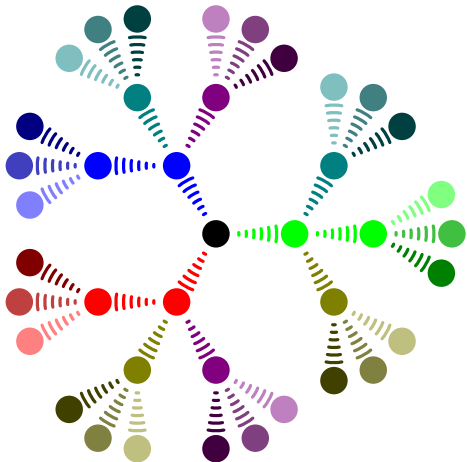


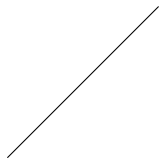
Grafiken mit TikZ

(TikZ = TikZ ist kein Zeichenprogramm)



Gerade Linien zeichnen:

```
\usepackage{tikz}  
[...]  
\begin{tikzpicture}  
\draw (0,0) -- (2, 2);  
\end{tikzpicture}
```



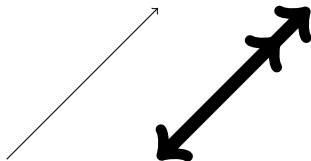
Pfeile Zeichnen und relative Koordinaten:

```
\begin{tikzpicture}

\draw[->] (0,0) -- (2, 2);

% mit "+" werden relative Koordinaten angegeben
\draw[<->>, line width=5pt] (2,0) -- +(2, 2);

\end{tikzpicture}
```

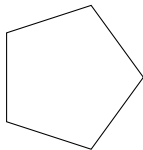


Polarkoordinaten (winkel:radius):

```
\begin{tikzpicture}

\draw (0:1cm) -- (72:1cm) -- (2*72:1cm) --
      (3*72:1cm) -- (4*72:1cm) -- cycle;

\end{tikzpicture}
```

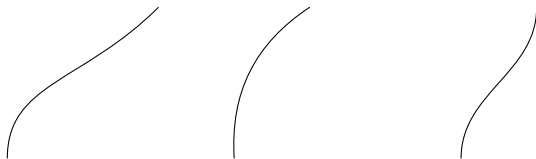


Kurven zeichnen:

```
\begin{tikzpicture}
% Direkte eingabe der Kontrollpunkte:
\draw (0,0) .. controls (0,1) and (1,1) .. (2, 2);

% Die Line krümmt sich um 30 Grad nach Links:
\draw[bend left=30] (3,0) to (4, 2);

% aus- und eingehenden Winkel festlegen:
\draw[out=90, in=-90] (6,0) to (7, 2);
\end{tikzpicture}
```



Kreise und Ellipsen zeichnen:

```
\begin{tikzpicture}  
\draw (0,0) circle (10pt);  
\draw (2,0) ellipse (10pt and 5pt);  
\end{tikzpicture}
```



Füllen von Objekten:

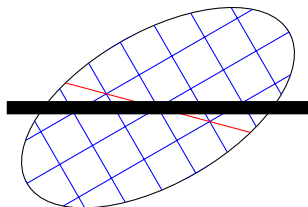
```
\begin{tikzpicture}
\fill (0,0) circle (0.25);
\fill[red] (1,0) circle (0.25);
\fill[blue] (2,0) circle (0.25);
\shade[ball color=green] (3,0) circle (0.25);

\fill[orange] (4,0) circle (0.25);
\fill[green,opacity=0.5] (4.25,0) circle (0.25);
\end{tikzpicture}
```



Zuschneiden clip und gruppieren scope:

```
\begin{tikzpicture}
\begin{scope}[rotate = 30]
\clip[draw] (0,0) ellipse (2cm and 1cm);
\draw[step=0.5cm, blue] (-2cm,-2cm) grid (2cm,2cm);
\draw[red] (2cm,-2cm) -- (-2cm,2cm);
\end{scope}
\draw[line width=5pt] (-2cm,0) -- (2cm,0);
\end{tikzpicture}
```



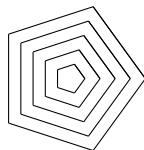
foreach-Schleifen:

```
\usepackage{pgffor}  
  
[...]  
  
\foreach \x in {2,4,6}  
{  
  $a^\x$,  
}
```

a^2 , a^4 , a^6 ,

Mehrere 5-Ecke mit einer foreach-Schleife:

```
\begin{tikzpicture}
\foreach \r in {1, 0.8,..., 0.2}
  \foreach \i in {0,...,5}
    \draw (360/5*\i:\r cm) -- ({360/5*(\i+1)}:\r cm);
\end{tikzpicture}
```



Text in Bildern:

```
\begin{tikzpicture}
\draw (0,0)
  node [rounded corners=8pt, fill=red]
    { $\int x^2 dx$ }
  -- (1.5,-1.5)
  node [text=white, fill=gray]
    {Ergebnis:  $\frac{x^3}{3}$ };
\end{tikzpicture}
```


$$\int x^2 dx$$

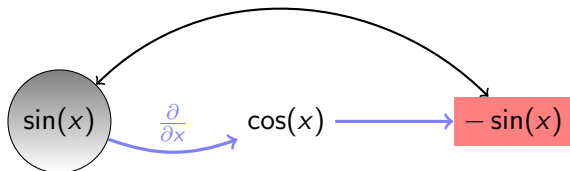


Ergebnis: $\frac{x^3}{3}$

Nodes und Verbindungen zwischen Nodes:

```
\begin{tikzpicture}
\node (A) at (0,0) [circle,shade,draw] {$\sin(x)$};
\node (B) at (3,0) {$\cos(x)$};
\node (C) at (6,0) [fill=red!50] {$-\sin(x)$};

\draw[->, blue!50, very thick] (A) to[bend right=20]
  node[above] {$\frac{\partial}{\partial x}$} (B);
\draw[->, blue!50, very thick] (B) to (C);
\draw[<->, thick] (A) to[out=45, in=135] (C);
\end{tikzpicture}
```



Benannte Koordinaten:

```
\begin{tikzpicture}
\coordinate[label=left:$A$] (A) at (0,0);
\coordinate[label=right:$B$] (B) at (4,1);

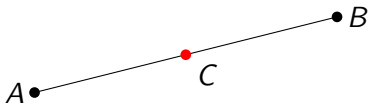
\draw (A) -- (B);

\fill (A) circle (2pt);
\fill (B) circle (2pt);
\end{tikzpicture}
```



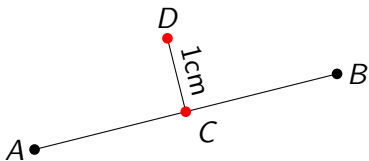
Rechnen mit Koordinaten:

```
\begin{tikzpicture}
[...]  
  
% C liegt genau auf halber Strecke zwischen A und B  
\coordinate[label=-45:$C$] (C) at ($(A)!0.5!(B)$);  
  
\fill[red] (C) circle (2pt);  
\end{tikzpicture}
```



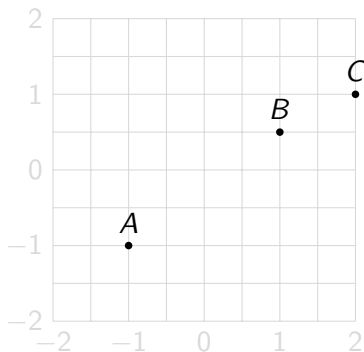
Rechnen mit Koordinaten (forts.):

```
\usetikzlibrary{calc}
[...]  
\begin{tikzpicture}  
[...]  
% D ist 2cm entfernt von der Strecke (C) -- (B):  
\coordinate[label=90:$D$] (D) at ($(C)!1cm!90:(B)$);  
  
\draw (C) -- (D) node[midway, sloped, above] {1cm};  
\fill[red] (C) circle (2pt);  
\fill[red] (D) circle (2pt);  
\end{tikzpicture}
```



Rechnen mit Koordinaten (forts.):

```
\begin{tikzpicture}
  [every node/.style={fill, circle, inner sep = 1pt}]
  \node[label=above:$A$] (A) at (-1,-1) {};
  \node[label=above:$B$] (B) at ($(A) + (2, 1.5)$) {};
  \node[label=above:$C$] (C) at ($2*(B)$) {};
\end{tikzpicture}
```

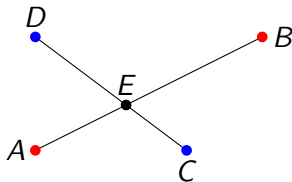


Schnittpunkte:

Gegeben sind 4 Koordinaten: $\{A, B, C, D\}$. Wir können den Schnittpunkt E der Geraden \overline{AB} und \overline{CD} berechnen.

```
\begin{tikzpicture}
[... ]
\coordinate[label=90:$E$] (E) at
(intersection of A--B and C--D);

\fill (E) circle (2pt);
\end{tikzpicture}
```



Kreise durch gegebene Punkte:

Wir zeichnen einen Kreis mit Mittelpunkt C der durch den Punkt E geht: Benötigt die tikzlibrary `through`

```
\usetikzlibrary{through}
[...]  
  
\begin{tikzpicture}  
[...]  
\node (kreis) at (C) [draw, circle through=(E)] {};  
\end{tikzpicture}
```

