A7), "Quantity Demanded" (B1:B7), and "Quantity Supplied" (C1:C7). The rows from 1 to 7 contain the following values: (4, 150, 24), (5, 106, 55), (6, 80, 80), (7, 65, 94), (8, 50, 100), (9, 29, 120). The "Quantity Demanded" and "Quantity Supplied" columns are bolded. The "Price" column is aligned to the right. The "Quantity Demanded" and "Quantity Supplied" columns are aligned to the left. The "Price" column has a wider width than the other two. The "Quantity Demanded" and "Quantity Supplied" columns have a narrower width than the "Price" column. The "Price" column is the primary key for the data, with "Quantity Demanded" and "Quantity Supplied" being dependent variables.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Price	Quantity Demanded	Quantity Supplied										
2	4	150	24										
3	5	106	55										
4	6	80	80										
5	7	65	94										
6	8	50	100										
7	9	29	120										
8													
9													
10													
11													
12													
13													
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15													
16													

Fig 1: Supply and Demand Data

2. Select columns of price, quantity demanded, and quantity supplied and click on the Insert Tab, choose line chart from chart group.

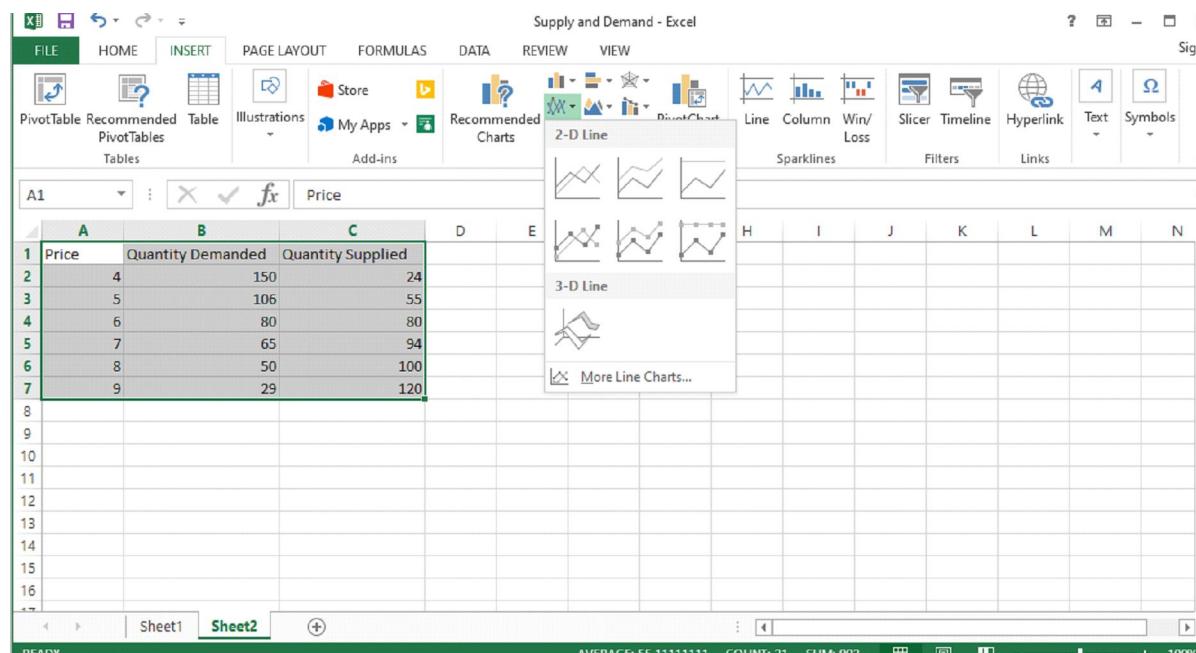


Fig 2: Line Chart

3. After choosing a line chart, it will appear with the mentioned data values on the x-axis and y-axis with different colors. By default, the price would be at x-axis.

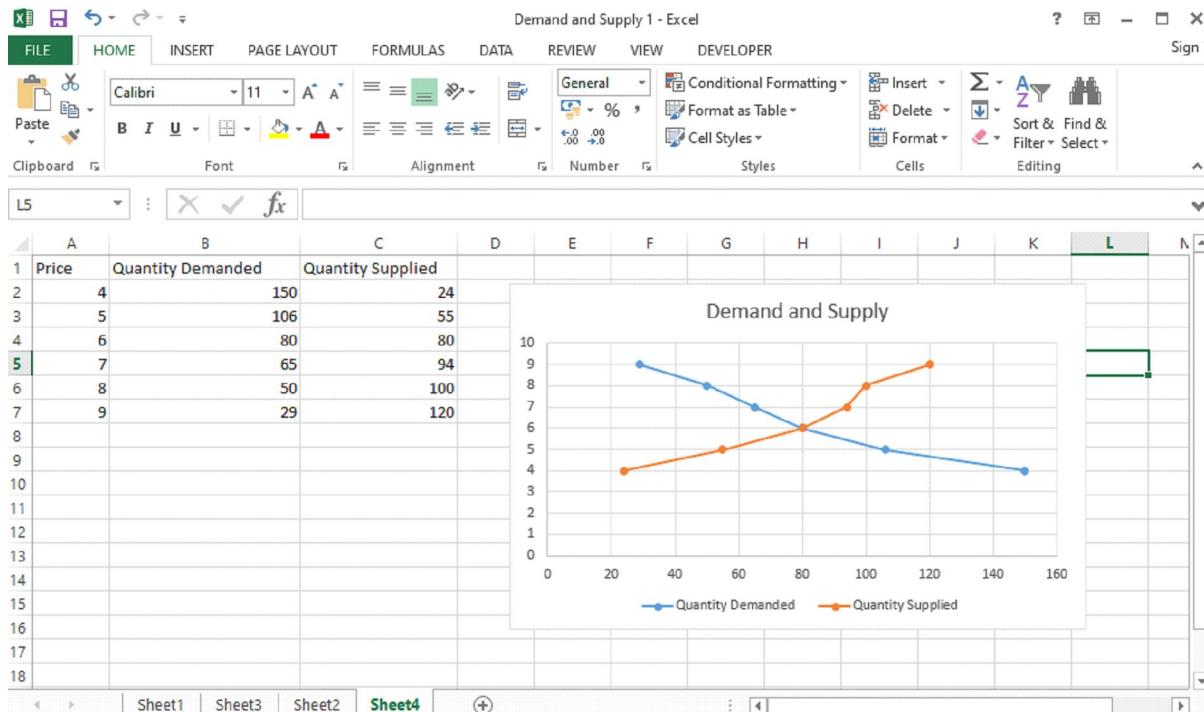


Fig 3: Supply and Demand Line Chart

With the same data, you can also visualize the data by using a scatter plot. The scatter chart is shown below. The supply and demand curve will intersect at a point which is your equilibrium point and it is visible in both the charts.

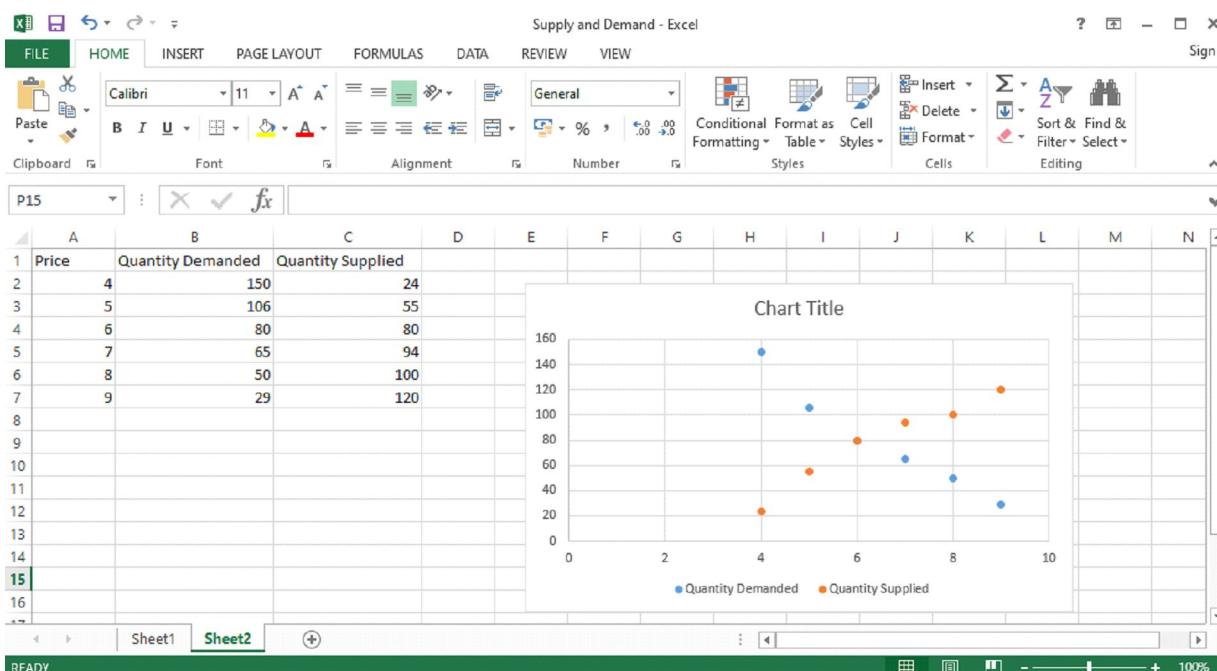


Fig 4: Supply and Demand Scatter Chart

## Matrix multiplication

Before going to matrix multiplication we need to know about the basics of the matrix, what is the matrix? A matrix is an arrangement of numbers in rows and columns.

For example, Matrix A has two rows and two columns

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

1. In Microsoft Excel, the MMULT function is used for multiplying any two matrices. So let's take two matrices 3x3 matrix A and matrix B as shown in the given figure below.

The screenshot shows a Microsoft Excel spreadsheet with the following details:

- Worksheet:** Matrix
- Cells A1 to A4:** Matrix A (3x3)
- Cells G1 to G4:** Matrix B (3x3)
- Cell C5:** AxB
- Cell C16:** Formula bar shows =MMULT(
- Font and Number groups:** Calibri, 11, General
- Cells H1 to I3:** Results of the multiplication: 2, 3, 5; 2, 6, 7; 1, 2, 8

Fig: 5: Two 3x3 Matrices A and B

2. For multiplication of two matrices A and B, the number of columns in the first matrix must be equal to the number of rows in the second matrix. After selecting the cells 3x3 and write down the MMULT () function in the given cell . You can see in the below figure once you write the MMULT function it asks for array 1 and array2.

The screenshot shows a Microsoft Excel spreadsheet with the following details:

- Worksheet:** Matrix
- Cells A1 to A4:** Matrix A (3x3)
- Cells G1 to G4:** Matrix B (3x3)
- Cell C5:** AxB
- Cell C5:** Formula bar shows =MMULT(
- Cell C5:** Formula bar shows =MMULT(array1, array2)
- Font and Number groups:** Calibri, 11, General

Fig 6: MMULT () function

So Array 1 is the first matrix and Array 2 is the second matrix. After opening the bracket of the MMULT function select the cells of Matrix A (A2:C4), as well as Matrix B (G2:I4) separated with comma as given the fig 7 and 8.

The screenshot shows an Excel spreadsheet with two matrices defined. Matrix A is a 3x3 matrix located in cells A2:C4, with values [1, 2, 4], [3, 2, 8], and [2, 4, 9]. Matrix B is a 3x3 matrix located in cells G2:I4, with values [2, 3, 5], [2, 6, 7], and [1, 2, 8]. The formula bar shows the formula =MMULT(A2:C4, G2:I4). The cells A2:C4 and G2:I4 are highlighted with dashed green borders, indicating they are selected for the function arguments.

Fig 7: Array 1(Matrix A)

This screenshot is identical to Fig 7, showing the same matrices A and B defined in cells A2:C4 and G2:I4 respectively. The formula bar shows the formula =MMULT(A2:C4, G2:I4). The cells A2:C4 and G2:I4 are highlighted with dashed red borders, indicating they are selected for the function arguments.

Fig 8: Array 2(Matrix B)

3. While calculating the result, key Combination Ctrl+Shift+Enter should be used and you will get the desired output. As you can see in fig 9.

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*Note: Do Not Press Enter Alone, Pressing enter alone will only show one value instead of a matrix.*

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Fig 9: Matrix Multiplication using MMULT ( ) Function

## Finding the Inverse matrix using MS Excel

- For calculating the inverse of a given matrix, the MINVERSE function is used. First, create the matrix A (3x3) given below in fig 10. Enter the values in rows and columns.

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Fig 10: 3x3 Matrix

- Once you create the matrix, then write the MINVERSE in the highlighted cell in which where you want to place the resulting matrix . For the array, select the Matrix A cells (B2:D4). As you can see in the below-given image fig:11.

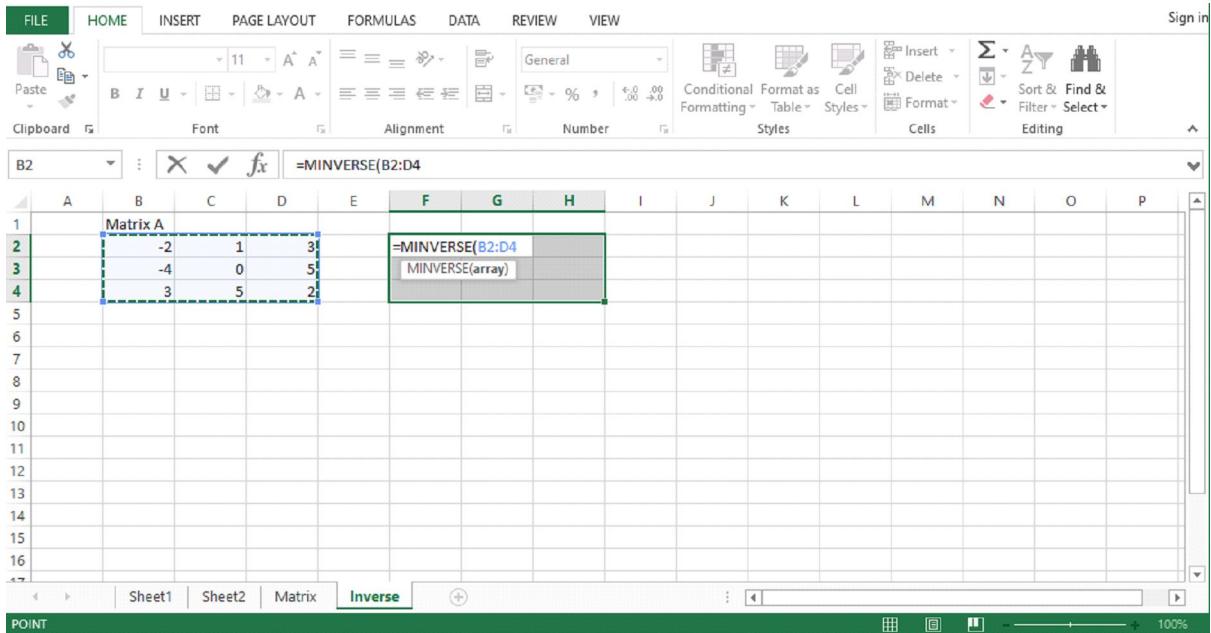


Fig 11: MINVERSE Function

- While calculating the result, key Combination **Ctrl+Shift+Enter** should be used and you will get the desired output. As you can see in fig 12.

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*Note: Do Not Press Enter Alone, Pressing enter alone will only show one value instead of a matrix.*

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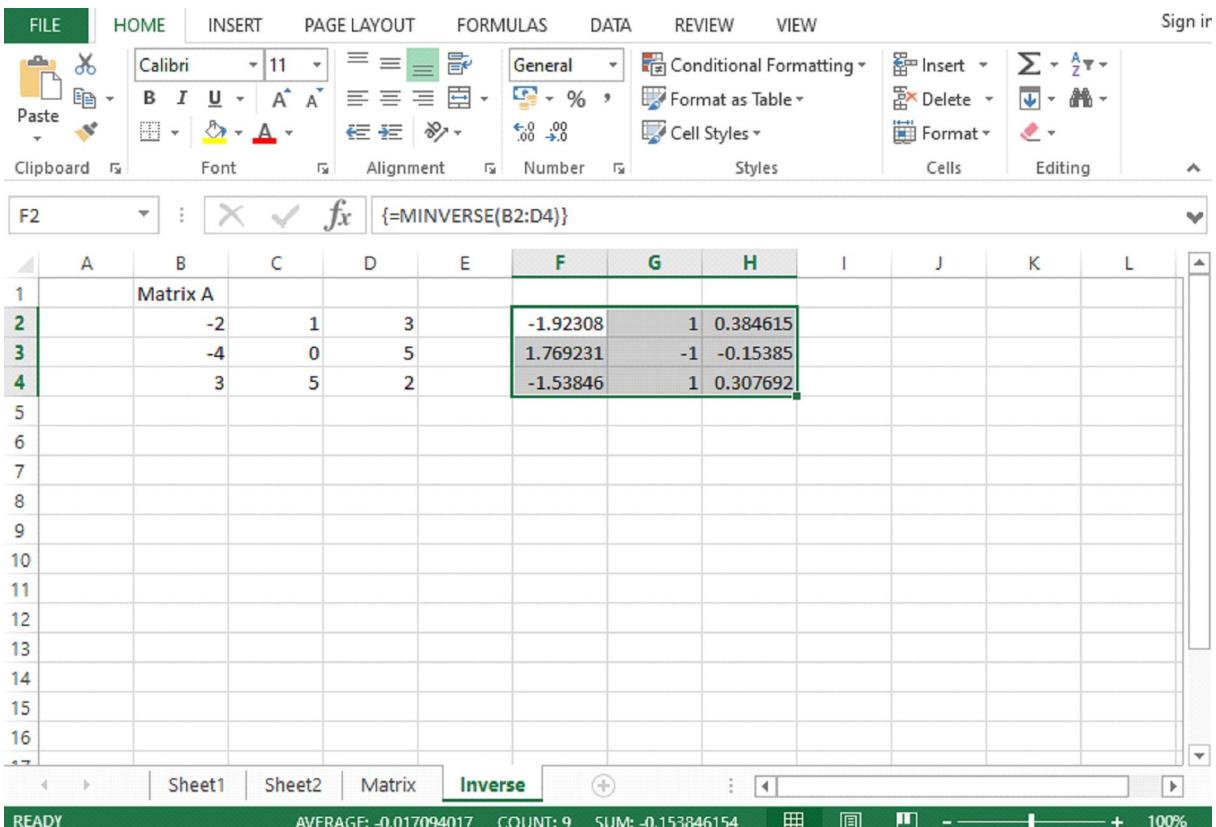


Fig 12: Inverse of Matrix

## How to Calculate Probability Using MS Excel?

Probability is the branch of mathematics and it is defined as the likelihood for which an event is probable, or likely to happen. MS Excel has built-in function PROB for calculating the probability. PROB function is classified under the MS Excel statistical functions. The function of probability worked in different domains like in business, sports, in financial analysis for estimating the long term business losses and gain.

Formula :

=PROB (x\_range, prob\_range, [lower\_limit],[upper\_limit])

- range – the range of numeric values containing our data
- prob range – the range of probabilities for each corresponding value in our range
- lower\_limit –the lower limit of the values for which we want to calculate the probability
- upper\_limit –the upper limit of the values for which we want to calculate the probability

Let's take an example to understand the usage of the built-in function PROB for calculating the probability.

The Below table contains grades and their corresponding probabilities. Here we set the lower limit to 50 and the upper limit to 80.

The screenshot shows a Microsoft Excel spreadsheet with the following data:

A	B
Grades	Probability of getting each grade
50	0.5
60	0.1
70	0.25
80	0.1
90	0.04
100	0.01

Fig 13: Table for Grades

1. After entering the data in the table we write the PROB function in the formula bar along with the arguments. Select the cell (A2:A7) for grades and B2:B7 for corresponding probabilities with lower limit 50 and upper limit 80.

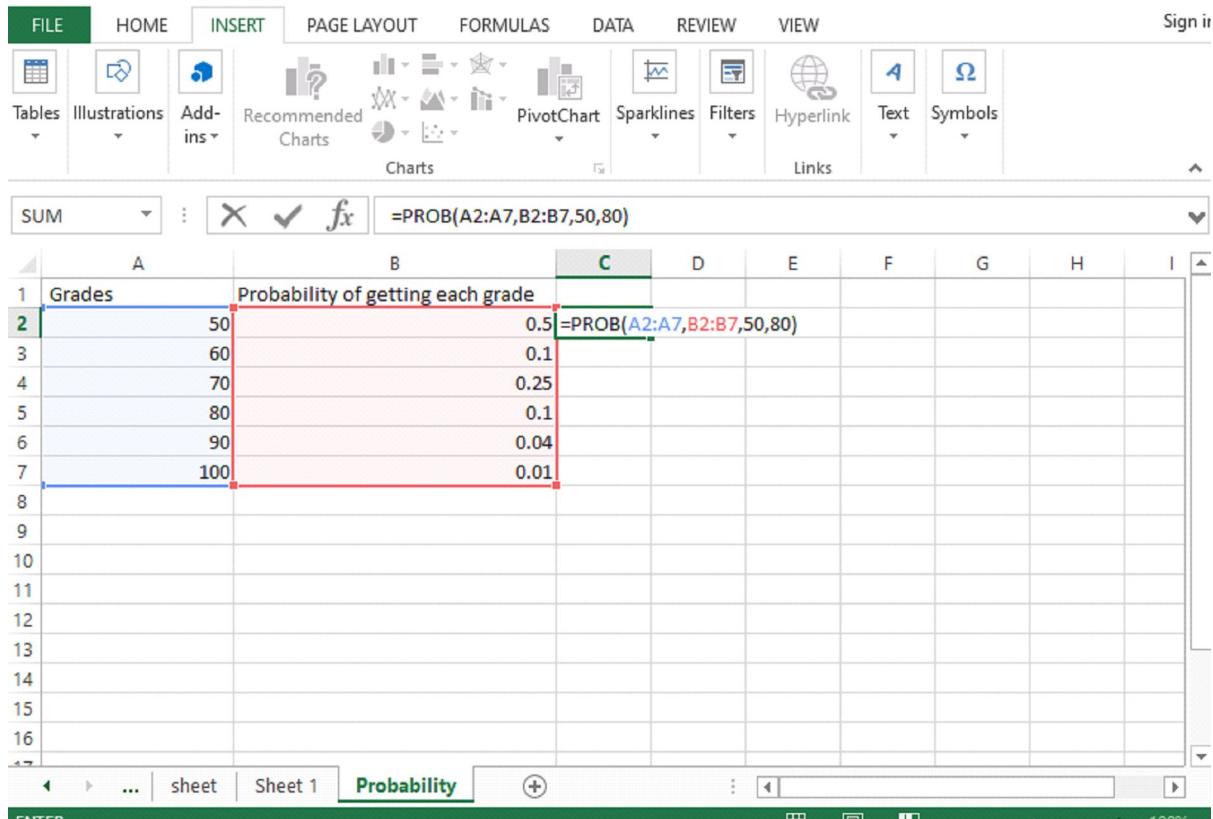


Fig 14: PROB function

- After applying the formula you will get the resultant in desired cell i.e.C2 cell 0.95.

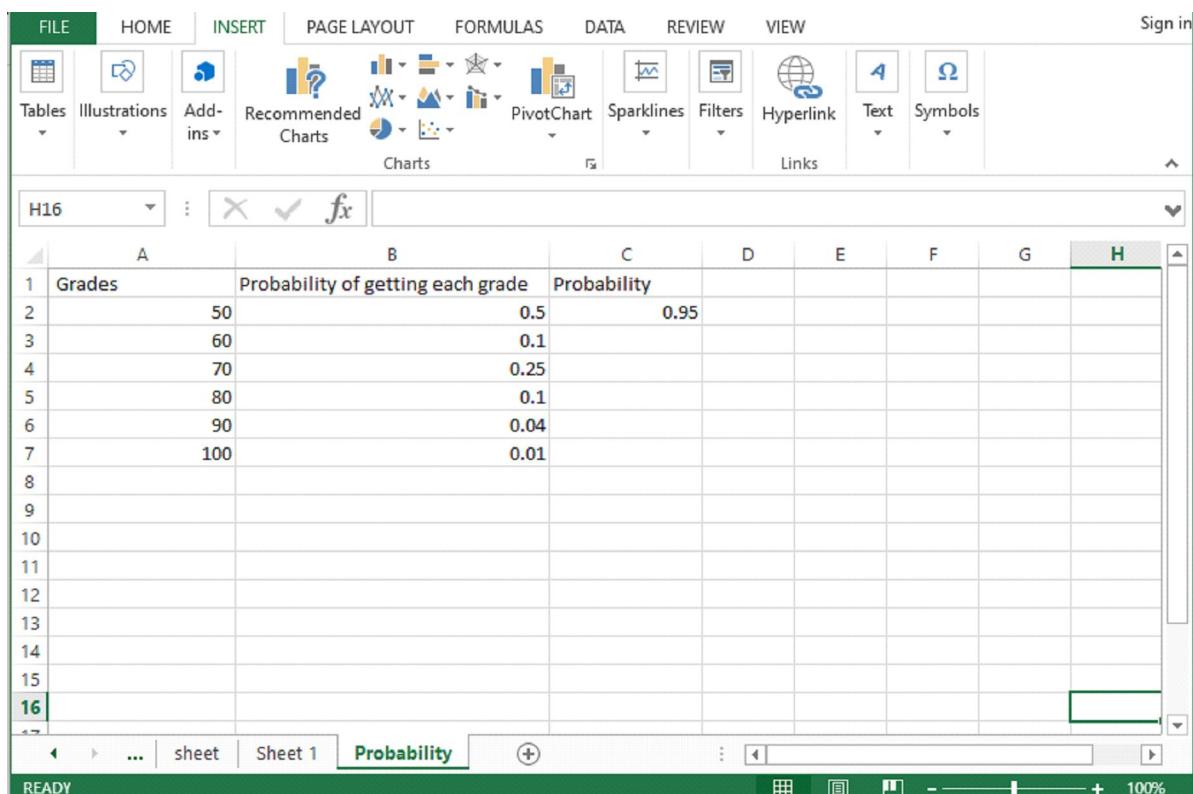


Fig 15: Result

## Dice roll simulation

The given example shows you how to simulate the dice roll in MS Excel. Following are the steps to follow which is given below:

1. The first is to choose the dice, for this go to the INSERT tab and click on the Symbols and select the Segoe UI symbol as shown in fig 16.

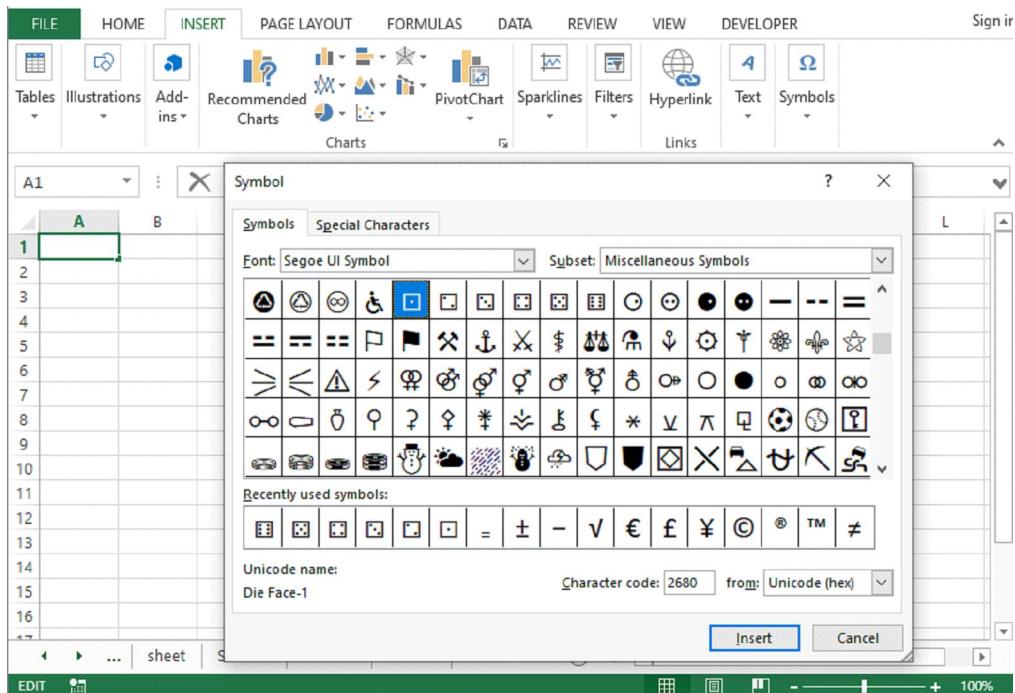


Fig 16: Dice Selection

2. After selecting the Segoe UI Symbol, select the dices from 1 to 6 in column B.

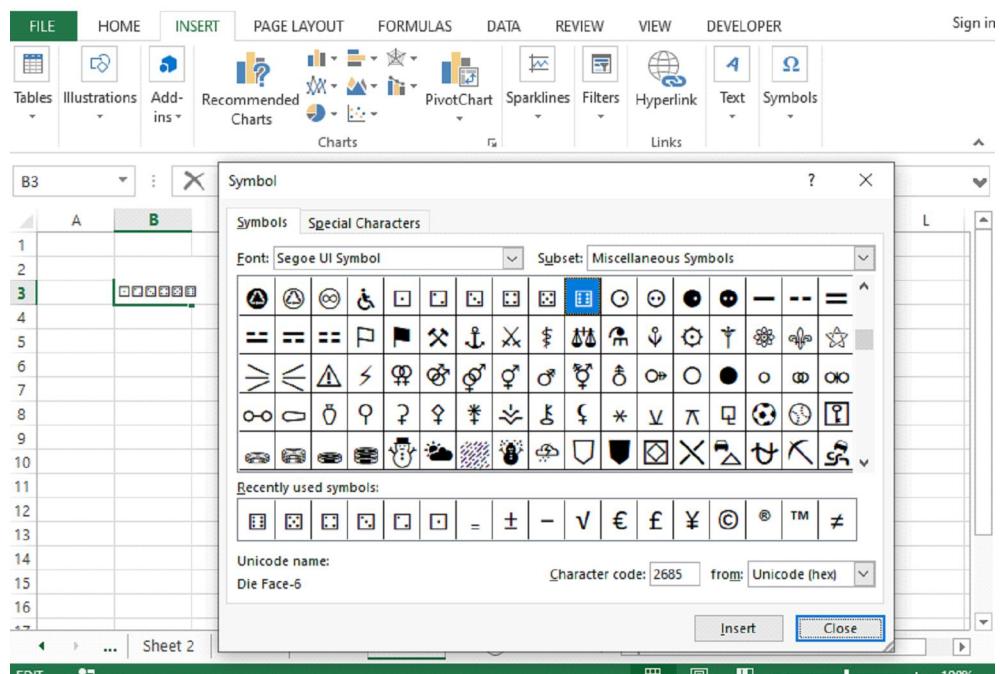


Fig 17: Dices

3. Put each dice on the single-cell by selecting the one dice Ctrl+X and paste it in another cell along with numbering 1 to 6 as shown in fig 18.

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2												
3		1										
4		2										
5		3										
6		4										
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												

Fig 18: Copying of Dices in individual cell

4. The Next step is to generate the random number between 1 and 6 just similar to the roll of dice by using built-in function RANDBETWEEN. By applying this function, you have to enter the bottom and top values.

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2												
3		1		=RANDBETWEEN()								
4		2		RANDBETWEEN(bottom, top)								
5		3										
6		4										
7		5										
8		6										
9												
10												
11												
12												
13												
14												
15												
16												

Fig 19: RANDBETWEEN Function

5. Put the 1 as the bottom value and 6 top value and enter it. Any random number would be generated as you can see in Fig 21.

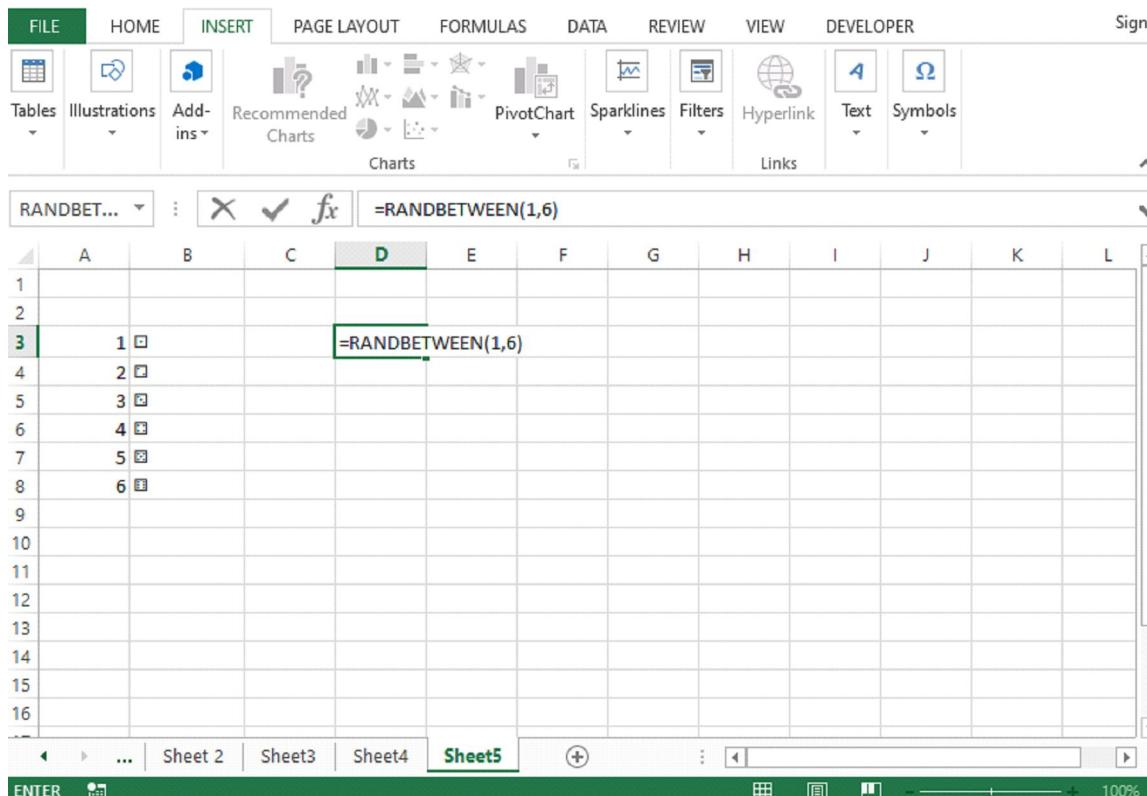


Fig 20: Top and Bottom value of RANDBETWEEN Function

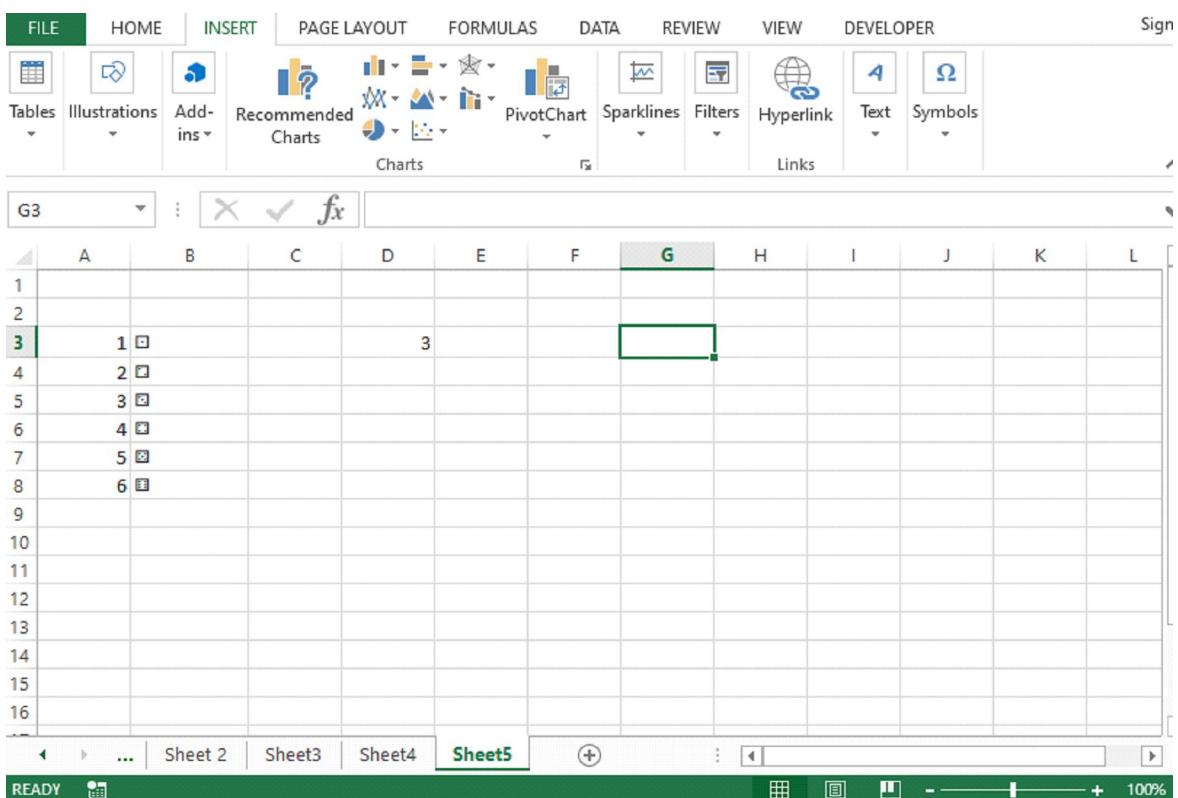


Fig 21: Random Number Generation

6. Apply the VLOOKUP function to select the outcome for each die. Place the number for the first die in column D and the number for the second die in column E as shown in fig 22 .

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2												
3	1				5	1						
4	2				=VLOOKUP(D3,							
5	3				)	VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])						
6	4											
7	5											
8	6											
9												
10												
11												
12												
13												
14												
15												
16												

The formula bar shows the formula =VLOOKUP(D3,). The status bar at the bottom right shows 100%.

Fig 22: VLOOKUP Function

7. Add different parameters like lookup value, table array col index and range lookup. Write down the formula in cell D4, open the bracket and choose D3 value and put a comma. For table array, select the column A and B along with the associated values within the cell and press F4. Add col index value is 2 and for range lookup to choose the argument FALSE. And press enter.

Syntax:

=VLOOKUP (value, table, col\_index, [range lookup])

Arguments:

**Value:** The value to look for in the first column.

**Table:** The table from which to retrieve a value.

**Col\_index:** The column in the table from which to retrieve a value.

**Range\_lookup:** - [optional] TRUE = approximate match (default),FALSE = exact match.

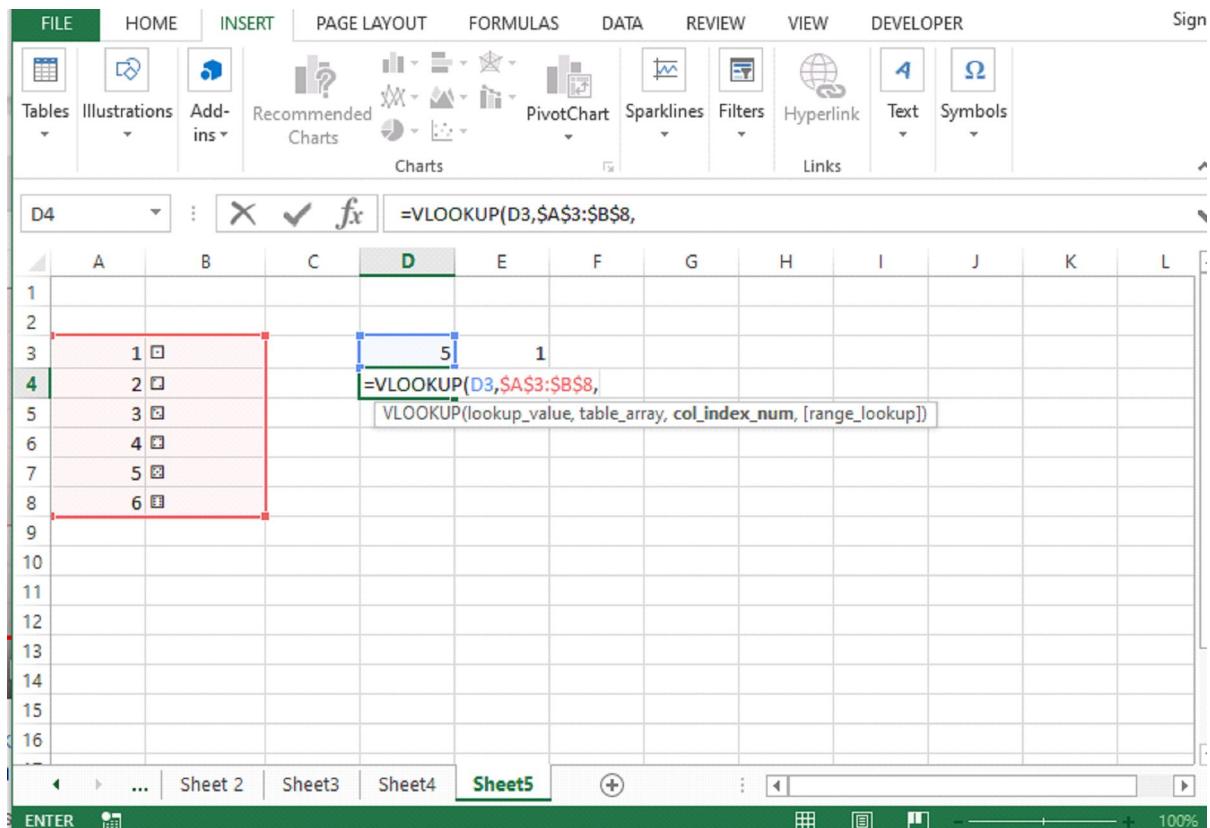


Fig 23: VLOOKUP Arguments

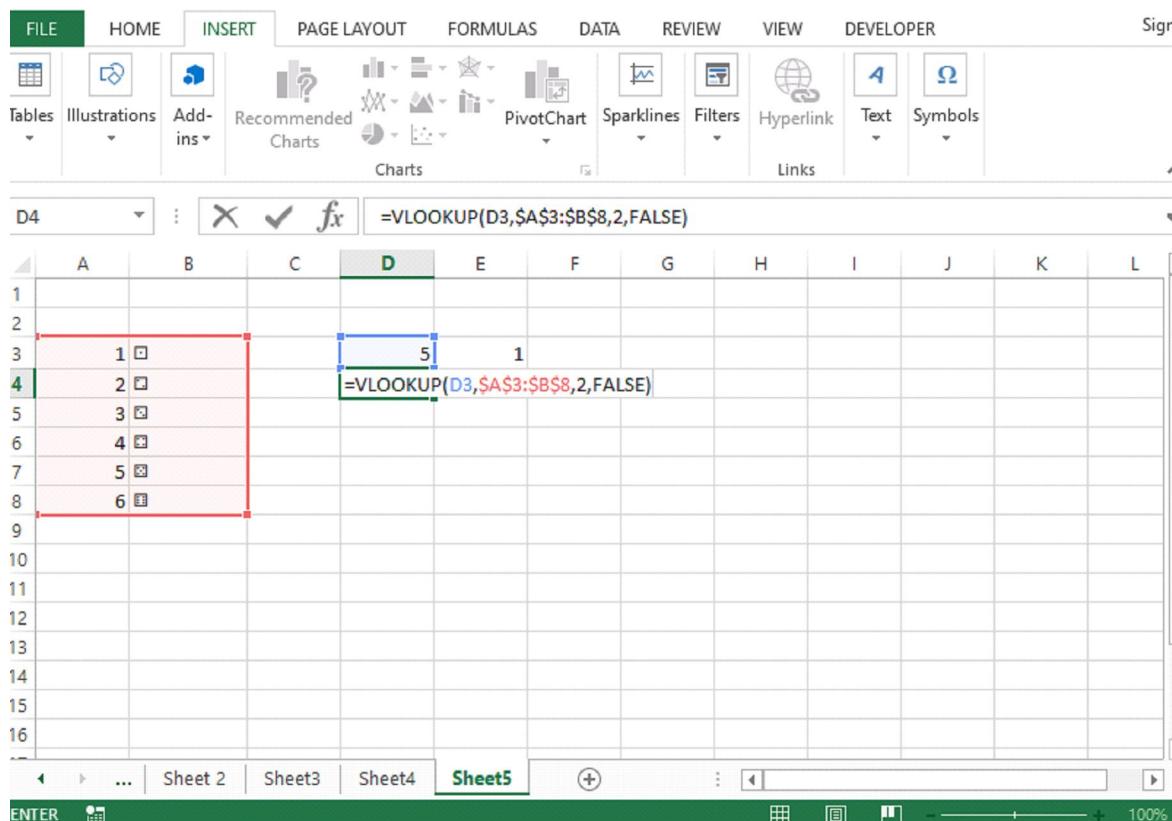


Fig 24: VLOOKUP Function

8. After press enter, you will get the dice roll in the desired cell which is mentioned below in the given fig 25 and 26.

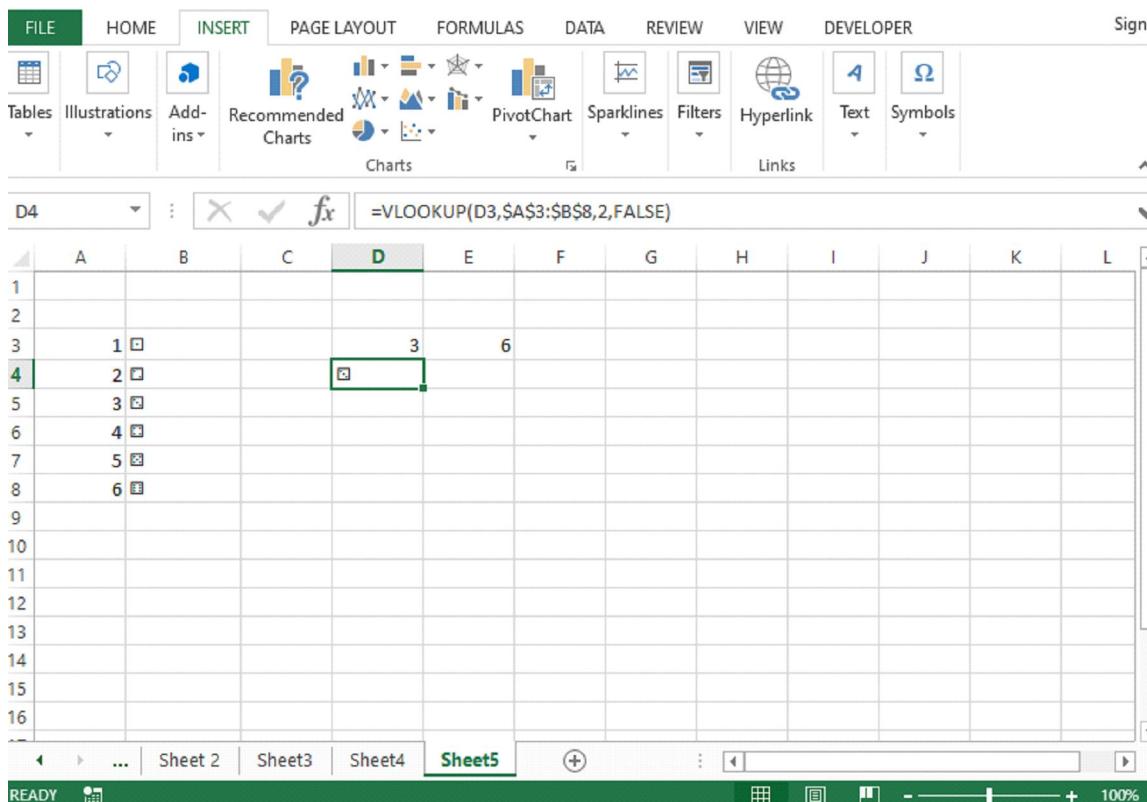


Fig 25: Dice Roll

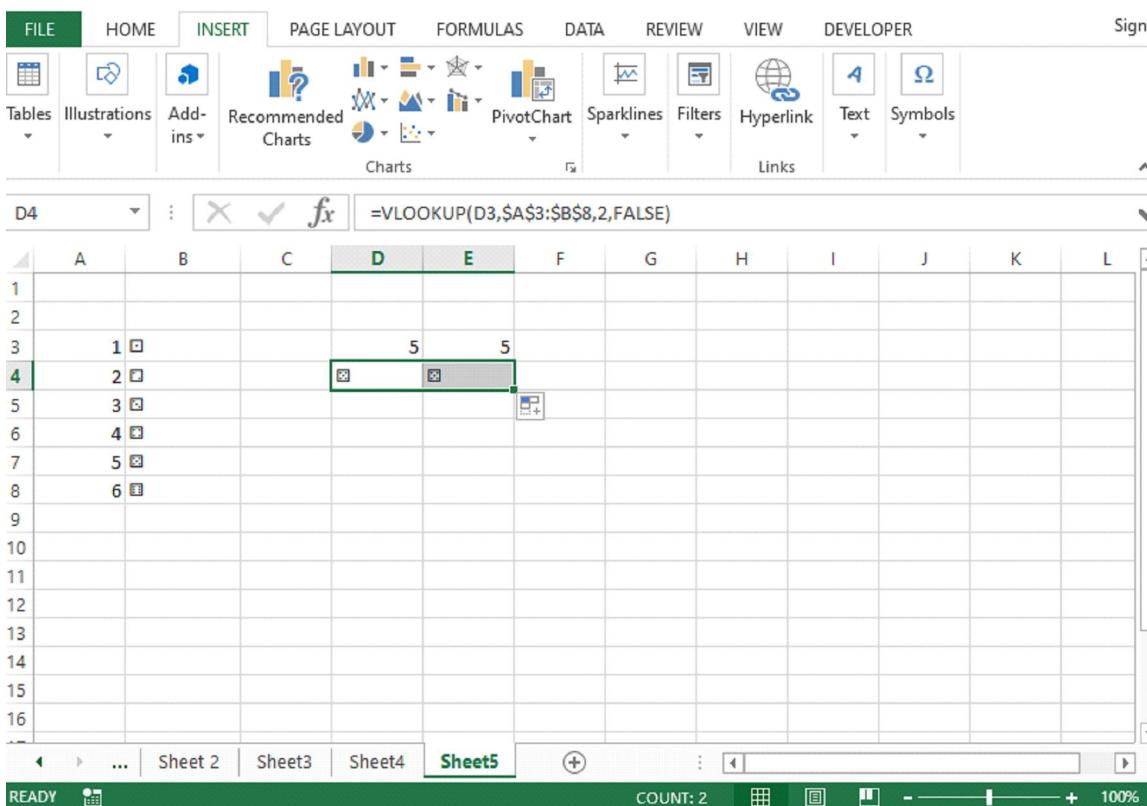


Fig 26: Two Dice Roll

9. For increasing the Dice size, click on the HOME tab and select the alignment and Increase font size. Adjust the size of both the dice.

The screenshot shows an Excel spreadsheet with the Home tab selected. The formula bar displays the formula `=VLOOKUP(D3,$A$3:$B$8,2,FALSE)`. Cells D4 and E4 contain dice icons. The font size is set to 48, and the dice are selected, indicated by a green border. The spreadsheet has columns A through L and rows 1 through 13. The status bar at the bottom right shows COUNT: 2 and 100%.

Fig 27: Resizing the Dice

- 10: Now select one dice, copy it and paste it on another sheet and check the formula bar.

The screenshot shows an Excel spreadsheet with the Home tab selected. The formula bar displays the formula `=Sheet5!$D$4`. Cell D4 contains a single dice icon. The font size is set to 48, and the dice is selected, indicated by a green border. The spreadsheet has columns A through L and rows 1 through 16. The status bar at the bottom right shows COUNT: 2 and 100%. A tooltip '(Ctrl)' is visible near the bottom center of the screen.

Fig 28: Formula for Dice 1

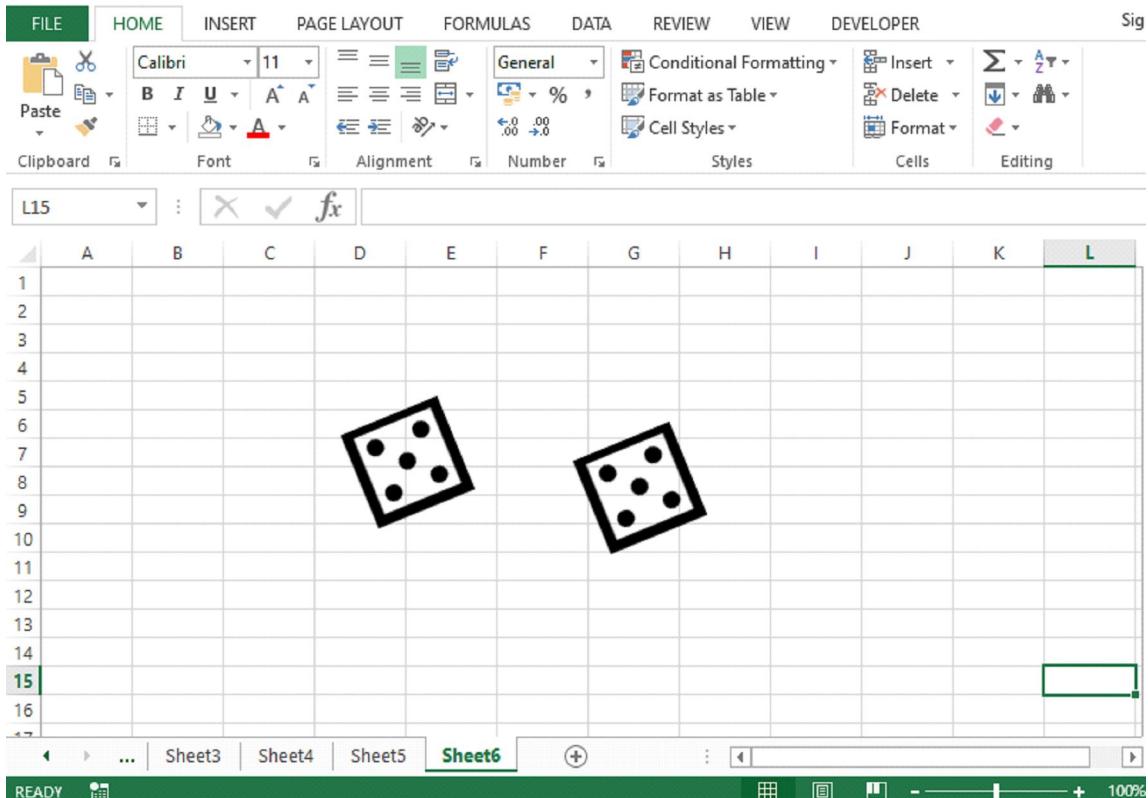


Fig 29: Two dices

11. Similarly check for dice 2 and add some changes for rolling the dice in the given cell on the formula bar for rolling the dice simulation.

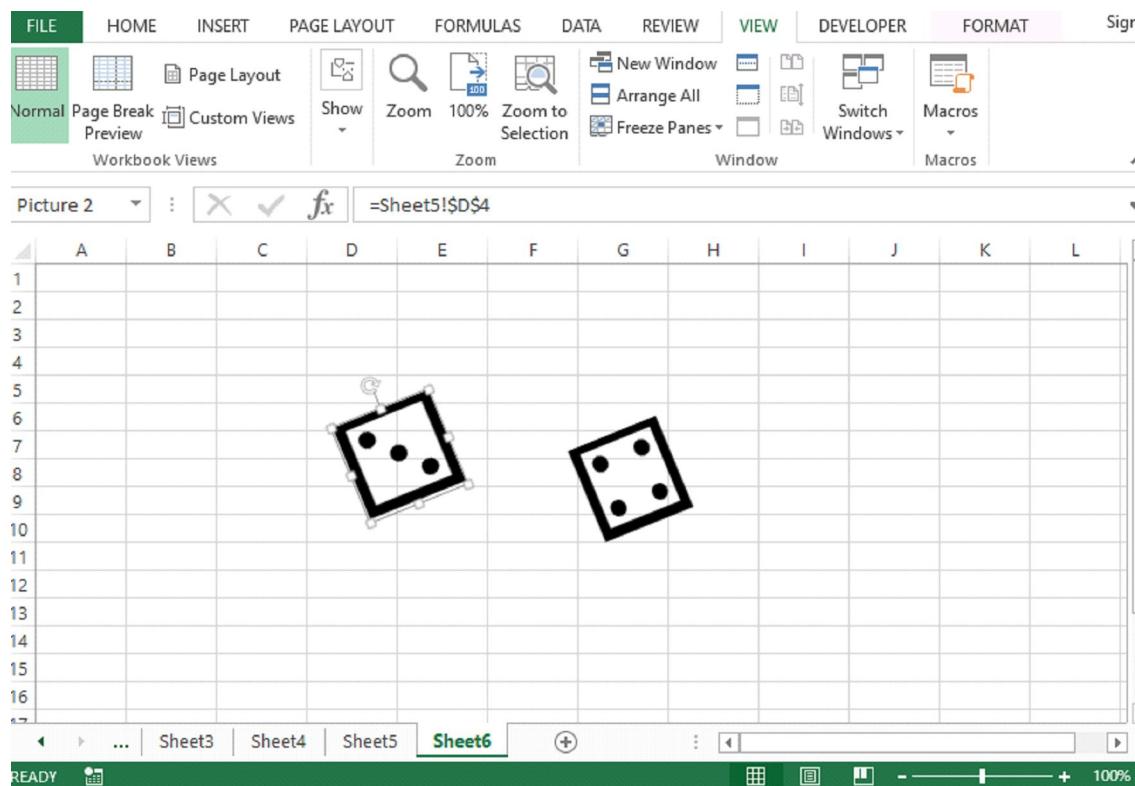


Fig 30: Dice rolling simulation

## Plot the Graphs of functions on Excel

**Linear Function:** In mathematics, linear functions have the form  $f(x) = ax + b$ , where  $a$  and  $b$  are constants. The graph of any linear function is a straight line. The Linear function is quite popular in economics. It is very useful in comparing the rates of pay.

Let's take an example if one company offers to pay you \$450 per week and the other offers \$10 per hour, and both the companies asked you to work 40 hours per week, then which company is going to offer the better rate of pay? For this kind of implementation, a linear equation can help you out in a better way. More applications in the daily life of linear equations are: In Budgeting, making predictions, variable costs etc.

In excel, plotting of linear function graph, here we take the different values of  $x$  and put the values in the mentioned formula  $f(x) = 3x-3$  and get the values. You can see in fig 31. Column A: Different values of  $x$  i.e. from 0 to 5 and Column B:  $f(x) = 3x-3$ . For calculating each value apply the formula for value 0, write it down in Column B second cell:  $=3*A2-3$ , and then press enter you will get the value i.e. -3 .

The screenshot shows a Microsoft Excel spreadsheet titled "Functions - Excel". The ribbon menu is visible at the top with tabs for FILE, HOME, INSERT, PAGE LAYOUT, FORMULAS, DATA, REVIEW, VIEW, DEVELOPER, and Sign in. The HOME tab is selected. The formula bar shows the formula  $=3*A2-3$ . The spreadsheet contains two columns: Column A labeled "Values of x" with values 1 through 5, and Column B labeled "f(x)=3x-3" with values -3 through 12. The formula for cell B2,  $=3*A2-3$ , is highlighted in blue. The status bar at the bottom right shows "100%".

A	B
1	Values of x
2	$f(x)=3x-3$
3	0
4	1
5	2
6	3
7	4
8	5
9	
10	
11	

Fig 31: Different Values of x

After getting the 1<sup>st</sup> value, drag the A2 cell till A7, you will get all the values by formula. See the values in the given below fig 32. Now select both column A and column B and then for plotting the graph, go to the INSERT tab and click on charts and choose to scatter plot. Your linear function would be plotted for the given values which are shown in Fig 33. The Graph shows the straight line.

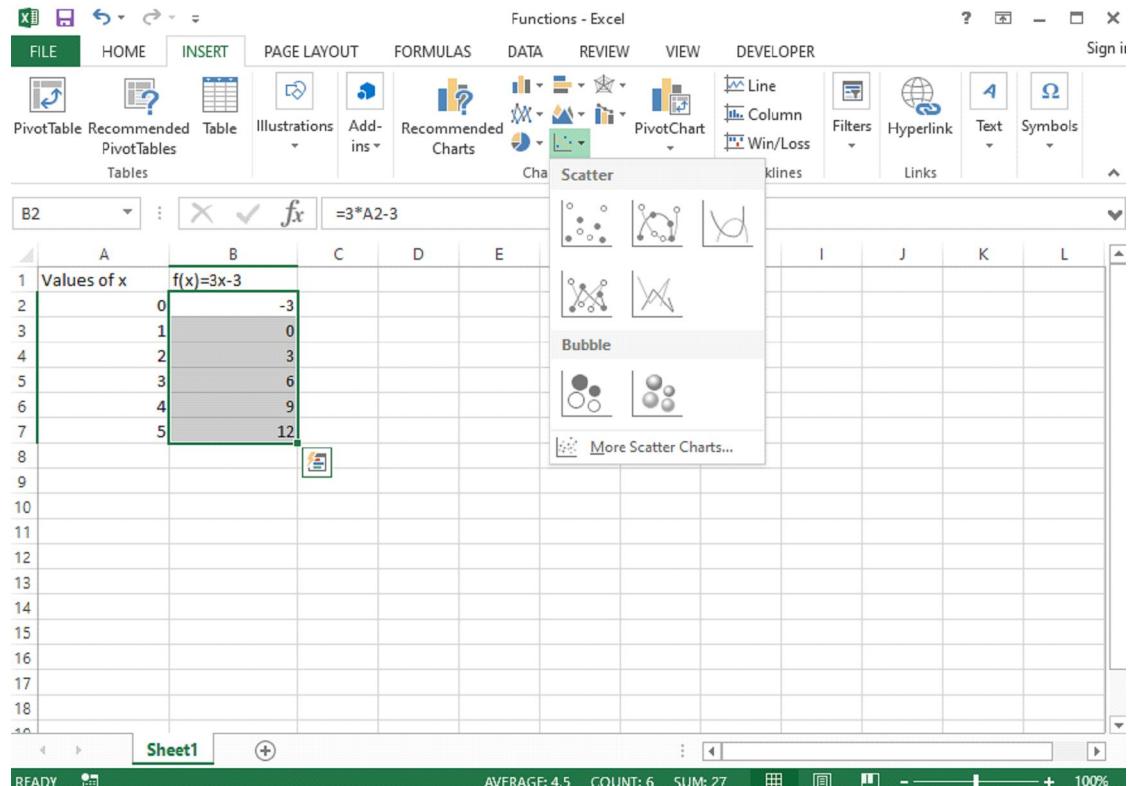


Fig 32: Scatter Plot Graph

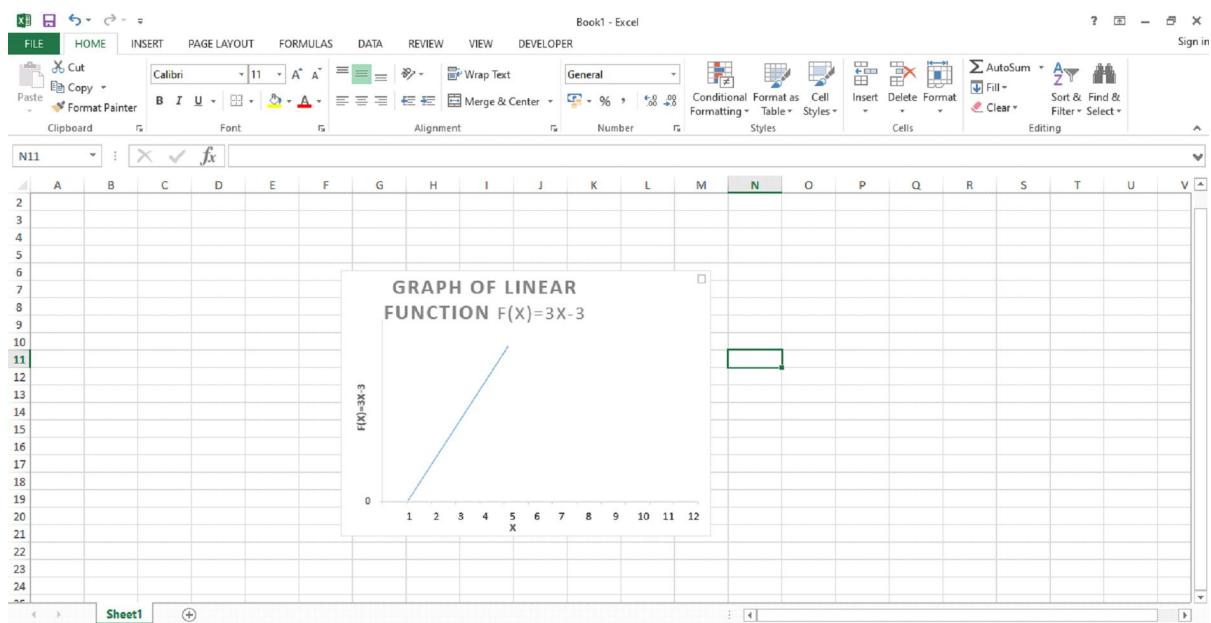


Fig 33: Graph of Linear Function

**Quadratic Function:** The quadratic function or polynomial of degree 2 is in the form of  $f(x) = ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are real numbers and  $a \neq 0$ . If  $a > 0$ , the parabola opens upward. If  $a < 0$ , the parabola opens downward. The graph of a quadratic function is a curve called a parabola. It may open upward or downward and can vary in their "width" but they all have the same basic "U" shape.

The quadratic functions are used in real-world situations or everyday life like optimizing profits for business, calculating areas of certain land, speed of an object like throwing a ball, determining a product's profit, etc.

In excel, for plotting graph of quadratic function  $f(x) = ax^2 + bx + c$ , we follow these steps.

1. Take different values of a, b and c for the given function  $f(x) = ax^2+bx+c$ , Let's take a=1, b=4 and c=2. Put these values in the given function you will get  $f(x) =x^2+4x+2$ . Put the values of a, b, and c in different cells of column B as shown in figure 34 below.
2. After assigning the values of a, b, and c, assign different values to x. Now substitute these values in the function  $f(x) = ax^2+bx+c$  based on each value of x assigned. Apply the formula in the formula bar by selecting the cell and their associated values in the given fig 34.

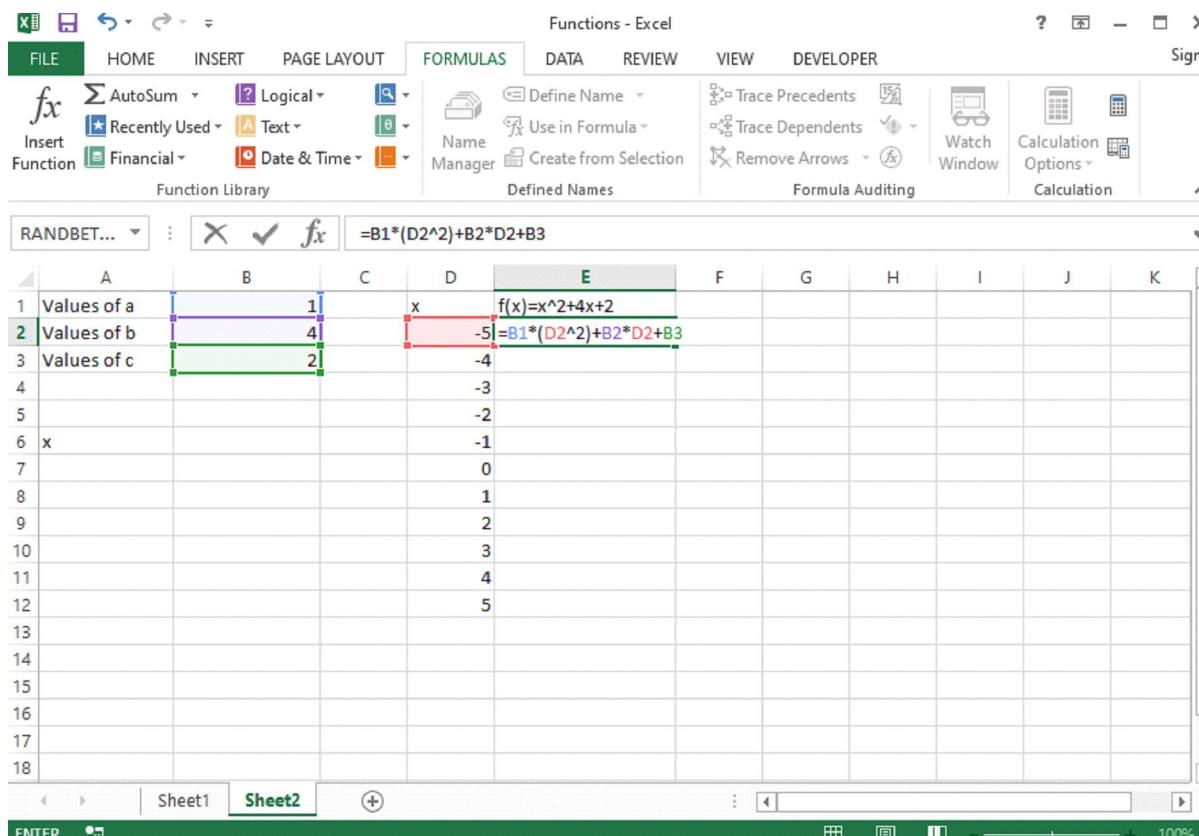


Fig 34: Formula for implementing Quadratic Function

3. After applying the formula, press enter and you will get the desired value of  $f(x)$  for value  $x = - 5$  i.e 7 in Fig 35.
4. Now if you want to use the auto-completion, we simply lock the cells containing the values of a, b, and c as shown in fig 36.

Functions - Excel												Sign in			
FILE		HOME		INSERT		PAGE LAYOUT		FORMULAS		DATA REVIEW		VIEW DEVELOPER		Sign in	
<b>fx</b>	AutoSum	Logical	Recently Used	Text	Financial	Date & Time	Name Manager	Define Name	Use in Formula	Trace Precedents	Trace Dependents	Watch Window	Calculation Options	Calculation	
Insert Function															
Function Library												Defined Names		Formula Auditing	
E2	:	X	✓	fx	=B1*(D2^2)+B2*D2+B3										
A	B	C	D	E											
1 Values of a	1	x	-5	f(x)=x^2+4x+2											
2 Values of b	4				7										
3 Values of c	2		-4												
4			-3												
5			-2												
6 x			-1												
7			0												
8			1												
9			2												
10			3												
11			4												
12			5												
13															
14															
15															
16															
17															
18															
Sheet1		Sheet2	+	:								100%			
READY															

Fig 35: Result

Functions - Excel												Sign in			
FILE		HOME		INSERT		PAGE LAYOUT		FORMULAS		DATA REVIEW		VIEW DEVELOPER		Sign in	
<b>fx</b>	AutoSum	Logical	Recently Used	Text	Financial	Date & Time	Name Manager	Define Name	Use in Formula	Trace Precedents	Trace Dependents	Watch Window	Calculation Options	Calculation	
Insert Function															
Function Library												Defined Names		Formula Auditing	
RANDBET...	:	X	✓	fx	= <b>\$B\$1</b> *(D2^2)+ <b>\$B\$2</b> *D2+ <b>\$B\$3</b>										
A	B	C	D	E											
1 Values of a	1	x	-5	f(x)=x^2+4x+2											
2 Values of b	4				=\$B\$1*(D2^2)+\$B\$2*D2+\$B\$3										
3 Values of c	2		-4												
4			-3												
5			-2												
6 x			-1												
7			0												
8			1												
9			2												
10			3												
11			4												
12			5												
13															
14															
15															
16															
17															
18															
Sheet1		Sheet2	+	:								100%			
READY															

Fig 36: Auto-completion (lock the cells)

5. After applying the auto-completion select the columns D and E with values and for plotting the graph click on the INSERT tab and then click on charts and then select the scatter plot and choose the scatter chart you can see the parabolic curve in the given below fig 37. In this way, you can plot the graph.

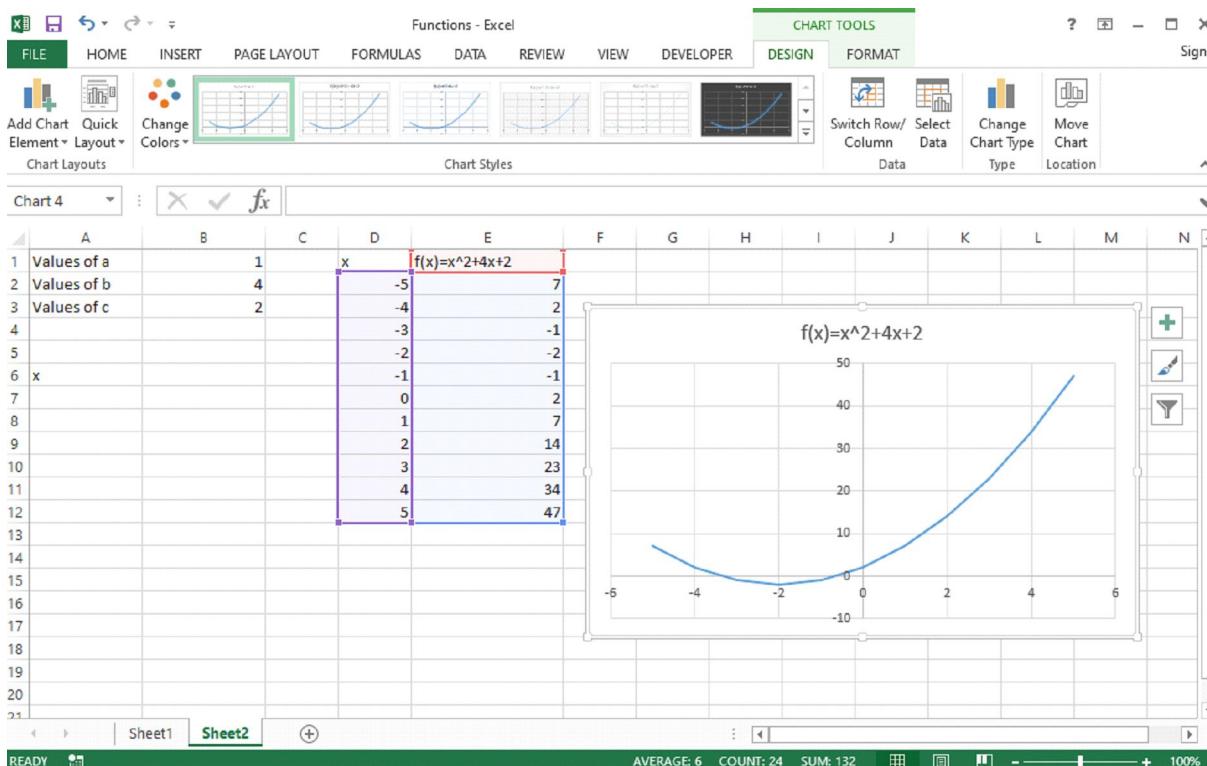


Fig 37: Quadratic Function Graph

**Exponential Function:** An exponential function is a Mathematical function in the form  $f(x) = a^x$ , where "x" is a variable and "a" is a constant which is called the base of the function and it should be greater than 0.

The real-world applications of exponential functions are bacterial growth/decay, population growth/decline, and compound interest, pandemics (exponential growth of disease), smartphone uptake and sale, the exponential growth of cancer cells, etc.

In Excel, there is a built-in exponential function called as EXP function that returns a numeric value, which is equal to e raised to the power of a given number.

The Syntax for the EXP function

=EXP( ) Note: In between parenthesis you write the number.

EXP function in Excel takes only one input, which is required; it is the exponent value raised to base e.

The number e is an irrational number, whose value is constant and is approximately equal to 2.7182. This number is also known as *Euler's Number*.

Now let's see that how to plot an exponential graph in excel. Let's take different values of x and apply the EXP function. In the given below fig 38. Apply the function EXP(1) for value 1 in Column B.

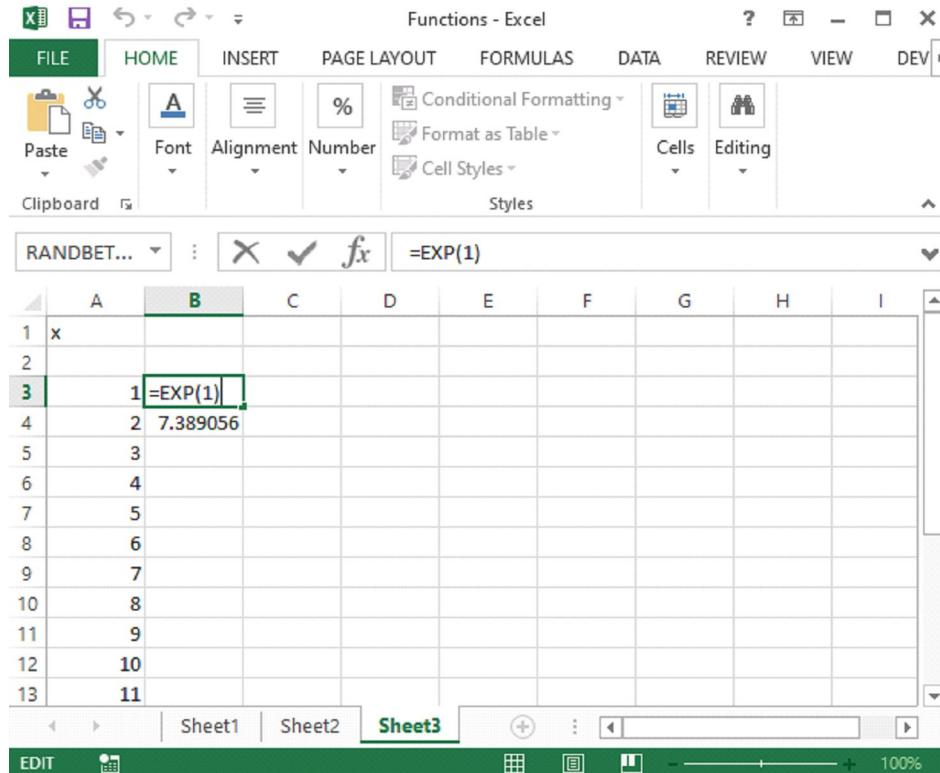


Fig 38: EXP () Function

After applying function for value 1 and then press enter you will get the value i.e. 2.718282 approximately. You can see in fig 39. Similarly, apply for different values and calculate the exponential values for different values of x.

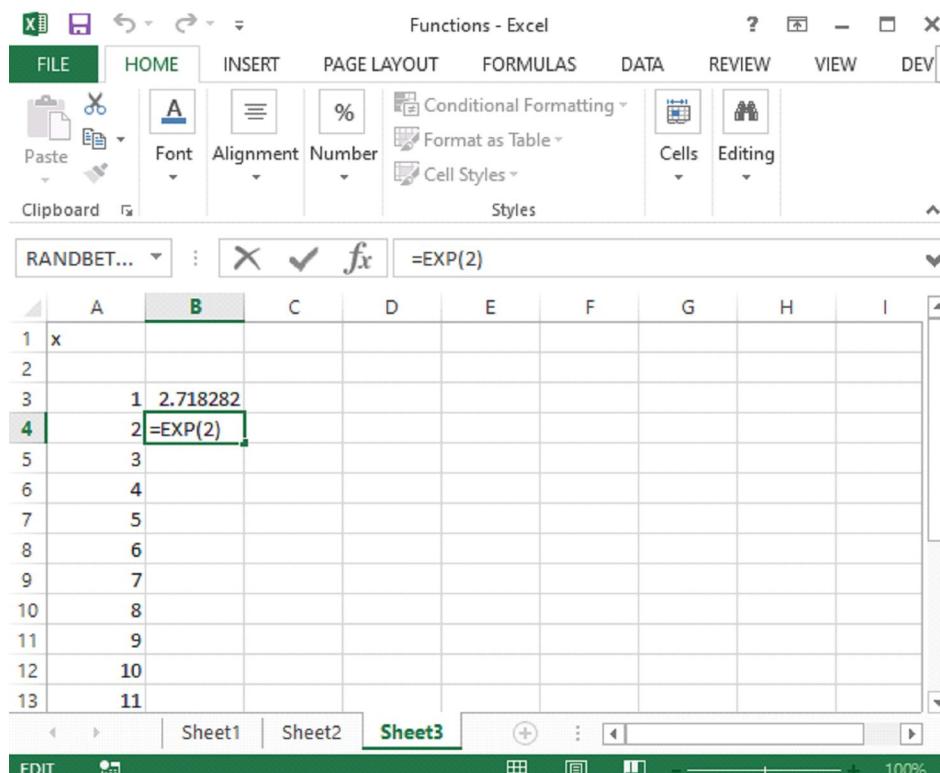


Fig 39: EXP (1) Result

After calculating the values plot the exponential function graph by clicking on the INSERT tab, select the graph and choose the scatter chart. The graph would be automatically plotted. The graph is shown in fig 40.

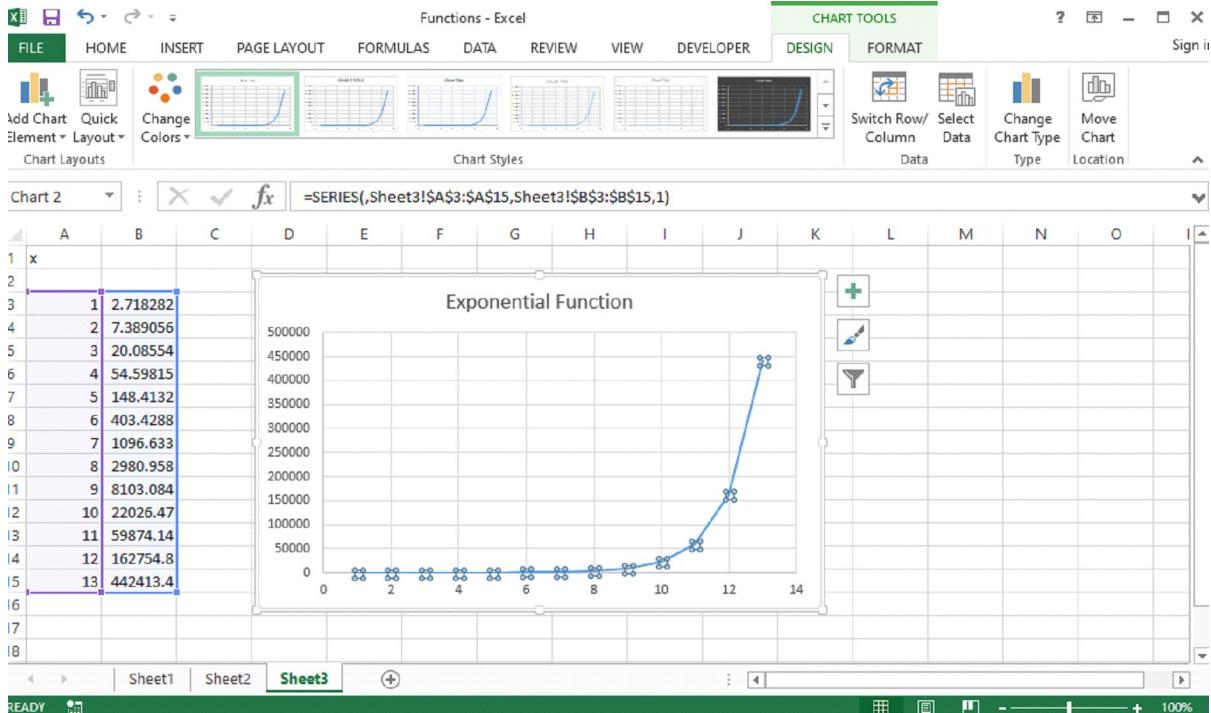


Fig 40: Exponential Function Graph

If you want to add Trend lines , right-click on the plotted graph line and select the Add Trend Line option as shown in fig 41.

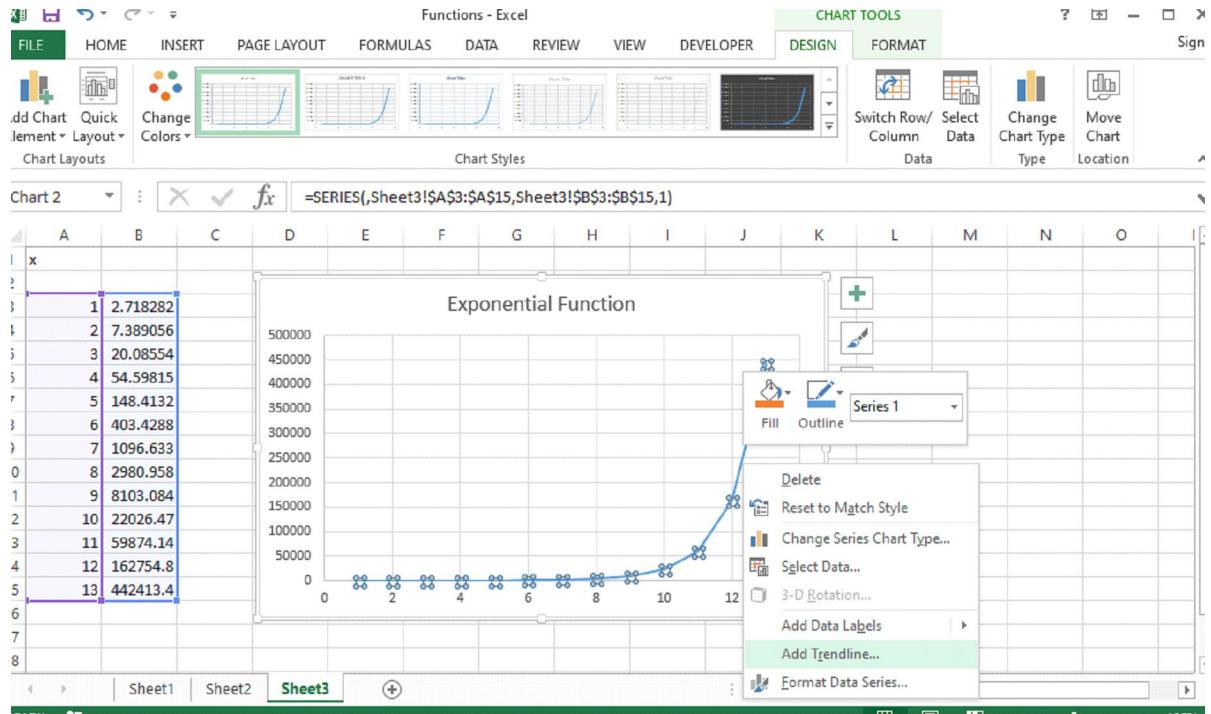


Fig 41: Add TRENDLINE

After choosing the Trend Line, select the Exponential option in the list of Trend line options and apply it . The final Exponential Function graph would be shown in given fig 42 and 43.

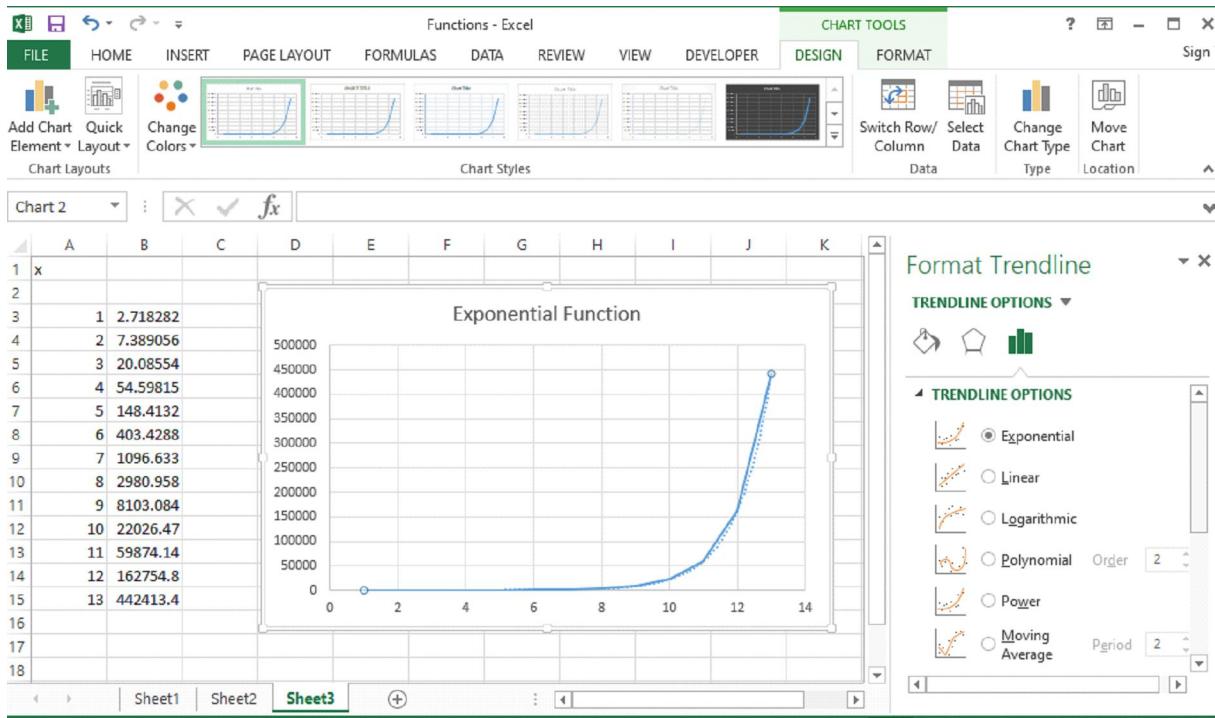


Fig 42: Exponential TRENDLINE

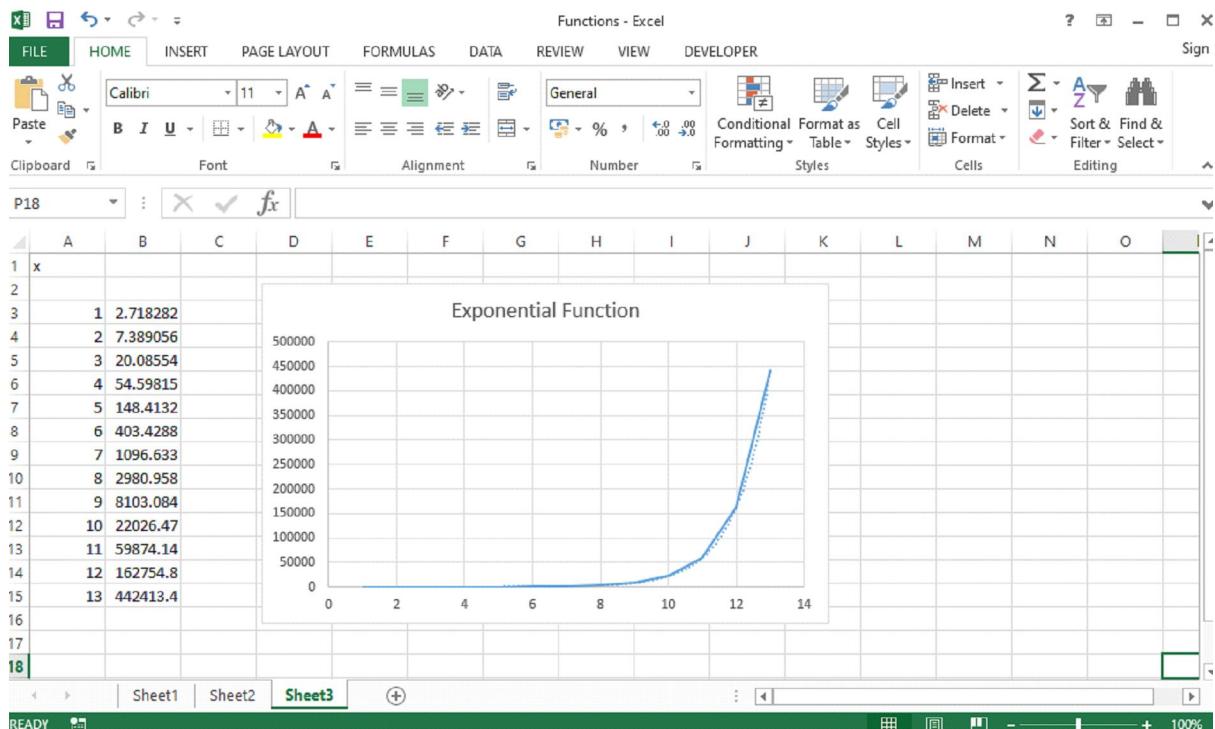


Fig 43: Exponential Function Graph with TRENDLINE

## Stock Market Data Sheet on Excel

In Microsoft 365 Excel, we get easily the stock and geographic data. We can convert the text into **Stock data type** as well as **Geography data type** which is mentioned in different cells.

In fig A which is given below in column, different cells with company names contain the Stocks data type. This icon:  symbolize the Stock Data Type. The Stocks data type is connected to an online source that contains more information. Columns B and C are used to extracting that information. Specifically, the values for price and change price are getting extracted from the Stocks data type in column A.

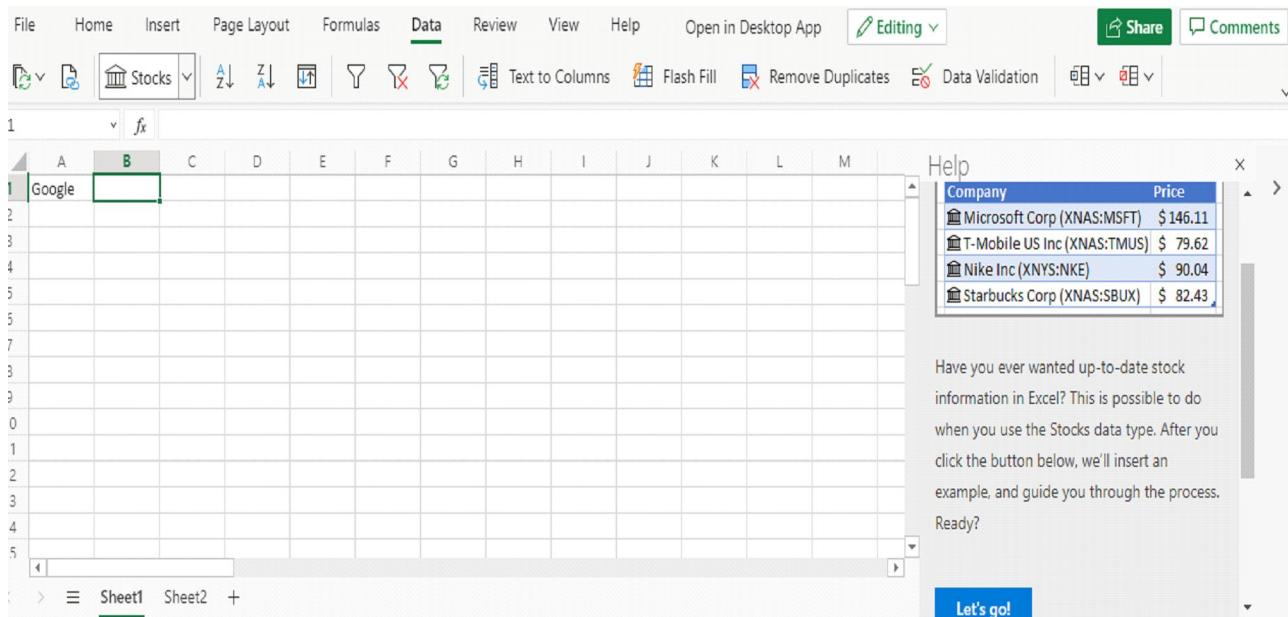
	A	B	C
1	Company	Price	Change
2	JM Smucker Co	\$ 126.04	\$ 1.19
3	Kellogg Co	\$ 66.29	\$ (0.73)
4	Post Holdings Inc	\$ 76.76	\$ 0.73
5	Tyson Foods Inc	\$ 74.29	\$ 0.53
6			

Fig A: Stock Data Type

Let's take an example to get a better understanding of using Stock data type . How you convert the text into Stock and Geography Data Type.

In fig 44 which is given below, first, you have to type any text in the cell-like I have written google text in Column A cell A1.

If you want stock information, type a ticker symbol, company name, or fund name into each cell. If you want geographic data, type a country, province, territory, or city name into each cell.



The screenshot shows the Microsoft Excel ribbon with the 'Data' tab selected. In the formula bar, the text 'Google' is typed into cell A1. A dropdown menu labeled 'Help' is open over the cell, displaying a list of stock information for companies like Microsoft, T-Mobile, Nike, and Starbucks. A tooltip at the bottom right provides instructions on how to use the Stocks data type. The status bar at the bottom indicates 'Sheet1' is active.

Fig 44: Stock Information

After selecting the Stock information, as you can see in fig 45 ,the table of stock information would be placed on an Excel worksheet.

B2 fx Company, ticker, or fund

	B	C	D	E
1				
2	Company, ticker, or fund			
3	MSFT			
4	TMUS			
5	Nike Inc			
6	Starbucks Corp			
7	VOO			
8	PAUIX			
9				
10				
11				
12				
13				
14				
15				

Calculation Mode: Automatic Workbook Statistics

Help

Here's the deal with stocks: You start with just plain text. Then you convert the text into the Stocks data type. Finally, you add fields like Price, Last trade time, and so on.

→ a. Convert to Stocks

- Click and drag to select cells B3 through B8.
- On the Data tab, click the Stocks button.
- Select the stock icon next to Starbucks, and then select the Extract Price to grid button that appears to the right of Price.

Fig 45: Stock Information

Now the next step is that you have to convert into Stock Data type . For this you have to select the cells to go to the Data Tab and select the Stocks Data Type or Geography Data Type as per your data choice. So here I would choose the Stock data type according to my data .You can see in fig 46, you'll know they're converted if they have this icon for stocks: and this icon for geography:

Highlighted

provided "as-is" and not for professional or trading purposes or advice. [Learn more...](#)

Stocks Geography

Convert to Stocks

Convert cells with company names or ticker symbols, like "MSFT", to get current stock info like price, exchange, and more.

Powered by Bing

	B	C	D	E
7	VOO			
8	PAUIX			
9				
10				
11				
12				
13				

Calculation Mode: Automatic Workbook Statistics

Help

→ a. Convert to Stocks

- Click and drag to select cells B3 through B8.
- On the Data tab, click the Stocks button.
- Select the stock icon next to Starbucks, and then select the Extract Price to grid button that appears to the right of Price.
- Now delete the price inside cell C6 because in the next few steps, we'll show you an even faster way.

Fig 46: Stock and Geography Data Type

After selecting the stock data type you will see that the first Company Name Microsoft Corporation converted into Stock Data Type and you can see the symbol on the left corner of the text. Similarly, one by one you can convert all company names into a stock data type. You can see in both fig 47 and 48.

B3

Company, ticker, or fund

MICROSOFT CORPORATION (XNAS:MSFT)

TMUS

Nike Inc

Starbucks Corp

VOO

PAUIX

Help

- a. Convert to Stocks
- Click and drag to select cells B3 through B8.
- On the Data tab, click the Stocks button.
- Select the stock icon next to Starbucks, and then select the Extract Price to grid button that appears to the right of Price.
- Now delete the price inside cell C6 because in the next few steps, we'll show you an even faster way.

Fig 47: Stock Data Type

B8

Company, ticker, or fund

MICROSOFT CORPORATION (XNAS:MSFT)

T-MOBILE US, INC. (XNAS:TMUS)

NIKE, INC. (XNYS:NKE)

STARBUCKS CORPORATION (XNAS:SBUX)

Vanguard 500 Idx;ETF (ARCX:VOO)

PIMCO All Asset All Authority Fund;Institutional

Help

- a. Convert to Stocks
- Click and drag to select cells B3 through B8.
- On the Data tab, click the Stocks button.
- Select the stock icon next to Starbucks, and then select the Extract Price to grid button that appears to the right of Price.
- Now delete the price inside cell C6 because in the next few steps, we'll show you an even faster way.

Fig 48: Stock Data Type

Once all done with the stock data type, after that you have to add different metrics or information related to different stocks in your data set. Select one or more cells with the data type and the Insert Data button will appear as you can see in the above-given fig 48. Click that button and you will notice a lot of different information or fields associated with that particular stock. Choose one field and it will be added to the right of your current data set.

In the given example as shown in fig 49, I choose 52 weeks high, you can choose price also. For Geography, you might pick Population.

Fig 49: 52-week high field

Once you press enter you will get the value associated with the chosen field. Similarly, apply the same formula with different data set and choose different fields also.

See the results in fig 50 and 51 which are given below.

Fig 50: Result of the selected field

		C	D	E	F	G	H	I
1								
2	<b>Company, ticker, or fund</b>	<b>52 Wk High</b>						
3	MICROSOFT CORPORATION (XNAS:MSFT)	\$ 255.99						
4	T-MOBILE US, INC. (XNAS:TMUS)	\$ 135.54						
5	NIKE, INC. (XNYS:NKE)	\$ 147.95						
6	STARBUCKS CORPORATION (XNAS:SBUX)	\$ 113.96						
7	Vanguard 500 Index Fund (ARCX:VOO)	\$ 378.40						
8								
9								
10								
11								
12								
13								
14								
15								

Fig 51: 52 Week High field result

Click the Insert Data button again to add more fields. If you're using a table, here's a tip: Type a field name in the header row. For example, type Change in the header row for stocks, and the change in the price column will appear.

### Collect Data on weather, price, inflation and pollution: Analyse the Data and make meaningful Inferences

Before going to the inferences we must know about Data Analysis. So **Data Analysis** is the process of cleaning, transforming and modelling the data to discover useful information for business decision-making. The main purpose of Data Analysis is to extract useful information from data and suggesting conclusions, taking the better and right decision based upon the data analysis.

**Data Analysis** is defined by the statistician John Tukey in 1961 as "Procedures for analysing data, techniques for interpreting the results of such procedures, ways of planning the gathering of data to make its analysis easier, more precise or more accurate, and all the machinery and results of (mathematical) statistics which apply to analysing data."

## Data Analysis through Excel

Excel provides different functions, commands, and tools for making data analysis easy. You can also do data analysis of large data sets by using PivotTables and produce desired reports.

### **Data Analysis consists of different phases:**



Fig 52: Data Analysis Phases

## Generating Inference from Data

Pivot tables are an amazing tool for analysing large data sets. It also helps in summarizing data and explore data insights.

For creating a Pivot table and analyse the data follow these steps. You can import the data set externally by clicking on the DATA tab choose the option From Other sources and select the option as per your requirement. You can import data from other options like From Access, From Web and Text. You can see the options in the given fig 53.

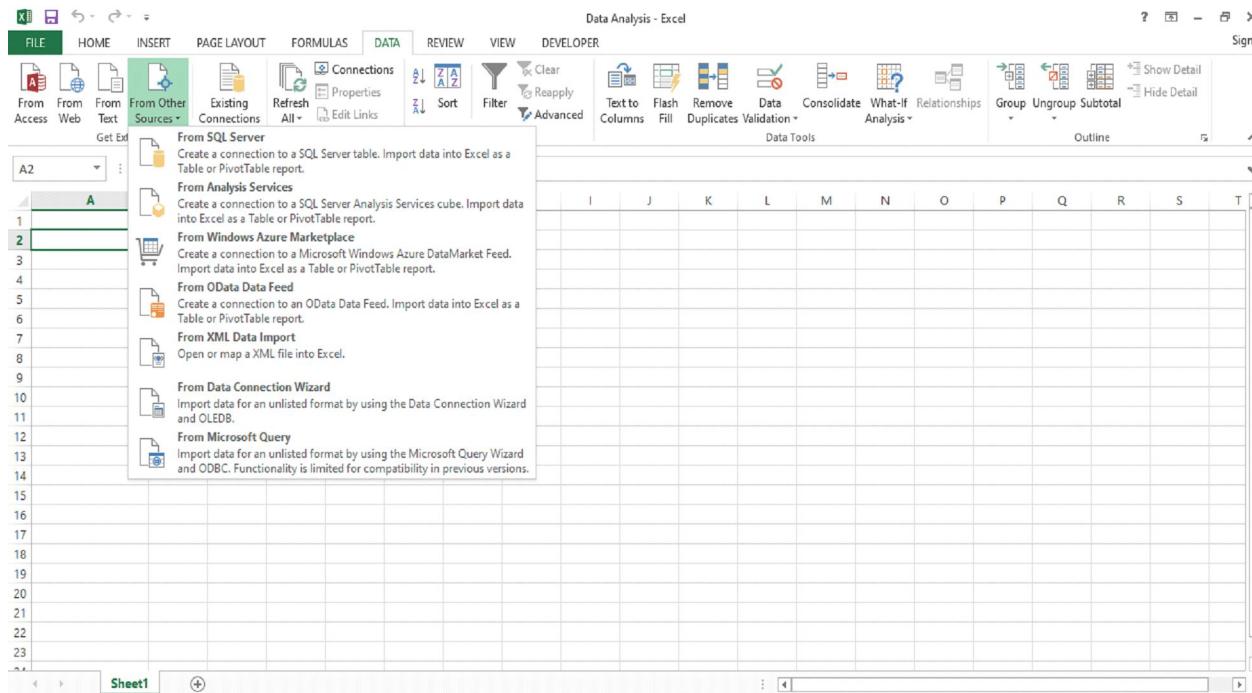


Fig 53: Import Dataset in Excel

Let's take an example like suppose you are working with company data, you have questions like "How much revenue is contributed by branches of North region?" or "What was the average number of customers for product A or B?" and many others. Then pivot table is the best tool for analysing this kind of data.

A pivot table provides different operations like count, average, sum, and perform other calculations according to the reference which you have selected i.e. It converts a data table to an inference table so that we can analyse the data and which helps us to make better decisions.

The table given in fig 54 has sales detail of each customer with the region and product mapping. In the table which is given in fig 55, we have summarized the information at the regional level which now helps us to generate an inference that the South region has the highest sales.

Figure 54 shows a dataset in Microsoft Excel. The dataset consists of 13 rows of data across columns A through K. The columns are labeled: Customer\_id, Policy\_id, Product Id, Premium(\$), and Region. The data shows various policy details and their corresponding regions.

	A	B	C	D	E	F	G	H	I	J	K
1	Customer id	Policy_id	Product Id	Premium(\$)	Region						
2		1	4010	C	2300	East					
3		2	1001	B	1500	South					
4		3	2030	B	5200	South					
5		4	1020	B	5600	West					
6		5	1025	C	18400	East					
7		6	4003	B	1500	North					
8		7	1090	C	17600	North					
9		8	4123	A	3000	South					
10		9	1111	C	9600	South					
11		10	1123	A	15800	West					
12		11	1233	A	6300	West					
13		12	3456	A	18400	South					
14											
15											
16											
17											
18											

Fig 54: Dataset

Figure 55 shows an inference table in Microsoft Excel. The table consists of 13 rows of data across columns A through L. The columns are labeled: Region, A, B, C, and Grand Total. The data shows regional totals for different categories.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Region	A	B	C	Grand Total							
2	East			20700	20700							
3	North		1500	17600	19100							
4	South	21400	6700	9600	37700							
5	West	22100	5600		27700							
6	Grand Total	43500	13800	47900	105200							
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												

Fig 55: Inference Table

## **How to create a Pivot table, follow the steps given below:**

1. First click anywhere in the list of the dataset, here I have selected the cell D7 of Column Premium and then click on the INSERT tab and choose Pivot Table in the left side corner of Tab. Once you choose, Excel automatically selects the chosen area which consists of the data values including the heading. If it doesn't select automatically then you have to do it manually to drag over the area to select a particular cell. See the given below fig 56 for selecting the pivot table.

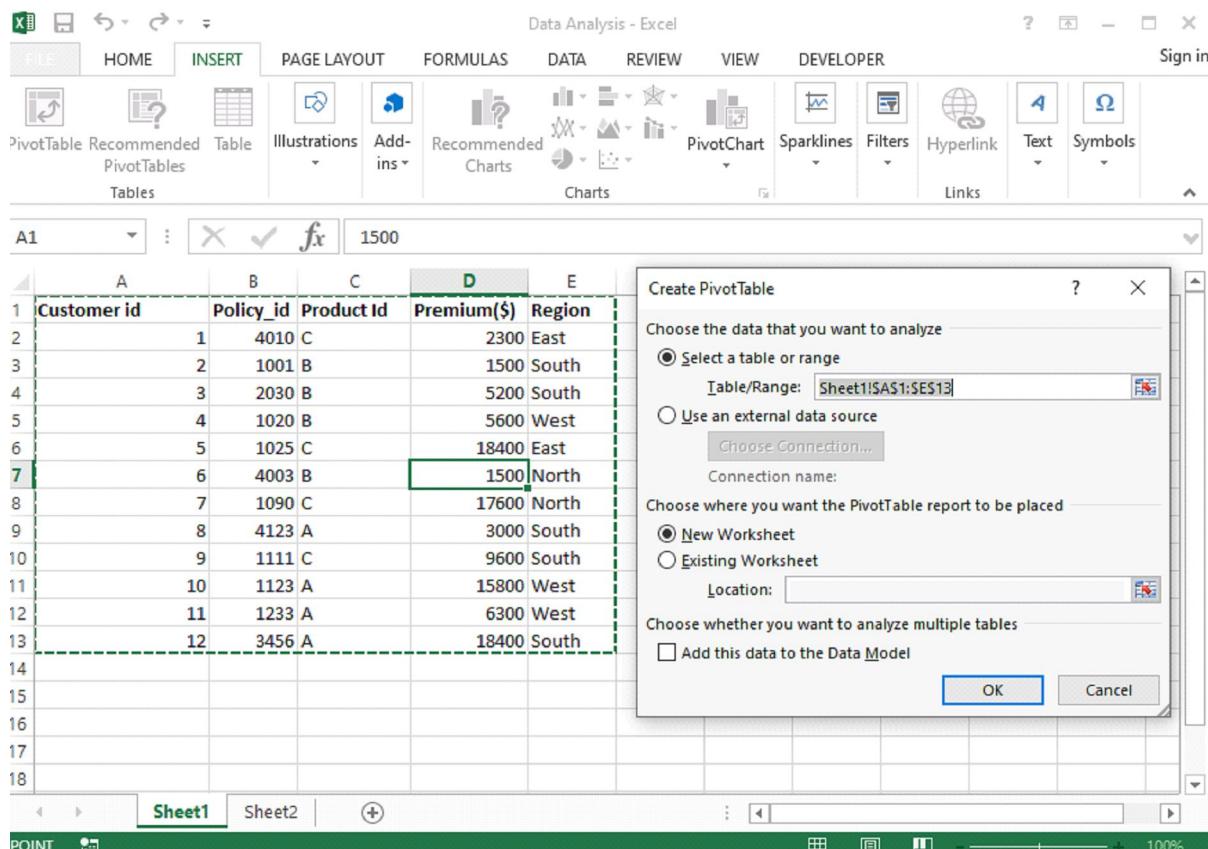


Fig 56: Create Pivot Table from INSERT Tab

2. After selecting the option new worksheet, place the pivot table on a new sheet and click ok. Now you can see the pivot table in the new worksheet shown in the fig 57.

The screenshot shows the Microsoft Excel ribbon with the 'ANALYZE' tab selected. On the left, a new worksheet named 'Sheet3' contains a placeholder for a PivotTable. A callout bubble highlights the 'PivotTable Fields' pane on the right, which lists fields like Customer id, Policy\_id, Product Id, Premium(\$), and Region. The 'VALUES' section is expanded, showing a sum symbol ( $\Sigma$ ) next to the word 'VALUES'. The status bar at the bottom indicates 'READY' and '100%'.

Fig 57: Pivot Table creation in the new worksheet

3. Now you can see the pivot table panel at the right-hand corner which contains different fields in the given list. Choose the field as per need for data analysis and making inferences based on them. Once you select the fields, here I have selected Product id, Premium and Region Field.

4. After that your pivot table is created you can see in the fig 58.

A3 : Row Labels

PivotTable Fields

Choose fields to add to report:

- Customer id
- Policy\_id
- Product Id
- Premium(\$)
- Region

MORE TABLES...

Drag fields between areas below:

FILTERS      COLUMNS

ROWS      VALUES

Product Id      Sum of Premium(\$)

Defer Layout Update      UPDATE

Fig 58: Pivot Table

5. If you want to change the rows and columns of the fields which you have selected then right-click the row or column label or the item in a label, point to Move, and then use one of the commands on the Move menu to move the item to another location. Seein fig 59 .

A4 : Row Labels

PivotTable Fields

Choose fields to add to report:

- Customer id
- Policy\_id
- Product Id
- Premium(\$)
- Region

MORE TABLES...

Drag fields between areas below:

FILTERS      COLUMNS

Product Id      Sum of Premium(\$)

ROWS      VALUES

Region      Sum of Premium(\$)

Defer Layout Update      UPDATE

Fig 59: Pivot Table (Generated Inference)

6. In Fig 59. given above, we have arranged the Region in row and Product Id in column and sum of premium taken as value. Now the pivot table is created and inferences generated. You can also use different functions like sum, average, min, max and other summary fields. We have summarized the information at the region level which now helps us to generate an inference that the South region has the highest sales.

**Creating Charts:** For taking better business decisions and making inferences, data visualization through charts or graphs would be very useful. In excel, for making different charts, click on the INSERT tab select charts and choose any chart .

For the above given data set, visualization of pivot table would be shown like this.

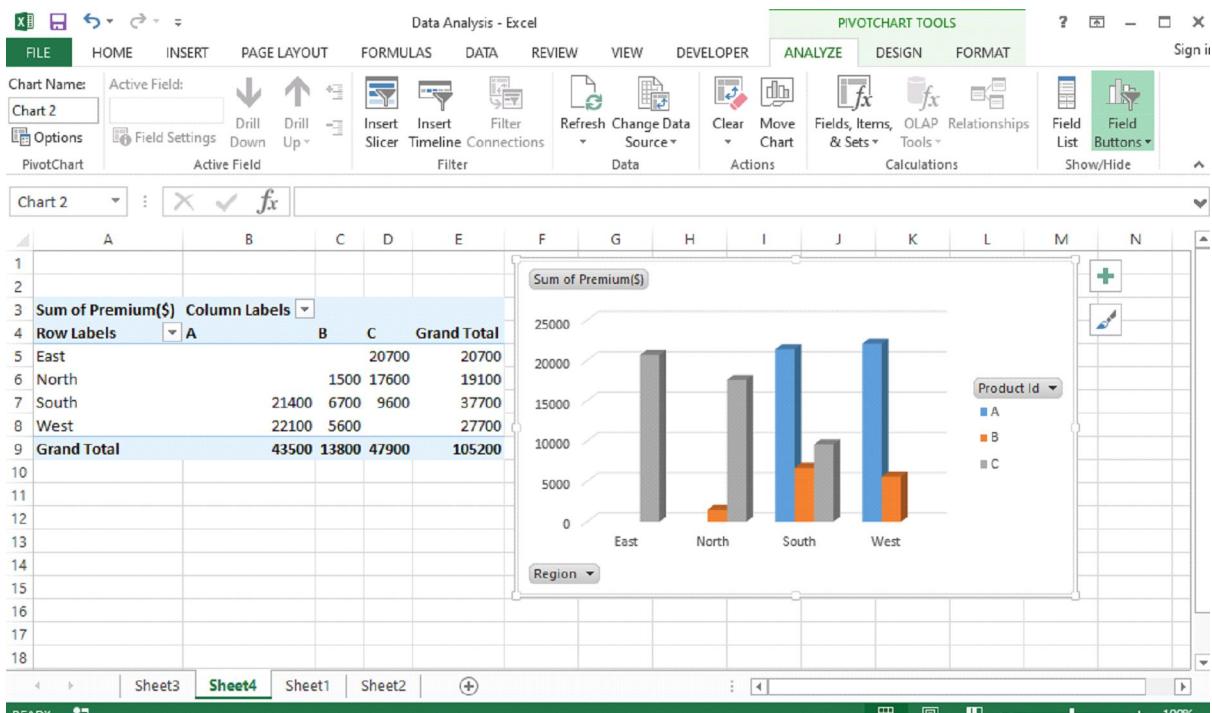


Fig 60: Creating Charts

Similarly, we can analyse the weather also by collecting the weather dataset and make inferences based on different parameters or metrics. Get the daily temperature and weather conditions .You can take the metrics: Weather Type and for visualization choose different colours for every different weather, whether its rain, cloud, snow or sun. Make a table with two columns one for weather description and another for type.

Now for analysis, Choose a date, day, temp and weather for making better predictions and making decisions.

**Collect data from newspapers on traffic, sports activities and on market trends and use excel to study future trends.**

Before going to study future trends first we must know about some terminologies which have worked and going to help you in predicting, analysing the trends.

**Forecasting:** It is the process of predicting the future by analysing the past and present data. When we talk about Quantitative forecasting so it will work on time series data like we want to know the number of passengers flying every year on planes by use of time series data.

Some important components of time -series are Trend and Seasonality.

**Trend:** It is the long term tendency of the variable to increase or decrease over a period of time. For example the number of passengers flying every year on planes by use of time series data.

Examining sales patterns to see if sales are declining because of specific customers or products or sales regions

**Seasonality:** In this pattern is repeating at a regular interval of time. For example, retail sales tend to peak for the Christmas season and then decline after the holidays. So time series of retail sales will typically show increasing sales from September through December and declining sales in January and February.

Forecasting is the most important technique for predicting future trends and opportunities. Companies use to make good and better business decisions.

Let's see more examples to get a better understanding of forecasting.

- Economists use forecasting techniques to predict future recessions, ups and downs in the market values and accordingly they recommend good plans.
- Government bodies use forecasting for making a plan and build their policies.
- Companies Managers use forecasting to predict sales and accordingly they make their budgets, plan things and hire employees.
- Profiling customer behaviour, preferences and buying habits.
- Finding uncommon developments over the period, which we need to address in our forecasts.
- Studying sales patterns to predict future performance.

In Excel, some important functions are available for forecasting like

- `forecast.linear()`: It predicts the values by using past values.
- `forecast.ets()`: It predicts values by existing values.
- `forecasting.ets.seasonality()`: It works on the number of seasonal patterns .
- `forecasting.ets.confint()`: It predicts the value at the specified target date.

### **Excel TREND function:**

Let's take an example to suppose that you are analysing some data for a sequential period of time and you want to analyse some trend or pattern.

In this example, we have the month numbers (independent x-values) in cell A2:A13 and sales numbers (dependent y-values) in cell B2:B13. Based on this data, we want to determine the overall trend in the time series. For this select the cells C2:C13, type the formula which is given below and press Ctrl + Shift + Enter to complete it:

=TREND (B2:B13, A2:A13)

If you want to draw the trend line, then select the sales and trend values cells (B1:C13) and select the line chart (Insert tab > Charts group > Line or Area Chart).

You can see the result, it consists of both the numeric values for the line of best fit and a visual representation of those values in a graph also.

Data Analysis - Excel												
FILE	HOME	INSERT	PAGE LAYOUT	FORMULAS	DATA	REVIEW	VIEW	DEVELOPER	?	□	-	×
Get External Data	Refresh All	Connections	Properties	A Z Z A Z Sort	Clear Filter Reapply Advanced	Text to Columns	Flash Fill Remove Duplicates	Group Ungroup Subtotal	Outline			
Get External Data	Refresh All	Connections	Properties	Connections	Sort & Filter	Data Tools						
RANDBET...	:	X ✓ fx	=TREND(B2:B13,A2:A13)									

A screenshot of Microsoft Excel showing the TREND function being used. The formula `=TREND(B2:B13,A2:A13)` is entered into cell C2. The range B2:B13 contains sales data for months 1 through 12, and the range A2:A13 contains month numbers 1 through 12. The formula is highlighted in blue in the formula bar.

Fig 61: TREND Function

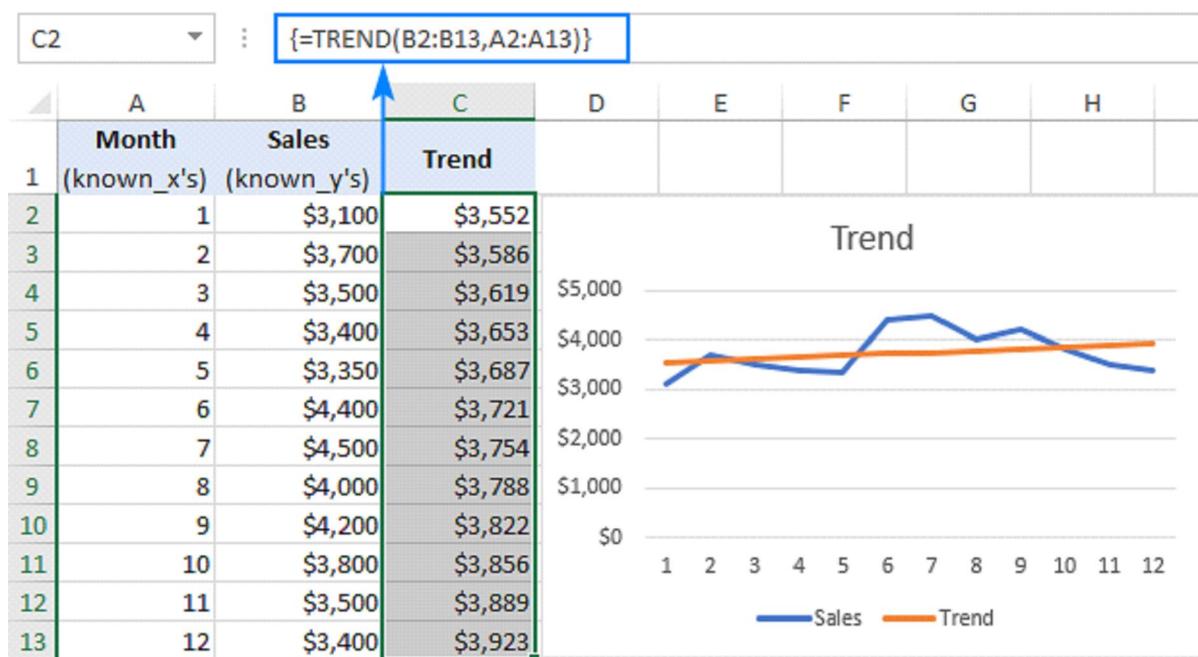


Fig 62: Visual Representation of Trend Analysis

