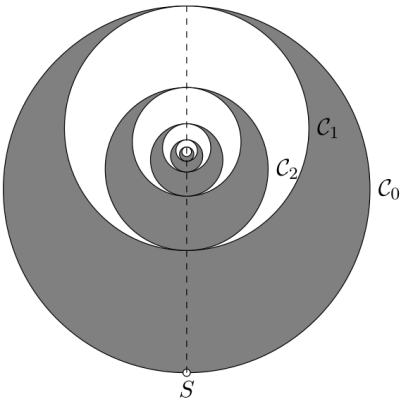
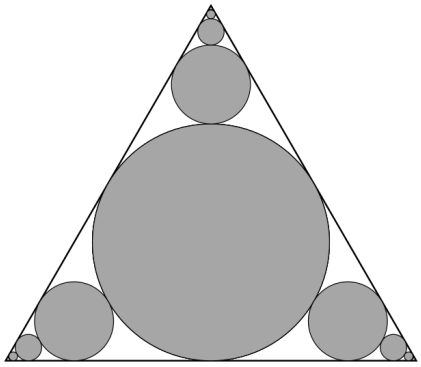
1 Geometrische Reihe

```
\begin{tikzpicture}[scale=3]
 \def\r{2/3}
 \pgfmathsetmacro{\mycoordinate}{0}
 \fill [gray, draw=black] (0,0) circle (1);
  \foreach \n in {2,...,10}{
   %dalla y del vecchio centro mi sposto del vecchio raggio in una
       direzione e poi del nuovo raggio nell'altra direzione
   \pgfmathsetmacro{\ff}{\mycoordinate + pow(-\r,\n-2) + pow(-\r,\n
       -1)}
   \pgfmathsetmacro\k{100*mod(\n,2)}
   \fill [gray!\k, draw=black] (0,\ff) circle ({pow(\r,\n-1)});
   \global\let\mycoordinate=\ff
  }
  \fill [white,draw=black] (0,-1) circle (.02) node[black,below]{$S
      $};
  \node at (0:1) [right] {$\mathcal C_0$};
  \node at (2/3,1/3) [right] {$\mathcal C_1$};
  \node at (4/9,1/9) [right] {$\mathcal C_2$};
  \draw [dashed] (0,-1) -- (0,1);
\end{tikzpicture}
```



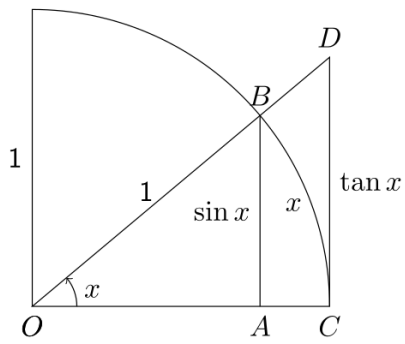
2 Geometrische Reihe

```
\begin{tikzpicture}[scale=4]
 \draw [thick] (90:1) -- (210:1) -- (330:1) -- cycle;
 \pgfmathsetmacro{\mycoordinate}{-2}
 \foreach \n in {1,...,9}{
   \pgfmathsetmacro{\ff}{\mycoordinate + 4/3*.5*pow(1/3,\n - 2)}
   \fill [gray!70,draw=black] (90:\ff) circle ({.5*pow(1/3,\n - 1)})
       ;
   \fill [gray!70,draw=black] (210:\ff) circle ({.5*pow(1/3,\n - 1)
       });
   \fill [gray!70,draw=black] (330:\ff) circle ({.5*pow(1/3,\n - 1)
       });
   \global\let\mycoordinate=\ff
 }
\end{tikzpicture}
```



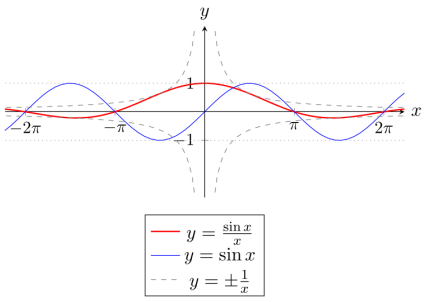
3 Beweis von $\lim_{x\to 0} \frac{\sin x}{x} = 1$

```
\begin{tikzpicture}[scale=4]
 \def\x{40}
 \coordinate (O) at (0,0);
 \coordinate (A) at ({cos(\x)},0);
 \coordinate (B) at (\x:1);
 \coordinate (C) at (0:1);
 \coordinate (D) at (1,{tan(\x)});

 \draw (O) -- (C) -- node[right]{$\tan x$} (D) -- cycle;
 \draw (C) arc (0:90:1) -- node[left]{1} (O);
 \draw (A) -- node[left]{$\sin x$} (B);
 \node at ({.5*\x}:1) [left]{$x$};
 \node at (\x:.5) [above] {1};

 \node at (O) [below]{$O$};
 \node at (A) [below]{$A$};
 \node at (B) [above]{$B$};
 \node at (C) [below]{$C$};
 \node at (D) [above]{$D$};
 \node at (O) [below]{$O$};

 \draw [->] (0:.15) arc (0:\x:.15);
 \node at ({.5*\x}:.15) [right]{$x$};
\end{tikzpicture}
```



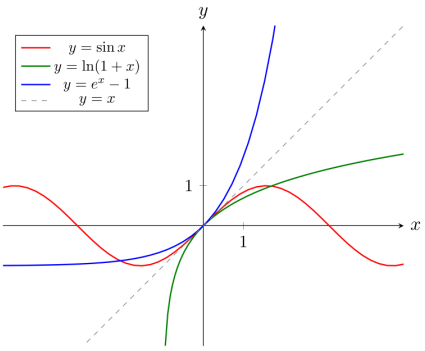
4 Graph von $f(x) = \frac{\sin x}{x}$

```
\begin{tikzpicture}
 \begin{axis}
  [axis equal image,
  ymin=-3, ymax=3,
  ytick={-1,1},
  xmin=-7, xmax=7,
  xtick={-6.28, -3.14, 3.14, 6.28},
  xticklabels={$-2\pi$, $-\pi$, $\pi$, $2\pi$},
  axis x line=middle, axis y line=middle,
  xlabel=$x$, ylabel=$y$,
  scale=1.2,
  x label style={anchor=west},
  y label style={anchor=south},
  legend style={at={(0.5,-0.1)},anchor=north},
  ticklabel style={font=\small}
  ]

  \addplot [domain=-11:11, samples=100, red, thick] { sin(\x r)/\x
      };
  \addplot [domain=-11:11, samples=100, blue] { sin(\x r) };

  \addplot [domain=.1:11, samples=100, gray, dashed] { 1/\x };
  \addplot [domain=-.1:-11, samples=100, gray, dashed] { 1/\x };
  \addplot [domain=.1:11, samples=100, gray, dashed] { -1/\x };
  \addplot [domain=-.1:-11, samples=100, gray, dashed] { -1/\x };

  \addplot [domain=-11:11, gray, dotted] {1};
  \addplot [domain=-11:11, gray, dotted] {-1};

  \legend{$y = \frac{\sin x}{x}$, $y = \sin x$,$y = \pm \frac{1}{x
      }$}
 \end{axis}
\end{tikzpicture}
```



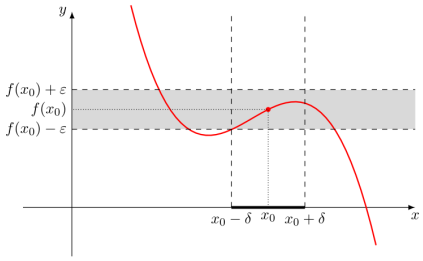
5 Verhalten in der Nähe der Ursprung

```
\begin{tikzpicture}
 \begin{axis}
  [axis equal image,
  ymin=-3, ymax=5,
  ytick={1},
  xmin=-5, xmax=5,
  xtick={1},
  axis x line=middle, axis y line=middle,
  xlabel=$x$, ylabel=$y$,
  scale=1.2,
  x label style={anchor=west},
  y label style={anchor=south},
  legend pos=north west,
  legend style={nodes={scale=0.8, transform shape}},
  ticklabel style={font=\small}
  ]

  \addplot [domain=-5:5, samples=50, red, thick] { sin(\x r) };
  \addplot [domain=-.95:5, samples=100, green!50!black, thick] { ln
      (1 + \x) };
  \addplot [domain=-5:5, samples=50, blue, thick] { exp(\x) - 1 };

  \addplot [domain=-4:5, dashed, gray] { \x };
  \legend{$y = \sin x$, $y = \ln(1+x)$, $y = e^x -1$, $y = x$}
 \end{axis}
\end{tikzpicture}
```



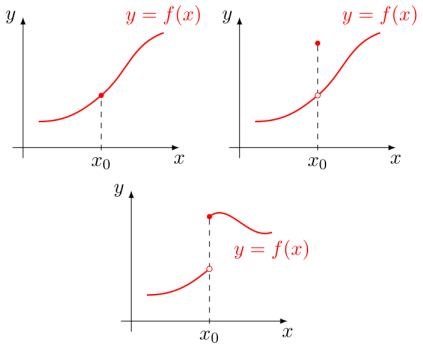
6 Stetigkeit

```
\begin{tikzpicture}[every node/.style={scale=.8}]
 \def\delt{.75}
 \def\eps{.4}

 % f(x) = 2 - 1/4 * (x-4) * (x-2) * (x-5)

 \def\xzero{4}
 \pgfmathsetmacro{\yzero}{2- 1/4 * (\xzero - 4) * (\xzero - 2) * (
     \xzero - 5)}

 \fill [gray!30] (0,{\yzero + \eps}) rectangle (7,{\yzero - \eps});

 \draw [-latex] (-1,0) -- (7,0) node[below]{$x$};
 \draw [-latex] (0,-1) -- (0,4) node[left]{$y$};

 \draw [thick, red, domain=1.2:6.2,samples = 50]
  plot (\x, {2 - 1/4 * (\x-4) * (\x-2) * (\x-5)} );

 \fill [red] (\xzero, \yzero) circle (0.05);

 \draw [dashed] (\xzero + \delt,0) node[below] {$x_0 + \delta$} -- (
     \xzero + \delt,4);
 \draw [dashed] (\xzero - \delt,0) node[below] {$x_0 - \delta$} -- (
     \xzero - \delt,4);

 \draw [dashed] (0,{\yzero + \eps}) node[left]{$f(x_0) + \varepsilon
     $} -- (7,{\yzero + \eps});
 \draw [dashed] (0,{\yzero - \eps}) node[left]{$f(x_0) - \varepsilon
     $} -- (7,{\yzero - \eps});

 \draw [densely dotted] (\xzero, 0) node[below]{$x_0$} -- (\xzero,
     \yzero) -- (0, \yzero) node[left]{$f(x_0)$};

 \draw [ultra thick] (\xzero + \delt,0) -- (\xzero - \delt,0);
\end{tikzpicture}
```



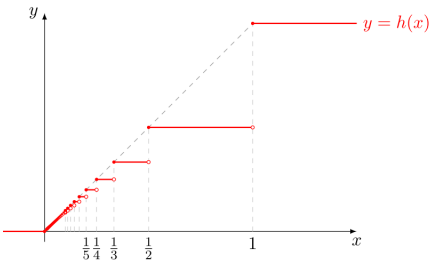
7 Stetigkeit vs Unstetigkeit

```
\begin{tikzpicture}[scale=1]
 \draw [-latex] (-.2,0) -- (3,0) node[below]{$x$};
 \draw [-latex] (0,-.2) -- (0,2.5) node[left]{$y$};
 \draw [thick, red] (.3,.5) to [in = 220, out = 0]
    (1.5,1) to [out = 40, in = 200]
    (2.7,2.2) node[above]{$y = f(x)$};
 \fill [red] (1.5,1) circle (0.05);
 \draw [dashed] (1.5,-.05) node[below]{$x_0$} -- (1.5,1);
\end{tikzpicture}
%
\begin{tikzpicture}[scale=1]
 \draw [-latex] (-.2,0) -- (3,0) node[below]{$x$};
 \draw [-latex] (0,-.2) -- (0,2.5) node[left]{$y$};
 \draw [dashed] (1.5,-.05) node[below]{$x_0$} -- (1.5,2);
 \draw [thick, red] (.3,.5) to [in = 220, out = 0]
    (1.5,1) to [out = 40, in = 200]
    (2.7,2.2) node[above]{$y = f(x)$};
 \draw [red,fill=white] (1.5,1) circle (0.05);
 \fill [red] (1.5,2) circle (0.05);
\end{tikzpicture}
%
\begin{tikzpicture}[scale=1]
 \draw [-latex] (-.2,0) -- (3,0) node[below]{$x$};
 \draw [-latex] (0,-.2) -- (0,2.5) node[left]{$y$};
 \draw [dashed] (1.5,-.05) node[below]{$x_0$} -- (1.5,2);
 \draw [thick, red] (.3,.5) to [in = 220, out = 0] (1.5,1);
 \draw [thick, red] (1.5,2) to [out = 40, in = 200] (2.7,1.7)
  node[below]{$y = f(x)$};
 \draw [red,fill=white] (1.5,1) circle (0.05);
 \fill [red] (1.5,2) circle (0.05);
\end{tikzpicture}
```



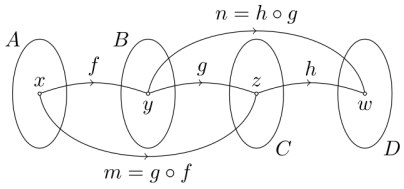
8 Beispiel: stetig in $x = 0$

```
\begin{tikzpicture}[scale=4.5]
 \draw [-latex] (-.5,0) -- (1.5,0) node[below]{$x$};
 \draw [-latex] (0,-.05) -- (0,1.05) node[left]{$y$};

 \draw [gray!80,dashed] (0,0) -- (1,1);

 \foreach \n in {1,...,10} {
   \draw [gray!40,dashed] (1/\n,0) -- (1/\n,1/\n);
   \draw [thick, red] ({1/(\n +1)},{1/(\n +1)}) -- ({1/\n},{1/(\n
       +1)});
   \draw [red,fill=white] ({1/\n},{1/(\n +1)}) circle (0.008);
   \fill [red] (1/\n,1/\n) circle (0.008);
 }
 \foreach \n in {10,...,100} {
   \draw [thick, red] ({1/(\n +1)},{1/(\n +1)}) -- ({1/\n},{1/(\n
       +1)});
   \draw [red,fill=white] ({1/\n},{1/(\n +1)}) circle (0.005);
   \fill [red] (1/\n,1/\n) circle (0.005);
 }
 \node at (1.5,1) [right,red,scale=1] {$y = h(x)$};
 \draw [thick, red] (-.5,0) -- (0,0);
 \draw [thick, red] (1,1) -- (1.5,1);

 \fill [red] (0,0) circle (0.008);

 \node at (1,0) [below] {$1$};
 \node at (1/2,0) [below] {$\tfrac{1}{2}$};
 \node at (1/3,0) [below] {$\tfrac{1}{3}$};
 \node at (1/4,0) [below] {$\tfrac{1}{4}$};
 \node at (1/5,0) [below] {$\tfrac{1}{5}$};
\end{tikzpicture}
```



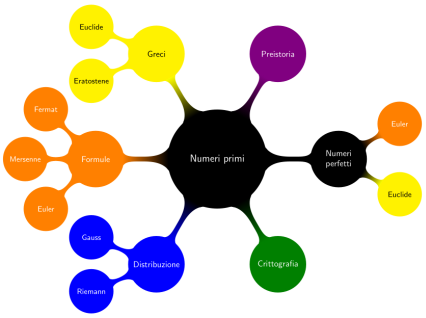
9 Assoziativität der Komposition

```
\begin{tikzpicture}[scale=1]
 \draw (0,0) ellipse (.5 and 1);
 \draw (2,0) ellipse (.5 and 1);
 \draw (4,0) ellipse (.5 and 1);
 \draw (6,0) ellipse (.5 and 1);

 \node at (-.5,1) {$A$};
 \node at (1.5,1) {$B$};
 \node at (4.5,-1) {$C$};
 \node at (6.5,-1) {$D$};

 \begin{scope}[decoration={markings,mark=at position 0.5 with {
     \arrow{>}}}]
  \draw[postaction={decorate}] (0,0) to [out = 20, in = 160]
    node[pos=0.5,above]{$f$} (2,0);
  \draw[postaction={decorate}] (2,0) to [out = 20, in = 160]
    node[pos=0.5,above]{$g$} (4,0);
  \draw[postaction={decorate}] (4,0) to [out = 20, in = 160]
    node[pos=0.5,above]{$h$} (6,0);

  \draw[postaction={decorate}] (0,0) to [out = 280, in = 260]
    node[pos=0.5,below]{$m = g \circ f$} (4,0);
  \draw[postaction={decorate}] (2,0) to [out = 80, in = 100]
    node[pos=0.5,above]{$n = h \circ g$} (6,0);
 \end{scope}

 \fill[white, draw=black] (0,0) circle (.03) node[black,above]{$x$};
 \fill[white, draw=black] (2,0) circle (.03) node[black,below]{$y$};
 \fill[white, draw=black] (4,0) circle (.03) node[black,above]{$z$};
 \fill[white, draw=black] (6,0) circle (.03) node[black,below]{$w$};
\end{tikzpicture}
```



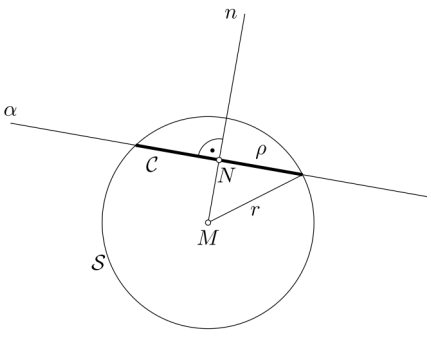
10 Mindmap

```
\begin{tikzpicture}[scale=.55, every node/.style={scale=.55}]
 \path[mindmap, concept color=black,text=white]
   node[concept] {Numeri primi}
   [counterclockwise from=60]
   child[concept color=violet] {
     node[concept] {Preistoria}
   }
   child[concept color=yellow, text=black] {
     node[concept] {Greci}
     [counterclockwise from=157.5, level 2 concept/.append style={
         sibling angle=45}]
     child { node[concept] {Euclide} }
     child { node[concept] {Eratostene} }
   }
   child[concept color=orange] {
     node[concept] {Formule}
     [counterclockwise from=135, level 2 concept/.append style={
         sibling angle=45}]
     child { node[concept] {Fermat} }
     child { node[concept] {Mersenne} }
     child { node[concept] {Euler} }
   }
   child[concept color=blue] {
     node[concept] {Distribuzione}
     [counterclockwise from=157.5, level 2 concept/.append style={
         sibling angle=45}]
     child { node[concept] {Gauss} }
     child { node[concept] {Riemann} }
   }
   child[concept color=green!50!black] {
     node[concept] {Crittografia}
   }
   child[concept color=black] {
     node[concept] {Numeri perfetti}
     [counterclockwise from=-30]
     child[concept color=yellow, text=black] { node[concept] {
         Euclide} }
     child[concept color=orange] { node[concept] {Euler} }
   };
\end{tikzpicture}
```



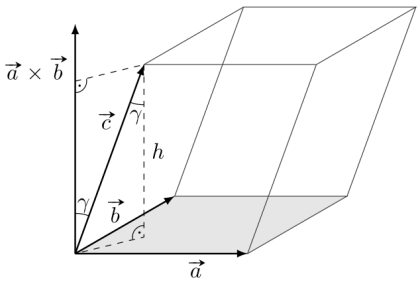
11 Schnittkreis Kugel-Ebene

```
\begin{tikzpicture}[scale=1.9]
 \draw (0,0) circle (1);
 \draw (0,0) -- (80:2) node[left]{$n$};
 \draw (80:.6) -- ++ (-10:2);
 \draw (80:.6) -- ++ (170:2) node[above]{$\alpha$};
 \draw [ultra thick] (80:.6) -- node[above]{$\rho$} ++ (-10:.8);
 \draw [ultra thick] (80:.6) -- ++ (170:.8) node[below, pos=0.8]{$
     \mathcal C$};
 \draw (80:.8) arc (80:170:.2);
 \fill (80:.6) ++ (125:.11) circle (0.02);
 \draw (80:.6) ++ (-10:.8) -- node[below]{$r$} (0,0);
 \fill [white, draw=black] (0,0) circle (0.025) node[black, below]{$
     M$};
 \fill [white, draw=black] (80:.6) circle (0.025) node[below,black]{
     \phantom{ly}$N$};
 \node at (200:1.1) {$\mathcal S$};
\end{tikzpicture}
```



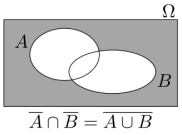
12 Vektorprodukt

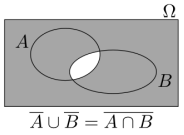
```
\begin{tikzpicture}[scale=1]
 \draw [gray!50!black, thin, fill=gray!20!white]
   (0,0) -- ++ (0:3) -- ++ (30:2) -- ++ (0:-3) -- ++ (30:-2);
 \draw [thin, gray!50!black]
   (0,0) ++ (70:3.5) -- ++ (0:3) -- ++ (30:2) -- ++ (0:-3) -- ++
      (30:-2);
 \draw [thin, gray!50!black] (0:3) -- ++ (70:3.5);
 \draw [thin, gray!50!black] (0:3) ++ (30:2) -- ++ (70:3.5);
 \draw [thin, gray!50!black] (30:2) -- ++ (70:3.5);
 \draw [thick, -latex] (0,0) -- node[pos=0.7,below]{$\vv{a}$} ++
     (0:3);
 \draw [thick, -latex] (0,0) -- node[pos=0.7,left]{$\vv{c}$} ++
     (70:3.5);
 \draw [thick, -latex] (0,0) -- node[pos=0.4,above]{$\vv{b}$} ++
     (30:2);

 \draw [thick, -latex] (0,0) -- node[left,pos=0.8]{$\vv{a} \times
     \vv{b}$} ++ (90:4);
 \draw [dashed] (70:3.5) -- node[right]{$h$} ++ (90:-3) -- (0,0);
 \draw [dashed] (90:3) -- (70:3.5);

 %56.430645653
 \draw (70:.7) arc (70:90:0.7);
 \node at (80:0.85) {$\gamma$};
 \draw (70:3.5) ++ (90:-0.7) arc (270:250:.7);
 \node at (66:2.6) {$\gamma$};

 \draw (90:2.8) arc (-90:56.430645653-45:.2);
 \fill (90:3) ++ (-45:.11) circle (0.02);

 \draw (70:3.5) ++ (90:-2.8) arc (90:56.430645653+135:.2);
 \fill (70:3.5) ++ (90:-3) ++ (135:.11) circle (0.02);
\end{tikzpicture}
```



13 De Morgan

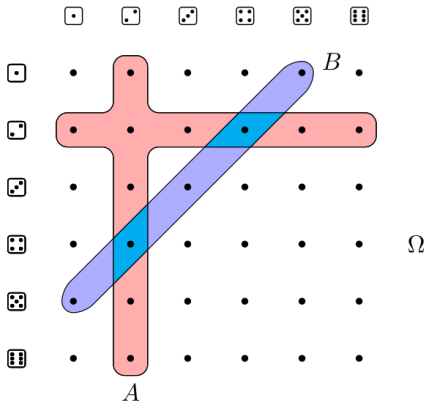
```
\begin{tikzpicture}[scale=.9]
 \draw[fill=gray!70] (-2,-1) rectangle (2,1);
 \fill[white] (.5,-.2) ellipse (1 and .5);
 \fill[white] (-.6,.2) ellipse (.8 and .6);
 \draw (.5,-.2) ellipse (1 and .5);
 \draw (-.6,.2) ellipse (.8 and .6);

 \node at (-1.6,.5) {$A$};
 \node at (1.7,-.4) {$B$};
 \node at (1.8,1.2) {$\Omega$};

 \node at (0,-1.3) {$\overline{A} \cap \overline{B} = \overline{A
     \cup B}$};
\end{tikzpicture}
\hspace{1cm}
\begin{tikzpicture}[scale=.9]
 \draw [fill=gray!70] (-2,-1) rectangle (2,1);

 \begin{scope}
  \clip (.5,-.2) ellipse (1 and .5);
  \fill [white] (-.6,.2) ellipse (.8 and .6);
 \end{scope}

 \draw (.5,-.2) ellipse (1 and .5);
 \draw (-.6,.2) ellipse (.8 and .6);

 \node at (-1.6,.5) {$A$};
 \node at (1.7,-.4) {$B$};
 \node at (1.8,1.2) {$\Omega$};

 \node at (0,-1.3) {$\overline{A} \cup \overline{B} = \overline{A
     \cap B}$};
\end{tikzpicture}
```





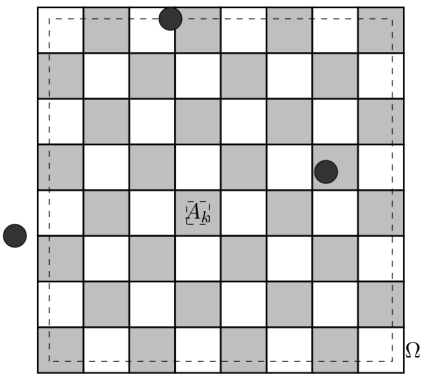
14 Bedingte Wahrscheinlichkeit

```
\begin{tikzpicture}[scale=.9]
 \draw [rounded corners=5pt, fill=red!80, fill opacity=.4]
   (1.7,-.7) -- (2.3,-.7) -- (2.3,-1.7) -- (6.3,-1.7) -- (6.3,-2.3)
       --
   (2.3,-2.3) -- (2.3,-6.3) -- (1.7,-6.3) -- (1.7,-2.3) --
   (.7,-2.3) -- (.7,-1.7) -- (1.7,-1.7) -- cycle;
 \draw [rounded corners=5pt, fill=blue!80, fill opacity=.4]
   (0.8,-4.8) -- (0.8,-5.2) -- (1.2,-5.2) -- (5.2,-1.2) -- (5.2,-.8)
       --
   (4.8,-.8) -- cycle;

 \begin{scope}
  \clip
   (1.7,-.7) -- (2.3,-.7) -- (2.3,-1.7) -- (6.3,-1.7) -- (6.3,-2.3)
       --
   (2.3,-2.3) -- (2.3,-6.3) -- (1.7,-6.3) -- (1.7,-2.3) --
   (.7,-2.3) -- (.7,-1.7) -- (1.7,-1.7) -- cycle;
  \draw [black,fill=cyan] (0.8,-4.8) -- (0.8,-5.2) -- (1.2,-5.2) --
  (5.2,-1.2) -- (5.2,-.8) -- (4.8,-.8) -- cycle;
 \end{scope}

 \draw [rounded corners=5pt]
   (1.7,-.7) -- (2.3,-.7) -- (2.3,-1.7) -- (6.3,-1.7) -- (6.3,-2.3)
       --
   (2.3,-2.3) -- (2.3,-6.3) -- (1.7,-6.3) -- (1.7,-2.3) --
   (.7,-2.3) -- (.7,-1.7) -- (1.7,-1.7) -- cycle;

 \foreach \x in {1,2,3,4,5,6}{
   \node at (\x,0) {\epsdice{\x}};
   \foreach \y in {1,2,3,4,5,6}{
     \fill (\x,-\y) circle (0.06);
     \node at (0,-\y) {\epsdice{\y}};
   }
 }
 \node at (5.2,-.8) [right] {$B$};
 \node at (2,-6.3) [below] {$A$};
 \node at (7,-4) {$\Omega$};
\end{tikzpicture}
```



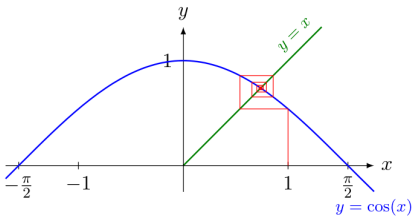
15 Geometrische Wahrscheinlichkeit

```
\begin{tikzpicture}[scale=.8]
 \foreach \x in {1,...,8}{
  \foreach \y in {1,...,8}{
   \pgfmathsetmacro{\z}{\x + \y - 1}
   \ifodd\z
    \draw [thick,fill=gray!50] (\x-1,\y-1) rectangle (\x,\y);
   \else
    \draw [thick] (\x-1,\y-1) rectangle (\x,\y);
   \fi
  }
 }
 \draw [dashed] (.25,.25) rectangle (7.75,7.75);
 \draw [dashed] (3.25,3.25) rectangle (3.75,3.75);
 \node at (3.5,3.5) {$A_k$};
 \draw [fill=black!60!gray] (6.3,4.4) circle (.25);
 \draw [fill=black!60!gray] (2.9,7.75) circle (.25);
 \draw [fill=black!60!gray] (-.5,3) circle (.25);
 \node at (8.2,.5) {$\Omega$};
\end{tikzpicture}
```



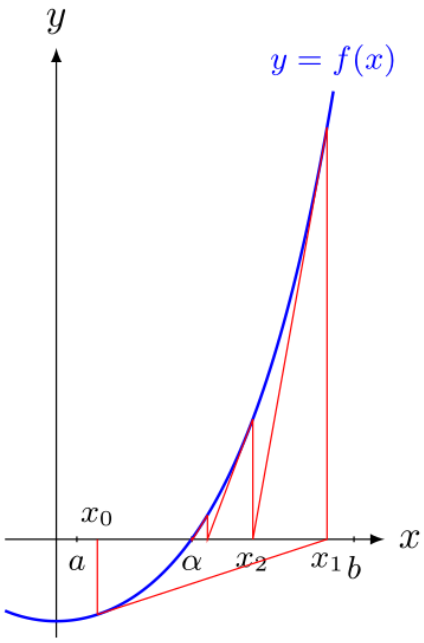
16 Fixpunktverfahren

```
\begin{tikzpicture}[scale=2]
 \tikzmath{function f(\x) {return cos(\x r);};}
 \pgfmathsetmacro{\xdottie}{0.739085}
 \pgfmathsetmacro{\ydottie}{f(\xdottie)}

 \pgfmathsetmacro{\dx}{0.5}
 \pgfmathsetmacro{\xi}{-0.5*pi-0.25*\dx}
 \pgfmathsetmacro{\xf}{0.5*pi+0.5*\dx}
 \pgfmathsetmacro{\ejex}{0.5*pi+0.5*\dx}
 \pgfmathsetmacro{\ejey}{0.5*pi-0.5*\dx}

 \draw[thick, green!50!black] (0,0) -- (\ejey,\ejey)
   node [very near end, sloped, above] {\footnotesize$y = x$};

 % Coordinate axis
 \draw[-latex] (\xi,0) -- (\ejex,0) node [right]{$x$};
 \foreach \x/\xtext in
  {-1/-1,1/1,-1.5708/-\frac{\pi}{2},1.5708/\frac{\pi}{2}}
  {
   \draw (\x,1pt) -- (\x,-1pt) node [below] {$\xtext$};
  }

 \draw[-latex] (0,-0.25) -- (0,\ejey) node [above]{$y$};
 \draw (1pt,1) -- (-1pt,1) node [left] {$1$};

 % The graph of the cosine function
 \draw[blue,thick] plot[domain=\xi:\xf,smooth] (\x,{cos(\x r)})
   node[below]{\footnotesize$y = \cos(x)$};

 % Initial values for the fixed-point method
 \pgfmathsetmacro{\xa}{1}
 \pgfmathsetmacro{\ya}{f(\xa)}
 \draw[red] (\xa,0) -- (\xa,\ya);
 % Cycle for the fixed-point method
 \foreach \i
  [remember=\x as \xlast (initially \xa),
  remember=\y as \ylast (initially \ya)] in {1,2,...,15}
  {
   \tikzmath{\x = \ylast; \y=f(\ylast); }
   \draw[red] (\xlast,\ylast) -- (\x,\ylast) -- (\x,\y);
  }

 % Indication of the location of the Dottie point:
 \fill[red] (\xdottie,\ydottie) circle (0.25pt);
\end{tikzpicture}
```



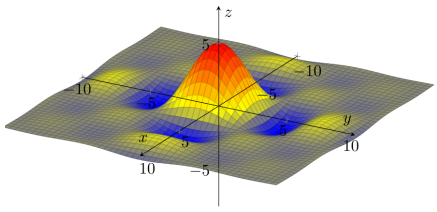
17 Newton Verfahren

```
\begin{tikzpicture}[scale=1, yscale=0.8]
 \tikzmath{function f(\x) {return cosh(\x) - 2;};}
 \tikzmath{function df(\x) {return sinh(\x);};}
 \pgfmathsetmacro{\xdottie}{1.32}
 \pgfmathsetmacro{\ydottie}{f(\xdottie)}

 \pgfmathsetmacro{\xmin}{-.5}
 \pgfmathsetmacro{\xmax}{3.2}
 \pgfmathsetmacro{\ymin}{-1.2}
 \pgfmathsetmacro{\ymax}{6}

 % Coordinate axis
 \draw[-latex] (\xmin,0) -- (\xmax,0) node [right]{$x$};
 \foreach \x/\xtext in
 {0.2/a, \xdottie/\alpha, 2.9/b}
 {
  \draw (\x,1pt) -- (\x,-1pt) node [below] {\footnotesize $\xtext$};
 }

 \draw[-latex] (0,\ymin) -- (0,\ymax) node [above]{$y$};

 \draw[blue,thick] plot[domain=-.5:2.7,smooth, samples=100] (\x,{
     cosh(\x) - 2})
    node[above]{\footnotesize$y = f(x)$};

 \node at (0.4,0) [above] {\footnotesize $x_0$};
 \node at (2.64,0) [below] {\footnotesize $x_1$};
 \node at (1.91,0) [below] {\footnotesize $x_2$};

 \pgfmathsetmacro{\xa}{.4}
 \pgfmathsetmacro{\ya}{f(\xa)}
 \draw[red] (\xa,0) -- (\xa,\ya);

 \foreach \i
  [remember=\x as \xlast (initially \xa),
  remember=\y as \ylast (initially \ya)]
  in {1,2,...,9}
 {
 \tikzmath{\x = \xlast - f(\xlast)/df(\xlast); \y=f(\x); }
 \draw[red] (\xlast,\ylast) -- (\x,0) -- (\x,\y);
 }

 \fill[red] (\xdottie,\ydottie) circle (0.25pt);
\end{tikzpicture}
```



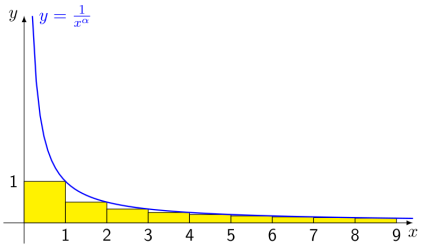
18 Funktionen von zwei Variablen

```
\begin{tikzpicture}
 \begin{axis}
 [
  axis on top,
  axis lines=center,
  ymin=-10, ymax=10, xmin=-10, xmax=10, zmin=-8, zmax=8,
  xlabel=$x$, ylabel=$y$, zlabel=$z$,
  every axis label/.append style={at=(ticklabel* cs:0)},
  domain=-10:10, y domain=-10:10,
  view={120}{30},
  scale=1.5
 ]
 \addplot3[surf, samples=50]
    (x, y, {5*sin(deg(x))/x *sin(deg(y))/y});
 \end{axis}
\end{tikzpicture}
```



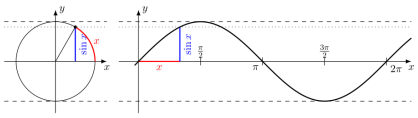
19 Integralkriterium

```
\begin{tikzpicture}[scale=0.9]
 \draw [-latex] (-.5,0) -- (9.4,0) node[below]{$x$};
 \draw [-latex] (0,-.5) -- (0,5) node[left]{$y$};

 \foreach \n in {1,...,9}{
  \fill [yellow, draw=black] (\n-1,0) rectangle (\n,1/\n);
  \node at (\n,0) [below] {\n};
 }
 \draw [thick, blue, domain=9.4:.2, samples=100] plot (\x, 1/\x)
     node[right]{$y = \frac{1}{x^\alpha}$};
 \node at (0,1) [left]{1};
\end{tikzpicture}
```



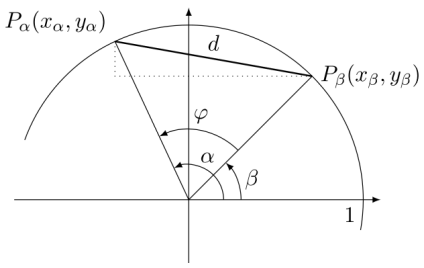
20 Graph von sin

```
\begin{tikzpicture}[scale=1]
 \def\factor{1}
   \coordinate (P) at (0.5,0.866025404);
   \draw [dotted] (-1.3,0.866025404) -- (1.3,0.866025404);
   \draw [dashed] (-1.3,1) -- (1.3,1);
   \draw [dashed] (-1.3,-1) -- (1.3,-1);
   \draw [thick, blue] (0.5,0) --node[below, rotate=90, scale=0.7]{$
       \sin x$} (P);
   \draw (0,0) circle (1);
   \draw [-latex] (-1.3,0) -- (1.3,0) node[below, scale=0.7]{$x$};
   \draw [-latex] (0,-1.3) -- (0,1.3) node[right, scale=0.7]{$y$};
   \draw (0,0) -- (P);
   \node at (0.866025404,0.5) [right, red, scale=0.7]{$x$};
   \draw [thick,red] (1,0) arc (0:60:1);
   \fill (P) circle (0.04);
\end{tikzpicture}
\begin{tikzpicture}[scale=1]
   \coordinate (P) at (0.5, 0.866025404);
   \draw [dotted] (-.5, 0.866025404) -- (2.2*pi, 0.866025404);
   \draw [dashed] (-.5,1) -- (2.2*pi, 1);
   \draw [dashed] (-.5,-1) -- (2.2*pi,-1);
   \draw [-latex] (-.5,0) -- (2.2*pi,0) node[below, scale=0.7]{$x$};
   \draw [-latex] (0,-1.3) -- (0,1.3) node[right, scale=0.7]{$y$};
   \draw [thick,red] (0,0) -- node[below,scale=0.7]{$x$} (pi/3,0);
   \draw [thick,blue] (pi/3,0) -- node[below,rotate=90,scale=0.7]{$
       \sin x$} (pi/3,0.866025404);
   \draw[thick, domain=-.1:2.2*pi, samples=100] plot (\x,{sin(\x r)
       });
   \draw (pi,0.1)--node[scale=0.7,below left]{$\pi$}(pi,-.1);
   \draw (2*pi,0.1)--node[scale=0.7,below right]{$2\pi$}(2*pi,-.1);
   \draw (pi/2,0.1)--node[scale=0.7,above]{$\frac{\pi}{2}$}(pi
       /2,-.1);
   \draw (3*pi/2,0.1)--node[scale=0.7,above]{$\frac{3\pi}{2}$}(3*pi
       /2, -.1);
\end{tikzpicture}
```



21 Additionstheoreme

```
\begin{tikzpicture}[scale=3]
 \coordinate (Pbeta) at (0.707106781,0.707106781);
 \coordinate (Palfa) at (-0.422618262,0.906307787);
 \draw [-latex] (-1,0) -- (1,0) node[below left]{$1$} -- (1.1,0);
 \draw [-latex] (0,-.5) -- (0,1.1);
 \draw (1,0) arc (0:160:1);
 \draw (1,0) arc (0:-10:1);
 \draw [thick] (Pbeta) node[right]{$P_\beta (x_\beta,y_\beta)$} --
     node[above]{$d$}
   (Palfa) node[above left]{$P_\alpha(x_\alpha,y_\alpha)$};
 \draw (Pbeta) -- (0,0) -- (Palfa);
 \draw [-latex] (0.3,0) arc (0:45:0.3);
 \node at (22.5:0.3) [right]{$\beta$};
 \draw [-latex] (0.2,0) arc (0:115:0.2);
 \node at (57.5:0.2) [above]{$\alpha$};
 \draw [-latex] (45:0.4) arc (45:115:0.4);
 \node at (80:0.4) [above]{$\varphi$};
 \draw [dotted] (Palfa) -- (Palfa |- Pbeta) -- (Pbeta);
\end{tikzpicture}
```



22 Sieb des Eratosthenes

```
\begin{tikzpicture}[scale=0.7]
 \foreach \x in {2,3,...,100}
 \node at ({\x-10*floor((\x-1)/10)},{-floor((\x-1)/10)}) [scale
     =0.7]{\x};

 \visible<2->{
 \draw ({2-10*floor((2-1)/10)},{-floor((2-1)/10)}) circle (0.4);
 }

 \visible<3->{
 \foreach \x in {4,6,...,100}
 \draw[thick,red] ({\x-10*floor((\x-1)/10)-.4},{-floor((\x-1)/10)
     -.4})
  -- ({\x-10*floor((\x-1)/10)+.4},{-floor((\x-1)/10)+.4});
 }

 \visible<4->{
 \draw ({3-10*floor((3-1)/10)},{-floor((3-1)/10)}) circle (0.4);
 }

 \visible<5->{
 \foreach \x in {6,9,...,100}
 \draw[thick,blue] ({\x-10*floor((\x-1)/10)-.4},{-floor((\x-1)/10)
     +.4})
  -- ({\x-10*floor((\x-1)/10)+.4},{-floor((\x-1)/10)-.4});
 }

 \visible<6->{
 \draw ({5-10*floor((5-1)/10)},{-floor((5-1)/10)}) circle (0.4);
 \foreach \x in {10,15,...,100}
 \draw[thick,green] ({\x-10*floor((\x-1)/10)-.4},{-floor((\x-1)/10)
     -.2})
  -- ({\x-10*floor((\x-1)/10)+.4},{-floor((\x-1)/10)+.2});
 }

 \visible<7->{
 \draw ({7-10*floor((7-1)/10)},{-floor((7-1)/10)}) circle (0.4);
 \foreach \x in {14,21,...,100}
 \draw[thick,magenta] ({\x-10*floor((\x-1)/10)-.4},{-floor((\x-1)
     /10)+.2})
  -- ({\x-10*floor((\x-1)/10)+.4},{-floor((\x-1)/10)-.2});
 }

 %\foreach \x in {2,3,5,7}
 %\draw ({\x-10*floor((\x-1)/10)},{-floor((\x-1)/10)}) circle (0.4);

 \visible<8->{
 \foreach \x in {2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43,
      47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97}
 \draw ({\x-10*floor((\x-1)/10)},{-floor((\x-1)/10)}) circle (0.4);
 }
\end{tikzpicture}
```