LaTeX 绘图

封面代码：

使用彩色

要在 LaTeX 中使用彩色，可以调用 xcolor 宏包

```
\usepackage{xcolor}
```

使用某种颜色之前，首先要给出定义，命令格式为：

`\definecolor{`⟨颜色名⟩`}{`⟨模式⟩`}{`⟨颜色值⟩`}`

其中

⟨颜色名⟩： 用户给出的字符串

⟨模式⟩： 系统预定义的彩色模式，
常用的有 `rgb`，`cmyk`，`wave` 等。

⟨颜色值⟩： 与彩色模式有关

`rgb`: $(0,0,0) \sim (1,1,1)$

`cmyk`: $(0,0,0,0) \sim (1,1,1,1)$

`wave`: $363 \sim 814$

以下颜色已经预定义：

black	gray	olive	teal
blue	green	orange	violet
brown	lightgray	pink	white
cyan	lime	purple	yellow
darkgray	magenta	red	

例如

```
\definecolor{red}{rgb}{1,0,0}
\definecolor{purple}{cmyk}{0.45,0.86,0,0}
\definecolor{yellow}{cmyk}{0,0,1,0}
```

```
\textcolor{red}{red texts}\\
\textcolor[rgb]{1,0,0}{red texts}\\
{\color{blue} blue texts}\\
{\color[wave]{600}波长为
600 nm 的光波颜色}
```

red texts

red texts

blue texts

波长为 600 nm
的光波颜色

指定颜色时，可以用颜色表达式代替颜色名。常用的颜色表达式有

```
<颜色1>!<百分数>!<颜色2>
   := <颜色1>*<百分数>% + <颜色2>*(1-<百分数>%)
<颜色>!<百分数> := <颜色>!<百分数>!<白色>
-<颜色>: 补色。
```

```
\textcolor{red!40}{test colors}\\
\textcolor{red!40!green}{test colors}\\
\textcolor{-red}{test colors}
```

test colors

test colors

test colors

使用已知颜色定义新颜色：

```
\colorlet{darkred}{red!50!black}
\textcolor{darkred}{dark red}
```

dark red

背景色:

```
\pagecolor{⟨页面颜色⟩}
\colorbox{⟨盒子颜色⟩}{⟨文字⟩}
\fcolorbox{⟨边框颜色⟩}{⟨盒子颜色⟩}{⟨文字⟩}
```

```
\fcolorbox{blue}{blue!15}
  {\color{red}彩色盒子}
```

彩色盒子

xcolor 与 colortbl 两个宏包合用，可以制作彩色表格，具体内容请参考宏包说明。

绘图

LaTeX 有很多绘图宏包，其中功能强大的有 pstricks 和 pgf。这里以 pgf 的前端宏包 tikz 为例。

绘制简单图形：

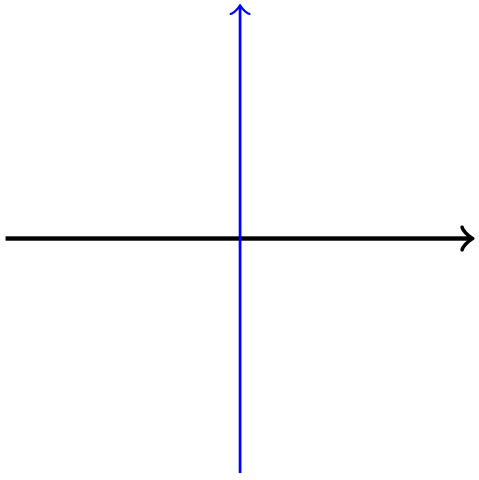
```
\tikz <绘图命令>;
```

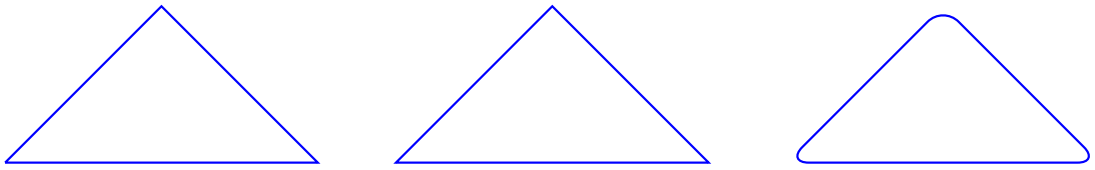
复杂图形：

```
\begin{tikzpicture}[选项]
  <绘图命令1>;
  <绘图命令2>;
  ... ...
  <绘图命令n>;
\end{tikzpicture}
```

直线

```
\begin{tikzpicture}
\draw[->,thick] (-1.5,0) -- (1.5,0);
\draw[->,line width=0.5pt,
  blue] (0,-1.5) -- (0,1.5);
\end{tikzpicture}
```





```
\begin{tikzpicture}[color=blue,scale=0.5]
\draw (0,0) --(4,0) --(2,2) --(0,0);
\draw[xshift=5cm] (0,0) --(4,0) --(2,2) -- cycle;
\draw[xshift=10cm, rounded corners] (0,0) --(4,0)
  --(2,2) -- cycle;
\end{tikzpicture}
```

定义坐标：

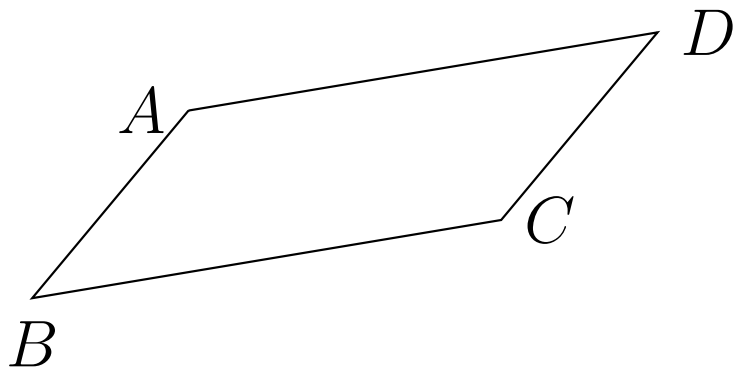
```
\coordinate [label=below:$A$] (A) at (-2.5,0);
```

坐标表达式：

```
$(A) + 2*(B) - 3*(C)$
```

参考：pgfmanual: 13.5 Coordinate Calculations

过直线外一点做它的平行线：




```
\begin{tikzpicture}
\coordinate [label=left:$A$](A) at (1,1.2);
\coordinate [label=below:$B$](B) at (0,0);
\coordinate [label=right:$C$](C) at (3,0.5);
\coordinate [label=right:$D$](D) at ($(A)+(C)-(B)$);
\draw (A) -- (B) -- (C) -- (D) -- (A);
\end{tikzpicture}
```

画线段中的某个点:

方法 1:<coordinate1>!<factor>!<angle>:<coordinate2>

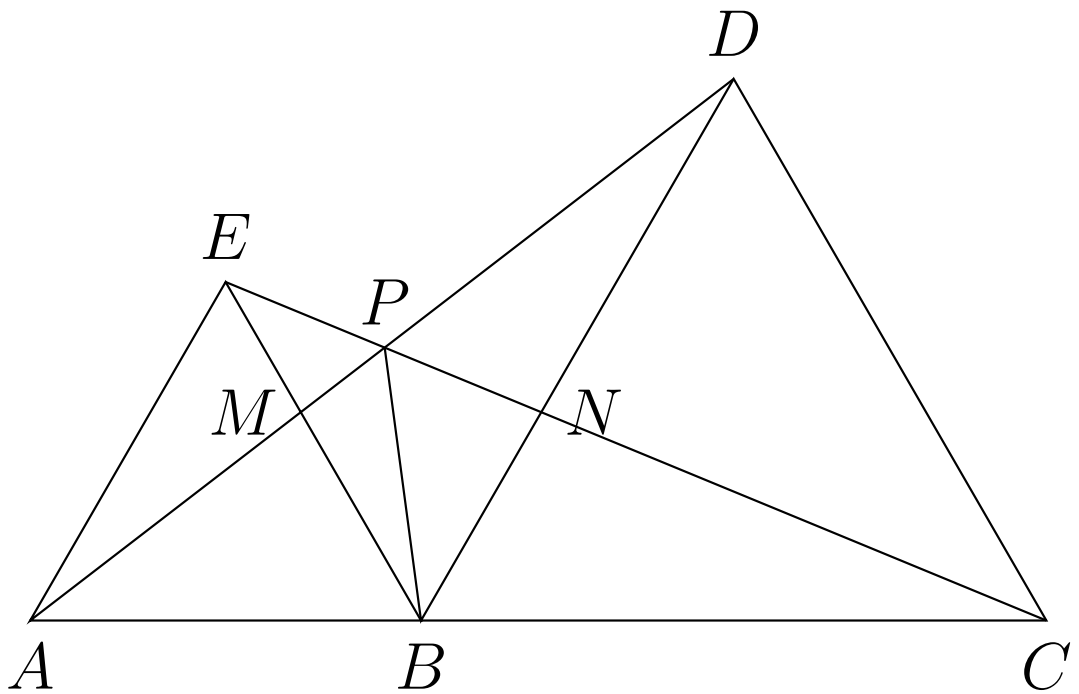
考虑一条由 <coordinate1> 到 <coordinate2> 的线段, 绕点 <coordinate1> 以 <angle> 角度旋转线段, 取旋转线段中位置为 <factor> 的点.

factor=0.5 表示线段中点, factor=0 表示起点, factor=1 表示终点.

如果这条线段没有旋转, 则可省略 <angle> 参数

方法 2：把 <factor> 改为距离。

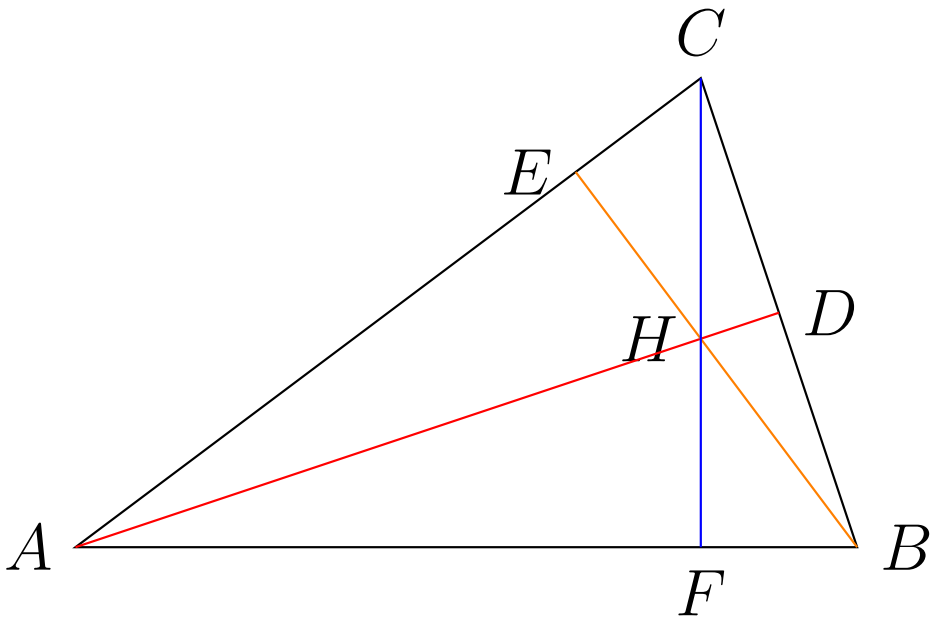
已知 B 在线段 AC 上，等边 $\triangle ABE$ 和等边 $\triangle BCD$ 在线段 AC 的同侧，AD 与 BE 交于点 M, CE 与 BD 交于点 N. 求证：(1) $BM = BN$. (2) BP 平分 $\angle APC$.



```
已知 $B$ 在线段 $AC$ 上， 等边 $\triangle ABE$ 和等边
$\triangle BCD$ 在线段 $AC$ 的同侧，
$AD$ 与 $BE$ 交于点 $M$, $CE$ 与 $BD$ 交于点 $N$.
求证： (1) $BM=BN$. (2) $BP$ 平分 $\angle APC$.

\begin{tikzpicture}
\coordinate [label=below:$A$] (A) at (-2.5,0);
\coordinate [label=below:$B$] (B) at (0,0);
\coordinate [label=below:$C$] (C) at (4,0);
\coordinate [label=above:$E$] (E) at ($(A)!1!60:(B)$);
\coordinate [label=above:$D$] (D) at ($(B)!1!60:(C)$);
\coordinate [label=above:$P$] (P) at (intersection cs:
 first line={(A)--(D)}, second line={(C)--(E)});
\coordinate [label=right:$N$] (N) at (intersection cs:
```

```
first line={(B)--(D)},
second line={(C)--(E)});
\coordinate [label=left:$M$] (M) at (intersection cs:
first line={(A)--(D)},
second line={(B)--(E)});
\draw (A)--(B)--(E)--(A)--(D);
\draw (B)--(C)--(D)--(B)--(P);
\draw (C)--(E);
\end{tikzpicture}
```

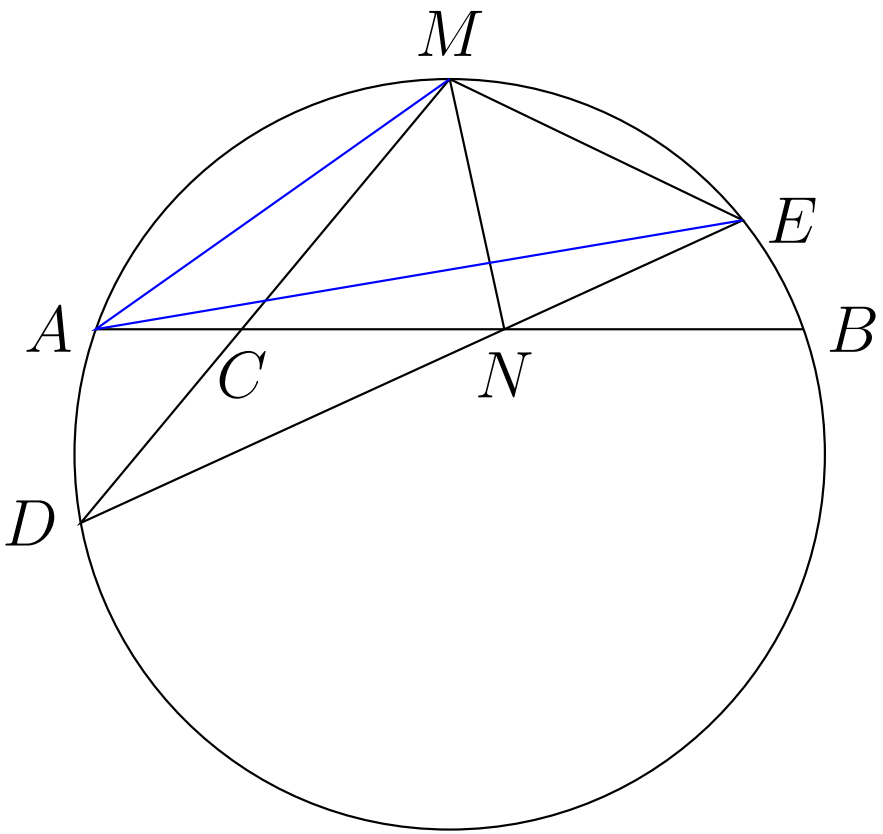
垂心定理 三角形的三条高交于一点.




```
\textbf{垂心定理}\,\,三角形的三条高交于一点.


\begin{tikzpicture}
\coordinate [label=left:$A$]  (A) at (0,0);
```

```
\coordinate [label=right:$B$] (B) at (5,0);
\coordinate [label=above:$C$] (C) at (4,3);
\coordinate [label=right:$D$] (D) at ($(B)!(A)!(C)$);
\coordinate [label=left:$E$] (E) at ($(A)!(B)!(C)$);
\coordinate [label=below:$F$] (F) at ($(A)!(C)!(B)$);
\coordinate [label=left:$H$] (H) at (intersection cs:
first line={(A)--(D)}, second line={(B)--(E)});

\draw (A) -- (B) -- (C)-- cycle;
\draw[red] (A) -- (D);
\draw[orange] (B) -- (E);
\draw[blue] (C) -- (F);
\end{tikzpicture}
```

M 为弧 AB 的中点，弦 MD 交 AB 于 C，作弦 ME 等于 MC, DE 交 AB 于 N。求证：MN 平分 $\angle CNE$。


M
E
A
B
C
N
D

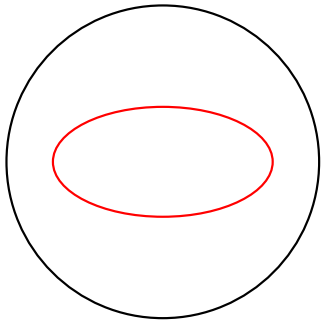
```
$M$ 为弧 $AB$ 的中点，
弦 $MD$ 交 $AB$ 于 $C$，作弦 $ME$ 等于 $MC$，
$DE$ 交 $AB$ 于 $N$。求证：$MN$ 平分 $\angle CNE$。


\begin{tikzpicture}[scale=0.8]
\coordinate   (O) at (0,0);
\draw[name path=Oc] (O) circle (3);

\coordinate[label=above:$M$]   (M) at (0,3);
\path   [name path=AB] (-3,1) -- (3,1);
```

```
\path [name intersections={of=Oc and AB, name=ABOc}];
\coordinate [label=left:$A$] (A) at (ABOc-2);
\coordinate [label=right:$B$] (B) at (ABOc-1);
\draw (A)--(B);


\path   [name path=Om] (M) circle (2.6);
\path [name intersections={of=Oc and Om, name=Ocm}];
\coordinate [label=right:$E$] (E) at (Ocm-1);

\path [name intersections={of=Om and AB, name=ABm}];
\coordinate [label=below:$C$] (C) at (ABm-1);

\coordinate(D) at ($(M)!3!(C)$);
```

```
\path   [name path=MD] (M) -- (D);
\path [name intersections={of=Oc and MD, name=MDOc}];
\coordinate [label=left:$D$] (D) at (MDOc-2);
\draw (M)--(D)--(E)--(M);

\coordinate [label=below:$N$] (N) at (intersection cs:↩
   first line={(A)--(B)}, second line={(D)--(E)});
\draw (M)--(N);

\draw [blue] (M) -- (A) -- (E);

\end{tikzpicture}
```

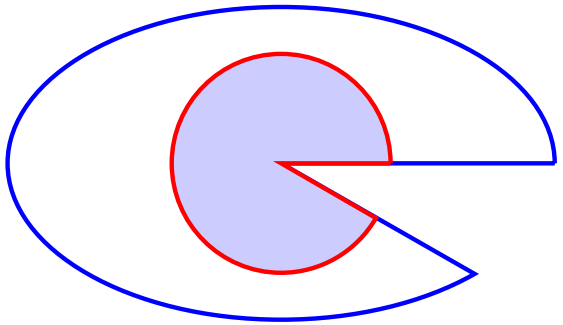
圆，椭圆

```
\begin{tikzpicture}
\draw (0,0) circle (1cm);
\draw[red] (0,0)
  ellipse (20pt and 10pt);
\end{tikzpicture}
```



圆弧

```
\begin{tikzpicture}
\draw[blue,thick] (0,0)
 arc (0:315:1.75cm and 1cm)
 -- (-1.75,0) -- ++(1.75,0);
\filldraw[draw=red,fill=blue!20,
 thick] (-1.05,0) arc (0:330:0.7)
 -- (-1.75,0) -- ++(0.7,0);
\end{tikzpicture}
```

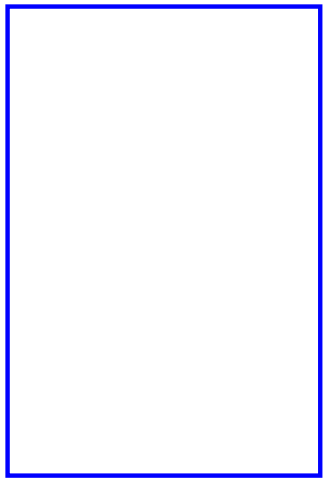


注意：arc 之前的参数并非圆心坐标，而是圆弧起点坐标。

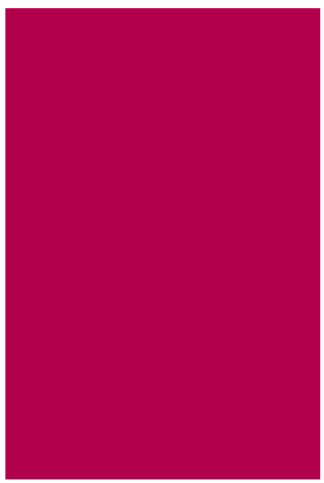
++(*,*): 增量，并且移动当前光标位置。

长方形

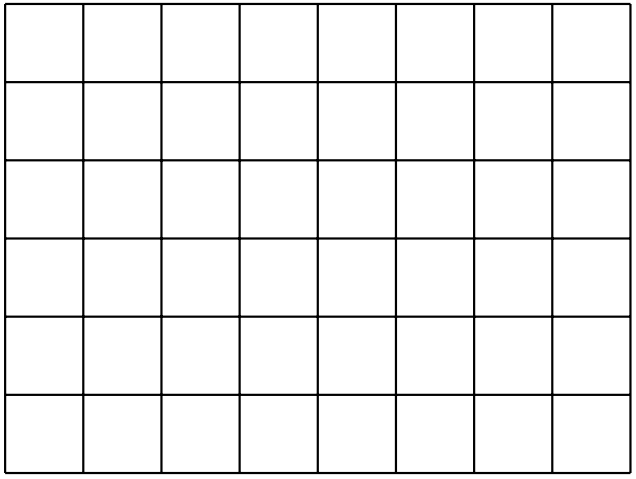
```
\begin{tikzpicture}
\draw[blue,thick] (1,1)
rectangle (3,4);
\end{tikzpicture}
```



```
\begin{tikzpicture}
\filldraw[color=blue!30!red]
  (1,1) rectangle +(2,3);
\end{tikzpicture}
```

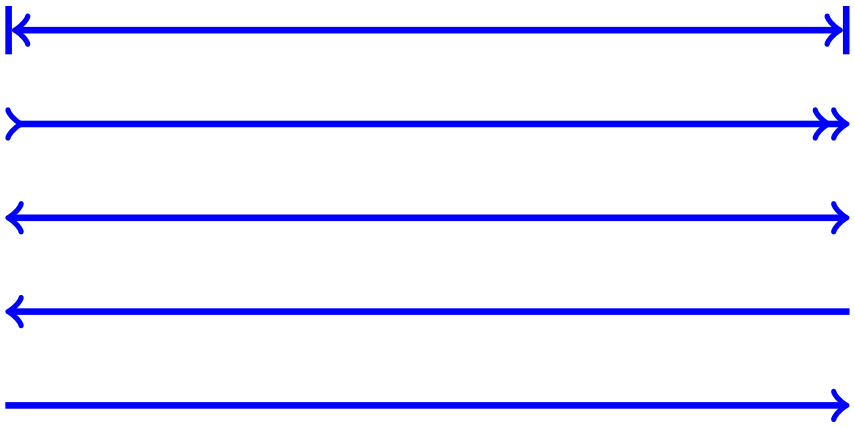


网格



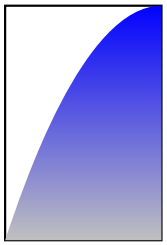
```
\begin{tikzpicture}
\draw [step=0.5] (0,0) grid (4,3);
\end{tikzpicture}
```

箭头



```
\begin{tikzpicture}[very thick,blue,scale=0.6]
\draw [->] (0,0) --(9,0);
\draw [<-] (0,1) --(9,1);
\draw [<->] (0,2) --(9,2);
\draw [>->>] (0,3) --(9,3);
\draw [|<->|] (0,4) --(9,4);
\end{tikzpicture}
```

抛物线

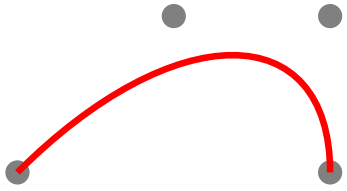


```
\begin{tikzpicture}
\draw(0,0)rectangle(1,1.5);
\shade[top color=blue, bottom color=gray!50]
(0,0) parabola[bend at end] (1,1.5) |-(0,0);
\end{tikzpicture}
```

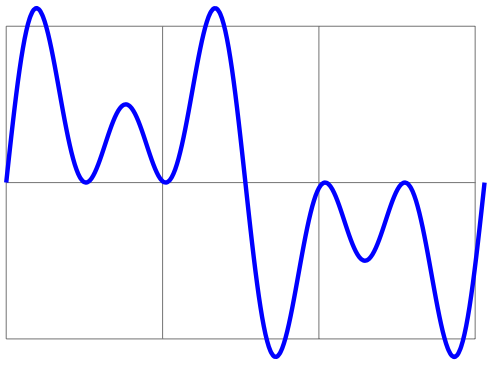
```
\begin{tikzpicture}
\draw (0,0) rectangle (1,1.5)
(0,0) parabola[bend at end] (1,1.5);
\draw[xshift=3cm] (0,0) rectangle (1,1.5)
(0,0) parabola bend (.75,1.75) (1,1.5);
\end{tikzpicture}
```

一般曲线

```
\begin{tikzpicture}
\filldraw [gray] (0,0) circle (2pt)
(1,1) circle (2pt)
(2,1) circle (2pt)
(2,0) circle (2pt);
\draw [red, very thick]
 (0,0) .. controls (1,1)
  and (2,1) .. (2,0);
\end{tikzpicture}
```

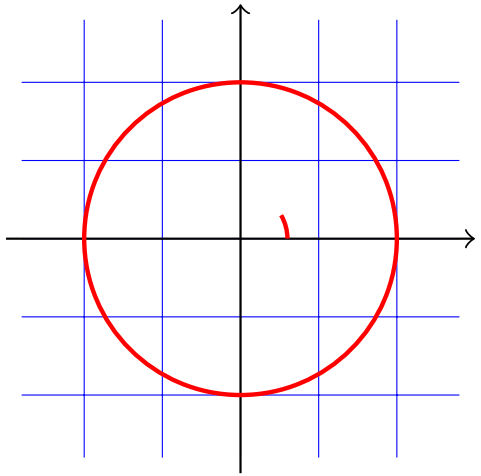


函数

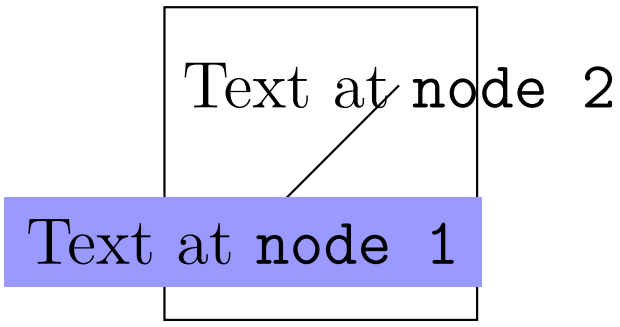


```
\begin{tikzpicture}
\draw [help lines] (0,0) grid (3,2);
\draw [blue, thick, x=0.0085cm, y=1cm,
declare function={sines(\t,\a,\b)=1 +
 0.5*(sin(\t)+sin(\t*\a) +sin(\t*\b));}]
plot [domain=0:360, samples=144, smooth]
 (\x,{sines(\x,3,5)});
\end{tikzpicture}
```

```
\begin{tikzpicture}
\draw[step=.5cm,blue,very thin]
 (-1.4,-1.4) grid (1.4,1.4);
\draw[->] (-1.5,0) -- (1.5,0);
\draw[->] (0,-1.5) -- (0,1.5);
\draw[red,thick] (0,0)
  circle (1cm);
\draw[red,thick] (3mm,0mm)
  arc (0:30:3mm);
\end{tikzpicture}
```

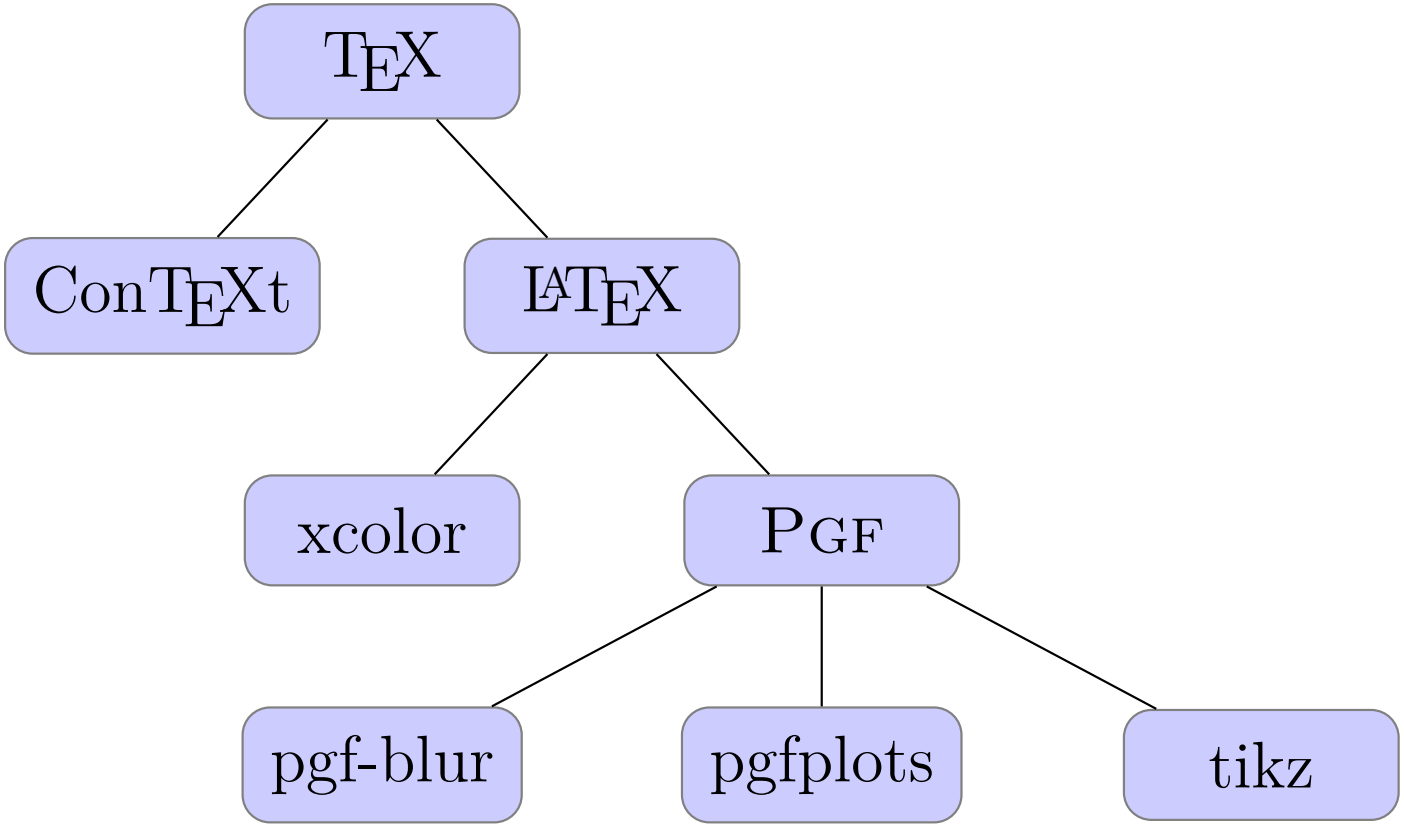


添加文本




```
\begin{tikzpicture}
\draw (0,0) rectangle (2,2);
\draw (0.5,0.5) node [fill=blue!40]
{Text at \verb!node 1!}
-- (1.5,1.5) node {Text at \verb!node 2!};
\end{tikzpicture}
```

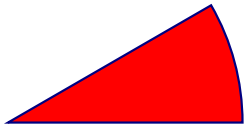
示意图



```
\tikzset{box/.style ={rectangle,rounded corners=5pt,
minimum width =50pt, minimum height =20pt,
inner sep=5pt,  draw=gray,fill=blue!20}}
\begin{tikzpicture}[sibling distance =80pt]
\node[box] {\TeX}
  child {node[box] {Con\TeX t}}
  child { node[box] {\LaTeX}
    child {node[box] {xcolor}}
    child {node[box] {\scshape Pgf}
      child {node[box] {pgf-blur}}
      child {node[box] {pgfplots}}
      child {node[box] {tikz}}}};
\end{tikzpicture}\newpage
```

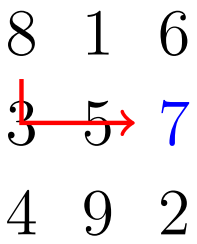
填充

```
\begin{tikzpicture}[scale=5]
\filldraw[fill=red,
 draw=blue!50!black]
(0,0) -- (3mm,0mm) arc
(0:30:3mm) -- cycle;
\end{tikzpicture}
```



矩阵

```
\begin{tikzpicture}
\matrix (magic) [matrix of nodes,
  row 2 column 3/.style=blue]
{
8 & 1 & 6 \\
3 & 5 & 7 \\
4 & 9 & 2 \\
};
\draw[thick,red,->] (magic-1-1)
  |- (magic-2-3);
\end{tikzpicture}
```



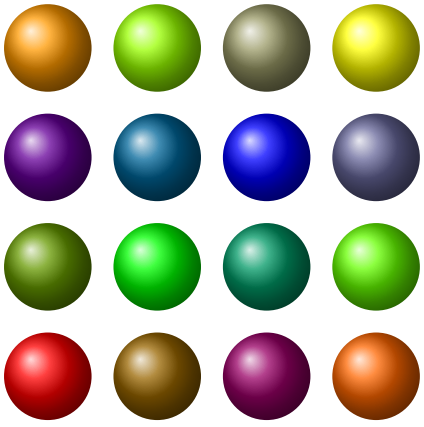
阴影与渐变色

```
\begin{tikzpicture}[rounded corners, ultra thick]
\shade[top color=blue,bottom color=red]
  (0,0) rectangle +(2,1);
\shade[left color=yellow,right color=white]
  (3,0) rectangle +(2,1);
\shadedraw[inner color=yellow,outer color=black,
  draw=yellow] (6,0) rectangle +(2,1);
\shade[ball color=green] (9,.5) circle (.5cm);
\end{tikzpicture}
```

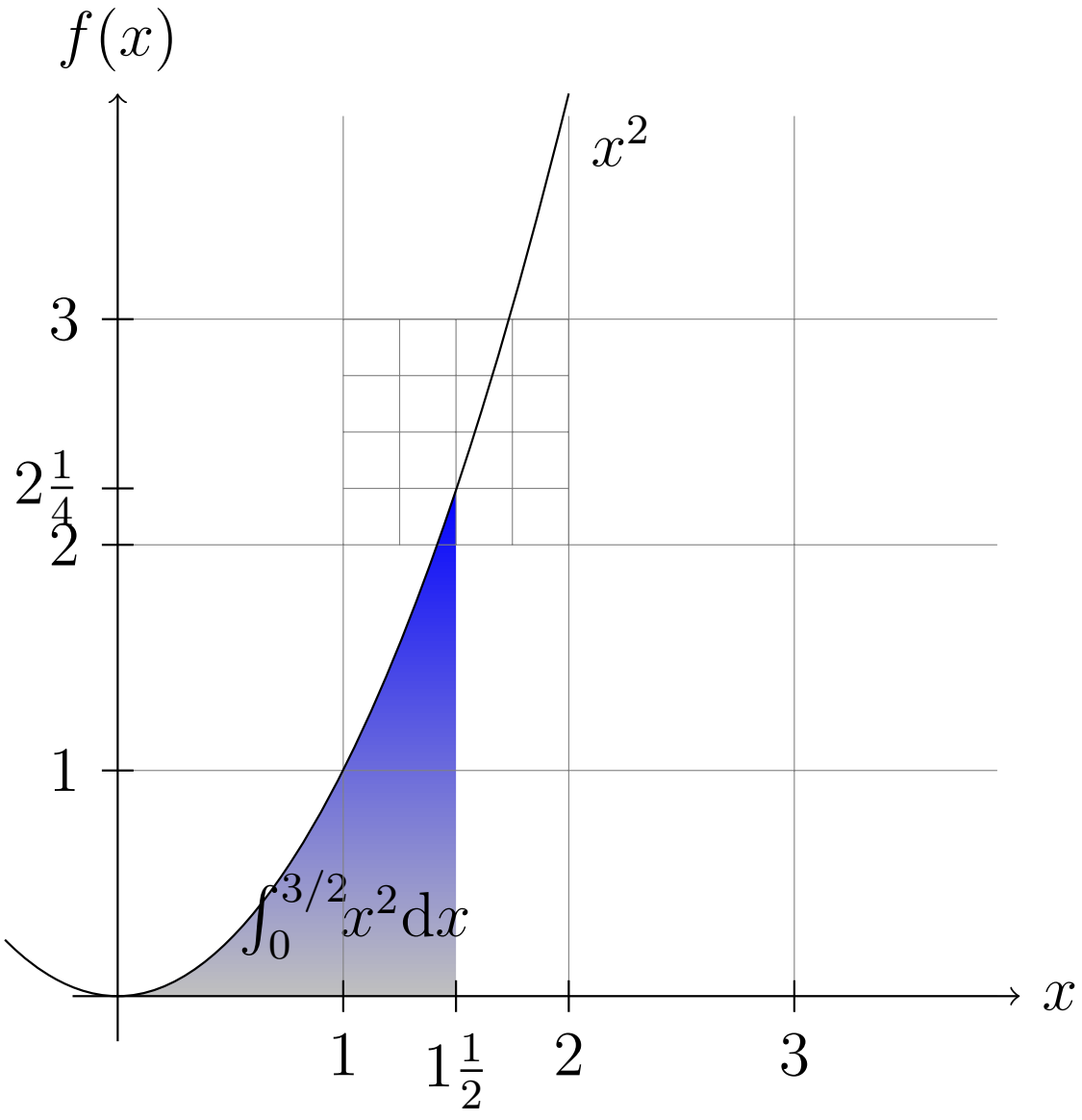
简单编程

光谱

```
\begin{tikzpicture}[scale=0.6]
\foreach \lambda in{363,364,...,814}
 \color[wave]{\lambda}\draw[line width=1pt]
 (\lambda pt,0)--(\lambda pt, 40pt);
\end{tikzpicture}
```



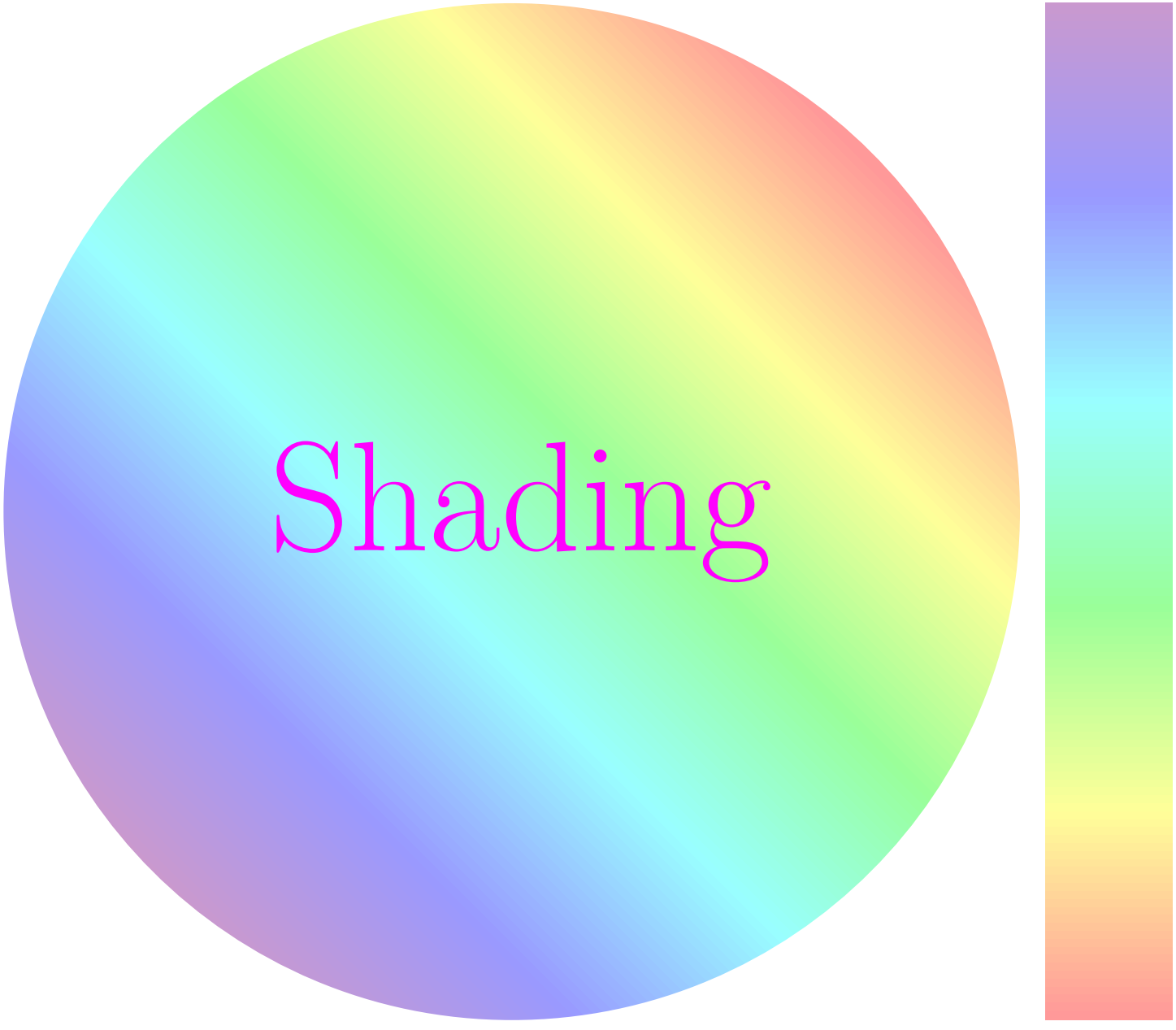
```
\tikz[shading=ball,scale=0.7]
\foreach \x / \cola in {0/red,1/green,2/blue,3/yellow}
\foreach \y / \colb in {0/red,1/green,2/blue,3/yellow}
\shade[ball color=\cola!40!\colb] (\x,\y)
 circle (0.4cm);
```


$f(x)$
x^2
3
$2\frac{1}{4}$
2
1
$\int_0^{3/2} x^2 \mathrm{d}x$
x
1
$1\frac{1}{2}$
2
3

```
\begin{tikzpicture}[scale=1.5]
\shade[top color=blue,bottom color=gray!50]
 (0,0) parabola (1.5,2.25) |- (0,0);
\draw (1.05cm,2pt) node[above]
 {$\int_0^{3/2} \!\!x^2\mathrm{d}x$};
\draw[help lines] (0,0) grid (3.9,3.9)
[step=0.25cm] (1,2) grid +(1,1);
\draw[->] (-0.2,0) -- (4,0) node[right] {$x$};
\draw[->] (0,-0.2) -- (0,4) node[above] {$f(x)$};
\foreach \x/\xtext in
  {1/1, 1.5/1\frac{1}{2}, 2/2,3/3}
  \draw[shift={(\x,0)}] (0pt,2pt) -- (0pt,-2pt)
    node[below] {$\xtext$};
\foreach \y/\ytext in {1/1, 2/2, 2.25/2\frac{1}{4},
```

```
    3/3}
\draw[shift={(0,\y)}] (2pt,0pt) -- (-2pt,0pt)
  node[left] {$\ytext$};
\draw (-.5,.25) parabola bend (0,0) (2,4)
  node[below right] {$x^2$};
\end{tikzpicture}
```

阴影



```
\pgfdeclareverticalshading{spectrum}{100bp}
{color(0bp)=(red!40); color(25bp)=(red!40);
  color(35bp)=(yellow!40);
color(45bp)=(green!40); color(55bp)=(cyan!40);
  color(65bp)=(blue!40);
color(75bp)=(violet!40); color(100bp)=(violet!40)}
\hskip 10mm
\begin{tikzpicture}[shading=spectrum]
\shade [shading angle=135] (3,0) node
 {\color[rgb]{1,0,1}  \fontsize{35pt}{40pt}
\selectfont Shading} circle  (4);
\shade (7.2,-4) rectangle ++(1,8);
\end{tikzpicture}
```

```
\pgfdeclareradialshading{rainbow}
  {\pgfpoint{-10bp}{10bp}}
{color(0bp)=(bg);color(16bp)=(bg);
  color(20bp)=(bg!70!blue);
color(20.2bp)=(blue!40);color(20.5bp)=(blue!40);
  color(21bp)=(cyan!40);
color(21.5bp)=(green!40);  color(22bp)=(yellow!40);
  color(22.5bp)=(red!40);
color(22.7bp)=(red!40);color(22.9bp)=(red!40);
  color(23.1bp)=(red!5)}
\hspace*{-150mm}\begin{tikzpicture}[shading=rainbow]
\shade  (-20,-22) rectangle +(50,50);
\end{tikzpicture}
```