Plotting in LaTeX: A Beginner's Guide

What are Plots?

Plots are graphical representations of data. Instead of looking at numbers in a table, a plot helps us understand the data visually. For example, we can clearly see trends, comparisons, and patterns.

Why Learn Plots in LaTeX?

LaTeX is used in professional reports, research papers, and academic publications. Creating plots directly inside LaTeX:

- Maintains a uniform style with the document
- Prevents image quality loss (vector graphics)
- Automatically updates if data changes

What is TikZ?

TikZ is a powerful drawing tool in LaTeX used to create graphics such as diagrams, shapes, and plots.

What is PGFPlots?

PGFPlots is built on TikZ and makes plotting easier. Instead of manually drawing graphs, PGFPlots automatically draws axes and plots points.

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Important Structure for Any Plot

Every plot will always have this basic structure:

```
\begin{tikzpicture}
\begin{axis}[ ... settings ... ]
\addplot coordinates { ... data ... };
\end{axis}
\end{tikzpicture}
```

- **tikzpicture** → the drawing area
- **axis** → creates x and y axes
- **addplot** → draws the actual graph

Only the settings and data change for different plots.
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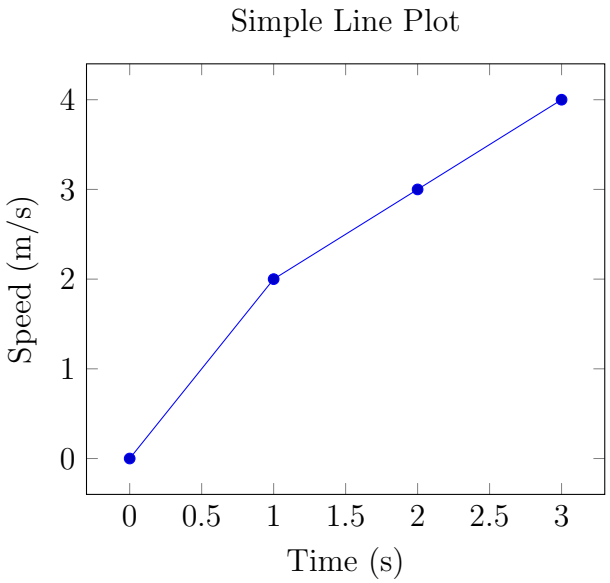
1) Simple Line Plot

Code:

```
\begin{tikzpicture}
\begin{axis}[
    xlabel=Time (s),
    ylabel=Speed (m/s),
    title=Simple Line Plot
]
\addplot coordinates {(0,0) (1,2) (2,3) (3,4)};
\end{axis}
\end{tikzpicture}
```



Important Explanation:

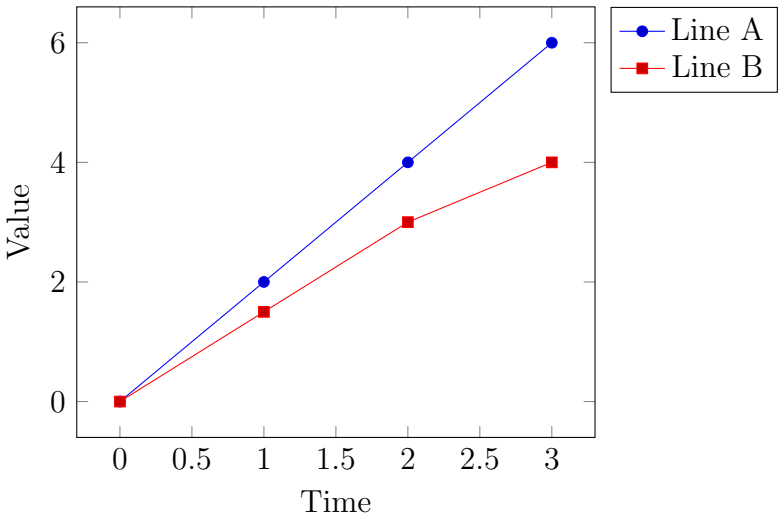
- `xlabel`, `ylabel` → Names for axes
- `title` → Heading for the plot
- `addplot` → Connects given points with a line

2) Two Line Comparison Plot

Code:

```
\begin{tikzpicture}
\begin{axis}[
    xlabel=Time,
    ylabel=Value,
    legend pos=outer north east
]
\addplot coordinates {(0,0) (1,2) (2,4) (3,6)};
\addlegendentry{Line A}

\addplot coordinates {(0,0) (1,1.5) (2,3) (3,4)};
\addlegendentry{Line B}
\end{axis}
\end{tikzpicture}
```



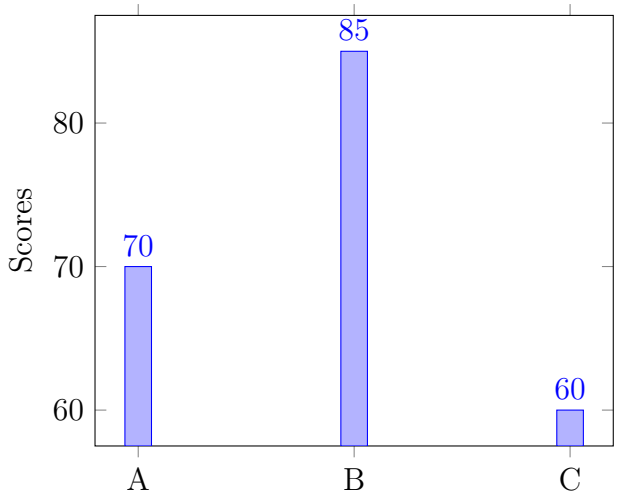
Important Explanation:

- Two `addplot` commands → two separate lines
- `legend pos` → places legend outside the plot area

3) Bar Chart

Code:

```
\begin{tikzpicture}
\begin{axis}[
    ybar,
    symbolic x coords={A,B,C},
    xtick=data,
    ylabel=Scores,
    nodes near coords
]
\addplot coordinates {(A,70) (B,85) (C,60)};
\end{axis}
\end{tikzpicture}
```



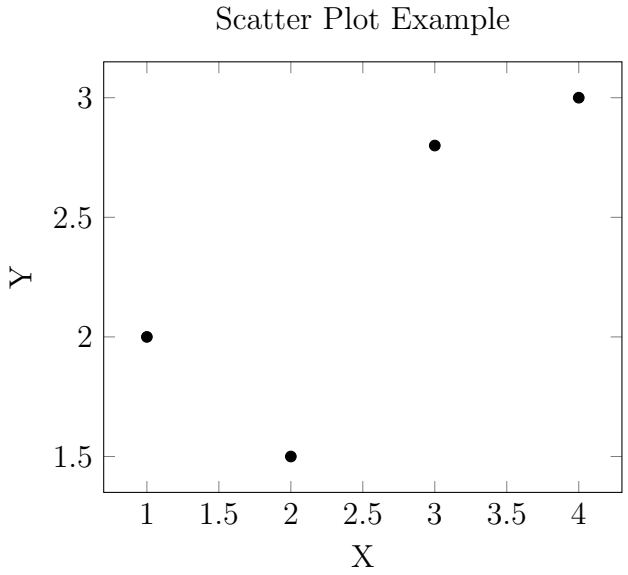
Important Explanation:

- `ybar` → makes bars instead of lines
- `symbolic x coords` → labels instead of numbers
- `nodes near coords` → values printed on bars

4) Scatter Plot

Code:

```
\begin{tikzpicture}
\begin{axis}[
    xlabel=X,
    ylabel=Y,
    title=Scatter Plot Example
]
\addplot[only marks] coordinates {(1,2) (2,1.5) (3,2.8) (4,3)};
\end{axis}
\end{tikzpicture}
```



Important Explanation:

- `only marks` → only points are shown (no connecting line)

Exercises

For each exercise, draw the correct plot in LaTeX using the examples above.

Exercise 1: Simple Line Plot

Data Table:

Time (s)	Temperature (°C)
0	20
1	22
2	25
3	30

Expected Solution:

A straight line going upward as temperature increases with time.

Exercise 2: Two Line Plot

Data Table:

Day	City A	City B
1	30	28
2	32	29
3	31	30
4	33	31

Expected Solution:

Two increasing lines with a legend showing City A and City B.

Exercise 3: Bar Chart

Student Marks:

Subject	Marks
Math	80
Science	75
English	90

Expected Solution:

Three bars where English is the highest.

Exercise 4: Scatter Plot

Distance (m)	Height (m)
1	2
2	2.5
3	3
4	3.5

Expected Solution:

Points forming an upward diagonal trend.