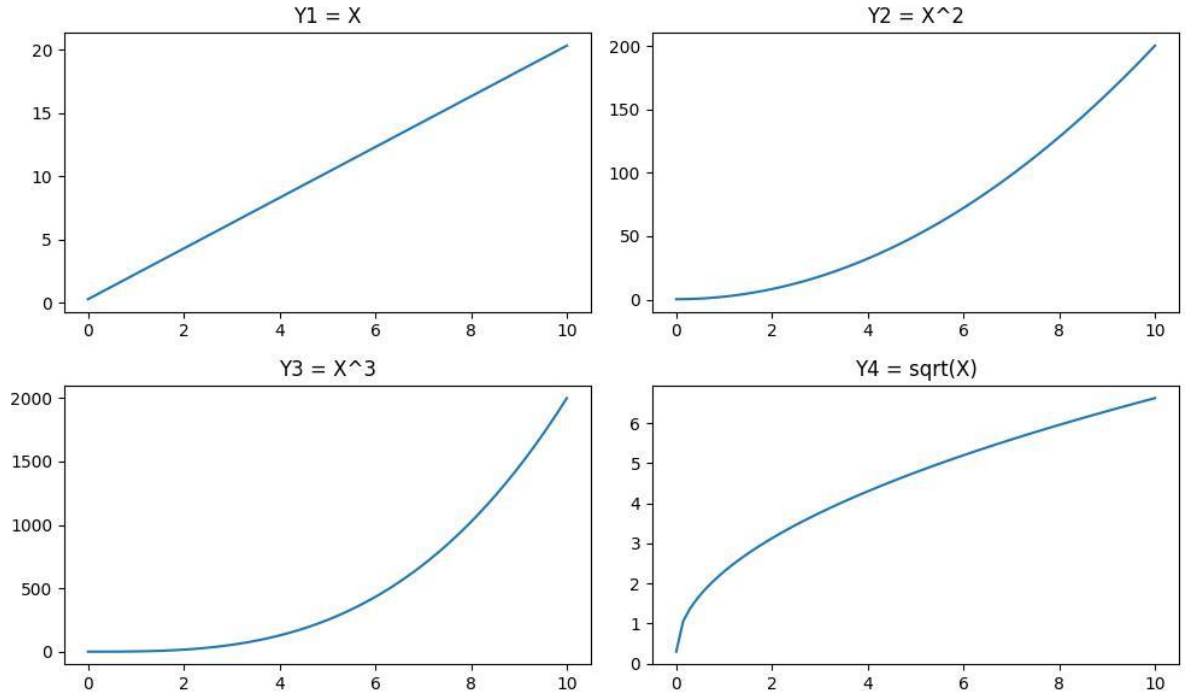
Data Visualization

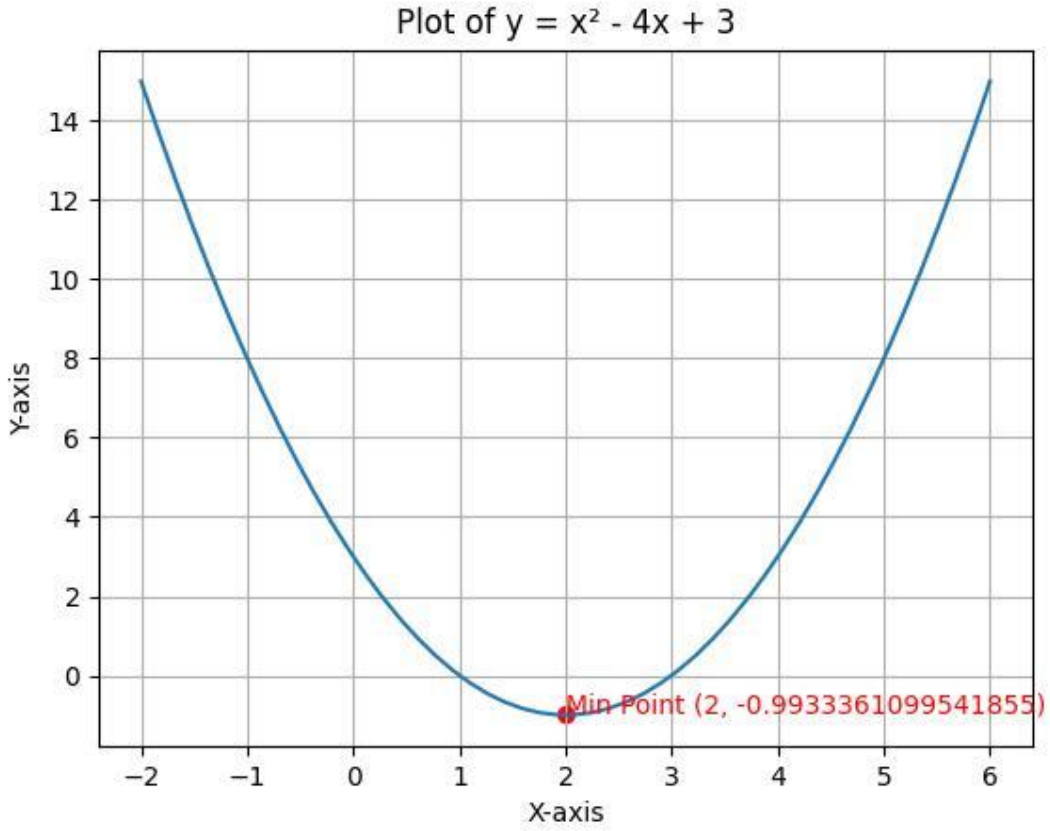
Lab 3

1. Write code for line chart to generate 70 numbers with X- axis and Y-axis is mx+c, were m=2 and c=0.3, Draw the four different line charts using matplotlib library. (Take Y1=X, Y2=X2,Y3=X**3 and Y4=sqrt(X)).**



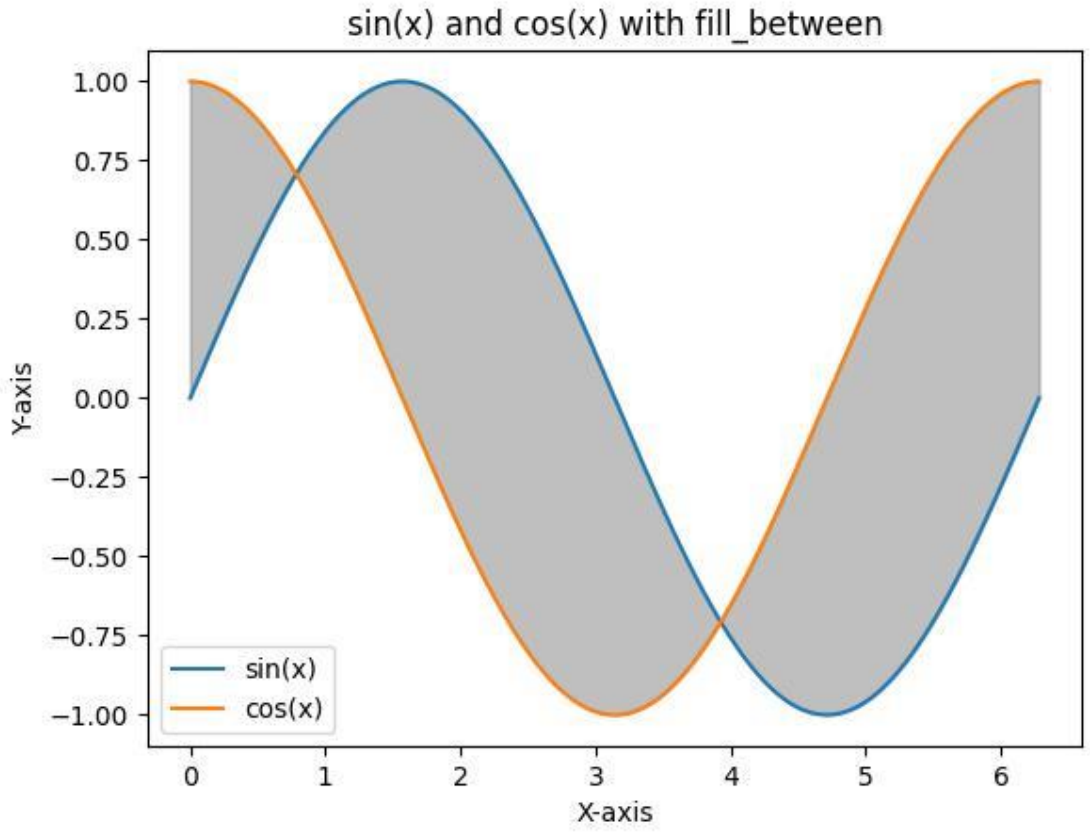
The task demonstrates how a linear relationship can modify different mathematical functions. By setting y = mx + c for four different forms of y (linear, quadratic, cubic, and square root), you see how the slope (m=2) and intercept (c=0.3) influence each line. These charts are useful for understanding how different mathematical functions scale and behave when applied with a linear transformation.

2. Plot the function $y = x^2 - 4x + 3$ for x ranging from -2 to 6. Identify and annotate the minimum point of the graph. Add appropriate labels, title, and grid.



The quadratic function forms a parabola, and the minimum point represents the vertex of the curve. This is crucial in optimization problems, where identifying minima (or maxima) is necessary. Annotating the minimum point helps visually interpret where the function achieves its lowest value. This graph can be used to show how the function behaves symmetrically around this point.

3. Plot sin(x) and cos(x) from 0 to 2π on the same graph. Use fill_between() to shade the area between the two curves where sin(x) is greater than cos(x). Add labels and a title.



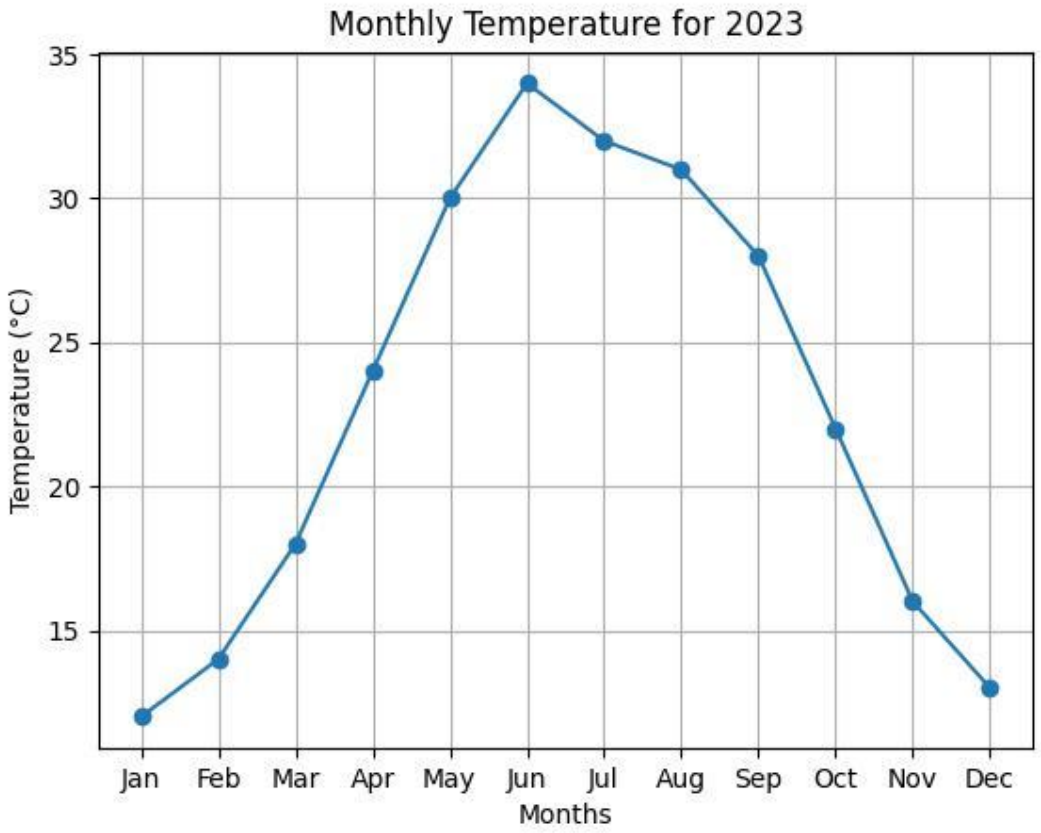
he sine and cosine curves are periodic functions and have alternating phases. Using fill_between() to shade areas where sin(x) is greater than cos(x) highlights the difference between the two curves visually. This method is valuable when comparing functions to see areas of dominance. It helps students understand the phase differences between the trigonometric functions.

4. Consider monthly temperature data for the year 2023 and plot it using a time-series line graph.

months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

temperature = [12, 14, 18, 24, 30, 34, 32, 31, 28, 22, 16, 13]

Label the x-axis as Months and y-axis as Temperature (°C). Format the x-axis to show month names instead of numbers.

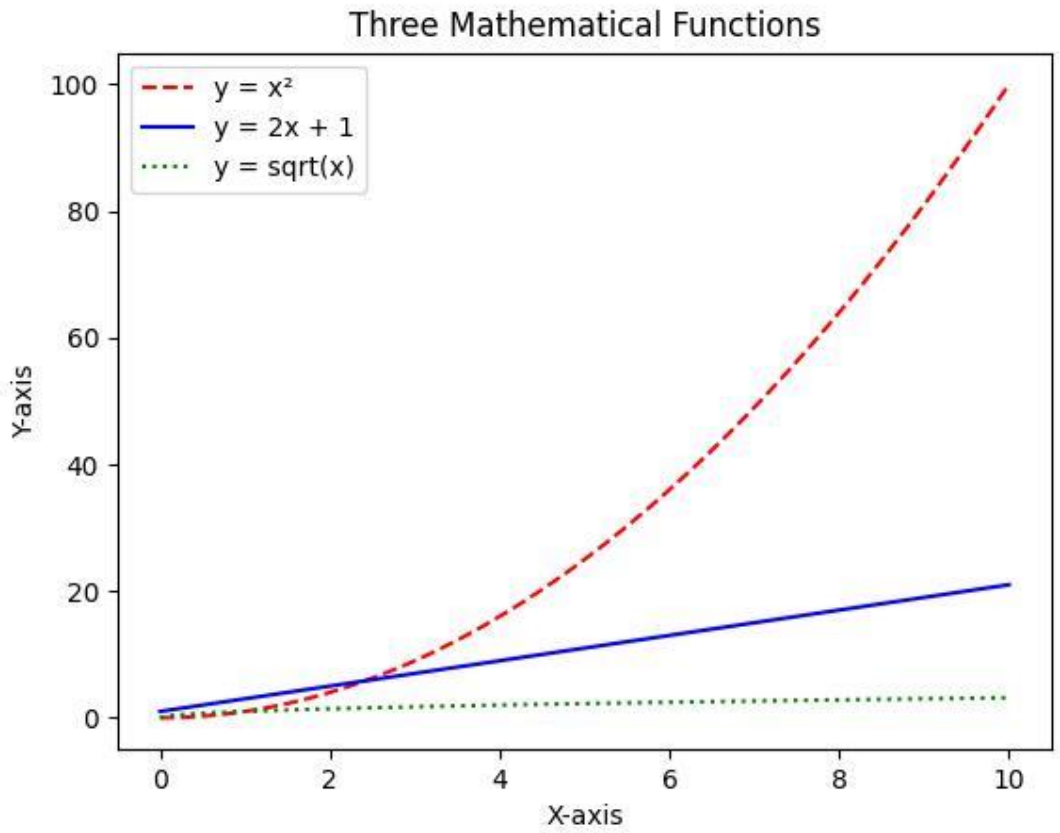


Time-series graphs help track data points over a period of time. In this case, the plot of monthly temperatures in 2023 showcases how temperatures fluctuate throughout the year, peaking in the summer months and dropping in winter. This is a practical way to visualize seasonal trends and patterns, such as weather or climate data, over time.

5. Plot three mathematical functions on the same graph:

- **$y = x^2$ (Red, Dashed Line)**
- **$y = 2x + 1$ (Blue, Solid Line)**
- **y = sqrt(x) (Green, Dotted Line)**

Add a legend, labels, and title.



By plotting three different functions on the same graph, you can compare how different types of functions (quadratic, linear, and square root) grow. The quadratic function grows faster, the linear function has a constant rate of change, and the square root function grows slowly at first but accelerates. This is useful in contexts where comparing different growth rates or trends is necessary (e.g., in economics or population studies).

6. Create a dual-axis plot where:

● The primary y-axis represents the monthly rainfall (in mm) in 2023 as a bar chart.

● The secondary y-axis represents the average temperature (in °C) as a line graph on

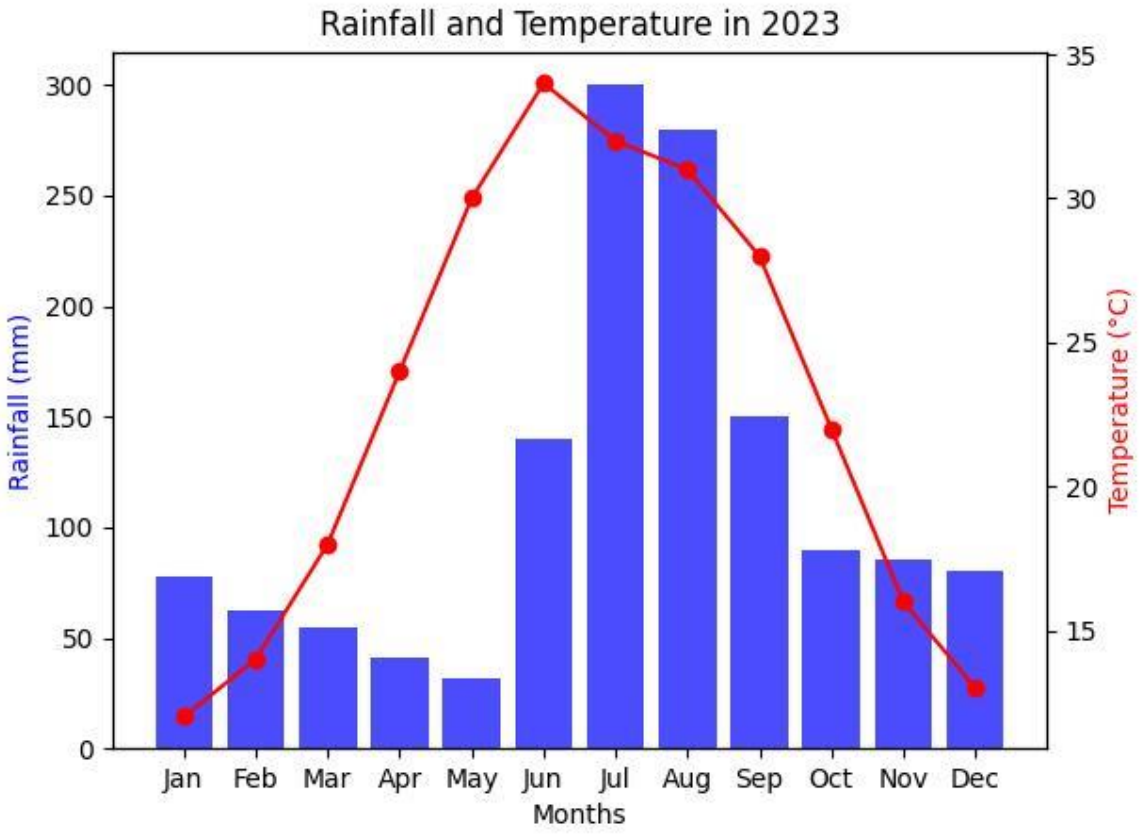
the same plot.

months = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']

rainfall = [78, 62, 55, 41, 32, 140, 300, 280, 150, 90, 85, 80]

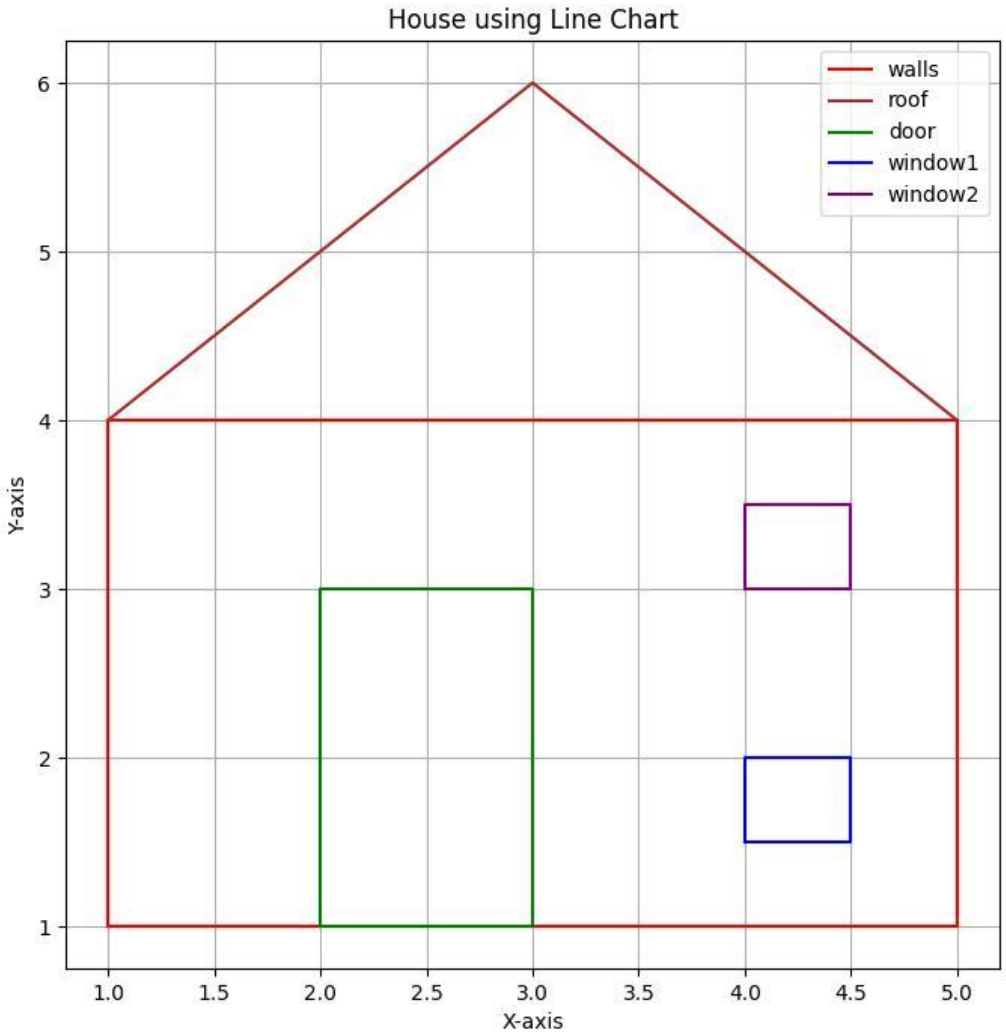
temperature = [12, 14, 18, 24, 30, 34, 32, 31, 28, 22, 16, 13]

Label both y-axes and use different colors for bars and the line.



A dual-axis plot allows the visualization of two related variables (rainfall and temperature) that may have different units and ranges. This plot shows how rainfall and temperature fluctuate over the same period (months of 2023). It provides insight into any possible correlation (e.g., higher temperatures in summer and increased rainfall during the monsoon months). Dual-axis plots are useful when you want to compare two datasets in one visual.

7. Draw a house using matplotlib line charts:



This task introduces the concept of using basic geometric shapes to create more complex images, such as a house. It demonstrates how lines (defined by coordinates) can form familiar objects when arranged in a structured manner. This exercise improves your ability to understand and manipulate basic shapes in data visualization, which can be applied to more advanced topics like geometric modeling or architectural visualization.