

Krzywe? Ależ to bardzo proste!

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BachTeX 2023, 3 May Constitution Day

Remarks about the title.

Le transistor ? mais c'est très simple ! - E. Aisberg



TeX is not a graphic tool.

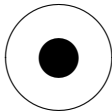
We have the `picture` environment.

```
\begin{picture}(10,200)(50,100)
```

```
\put(100,200){\circle{49}}
```

```
\put(100,200){\circle*{49}}
```

```
\end{picture}
```



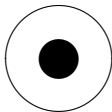
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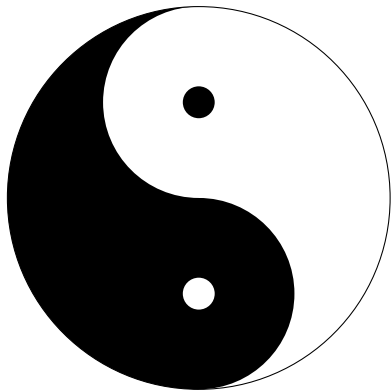
```
\put(100,200){\circle*{49}}
```

```
\end{picture}
```



Marek Zakrzewski, Tomasz Żak, Kombinatoryka,
prawdopodobieństwo i zdrowy rozsądek

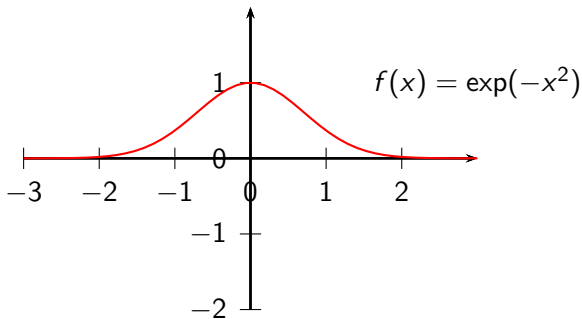
```
%Wg R. Smitha
144 -144 translate
0 0 144 90 270 arc %Czarne p/o/lkole
fill
0 -72 72 0 360 arc %Dolne czarne ko/lo
fill
gsave %Dwa bia/le ko/la
1 setgray
0 72 72 0 360 arc %G/orne bia/le ko/lo
fill
0 -72 12 0 360 arc %Bia/la kropka
fill
grestore
0 72 12 0 360 arc %Czarna kropka
fill
0 0 144 0 360 arc %Czarny okr/ag
stroke
/Times-Roman findfont 20 scalefont setfont
-60 -200 moveto
1 2 scale
(T'AI CHI T'U) show
showpage
```



T'AI CHI T'U

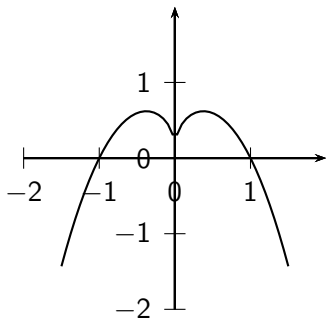
Elementary functions:

```
\pspicture(-3,-3)(3,3)  
\psaxes{->}(0,0)(-3,-2)(3,2)  
\psplot[linecolor=red]{-3}{3}  
  {2.7172 x x mul -1 mul exp}  
\rput(3,1){{$f(x)=\exp(-x^2)$}}  
\endpspicture
```



In this case function $(x^2)^{1/6}(1 - x^2)$.

```
\pspicture(-2,-2)(2,2)
  \psaxes{->}(0,0)(-2,-2)(2,2)
  \psplot{-1.2}{1.2}{/nu 1 6 div def
  /aa x x mul nu exp def
  /bb x x mul neg 1 add def
  aa bb mul}
\endpspicture
```

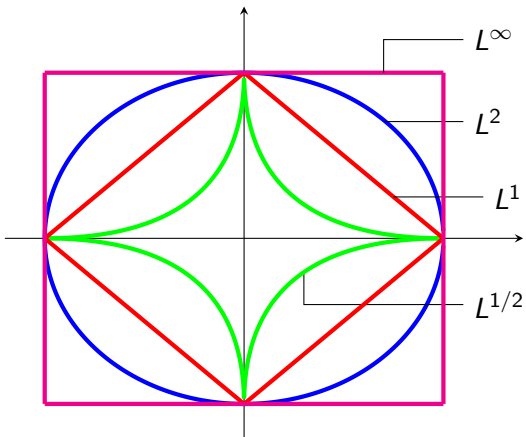


An example of balls in L^p (actually, l_2^p).

```
\begin{tikzpicture}
\begin{axis}[ticks=none,
            axis x line=middle,
            axis y line=middle,
            xmax=1.4,
            ymax=1.4,
            xmin=-1.2,
            ymin=-1.2,
            %      ymax=0.1E8, ylabel=$y$,
            %      xlabel=$x$
            ]
% \addplot[domain=-10000:10000, blue, ultra thick] {14*x - x^2};
\addplot[domain=-1:1, samples=2000, blue, ultra thick] {(1 - x^2)^(1/2)};
% \addlegendentry{$L^2$};
\addplot[domain=-1:1, samples=2000, blue, ultra thick] {-(1 - x^2)^(1/2)};
\draw (axis cs:0.705,0.705) -- (axis cs:1.1,0.705) node [right] {$L^2$};
\addplot[domain=-1:1, samples=2000, green, ultra thick] {(1 - ((abs(x))^(1/2)))^2)};
\draw (axis cs:0.3,-0.2) |- (axis cs:1.1,-0.4) node [right] {$L^{1/2}$};
% \addlegendentry{$L^{1/2}$};
\addplot[domain=-1:1, samples=2000, green, ultra thick] {-(1 - ((abs(x))^(1/2)))^2)};
\addplot[domain=-1:1, samples=200, red, ultra thick] {(1 - ((abs(x))^(1/2)))^2)};
\draw (axis cs:0.75,0.25) -- (axis cs:1.2,0.25) node [right] {$L^1$};
% \addlegendentry{$L^1$};
\addplot[domain=-1:1, samples=200, red, ultra thick] {-(1 - ((abs(x))^(1/2)))^2)};
\addplot[domain=-1:1, samples=200, magenta, ultra thick] {1};
\draw (axis cs:0.7,1) |- (axis cs:1.1,1.2) node [right] {$L^{\infty}$};
% \addlegendentry{$L^{\infty}$};
\addplot[domain=-1:1, samples=200, magenta, ultra thick] {-1};
\draw [magenta, ultra thick] (axis cs:-1,-1) -- (axis cs:-1,1) ;

\draw [magenta, ultra thick] (axis cs:1,-1) -- (axis cs:1,1) ;

\end{axis}
\end{tikzpicture}
```



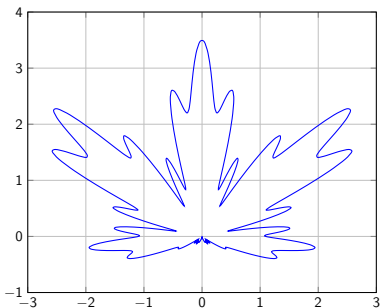
Anna Dąbrowska, *Znane i mniej znane krzywe* (Known and less known curves).

A maple leaf.

In polar coordinates:

$$r(\theta) = \left(\frac{100}{100 + (\theta - \frac{\pi}{2})^8} \right) \times \left(2 - \sin(7\theta) - \frac{1}{2} \cos(30\theta) \right)$$

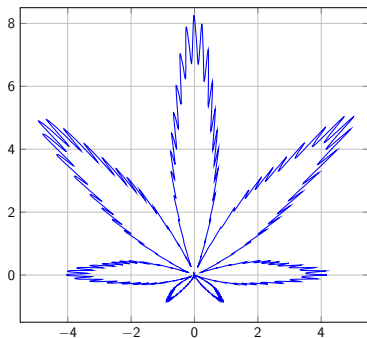
where $-\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2}$.



Cannabis Curve

$$r(\theta) = a \left[1 + \frac{9}{10} \cos(8\theta) \right] \left[1 + \frac{1}{10} \cos(24\theta) \right] \times \\ \cdot \left[\frac{9}{10} + \frac{1}{10} \cos(200\theta) \right] (1 + \sin \theta)$$

where $\theta \in (0, 2\pi]$.



Batman logo.

$f(x)$ — the upper part, $g(x)$ — the lower part.

$$f(x) = (h - l)H(x + 1) + (r - h)H(x - 1) + \\ + (l - w)H(x + 3) + (w - r)H(x - 3) + w$$

and

$$g(x) = \frac{1}{2} \left[\left| \frac{1}{2}x \right| + \sqrt{1 - (||x| - 2| - 1)^2} - \frac{(3\sqrt{33} - 7)}{112}x^2 + 3\sqrt{1 - \left(\frac{1}{7}x\right)^2} - 3 \right] \times \\ \cdot [\operatorname{sgn}(x + 4) - \operatorname{sgn}(x - 4)] - 3\sqrt{1 - \left(\frac{1}{7}x\right)^2}$$

Where $H(x)$ is the Heaviside function:

$$H(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{2} & x = 0 \\ 1 & x > 0 \end{cases}$$

and w , l , h i r are defined as follows

$$w = 3\sqrt{1 - \left(\frac{x}{7}\right)^2}$$

$$l = \frac{1}{2}(x+3) - \frac{3}{7}\sqrt{10}\sqrt{4 - (x+1)^2} + \frac{6}{7}\sqrt{10}$$

$$h = \frac{1}{2} \left[f \left(\left| x + \frac{1}{2} \right| + \left| x - \frac{1}{2} \right| + 6 \right) - 11 \left(x + \frac{3}{4} \right) + \left| x - \frac{3}{4} \right| \right]$$

$$r = \frac{1}{2}(3-x) - \frac{3}{7}\sqrt{10}\sqrt{4 - (x-1)^2} + \frac{6}{7}\sqrt{10}$$

