

第十二章

绘图软件介绍

—— PGF/TikZ 绘图宏包

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函数作图 plot

👉 函数作图: plot

```
plot[选项] coordinates {( $x_1, y_1$ ) ( $x_2, y_2$ ) ... ( $x_n, y_n$ )}
```

```
plot[选项] file {文件名}
```

```
plot[选项] 坐标表达式
```

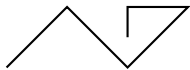
```
plot[选项] function {函数 (gnuplot)}
```

plot

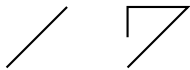
```
plot[选项] coordinates  $\{(x_1, y_1) (x_2, y_2) \dots (x_n, y_n)\}$ 
```



```
\begin{tikzpicture}
  \draw plot coordinates %
    {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```

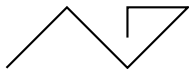


```
\begin{tikzpicture}
  \draw (0,0) -- (1,1) plot coordinates %
    {(2,0) (3,1) (2,1) (2,0.5)};
  \draw (0,0) -- (1,1) -- plot coordinates %
    {(2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```



plot

→ 光滑选项: `smooth`



```
\begin{tikzpicture}[thick,scale=0.8]
  \draw[yshift=2cm] plot coordinates %
    {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
```



```
\draw plot[smooth] coordinates %
  {(0,0) (1,1) (2,0) (3,1) (2,1) (2,0.5)};
\end{tikzpicture}
```

→ `smooth cycle`: 光滑封闭曲线

plot

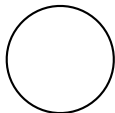
→ 松紧度选项: `tension`, 缺省值为: 0.55



```
\begin{tikzpicture}[thick,smooth cycle]
  \draw[yshift=4cm] plot coordinates %
    {(0,0) (1,0) (1,1) (0,1)};
```



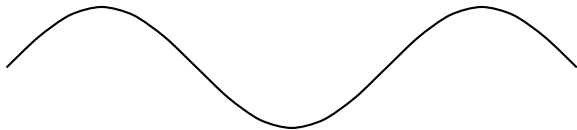
```
\draw[yshift=2cm] plot[tension=0.2] %
  coordinates {(0,0) (1,0) (1,1) (0,1)};
```



```
\draw plot[tension=1] coordinates %
  {(0,0) (1,0) (1,1) (0,1)};
\end{tikzpicture}
```

利用文件中的数据绘图

```
plot[选项] file {文件名}
```



```
\begin{tikzpicture}[thick,smooth,scale=0.8]  
  \draw plot file {pgf-file.table};  
\end{tikzpicture}
```

- 数据文件要求：每行只能有两个数字，用空格隔开；井号“#”或百分号“%”开始的行为注释行

坐标表达式绘图

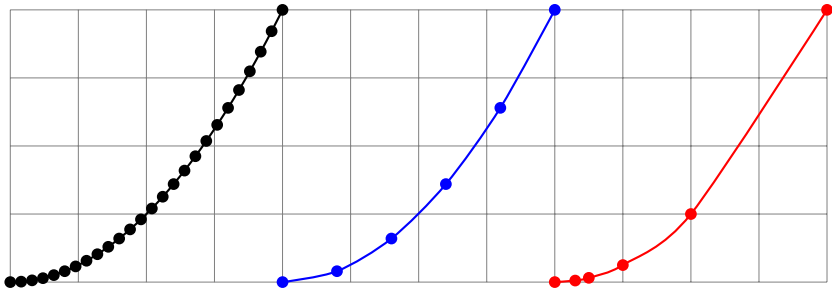
plot[选项] {坐标表达式}



```
\begin{tikzpicture}[thick,smooth,scale=0.6]
  \draw plot[domain=0:2] (\x,{\x * \x/2});
\end{tikzpicture}
```

☞ 相关选项

- `variable=变量名`: 指定变量, 默认为 x
- `samples=数`: 样本点的个数, 默认为 25
- `domain=a:b`: 绘图区间, 默认为 $-5:5$
- `samples at={ x_1, x_2, \dots, x_n }`: 指定样本点



```

\begin{tikzpicture}[thick,smooth,domain=0:4,mark=*]
  \draw[very thin,gray] (0,0) grid (12,4);
  \draw plot (\x,{\x * \x/4});
  \draw[blue,xshift=4cm] %
    plot[samples=5,variable=\t] (\t,{\t * \t/4});
  \draw[red,xshift=8cm] %
    plot[samples at={0,0.3,0.5,1,2,4}] (\x,{\x * \x/4});
\end{tikzpicture}

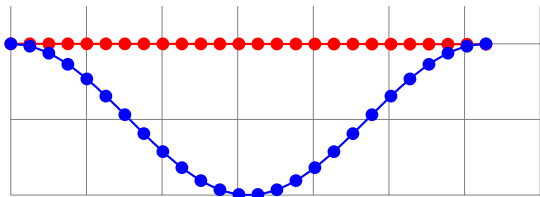
```

支持的数学运算和函数

→ +, -, *, /, ^

→ abs, exp, ln, pow, sqrt, sin, cos, tan, sec, pi, ...

→ x r → 将弧度转化成度数



```
\begin{tikzpicture}[thick,smooth,domain=0:2*pi,mark=*]
  \draw[very thin,gray] (0,-1) grid (12,2);
  \draw[red] plot (\x,{cos(\x)});
  \draw[blue] plot (\x,{cos(\x r)});
\end{tikzpicture}
```

Gnuplot 绘图

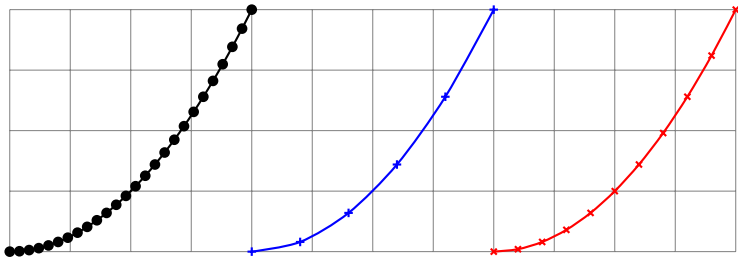
与 Gnuplot 结合绘图

```
plot[选项] function {函数 (gnuplot)}
```

```
\begin{tikzpicture}[thick,smooth,domain=0:4]  
  \draw[very thin,gray] (0,0) grid (4,4);  
  \draw plot function{x*x/4};  
\end{tikzpicture}
```

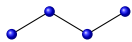
标记选项

 **mark** 选项：给绘图节点做标记，取值有：*, +, x

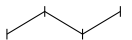


```
\begin{tikzpicture}[thick,smooth,domain=0:4,scale=0.9]
  \draw[very thin,gray] (0,0) grid (12,4);
  \draw plot[mark=*] (\x,{\x * \x/4});
  \draw[blue,xshift=4cm] plot[samples=5,mark=+] (\x,{\x * \x/4});
  \draw[red,xshift=8cm] plot[samples=10,mark=x] (\x,{\x * \x/4});
\end{tikzpicture}
```

更多标记选项: `\usetikzlibrary{plotmarks}`



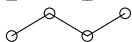
```
\tikz\draw plot [mark=ball] ...
```



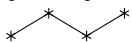
```
\tikz\draw plot [mark=|] ...
```



```
\tikz\draw plot [mark=-] ...
```



```
\tikz\draw plot [mark=o] ...
```



```
\tikz\draw plot [mark=asterisk] ...
```



```
\tikz\draw plot [mark=star] ...
```



```
\tikz\draw plot [mark=oplus] ...
```



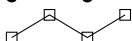
```
\tikz\draw plot [mark=oplus*] ...
```



```
\tikz\draw plot [mark=otimes] ...
```



```
\tikz\draw plot [mark=otimes*] ...
```

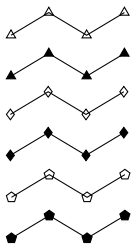


```
\tikz\draw plot [mark=square] ...
```



```
\tikz\draw plot [mark=square*] ...
```

更多标记选项: `\usetikzlibrary{plotmarks}`



```
\tikz\draw plot [mark=triangle] ...
```

```
\tikz\draw plot [mark=triangle*] ...
```

```
\tikz\draw plot [mark=diamond] ...
```

```
\tikz\draw plot [mark=diamond*] ...
```

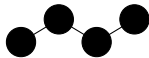
```
\tikz\draw plot [mark=pentagon] ...
```

```
\tikz\draw plot [mark=pentagon*] ...
```

👉 设置标记的大小: `mark size`

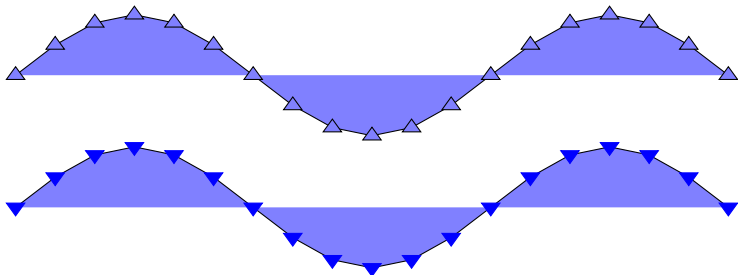


```
\tikz\draw plot[mark=*] coordinates ...
```



```
\tikz\draw plot[mark=*,mark size=1ex] ...
```

👉 设置标记的属性: `mark options={. . .}`

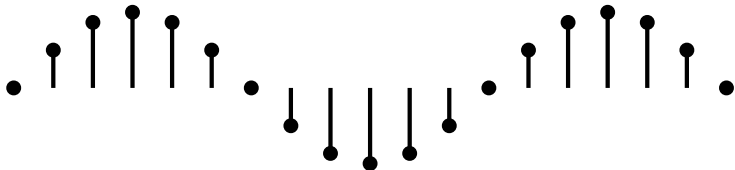


```
\tikz\draw plot[mark=triangle*] file {pgf-file.table};
\tikz\draw plot[mark=triangle*, %
  mark options={color=red,rotate=180}] file {pgf-file.table};
```

其它选项

其它选项

→ `ycomb`, `xcomb`, `polar comb`

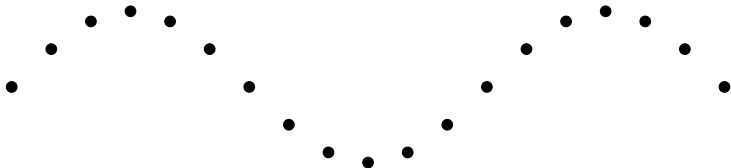


```
\tikz\draw[ultra thick] plot[ycomb,mark=*] %  
file {pgf-file.table};
```

其它选项

👉 其它选项

→ only marks



```
\tikz\draw plot[only marks,mark=*] %  
file {pgf-file.table};
```

其它选项

- 👉 图形的 **Bounding Box**: 绘图结束后, pgf 会计算出所画图形的边界, 并改变图形盒子的大小, 使之与实际图形的边界相吻合
- 👉 **baseline**: 设置图形盒子的基线 (与周边文本的对齐方式)
 - 没使用这个选项时, 图形盒子的底线为基线

$A \longrightarrow B$	<pre>\$A \mathbin{\tikz % \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B\$</pre>
$A \longrightarrow B$	<pre>\$A \mathbin{\tikz[baseline=0pt] % \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B\$</pre>
$A \longrightarrow B$	<pre>\$A \mathbin{\tikz[baseline=2pt] % \draw[->>] (0pt,0.5ex) -- (3ex,0.5ex);} B\$</pre>

更多用法

👉 PGF/TikZ 的更多用法: 参见 [pgfmanual.pdf](#)