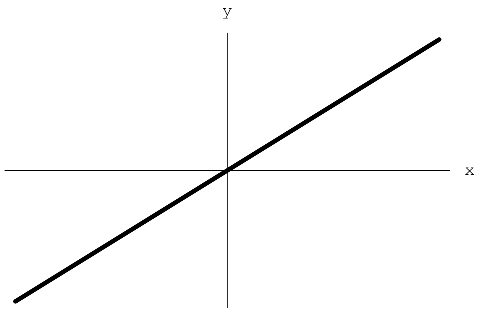
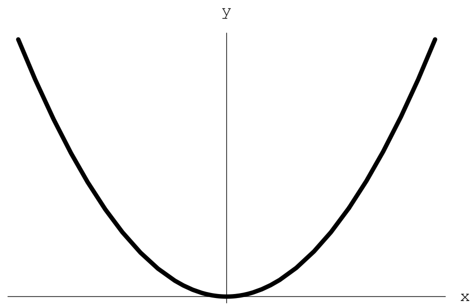
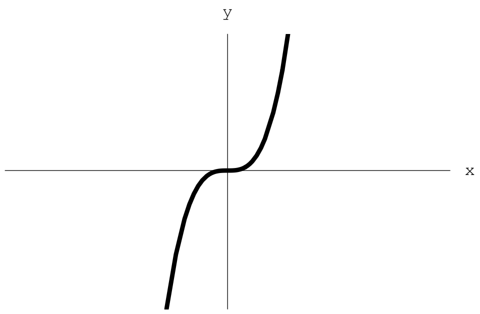
Graphs of some basic mathematical functions



$f(x) = x$

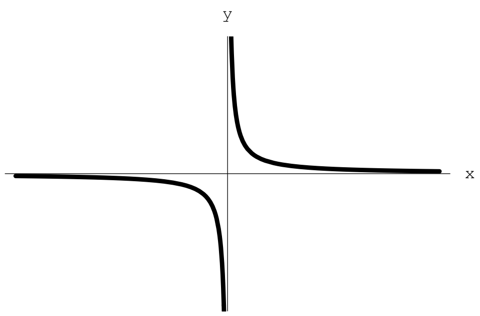


$f(x) = x^2$

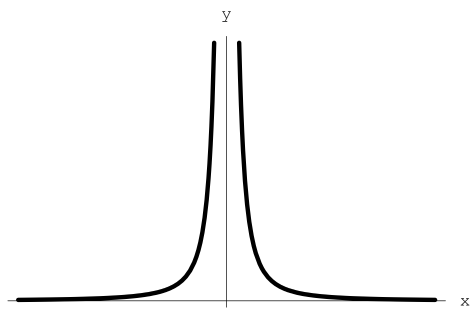


$f(x) = x^3$

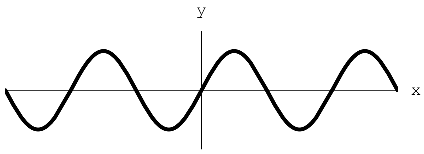
$f(x) = \sqrt{x}$



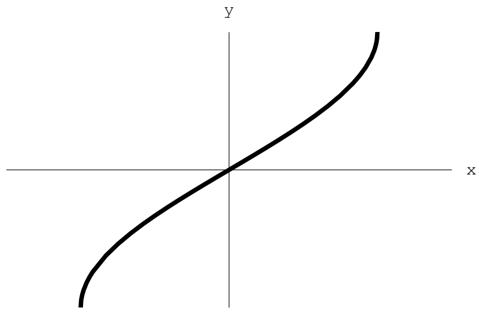
$f(x) = \frac{1}{x}$



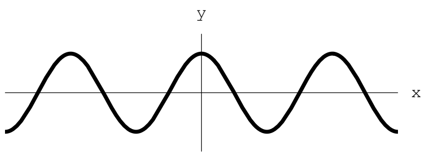
$f(x) = \frac{1}{x^2}$



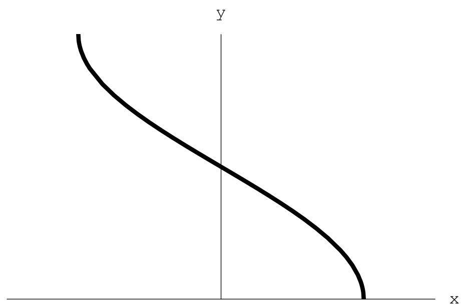
$f(x) = \sin x$
($\int_0^M \sin(x)dx \leq 2$ for all M,
but $\int_0^\infty \sin(x)dx$ does not converge)



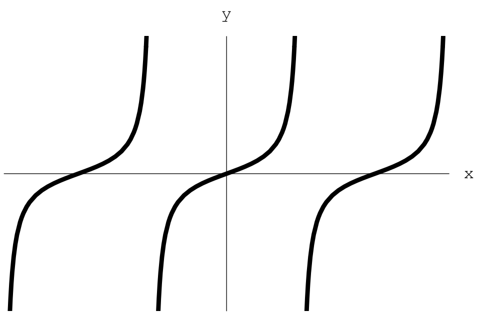
$f(x) = \arcsin x$



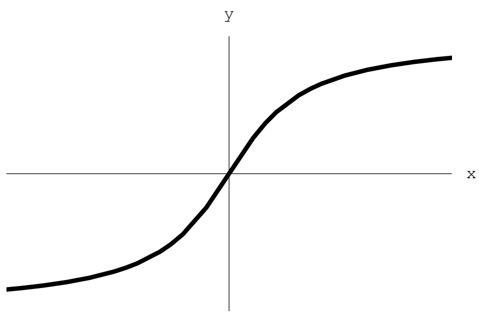
$f(x) = \cos x$



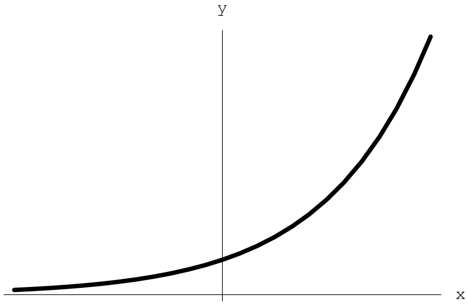
$f(x) = \arccos x$



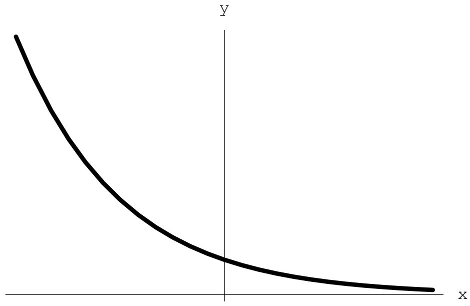
$f(x) = \tan x$



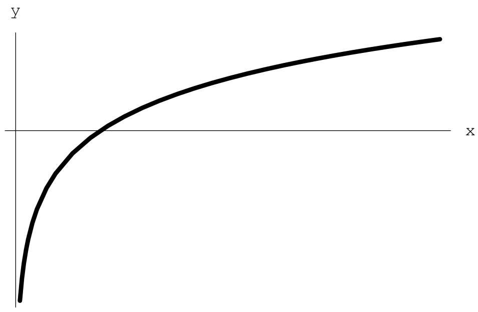
$f(x) = \arctan x$



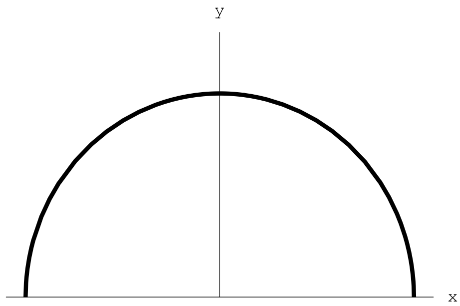
$f(x) = \mathrm{e}^x$



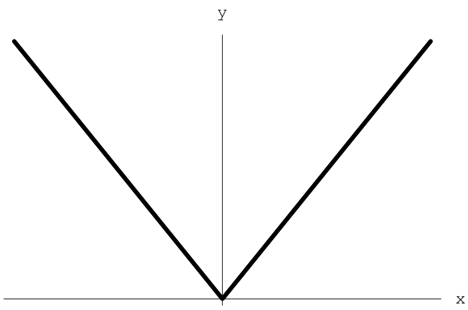
$f(x) = \mathrm{e}^{-x}$



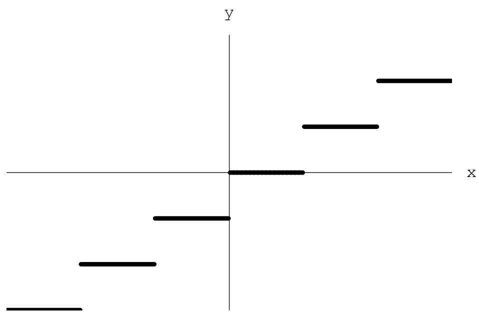
$f(x) = \ln x$



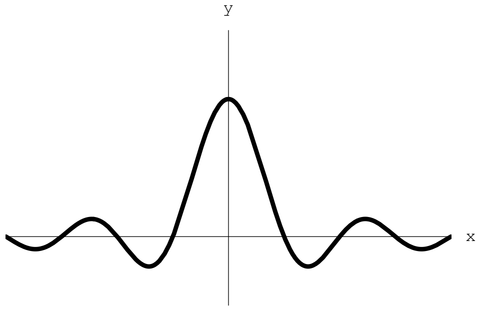
$f(x) = \sqrt{a - x^2}$



$f(x) = |x|$
(f is not differentiable at $x = 0$)

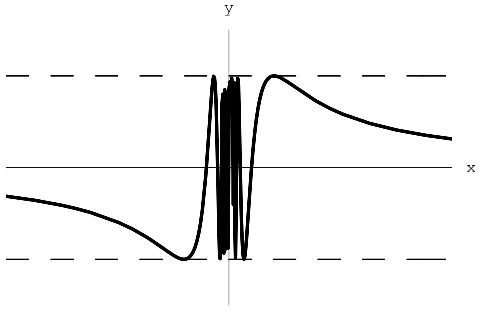


$f(x) = [x]$
(Although f is Riemnann-integrable on $[0, 2]$, it has no primitive function there)



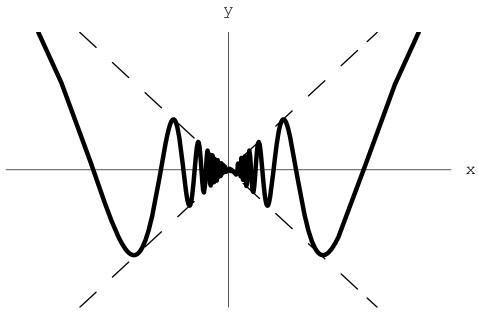
$$f(x) = \begin{cases} \dfrac{\sin x}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$$

($\int_0^\infty f(x)dx$ is conditionally convergent,
f has a primitive function, which is not elementary)



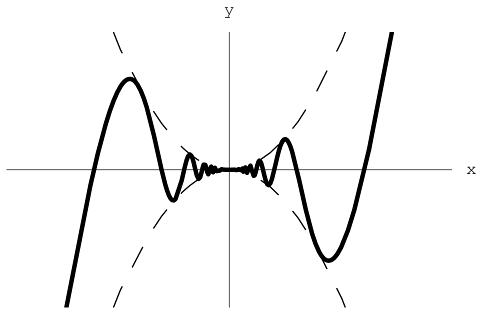
$$f(x) = \begin{cases} \sin \dfrac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

(f has no limit at $x = 0$)



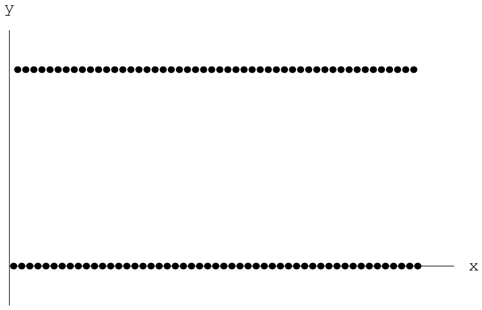
$$f(x) = \begin{cases} x \sin \dfrac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

(f is continuous, but
f is not differentiable at $x = 0$)



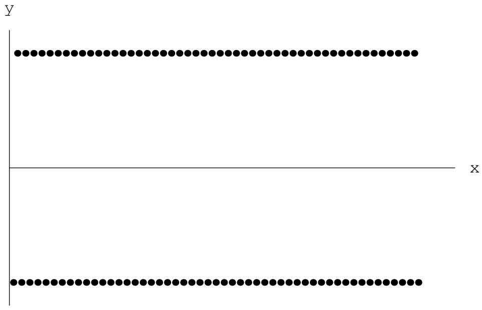
$$f(x) = \begin{cases} x^2 \sin \dfrac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

(f is differentiable, $f'(0) = 0$, but
f' is not continuous at $x = 0$)



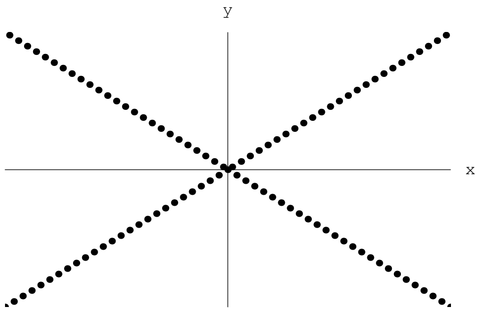
$$f(x) = \begin{cases} 1 & x \in \mathbb{Q} \\ 0 & x \notin \mathbb{Q} \end{cases}$$

(f has no limit at any point,
f is not Riemann-integrable)



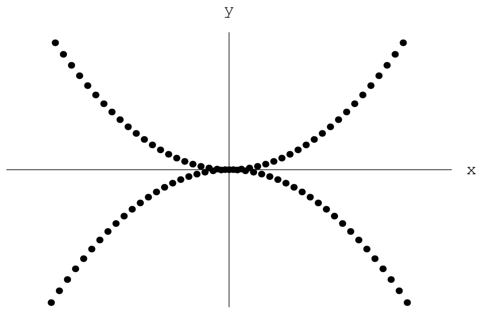
$$f(x) = \begin{cases} 1 & x \in \mathbb{Q} \\ -1 & x \notin \mathbb{Q} \end{cases}$$

(f is not continuous,
but $|f|$ and f^2 are)



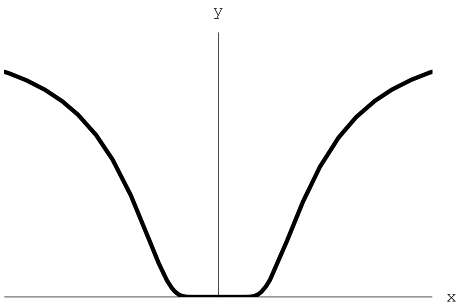
$$f(x) = \begin{cases} x & x \in \mathbb{Q} \\ -x & x \notin \mathbb{Q} \end{cases}$$

(f is continuous only at $x = 0$)



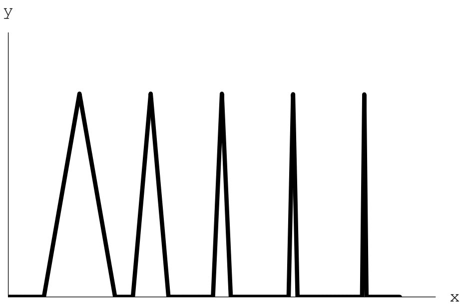
$$f(x) = \begin{cases} x^2 & x \in \mathbb{Q} \\ -x^2 & x \notin \mathbb{Q} \end{cases}$$

(f is differentiable only at $x = 0$)



$$f(x) = \begin{cases} \mathrm{e}^{-1/x^2} & x \neq 0 \\ 0 & x = 0 \end{cases}$$

(The Taylor polynomial of f
at $x_0 = 0$ is 0 for all n)



"Tent" function

(f is continuous, $f \geq 0$,
$\int_0^\infty f(x)dx < \infty$, but $\lim_{x\to\infty} f(x) \neq 0$)