Zeichnen mit TikZ

Dennis Labitzke

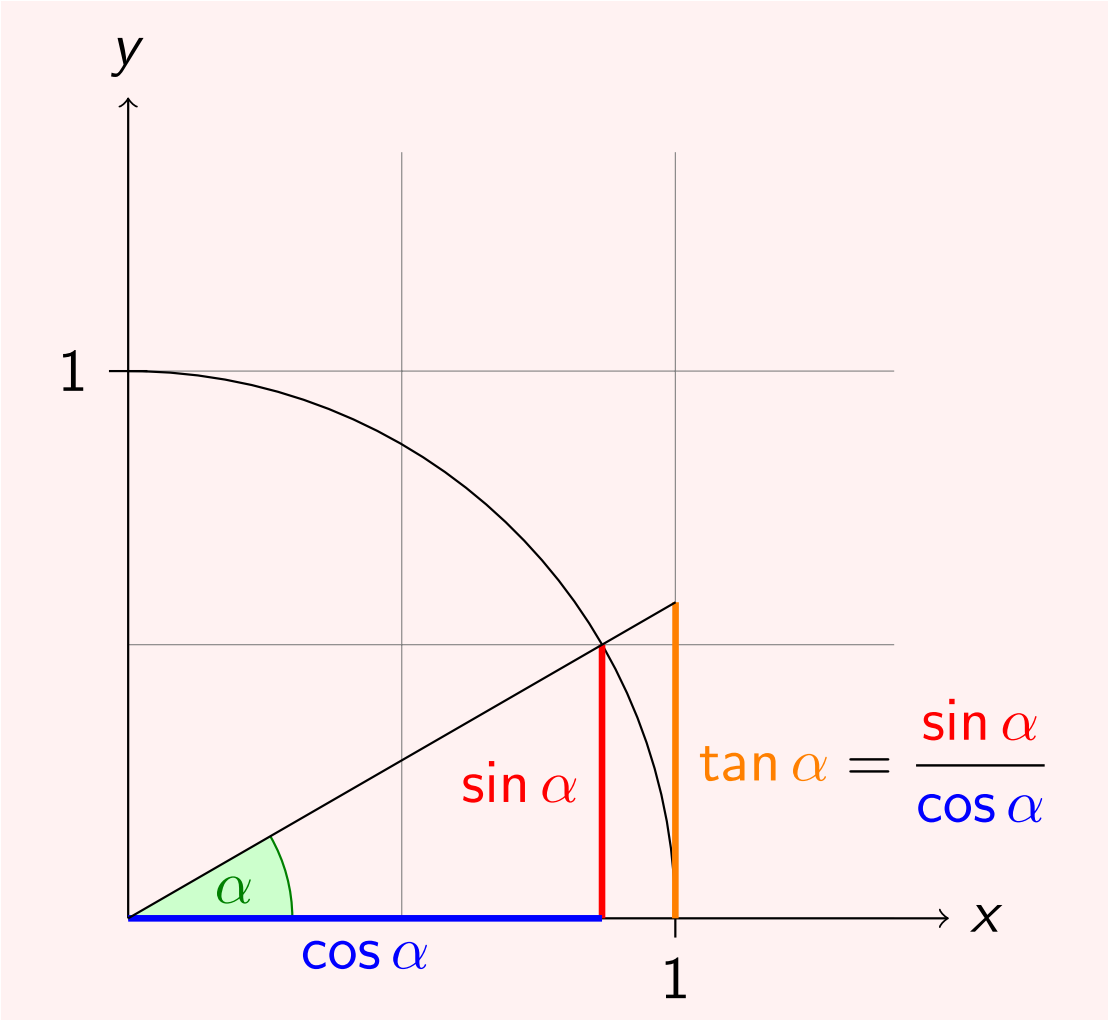
11.11.2016 – MetaNook

Überblick

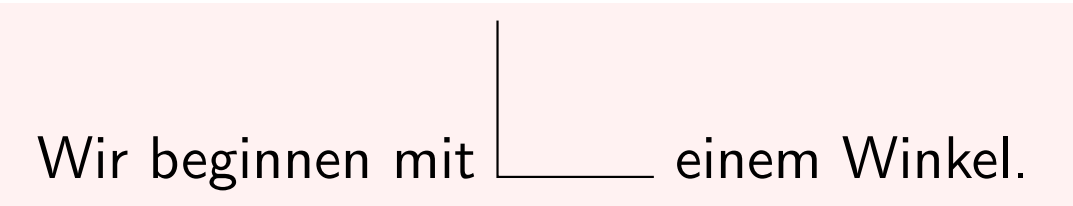
Was ist TikZ?

- TikZ ist kein Zeichenprogramm
- TikZ ist Makropaket zum Zeichnen von Grafiken mit LaTeX
- TikZ verfügt über eine sehr ausführliche und gute Anleitung

Ein erstes Beispiel



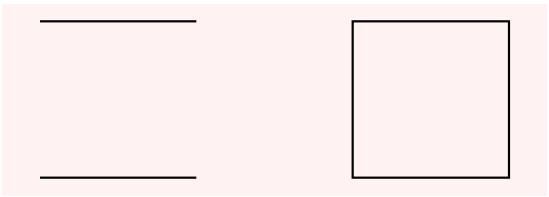
TikZ verwenden




```latex
\documentclass{scrartcl}
\usepackage{tikz}
\begin{document}
    Wir beginnen mit
    \begin{tikzpicture}
        \draw (0,1) -- (0,0) -- (1,0);
    \end{tikzpicture}
    einem Winkel.
\end{document}
```

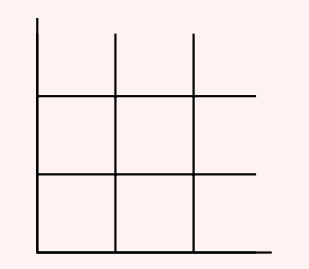
Pfade

- Ein Pfad ist eine Folge von Koordinaten
  - Links unten ist der Ursprung (0,0)
  - Erste Koordinate: x-Richtung
  - Zweite Koordinate: y-Richtung
- Linien zeichnen mit `--`
- Relative Koordinaten beginnen mit `++`



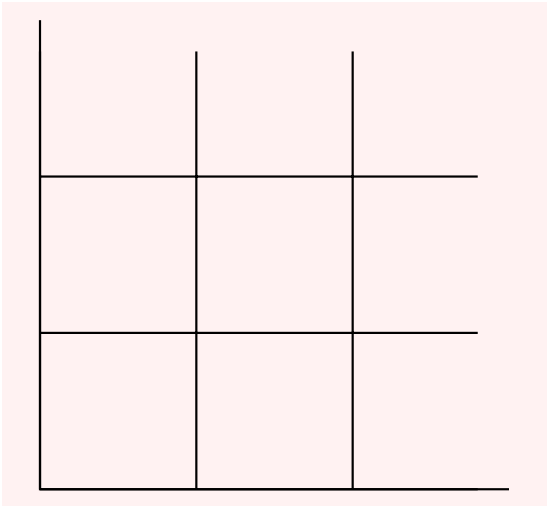
```
\begin{tikzpicture}
    \draw (0,0) -- ++ (1,0) ++ (0,1) -- ++ (-1,0);
    \draw (2,0) rectangle (3,1);
\end{tikzpicture}
```

Gitterpfade



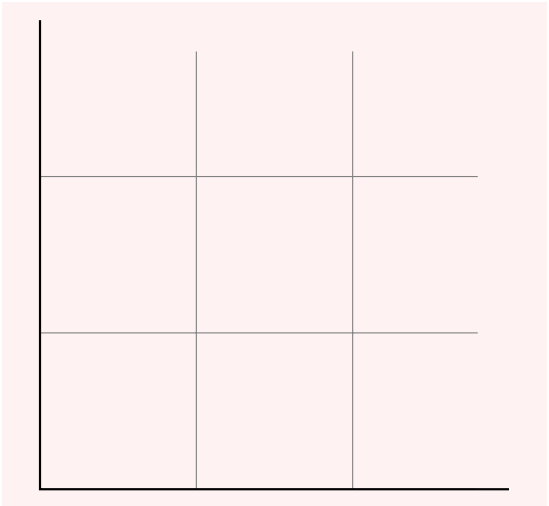
```
\begin{tikzpicture}
    \draw [step=0.5cm]
        (0,0) grid (1.4,1.4);
    \draw (0,1.5) -- (0,0) -- (1.5,0);
\end{tikzpicture}
```

Skalierung



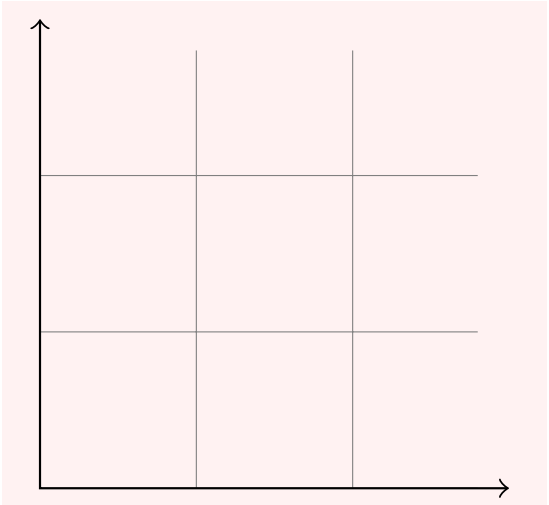
```
\begin{tikzpicture}[scale=2]
    \draw [step=0.5cm]
        (0,0) grid (1.4,1.4);
    \draw (0,1.5) -- (0,0) -- (1.5,0);
\end{tikzpicture}
```

Stile



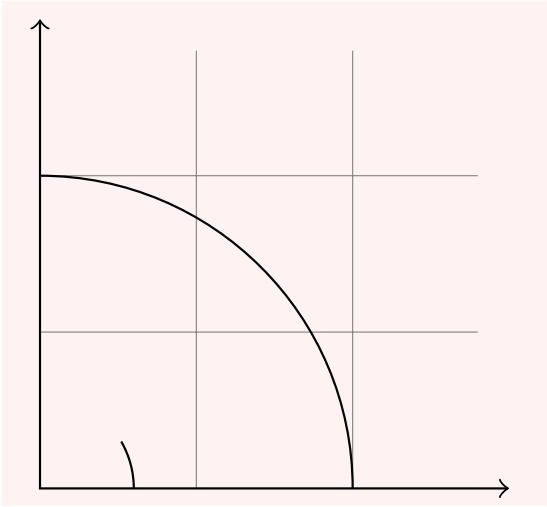
```
\begin{tikzpicture}[scale=2]
    \draw [step=0.5cm,gray, very thin]
        (0,0) grid (1.4,1.4);
    \draw (0,1.5) -- (0,0) -- (1.5,0);
\end{tikzpicture}
```

Pfeilspitzen



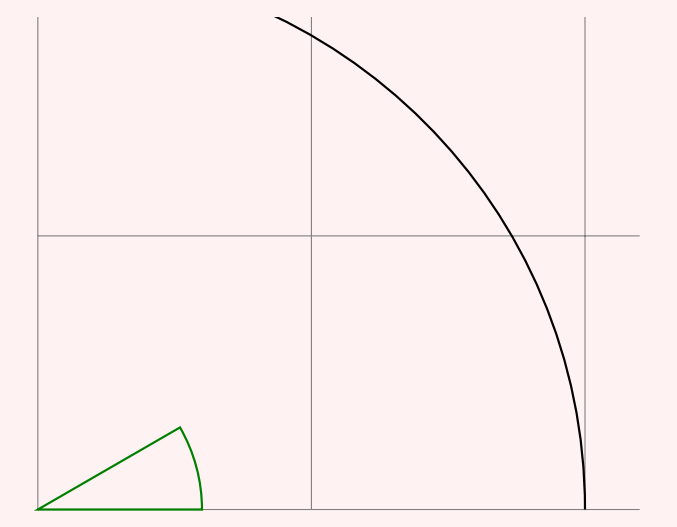
```
\begin{tikzpicture}[scale=2]
    \draw [step=0.5cm,gray, very thin]
        (0,0) grid (1.4,1.4);
    \draw [<->] (0,1.5) -- (0,0) -- (1.5,0);
\end{tikzpicture}
```

Bogenpfade



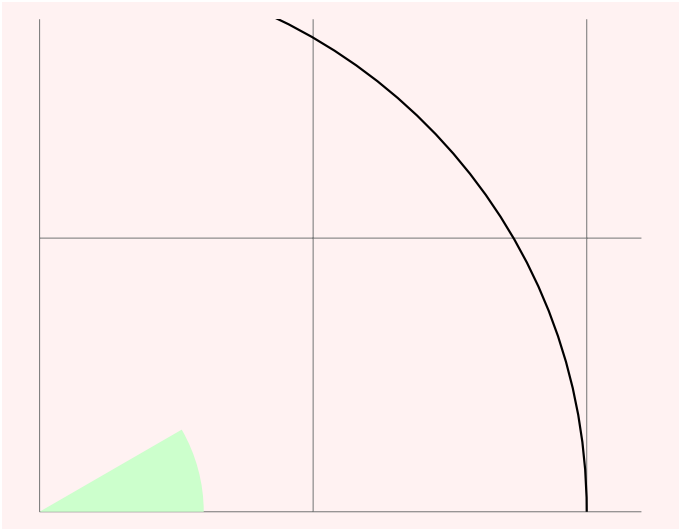
```
1 \draw % 0 bis 90 Grad, Radius 1 cm
2     (1,0) arc (0:90:1cm)
3     % 0 bis 30 Grad, Radius 3 mm
4     (3mm,0pt) arc (0:30:3mm);
```

Farbig zeichnen



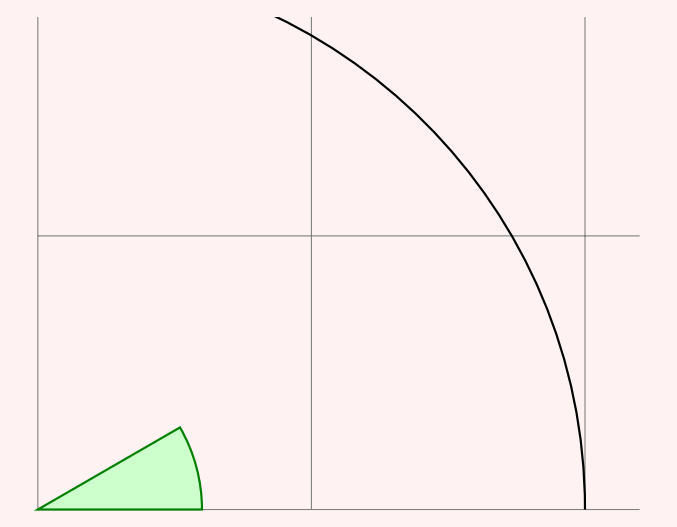
```
\draw [green!50!black]
    (0,0) -- (3mm,0pt) arc (0:30:3mm) -- cycle;
```

Farbig füllen



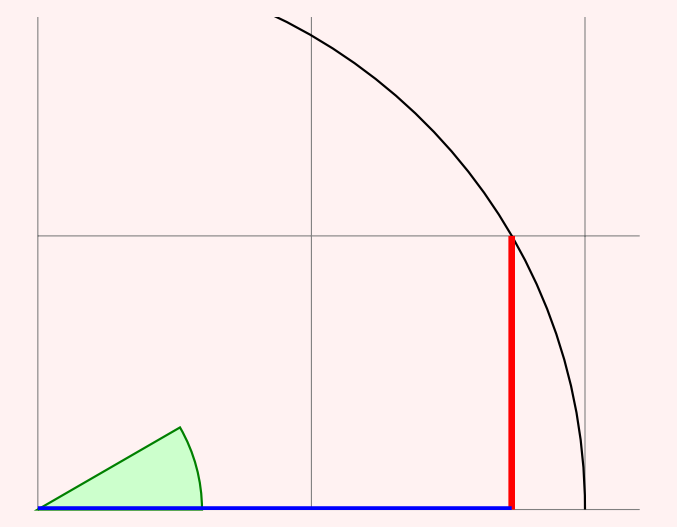
```
\fill [green!20]
    (0,0) -- (3mm,0pt) arc (0:30:3mm) -- cycle;
```

Farbig zeichnen und füllen



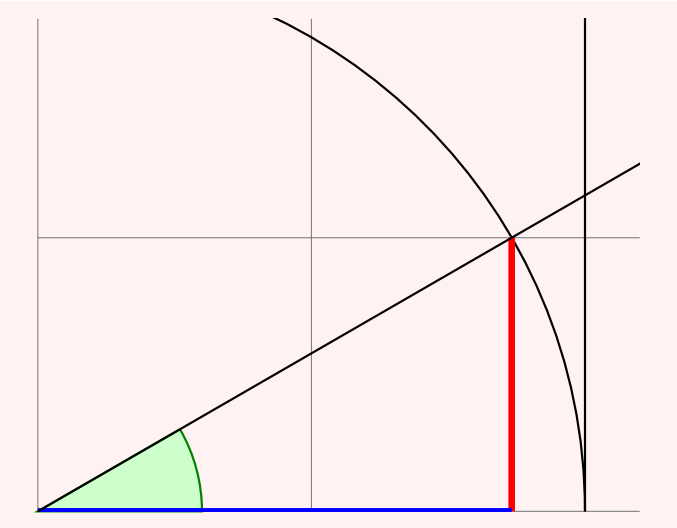
```
\filldraw [fill=green!20,draw=green!50!black]
    (0,0) -- (3mm,0pt) arc (0:30:3mm) -- cycle;
```

Polarkoordinaten und Schnittpunkte



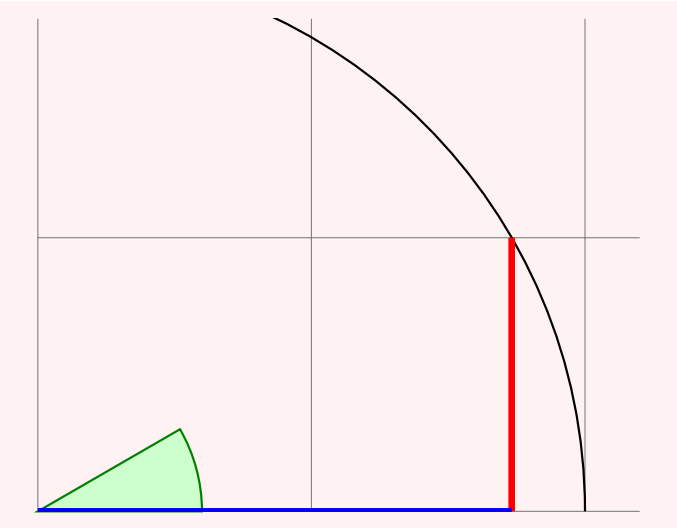
```
\draw [very thick, red] (30:1cm) -- (30:1cm |- 0,0);
\draw [very thick, blue] (0,0) -- (30:1cm |- 0,0);
```

Schnittpunkte von Pfaden definieren



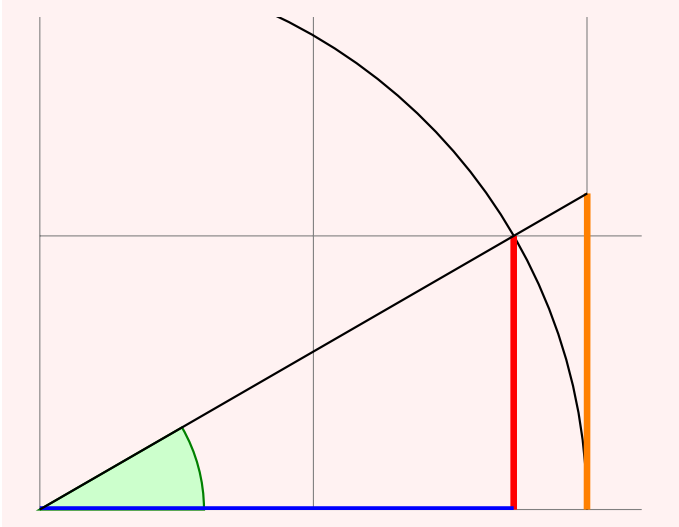
```
\draw [name path=l1] (1,0) -- (1,1);
\draw [name path=l2] (0,0) -- (30:1.5cm);
\draw [name intersections={of=l1 and l2, by=tan}];
```

Unsichtbare Pfade



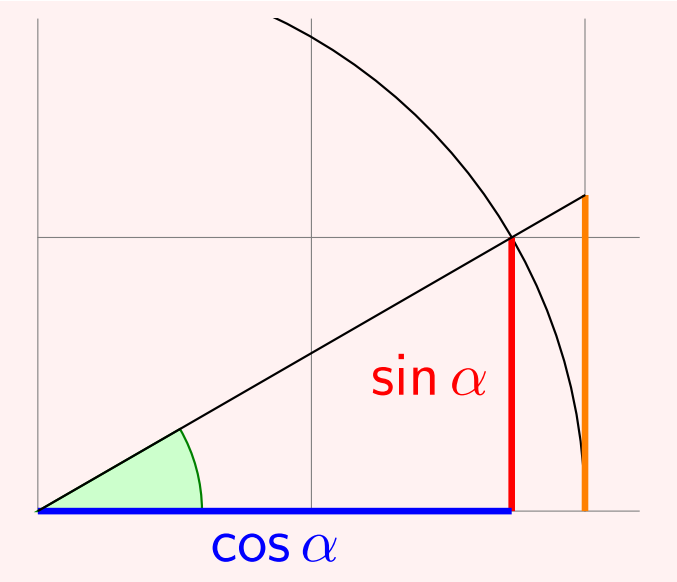
```
\path [name path=l1] (1,0) -- (1,1);
\path [name path=l2] (0,0) -- (30:1.5cm);
\draw [name intersections={of=l1 and l2, by=tan}];
```

Schnittpunkte von Pfaden verwenden



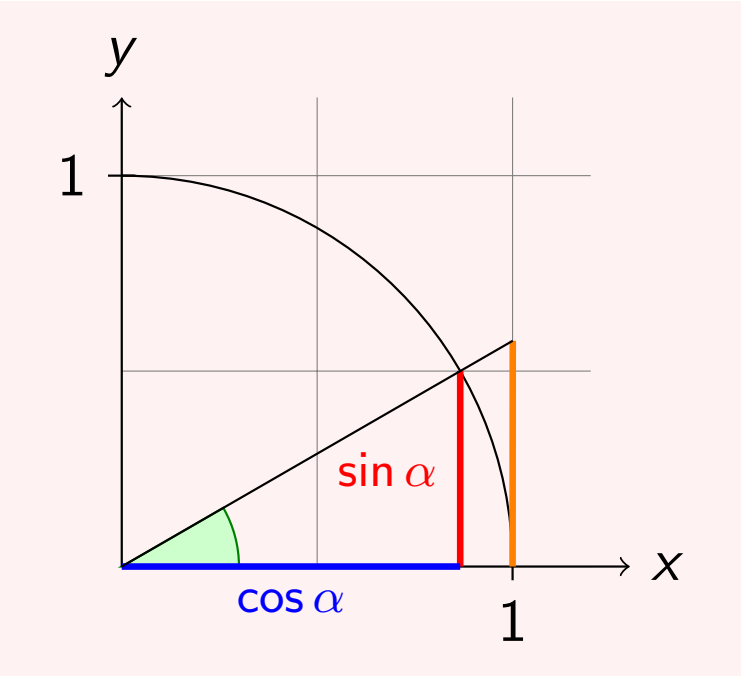
```
\draw [very thick, orange] (1,0) -- (tan);
\draw (0,0) -- (tan);
```

Beschriftungen




```
1 \draw [very thick, red] (30:1cm) --
2     node [left] {$\sin \alpha$} (30:1cm |- 0,0);
3 \draw [very thick, blue] (0,0) --
4     node [below] {$\cos \alpha$} (30:1cm |- 0,0);
```

Beschriftungen der Achsen




```
\draw[->] (0,0) -- (1.5,0) node[right] {$x$};
\draw[->] (0,0) -- (0,1.5) node[above] {$y$};
\draw (1,1pt) -- (1,-1pt) node[below] {$1$};
\draw (1pt,1) -- (-1pt,1) node[left] {$1$};
```

Knoten

Eingabe a, b

$r = a \mod b$

$a = b, b = r$

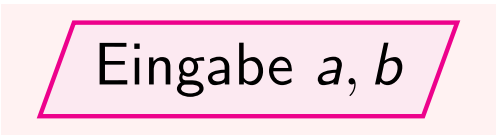
$b = 0?$

Ausgabe a

```
\node at (0,4) {...};
\node at (0,3) {...};
\node at (0,2) {...};
\node at (0,1) {...};
\node at (0,0) {...};
```

Knoten haben Stile

Ein- und Ausgabe




```
\begin{tikzpicture}
    [io/.style={trapezium,
        trapezium left angle=70,
        trapezium right angle=110,
        fill=magenta!10, draw=magenta}, thick]
    \node[io] {Eingabe $a,b$};
\end{tikzpicture}
```

Knoten haben Stile

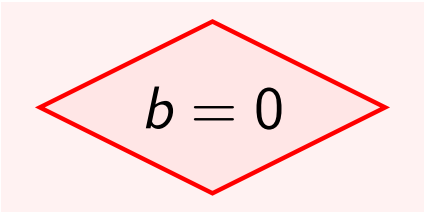
Operationen

$$R = a \mod b$$

```
\begin{tikzpicture}
    [op/.style={rectangle,
        fill=orange!10, draw=orange}, thick]
    \node[op] {$R = a \mod b$};
\end{tikzpicture}
```

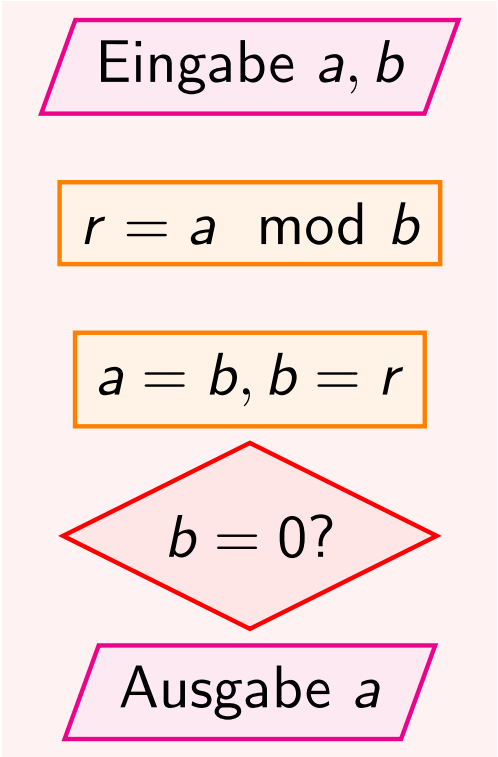
Knoten haben Stile

Entscheidungen



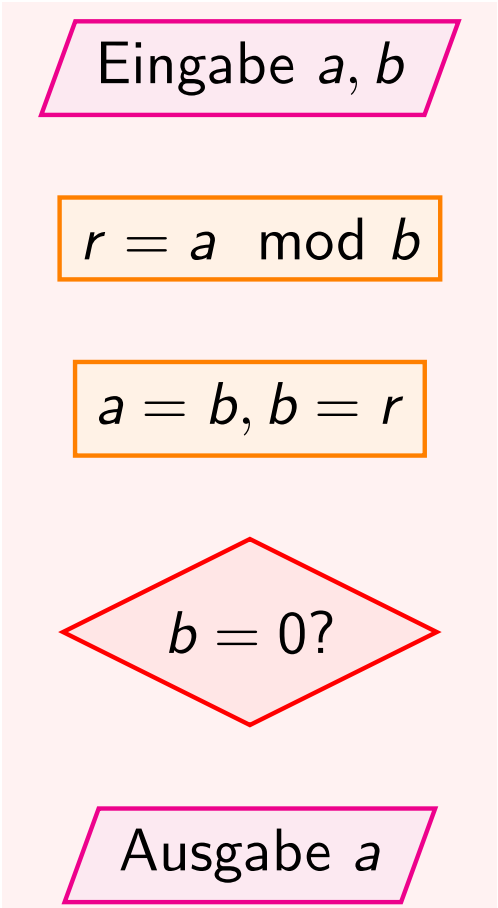

```
\begin{tikzpicture}
    [cn/.style={diamond,
        aspect=2,
        fill=red!10, draw=red}, thick]
    \node[cn] {$b=0$};
\end{tikzpicture}
```

Knoten haben Namen



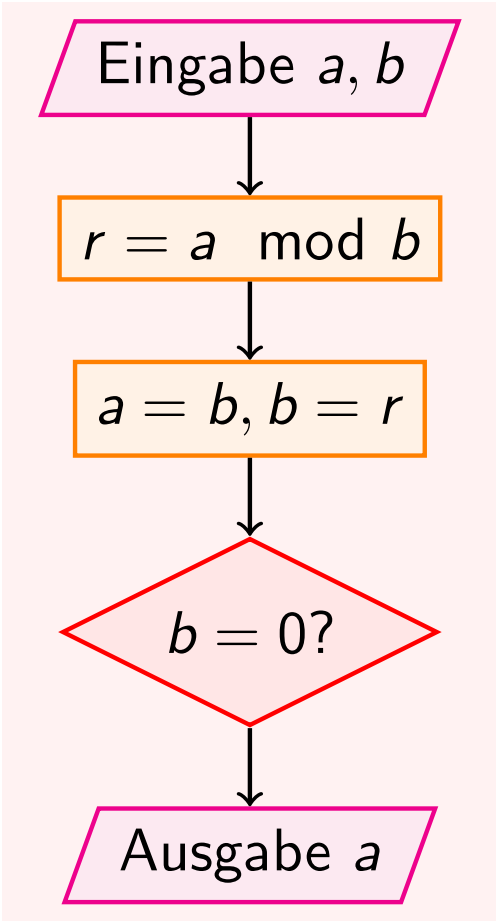

```
\node[io] at (0,4)
    (in) {Eingabe $a,b$};
\node[op] at (0,3)
    (div) {$r = a \mod b$};
\node[op] at (0,2)
    (set) {$a=b, b=r$};
\node[cn] at (0,1)
    (cond) {$b=0?$};
\node[io] at (0,0)
    (out) {Ausgabe $a$};
```

Knoten relativ positionieren



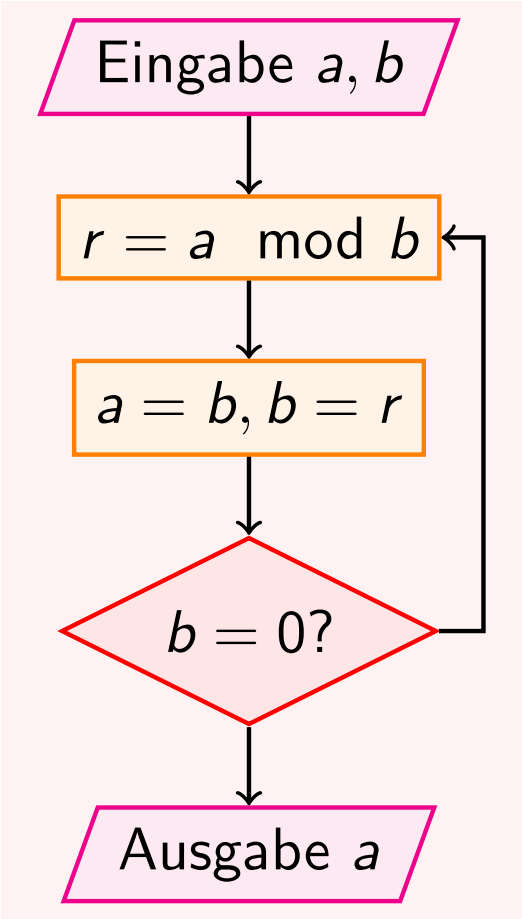

```
\node[io]
    (in) {Eingabe $a,b$};
\node[op, below=of in]
    (div) {$r = a \mod b$};
\node[op, below=of div]
    (set) {$a=b, b=r$};
\node[cn, below=of set]
    (cond) {$b=0?$};
\node[io, below=of cond]
    (out) {Ausgabe $a$};
```

Kanten



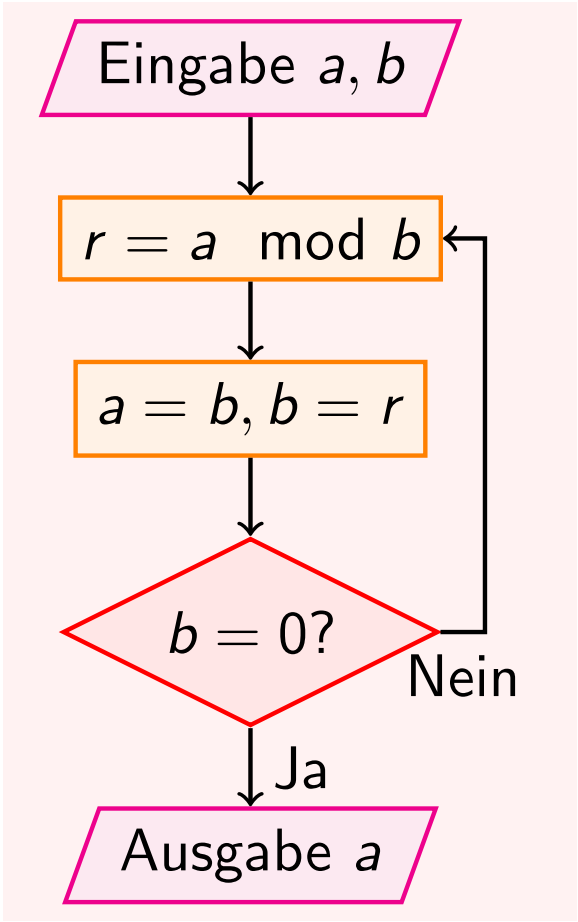

```
\path[->]
    (in)    edge (div)
    (div)   edge (set)
    (set)   edge (cond)
    (cond)  edge (out);
```

Ein Pfad um die Ecke

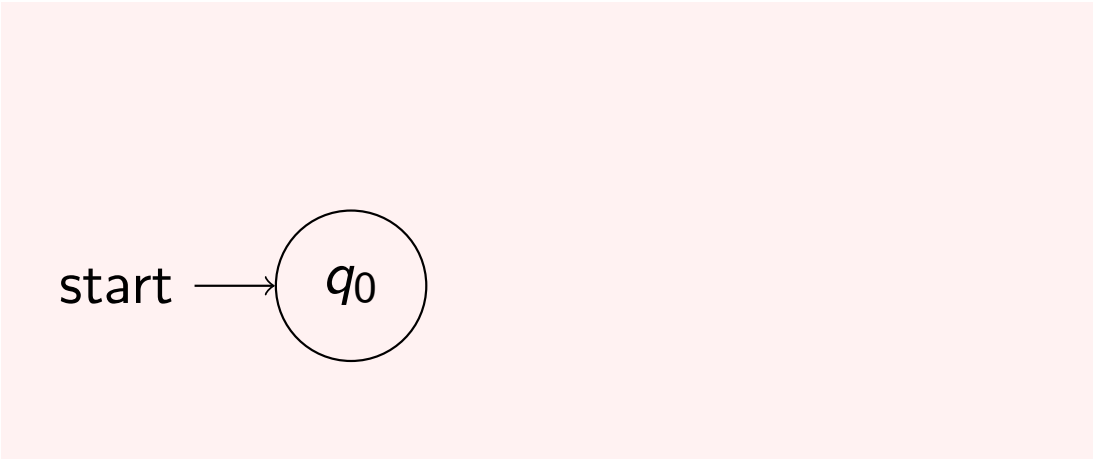



```
1 \draw[->]
2     (cond)  -- ++ (1.5,0)
3             |- (div);
```

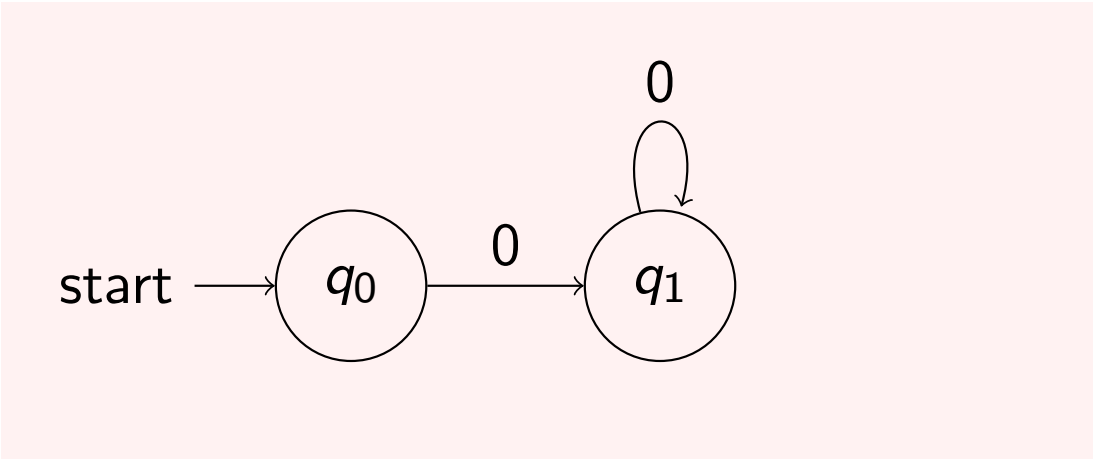
Ein Pfad um die Ecke



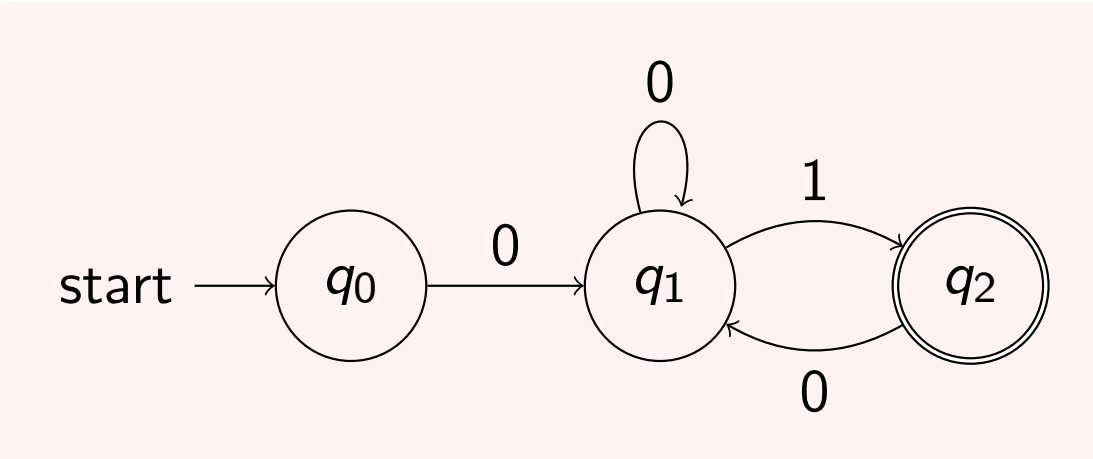

```
\path[->]
    (cond) edge
        node[right] {Ja}
            (out);

\draw[->] (cond)  --
    node[below] {Nein}
        ++ (1.5,0) |- (div);
```



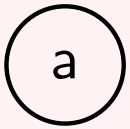

```
1 \node[initial, state] (q0) {$q_0$};
2
3
4
5
6
7
8
```



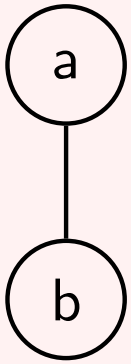

```
1 \node[initial, state] (q0) {$q_0$};
2 \node[state, accepting, right=of q1] (q2) {$q_2$};
3
4
5 \path (q0)     edge[->] node[above] {0} (q1)
6       (q1)     edge[->, loop above] node {0} ();
7
8
```



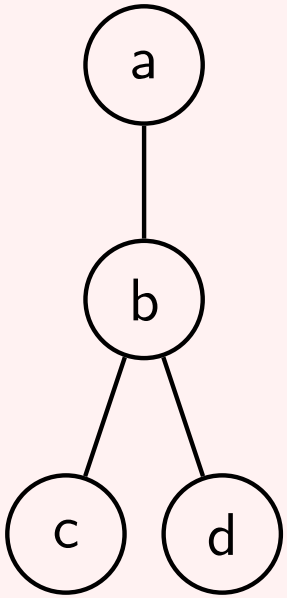

```
1 \node[initial, state] (q0) {$q_0$};
2 \node[state, accepting, right=of q1] (q2) {$q_2$};
3 \node[state, right=of q0] (q1) {$q_1$};
4
5 \path (q0)    edge[->] node[above] {0} (q1)
6       (q1)    edge[->, loop above] node {0} ()
7               edge[->, bend left] node[above] {1} (q2)
8       (q2)    edge[->, bend left] node[below] {0} (q1);
```



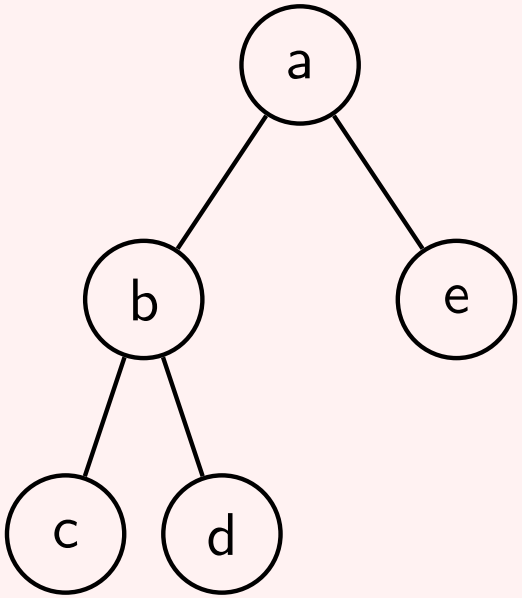

```
1 \node {a};
2
3
4
5
6
7
8
9
```



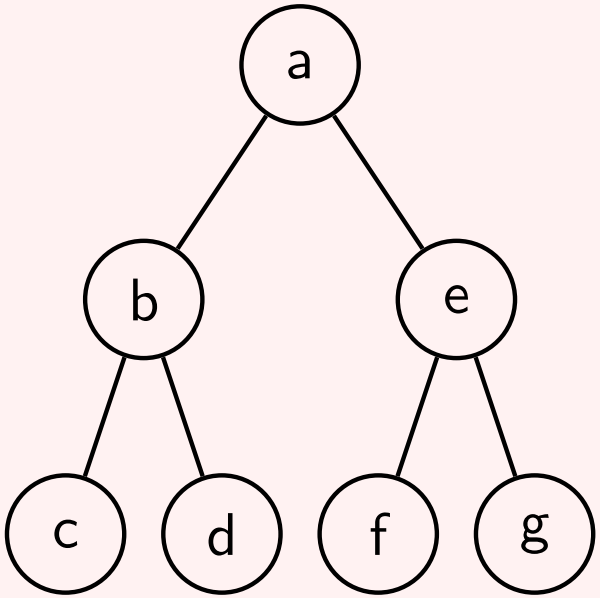

```
\node {a}
    child { node {b} };
```




```
\node {a}
    child { node {b}
        child { node {c} }
        child { node {d} }
    };
```

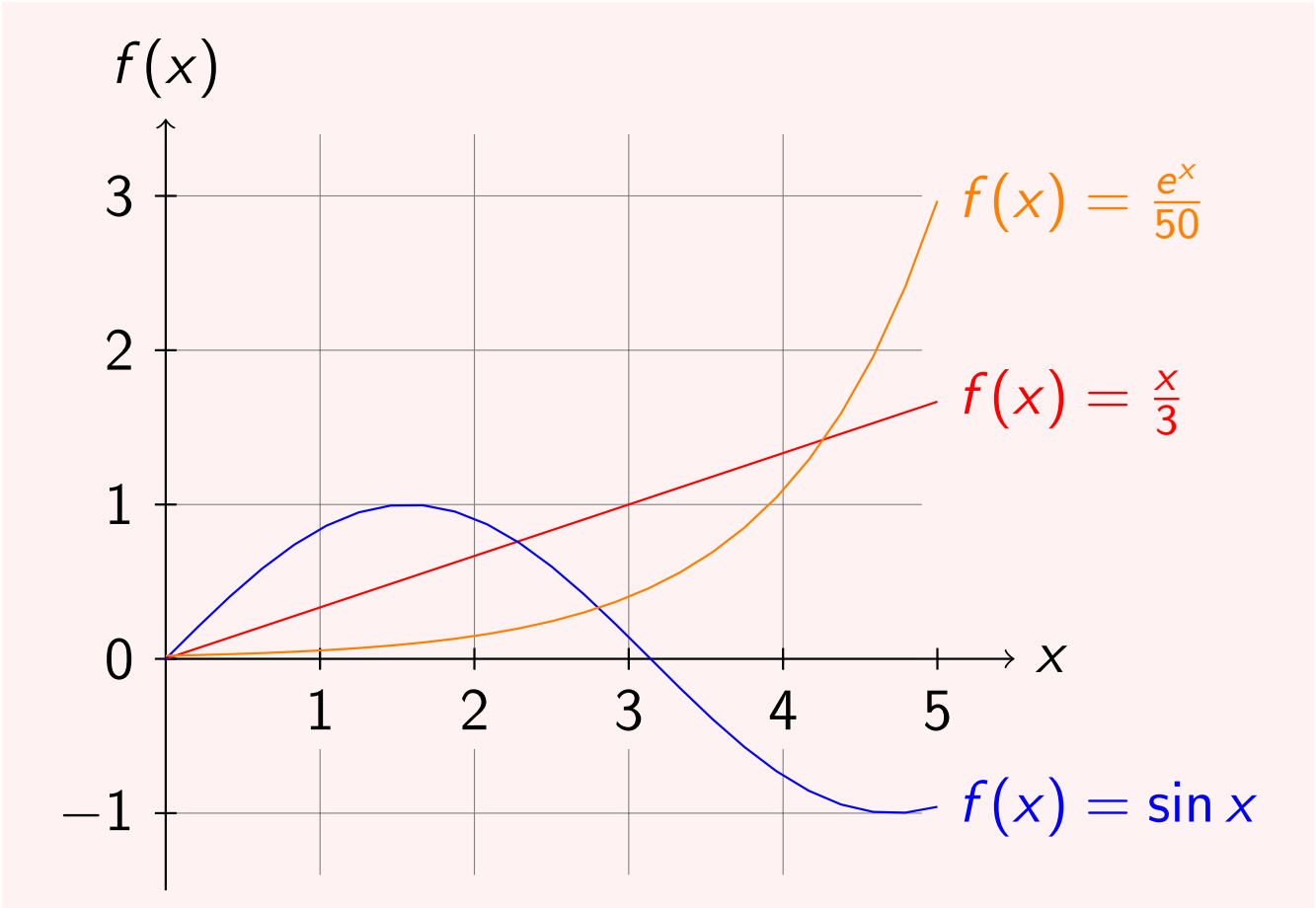


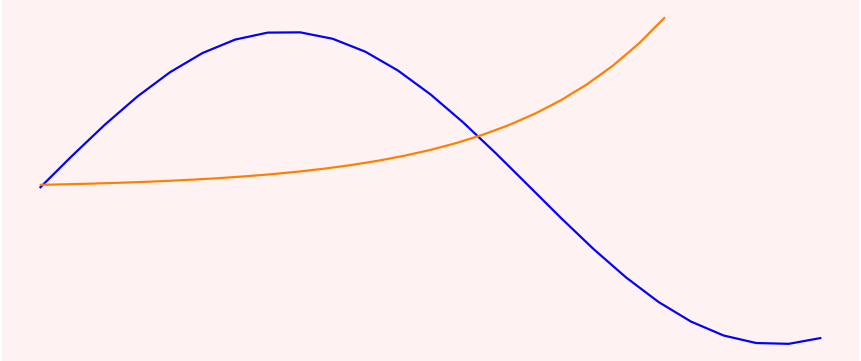

```
\node {a}
    child { node {b}
        child { node {c} }
        child { node {d} }
    }
    child { node {e} };
```




```
\node {a}
    child { node {b}
        child { node {c} }
        child { node {d} }
    }
    child { node {e}
        child { node {f} }
        child { node {g} }
    };
```

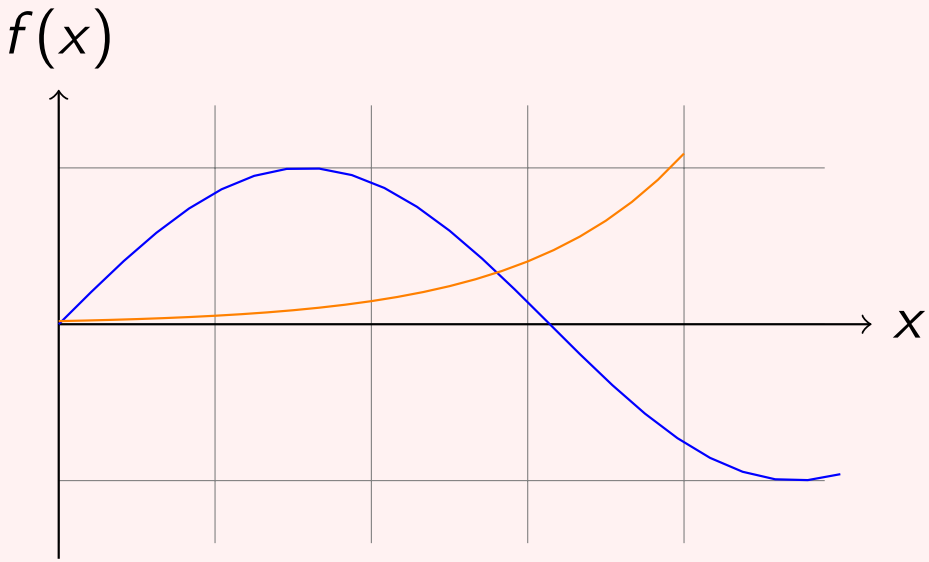
Beispiel eines Funktionsplots





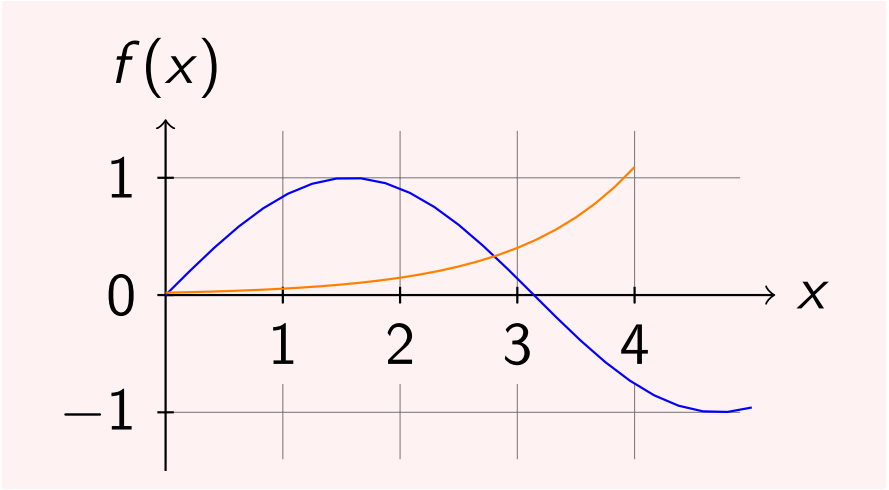
```
\draw[blue,domain=0:5] plot (\x,{sin(\x r)});
\draw[orange,domain=0:4] plot (\x,{exp(\x)/50});
```

Koordinatensystem



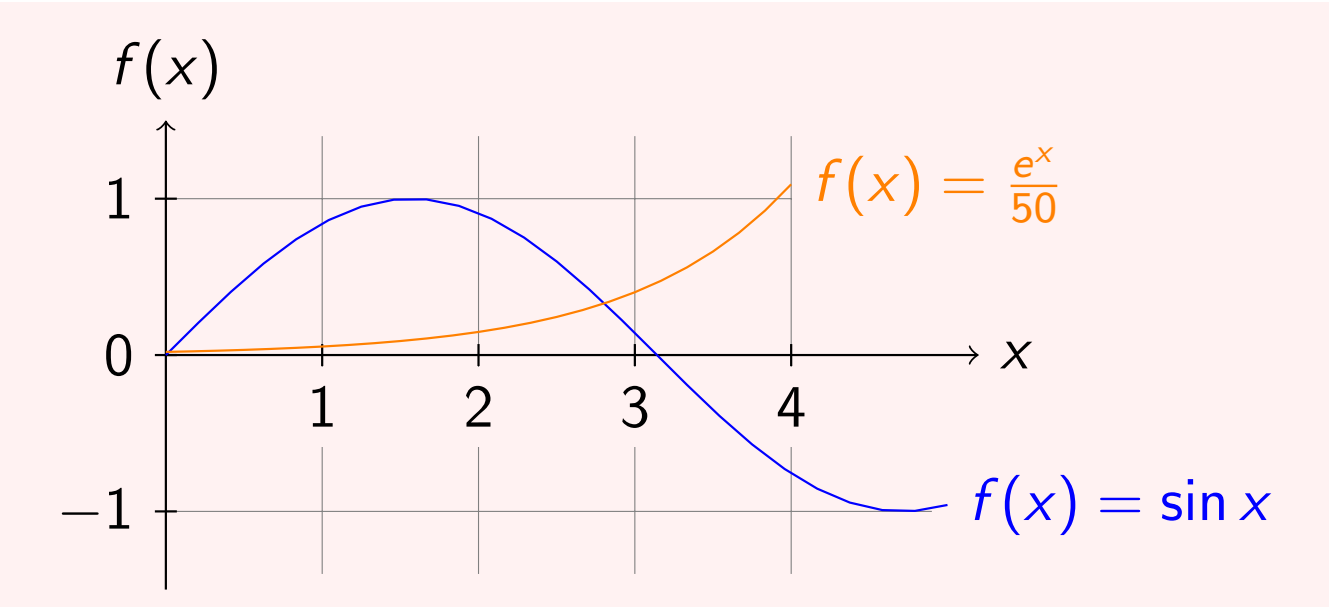

```
\draw[very thin,gray] (0,-1.4) grid (4.9,1.4);
\draw[->] (0,0) -- (5.2,0) node[right] {$x$};
\draw[->] (0,-1.5) -- (0,1.5) node[above] {$f(x)$};
```

Beschriftung der Achsen




```
\foreach \x in {1,...,4}
    \draw (\x cm,2pt) -- (\x cm,-2pt)
        node[below,fill=white] {$\x$};
\foreach \y in {-1,...,1}
    \draw (2pt,\y cm) -- (-2pt,\y cm)
        node[left,fill=white] {$\y$};
```

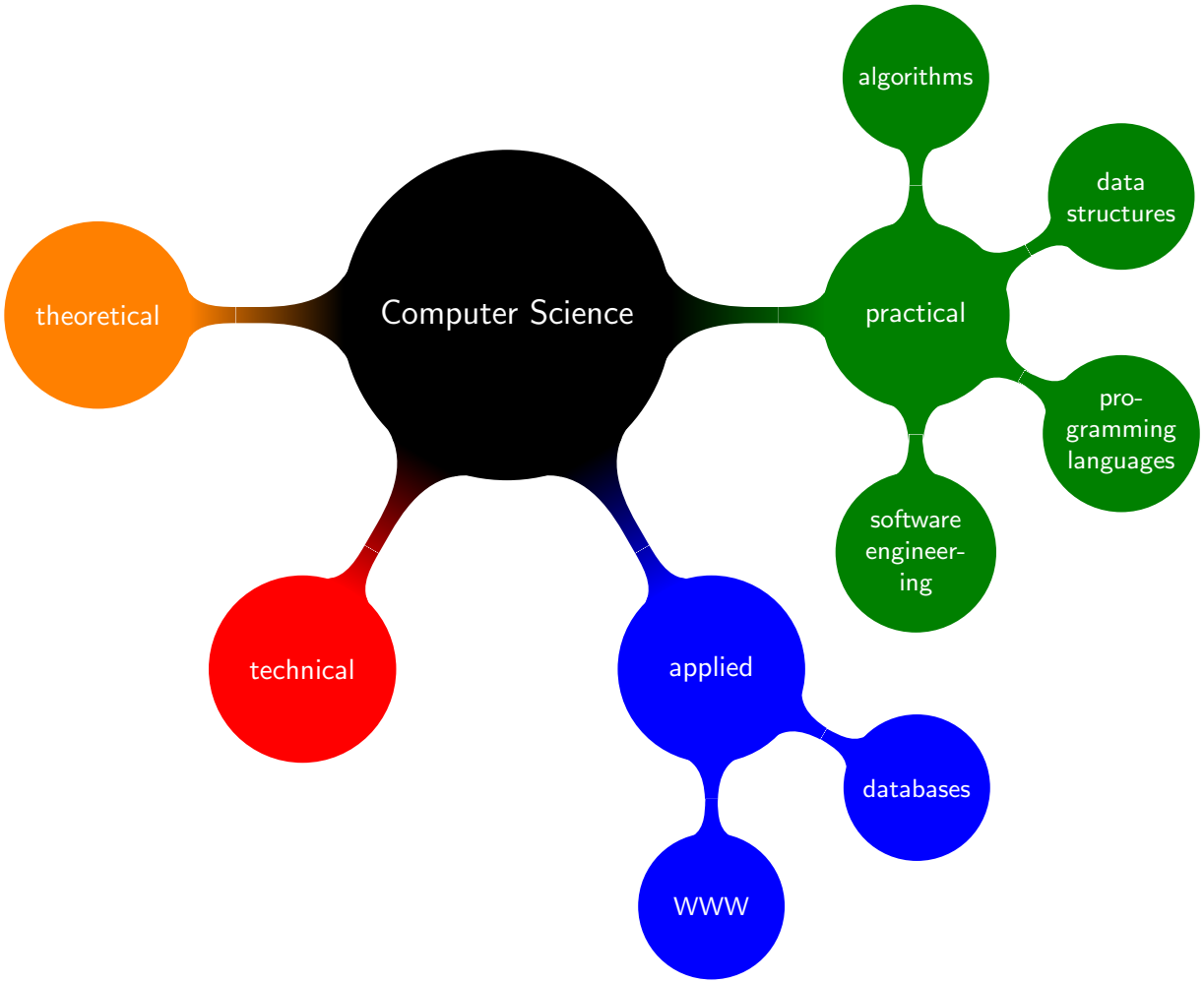
Beschriftung der Graphen




```
1 \draw[blue,domain=0:5] plot (\x,{sin(\x r)})
2     node[right,fill=white] {$f(x) = \sin x$};
3 \draw[orange,domain=0:4] plot (\x,{exp(\x)/50})
4     node[right,fill=white] {$f(x) = \frac{e^x}{50}$};
```

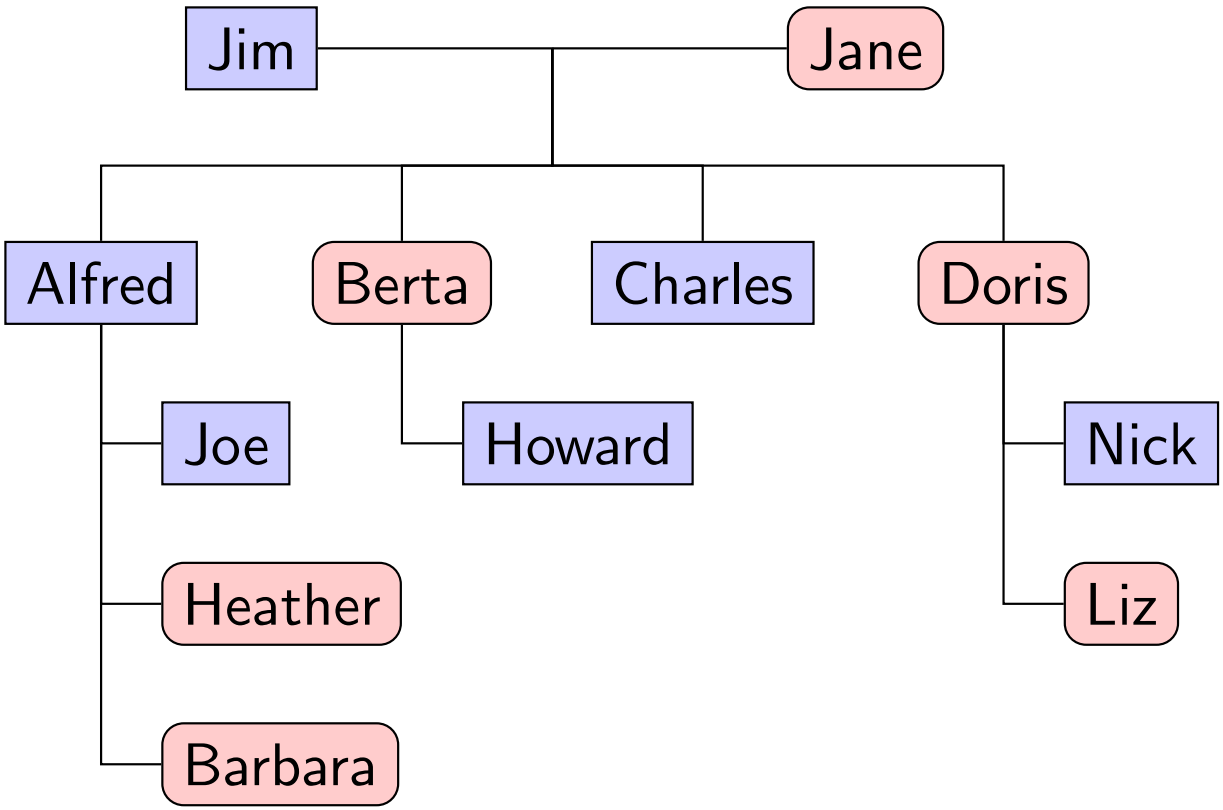
Computer science mindmap

Autor: Till Tantau



A family tree

Autor: Stefan Kottwitz

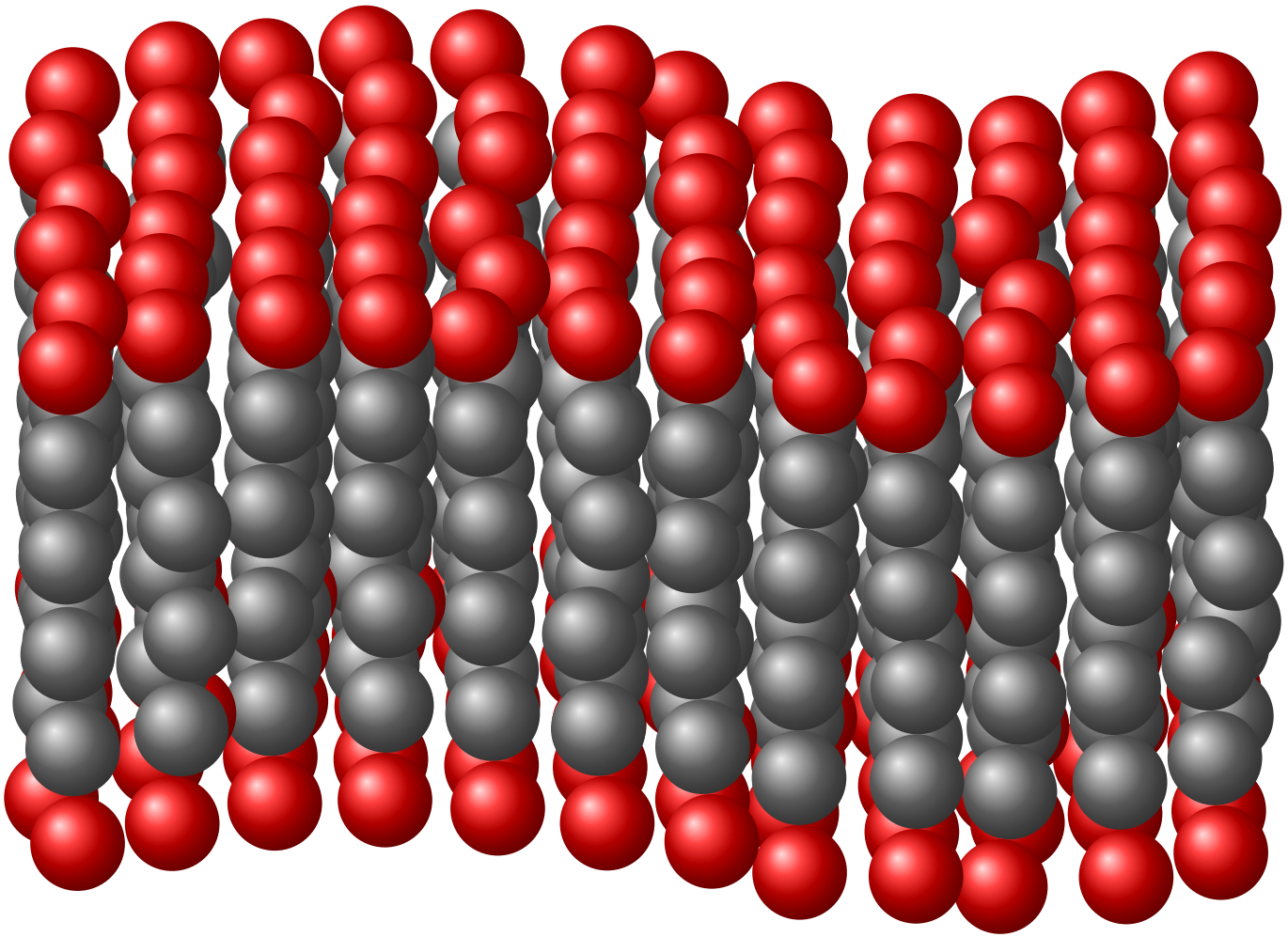


Christmas tree with balls, candles and snowflakes

Autor: Alain Matthes

Membrane-like surface

Autor: Yotam Avital



Zusammenfassung

1. TikZ-Zeichnungen bestehen aus Pfaden, die über Koordinaten definiert werden.
2. Fast alle scheamtischen Zeichnungen sind ein Graph, bestehen also aus Knoten und Kanten und werden auch als solche in TikZ gezeichnet.
3. TikZ ist sehr umfangreich und enthält sehr viele Bibliotheken.
4. Bei Problemen und Fragen lies die Anleitung!

Zum Weiterlesen

Till Tantau.
The TikZ and pgf Packages,
Manual for version 2.10,
`pgfmanual.pdf`, November 2012.

Kjell Magne Fauske und Stefan Kottwitz.
TEXample.net,
Sample resources for TeX users,
`texample.net`.

GitHub – Links

- Meine Dateien:
  `https://github.com/labitzkedennis/Nook2016-TikZ`
- LaTeX - Präsentationen mit Beamer von Anika Oellerich
  `https://github.com/anioell/Nook-LaTeX-Beamer`
- Einführung in LaTeX von Malte Schmitz
  `https://github.com/malteschmitz/latex`