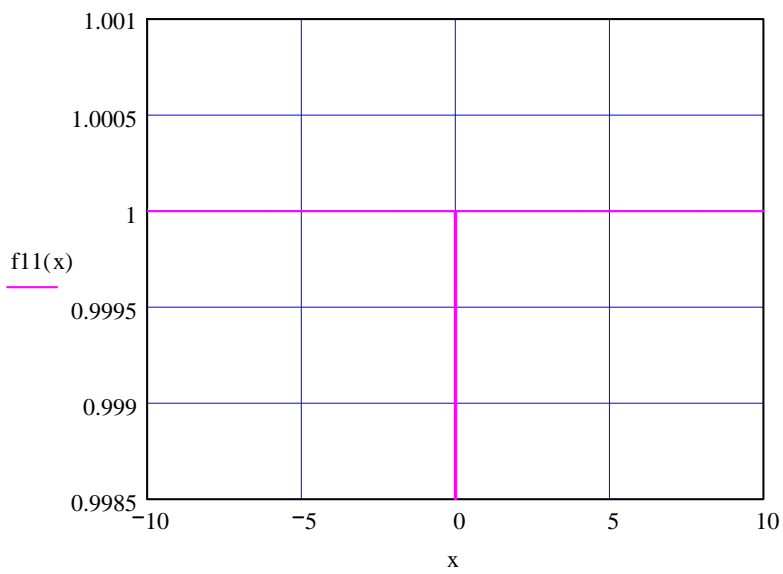
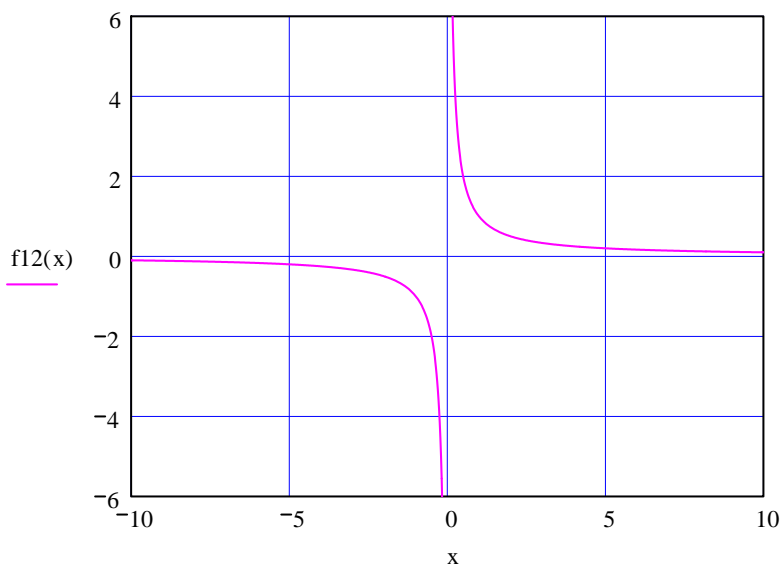


seminar 4

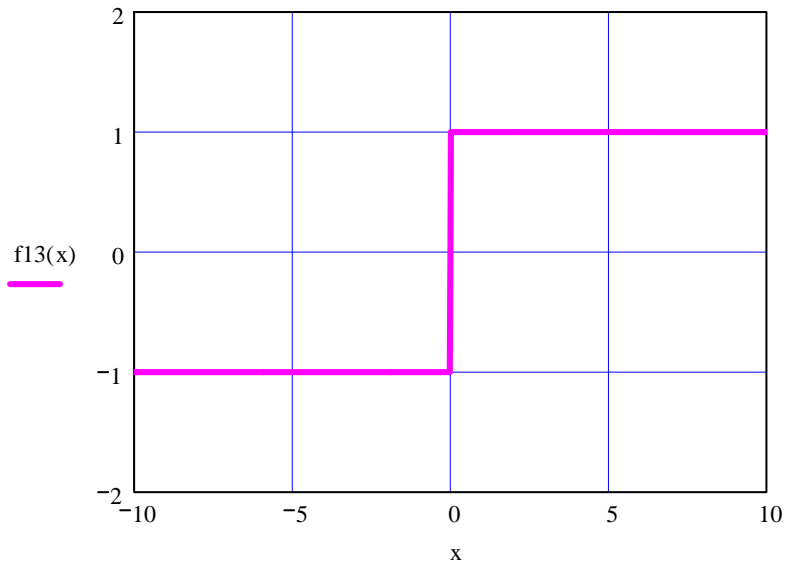
$$f11(x) := \frac{x}{x}$$



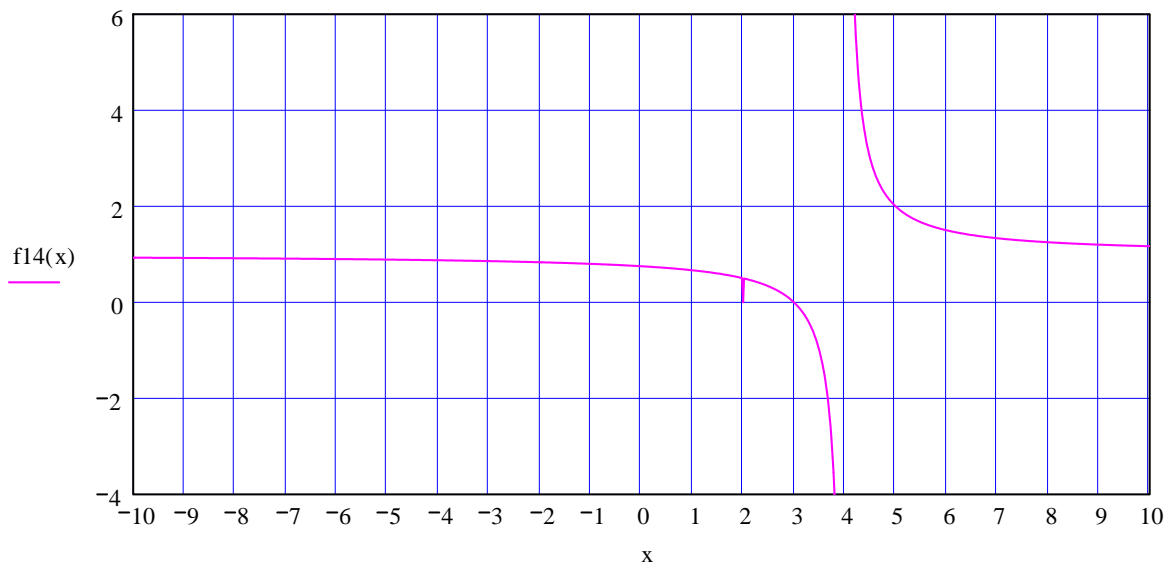
$$f12(x) := \frac{1}{x}$$



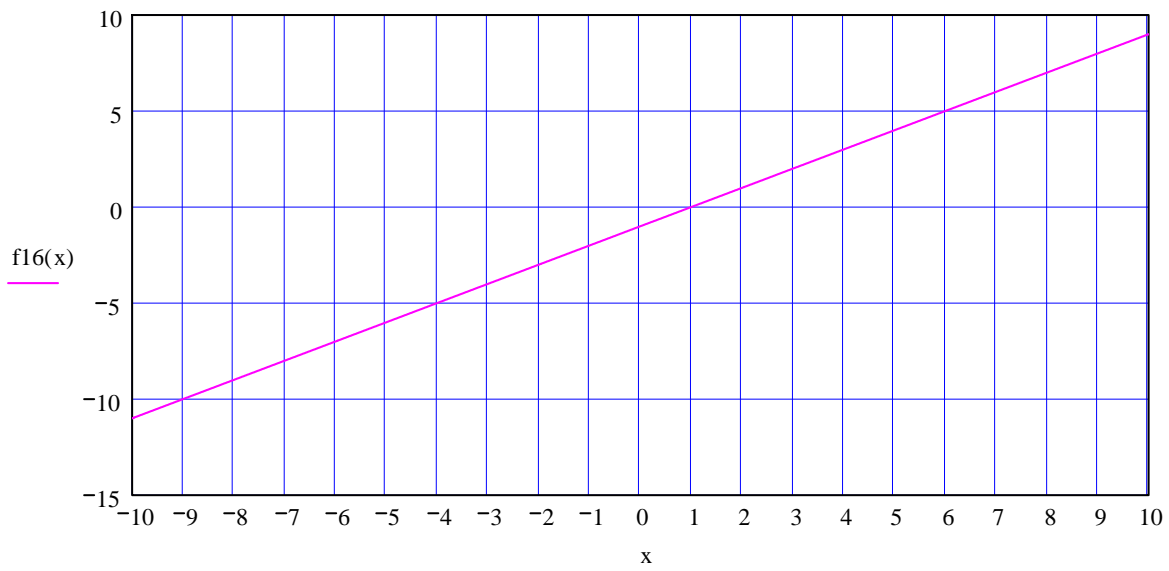
$$f13(x) := \frac{x}{|x|}$$



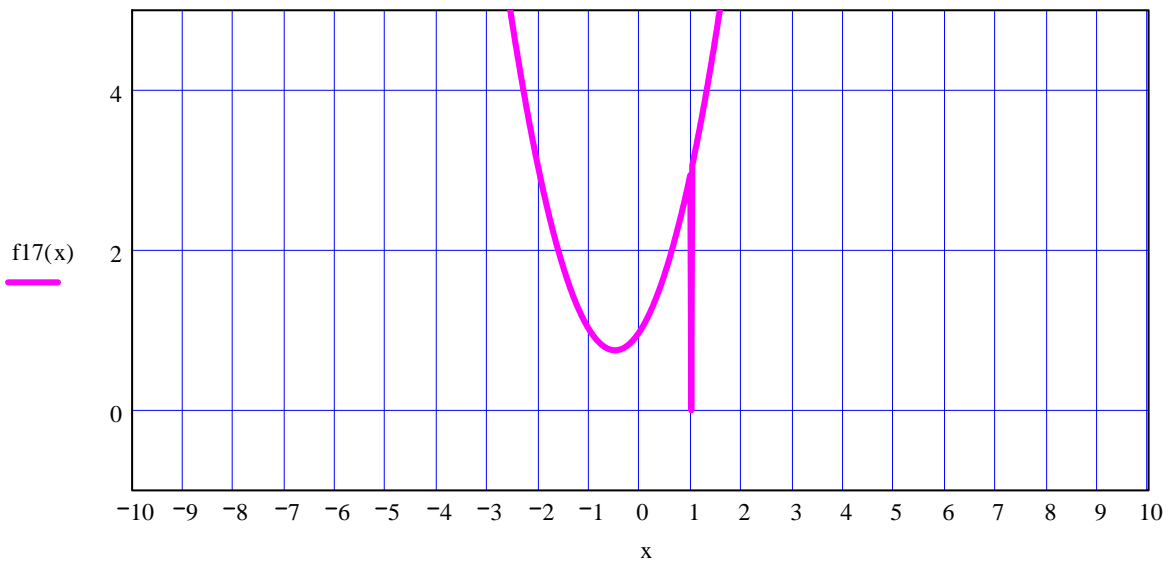
$$f_{14}(x) := \frac{(x-2) \cdot (x-3)}{(x-2) \cdot (x-4)}$$



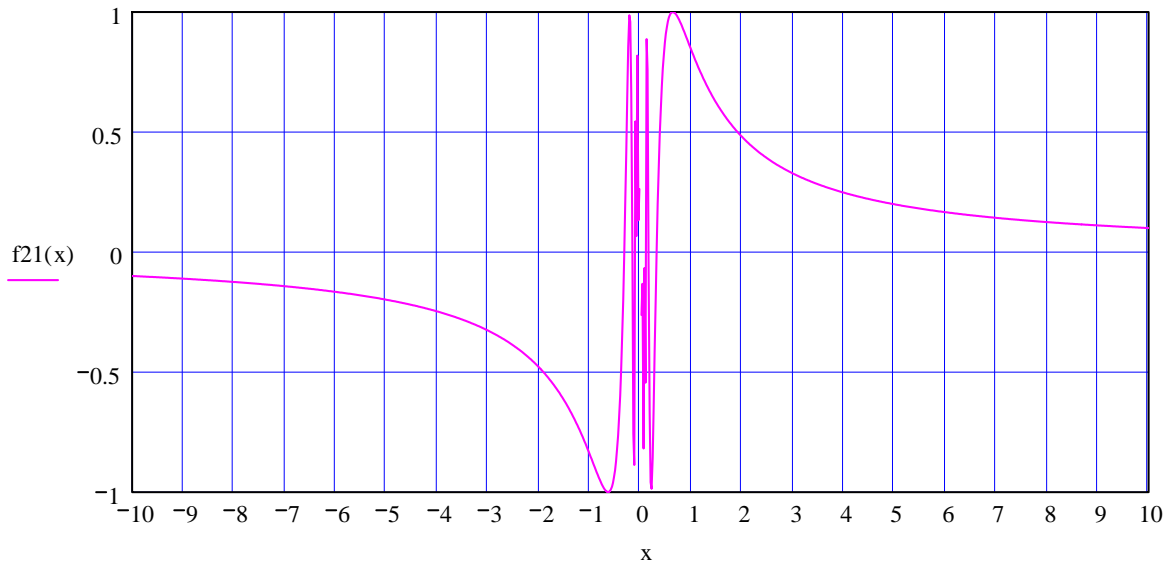
$$f_{16}(x) := \frac{x^3 - 1}{x^2 + x + 1}$$



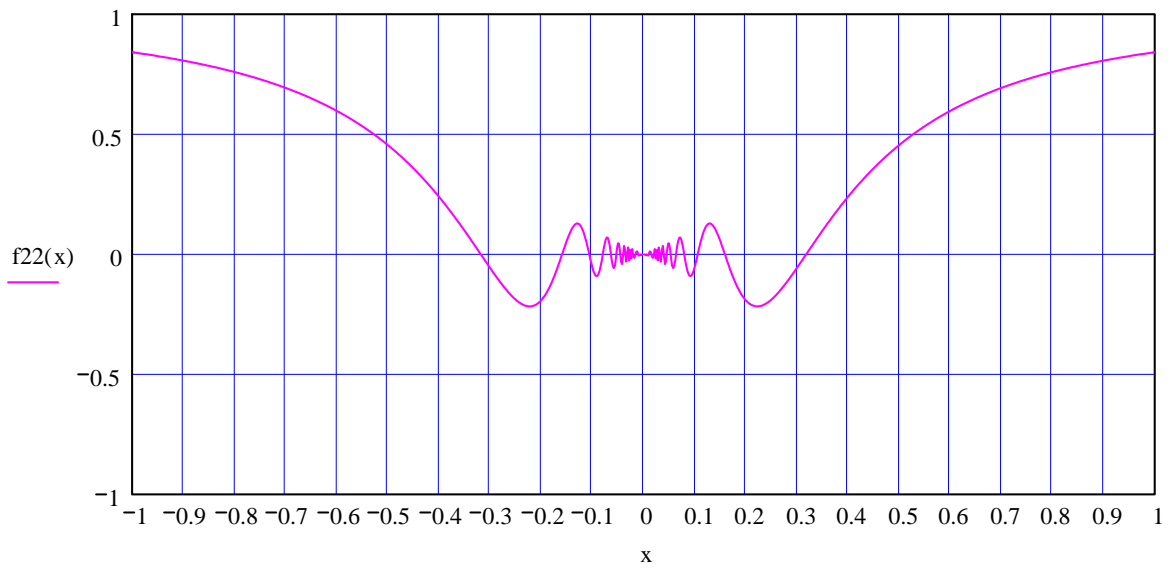
$$f_{17}(x) := \frac{x^3 - 1}{x - 1}$$



$$f_{21}(x) := \sin\left(\frac{1}{x}\right)$$

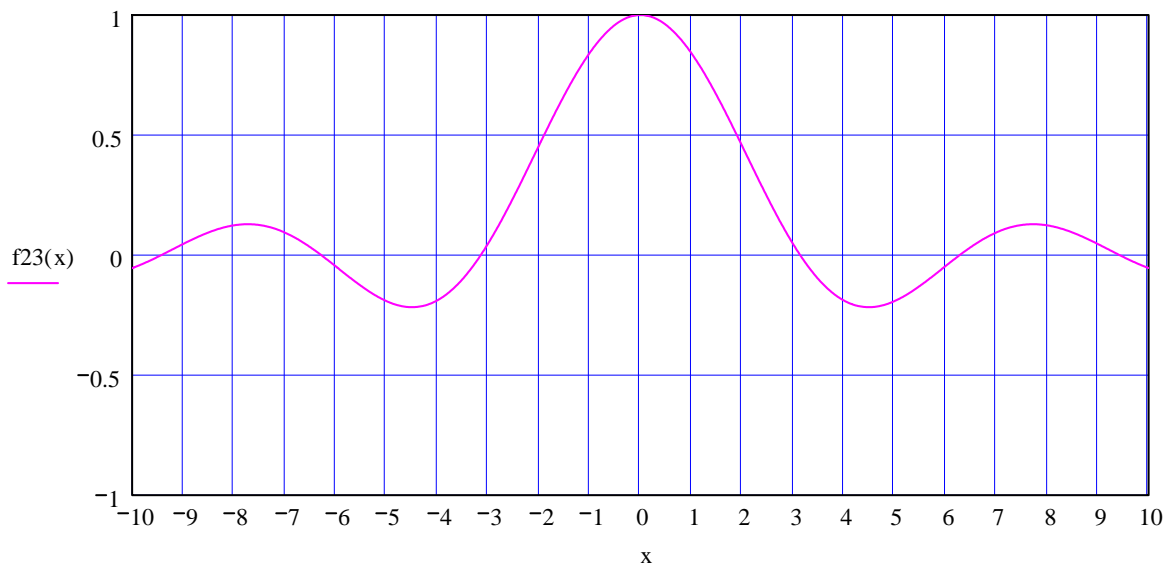


$$f_{22}(x) := x \cdot \sin\left(\frac{1}{x}\right)$$

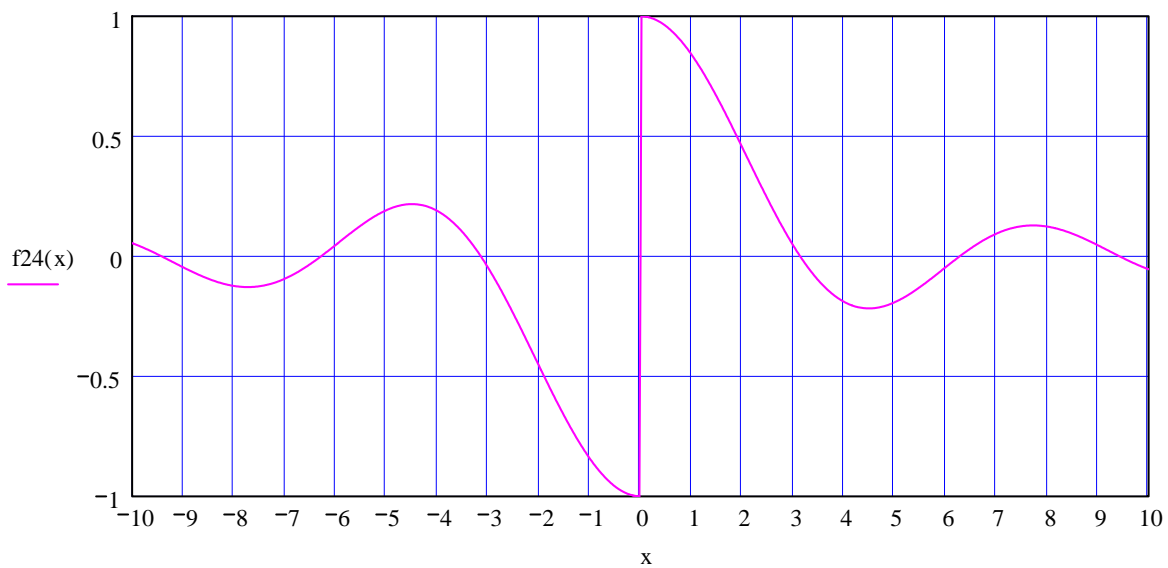


$$f_{23}(x) := \frac{\sin(x)}{x}$$

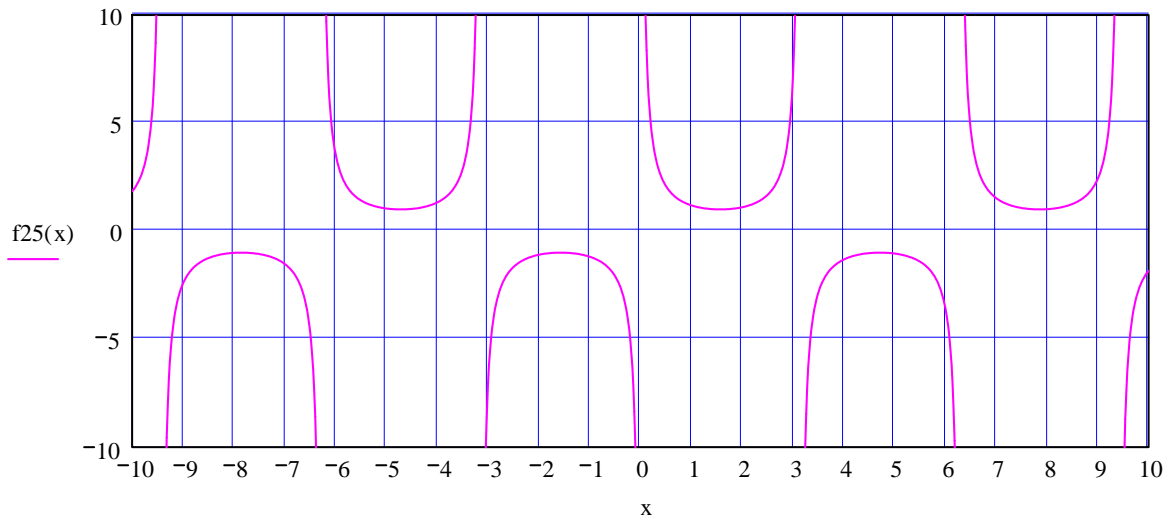
see $x=0!$



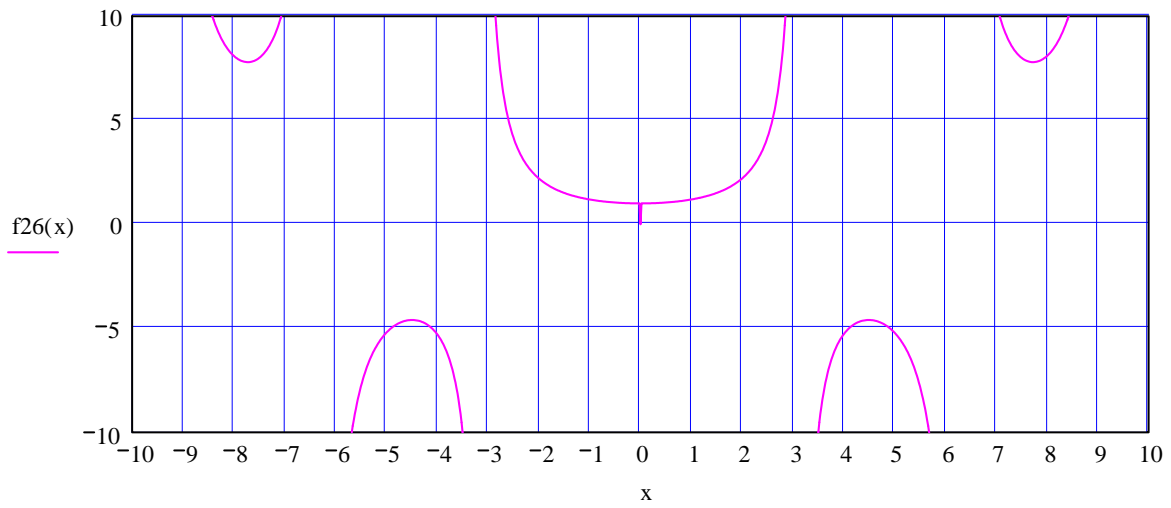
$f_{24}(x) := \frac{\sin(x)}{|x|}$ see $x=0!$



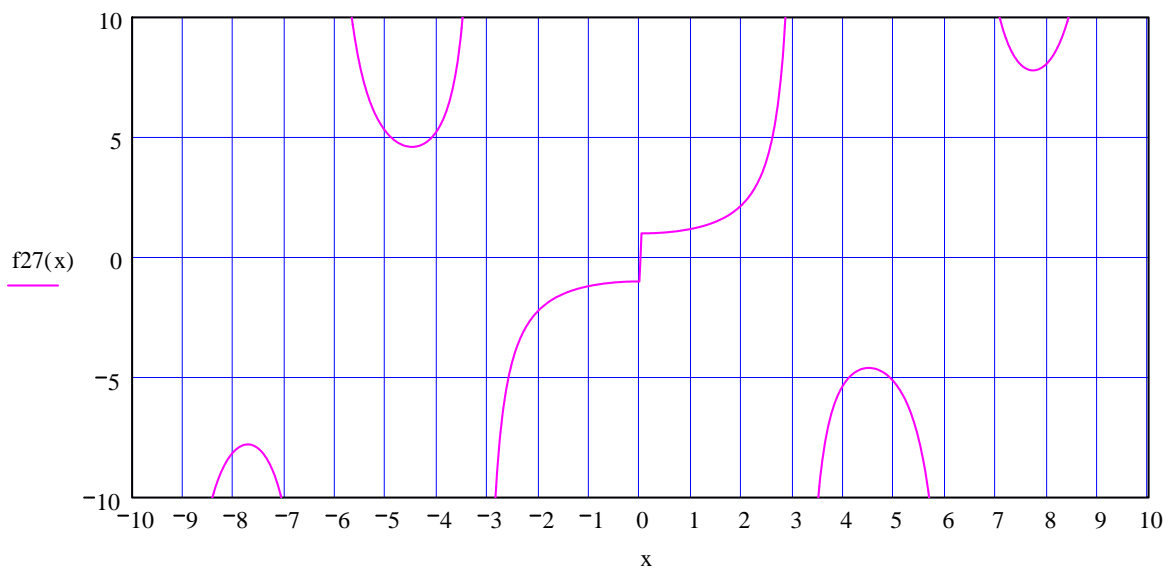
$f_{25}(x) := \frac{1}{\sin(x)}$



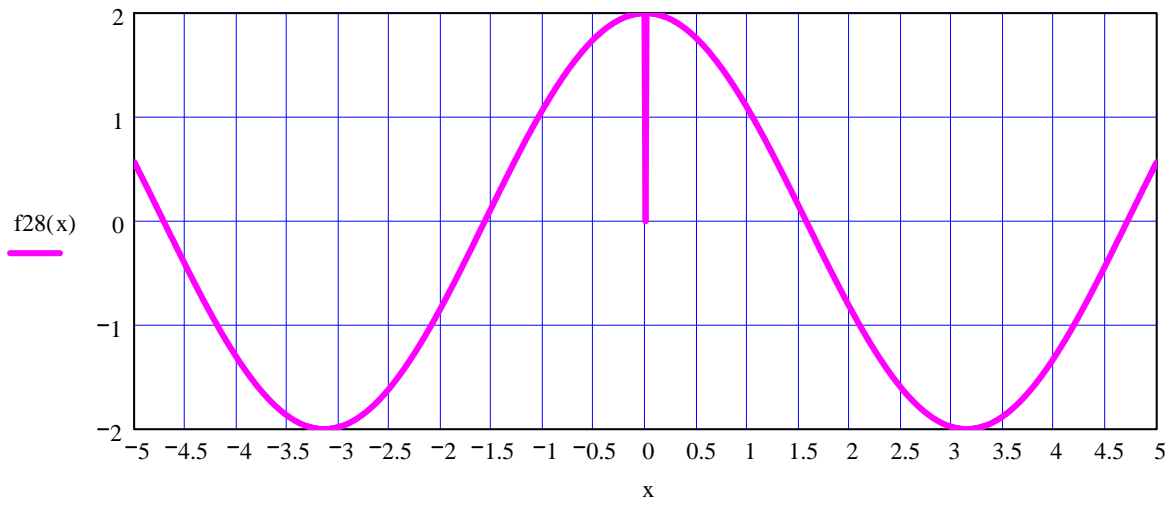
$f_{26}(x) := \frac{x}{\sin(x)}$ **see x=0!**



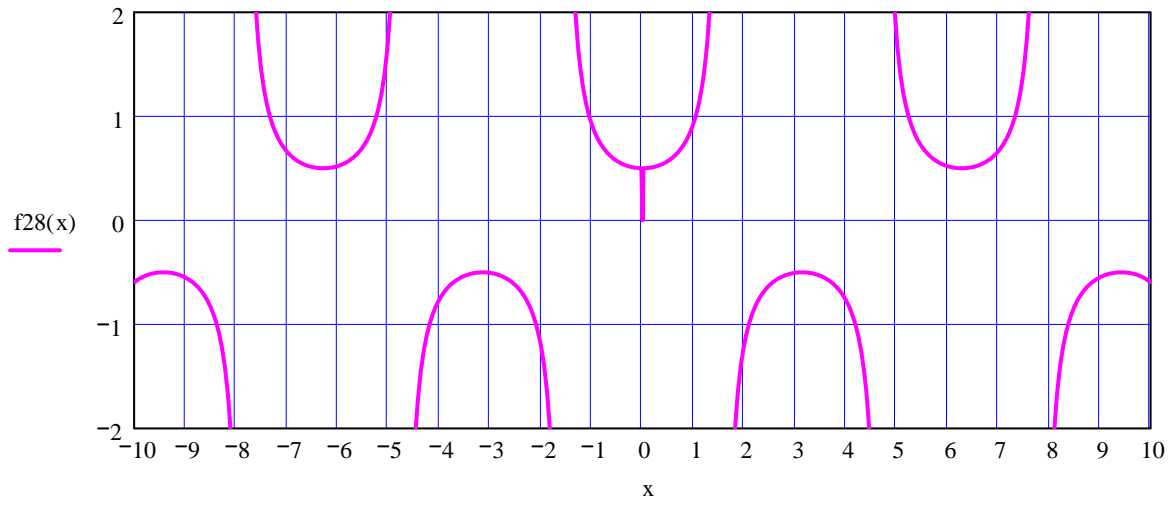
$f_{27}(x) := \frac{|x|}{\sin(x)}$ **see x=0!**



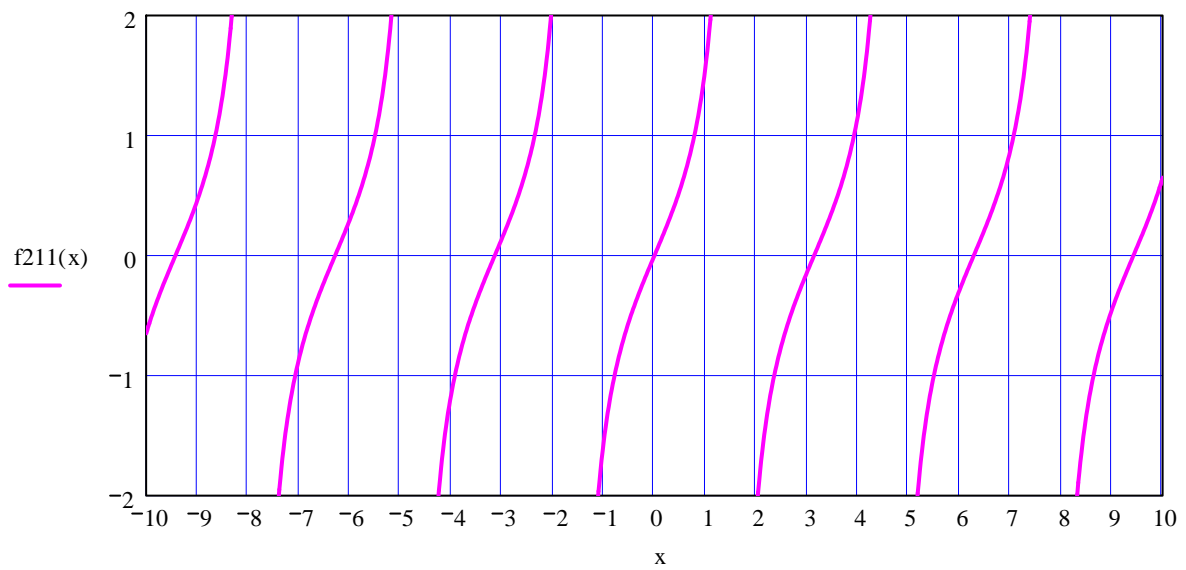
$f_{28}(x) := \frac{\sin(2 \cdot x)}{\sin(x)}$ **see x=πn**



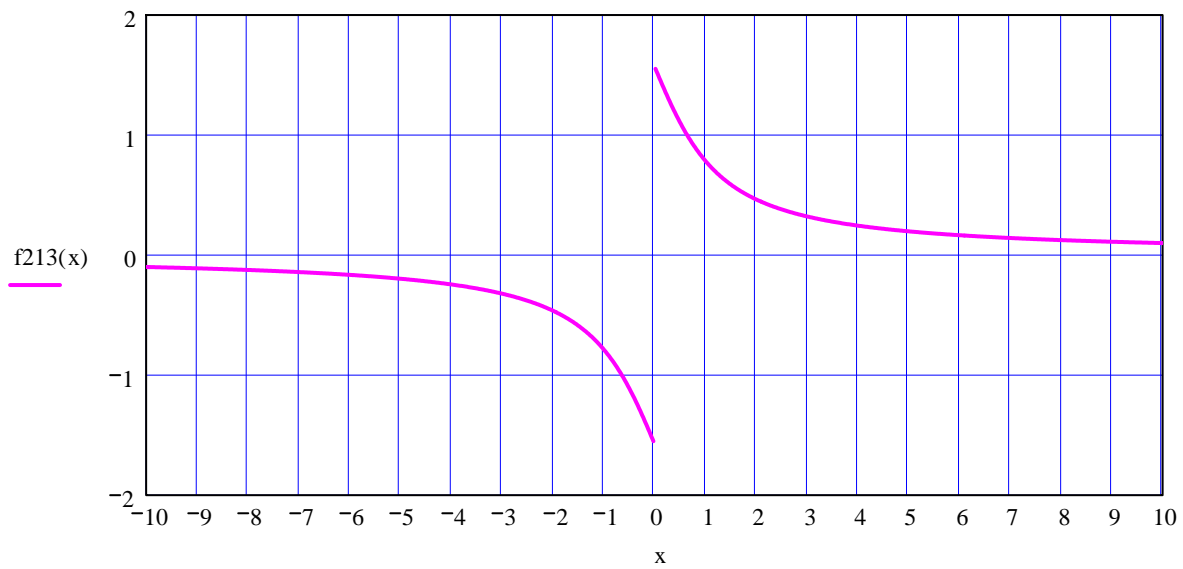
$f_{28}(x) := \frac{\sin(x)}{\sin(2 \cdot x)}$ see $x=\pi n/2$



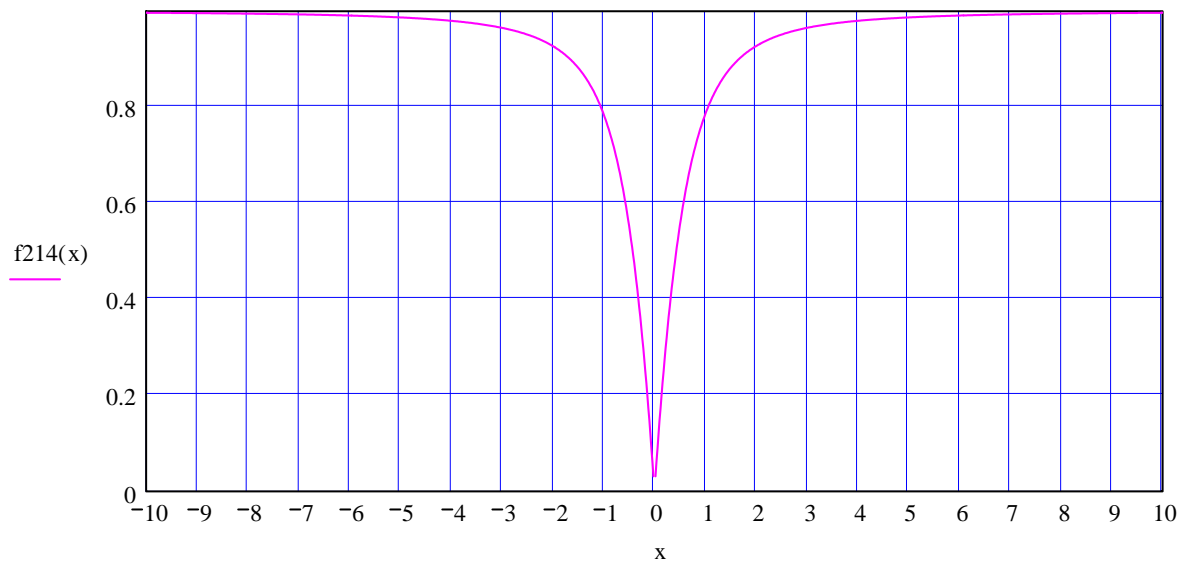
$f_{211}(x) := \tan(x)$



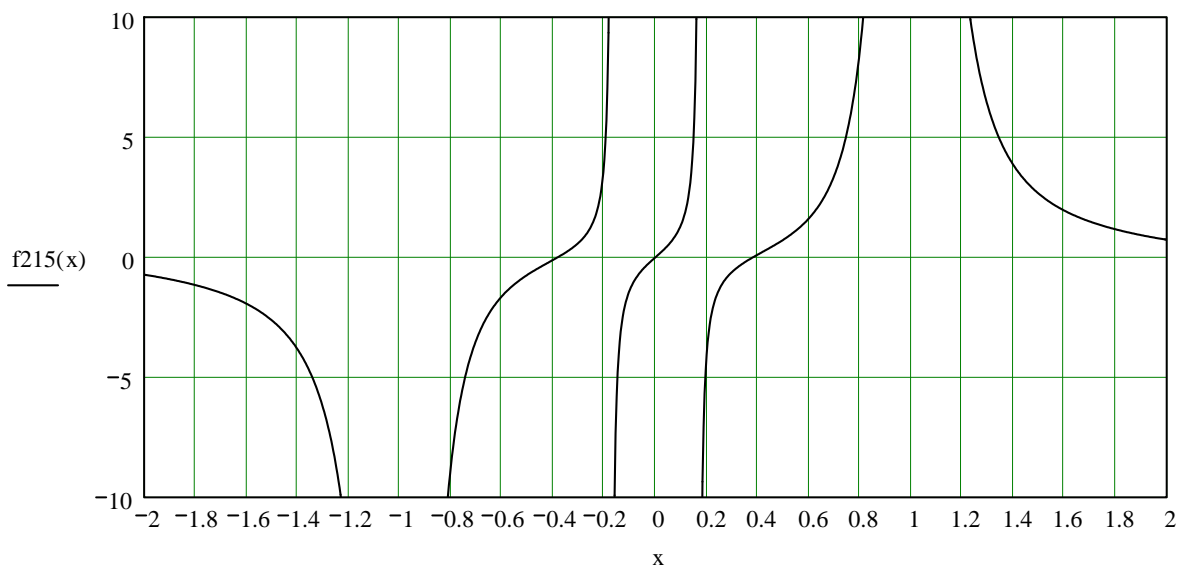
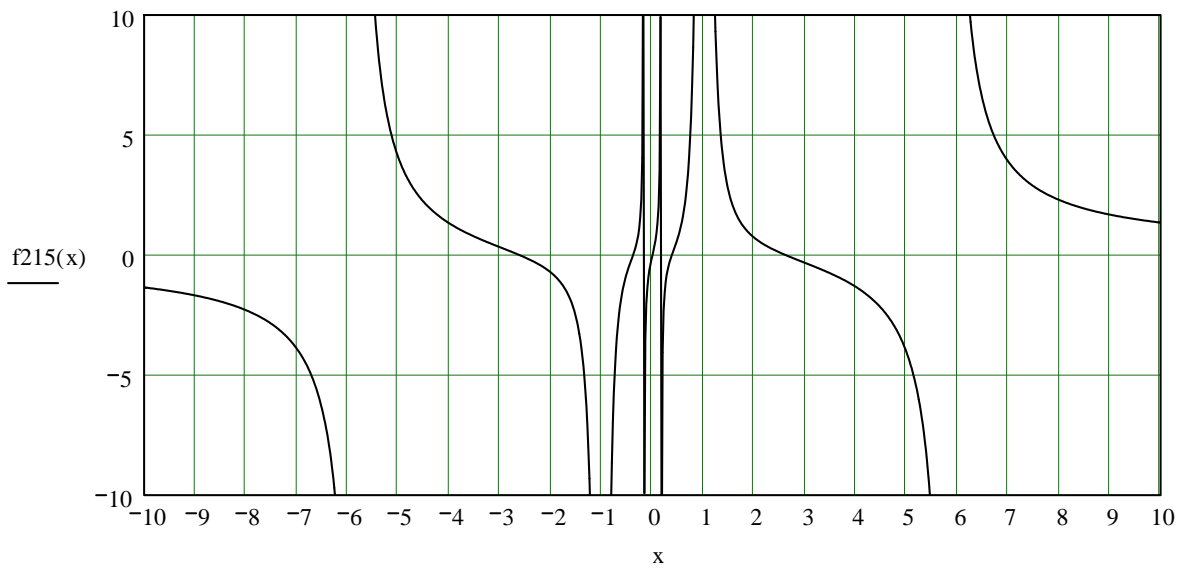
$f_{213}(x) := \operatorname{atan}\left(\frac{1}{x}\right)$



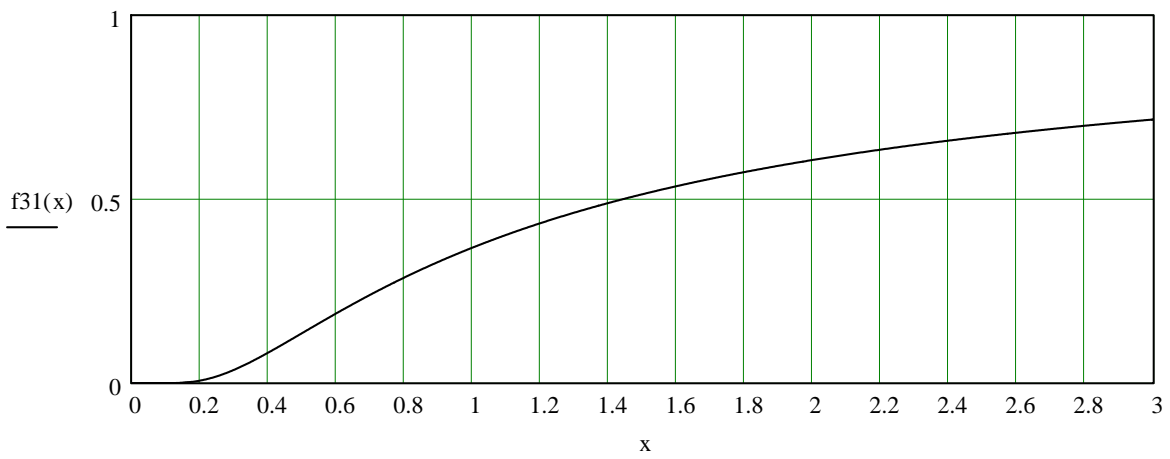
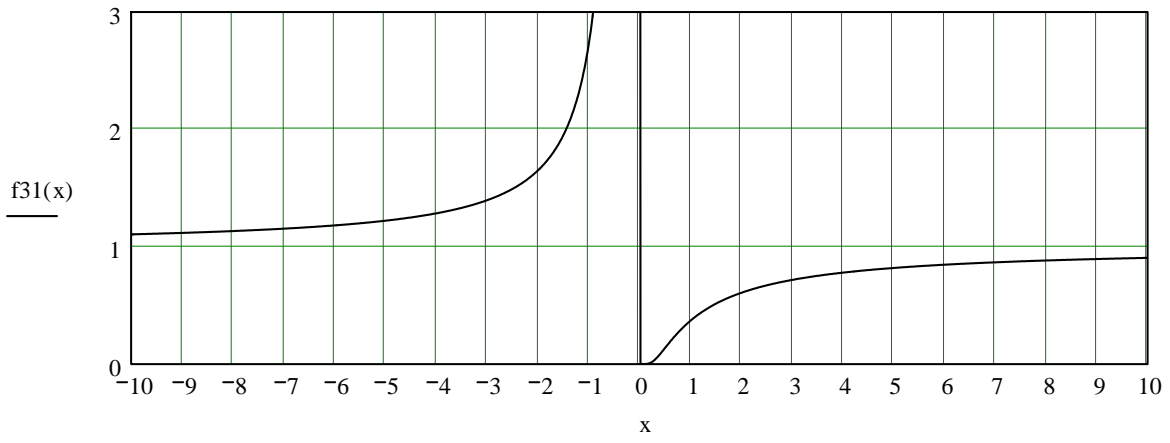
$$f_{214}(x) := x \cdot \operatorname{atan}\left(\frac{1}{x}\right)$$



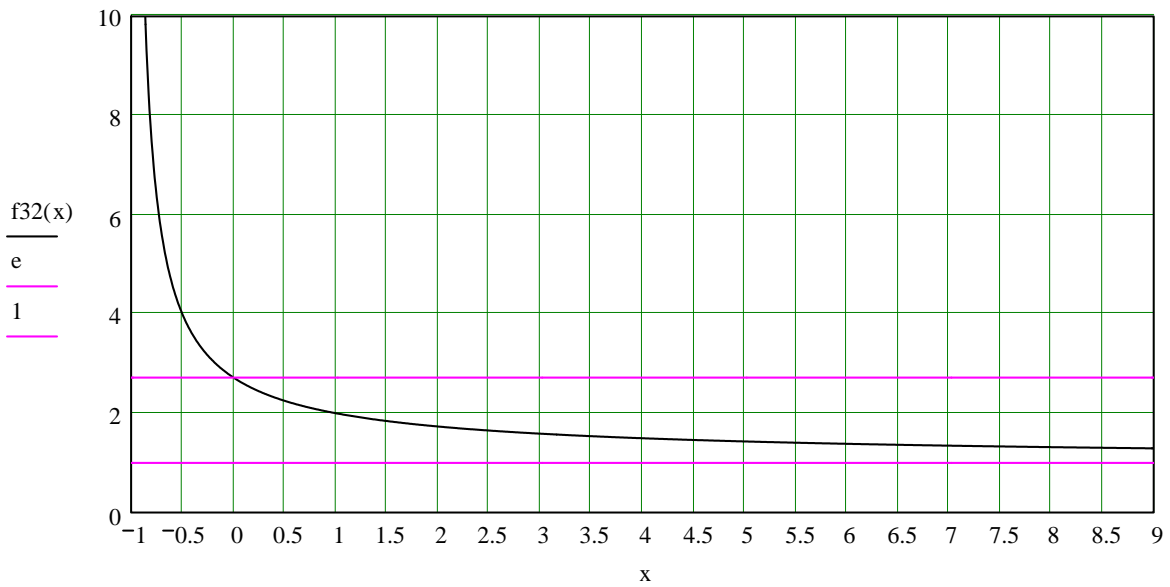
$$f_{215}(x) := \tan\left(\frac{3 \cdot \pi \cdot x}{1 + x^2}\right)$$



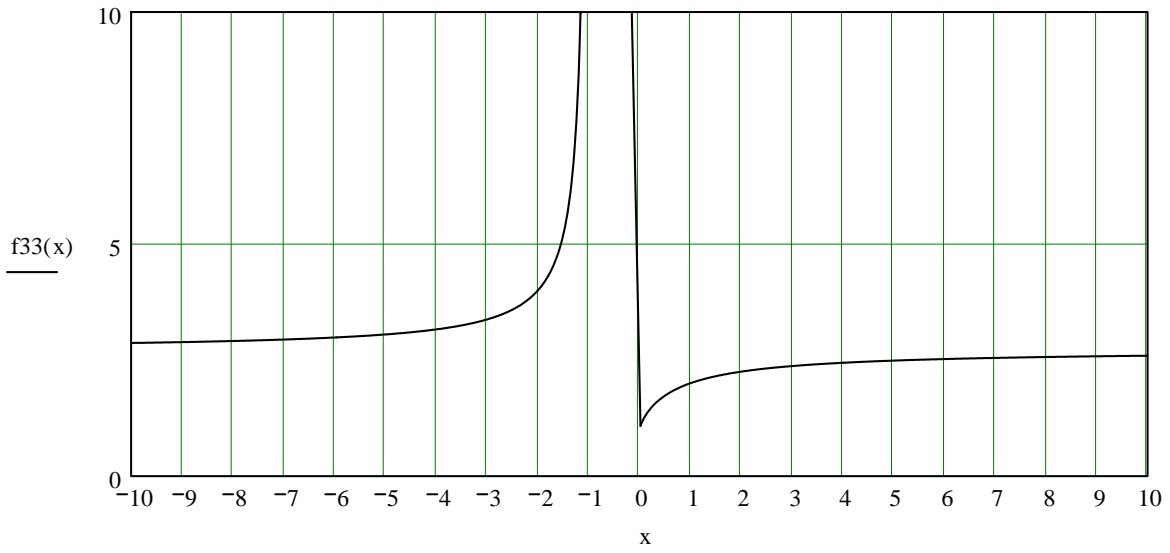
$$f_{31}(x) := e^{-\frac{1}{x}}$$



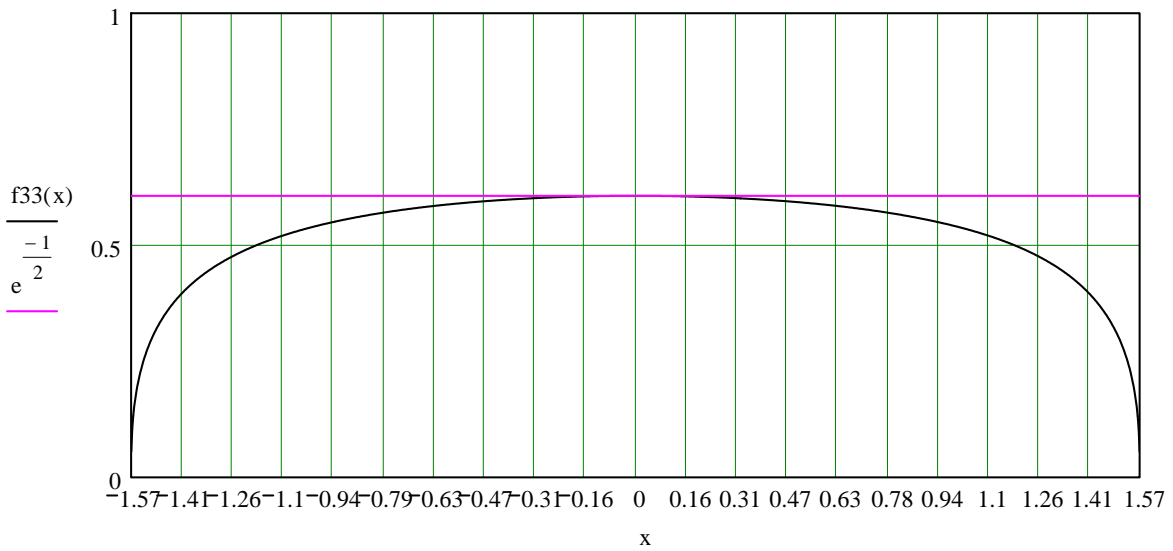
$$f32(x) := (1 + x)^{\frac{1}{x}}$$



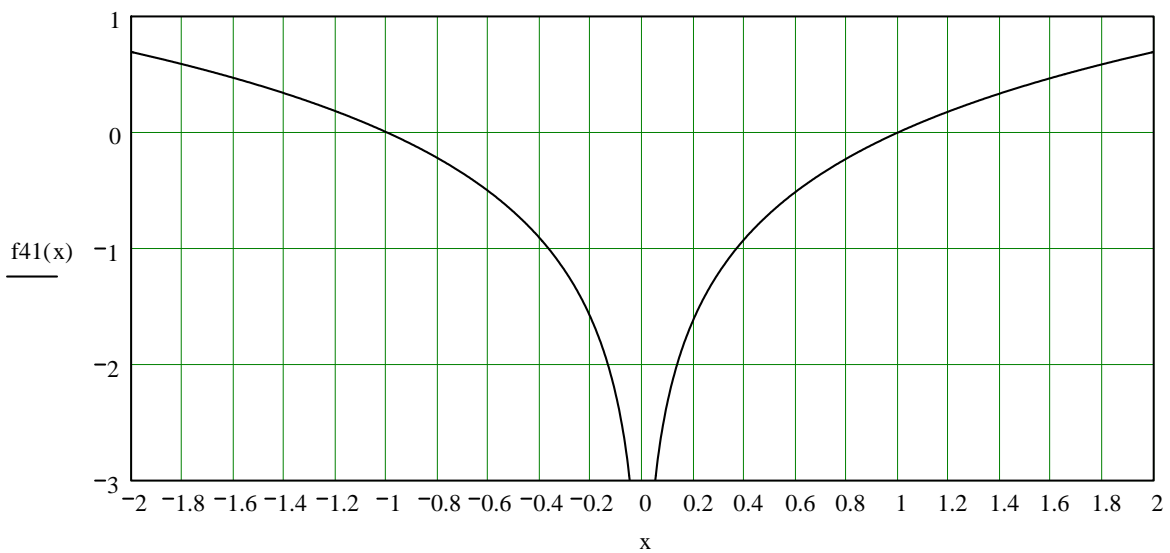
$$f33(x) := \left(1 + \frac{1}{x}\right)^x$$



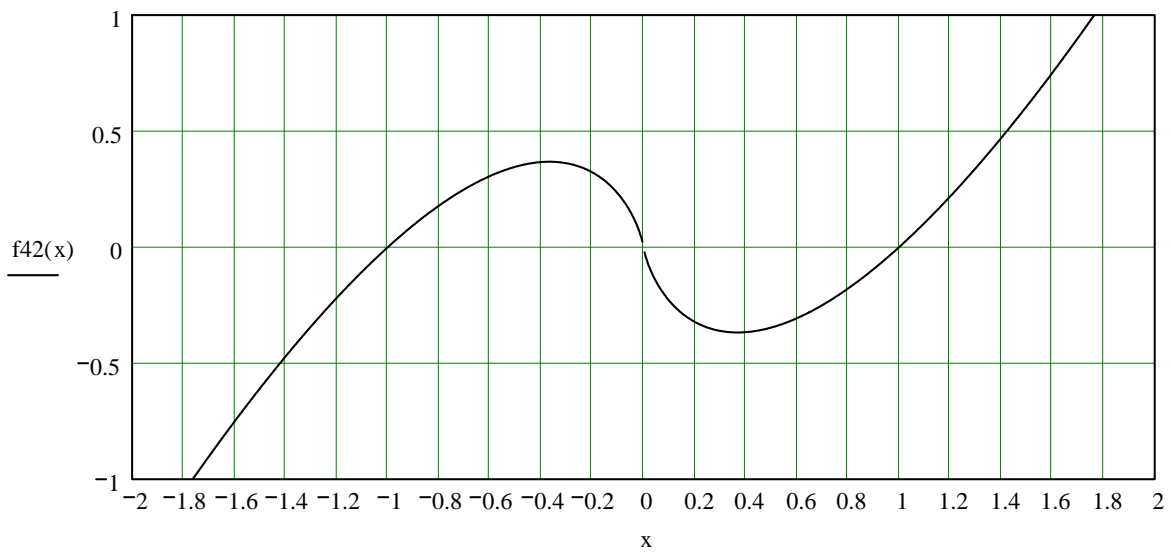
$$f33(x) := \cos(x) \frac{1}{x^2}$$



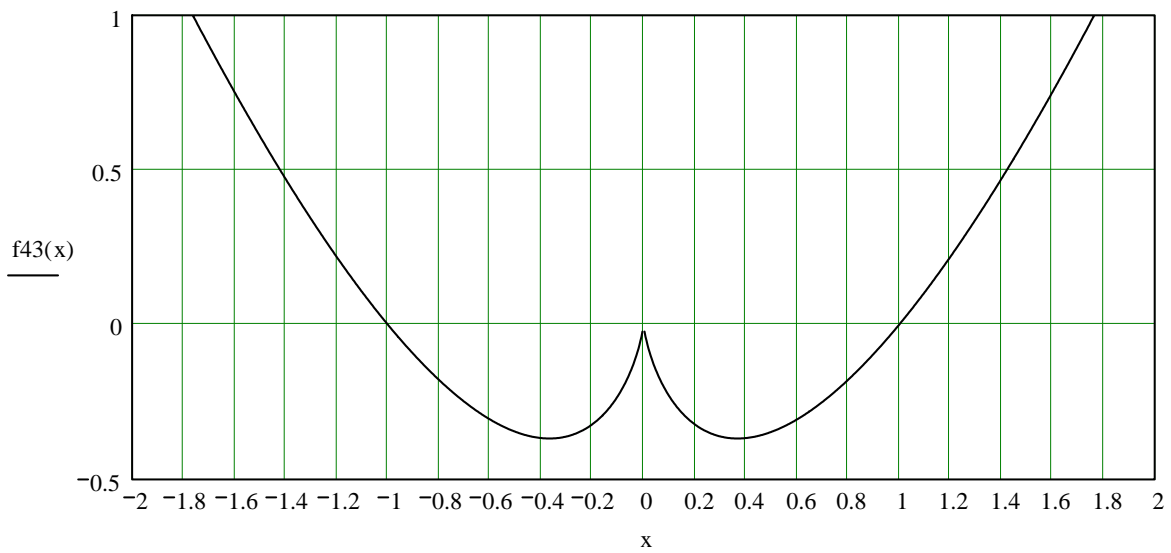
$$f41(x) := \ln(|x|)$$



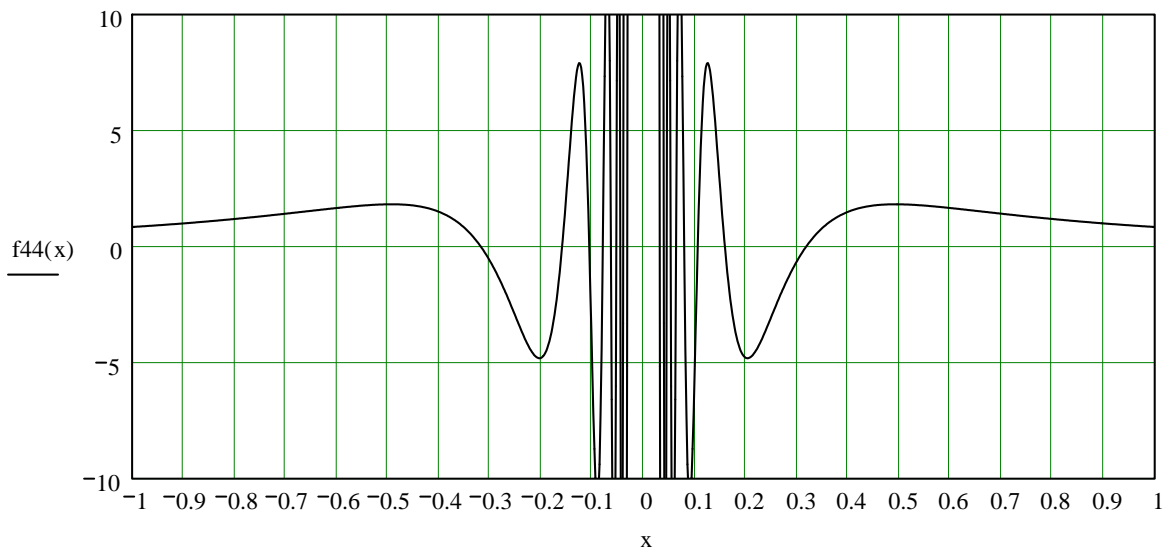
$$f42(x) := x \cdot \ln(|x|)$$



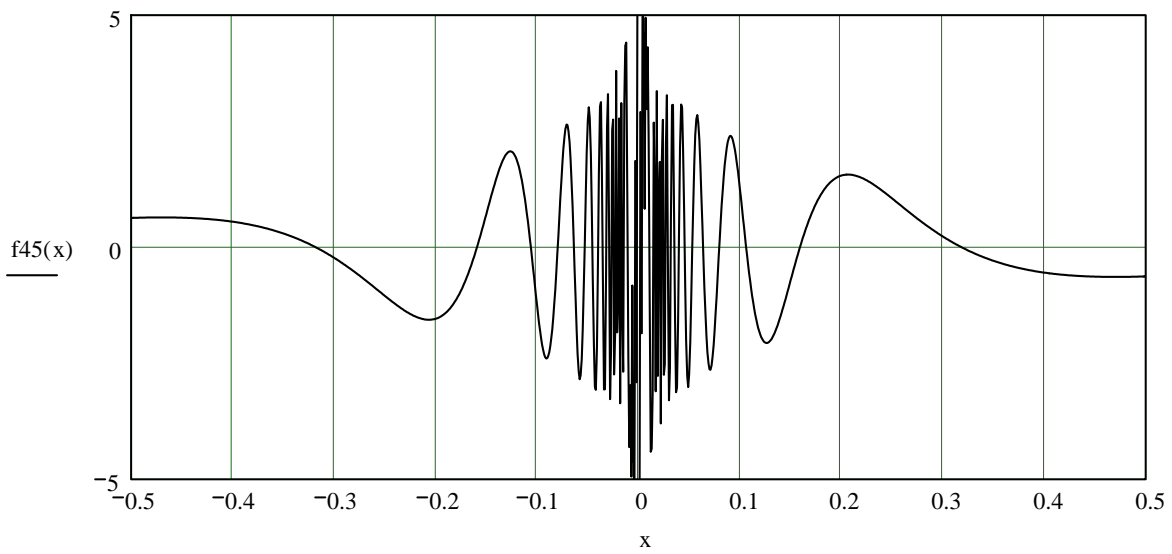
$$f_{43}(x) := |x| \cdot \ln(|x|)$$



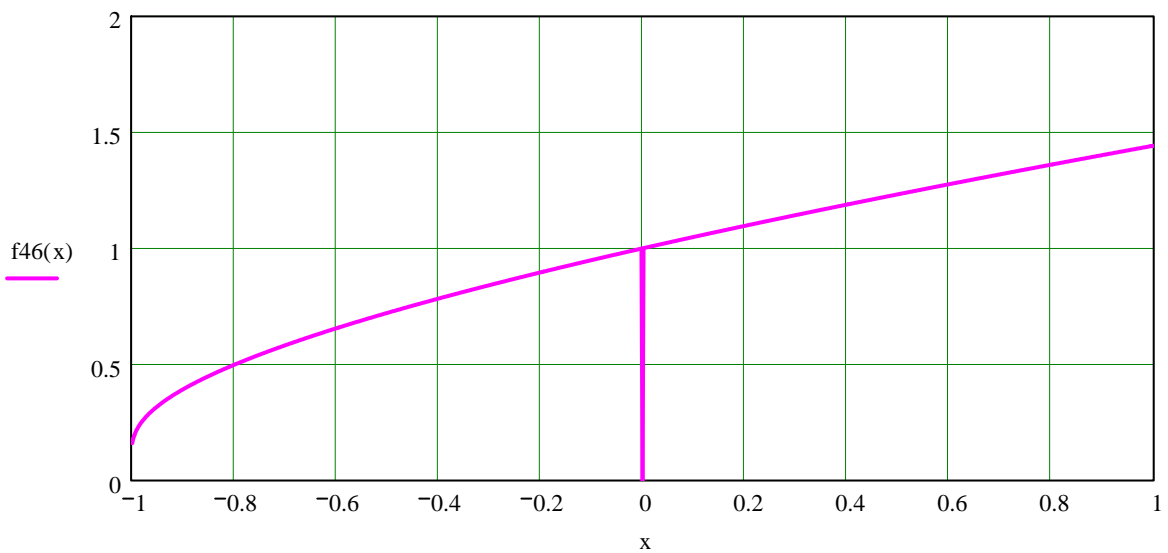
$$f_{44}(x) := \frac{1}{x} \cdot \sin\left(\frac{1}{x}\right)$$



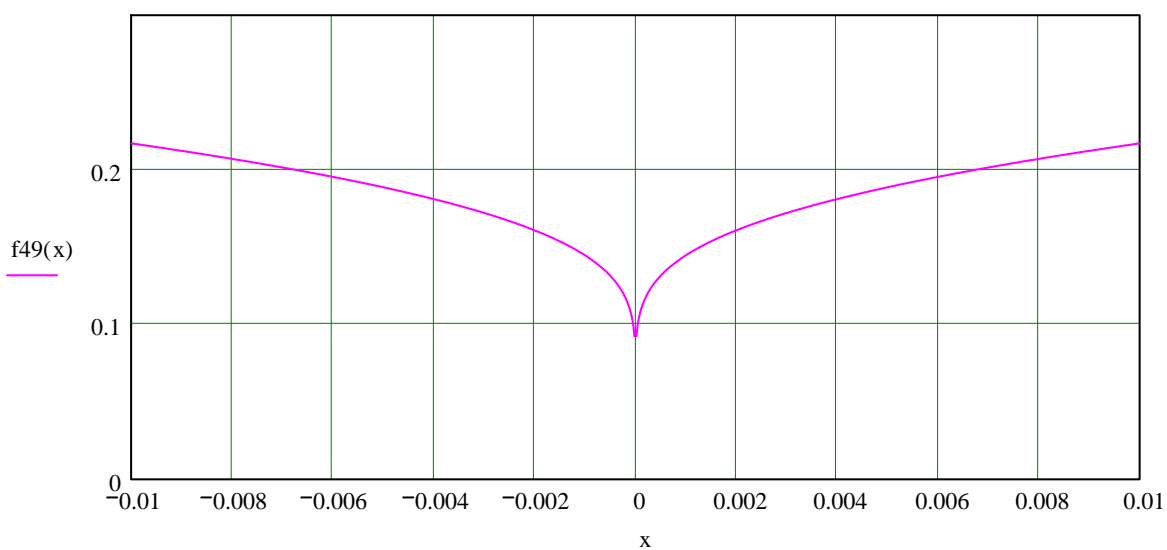
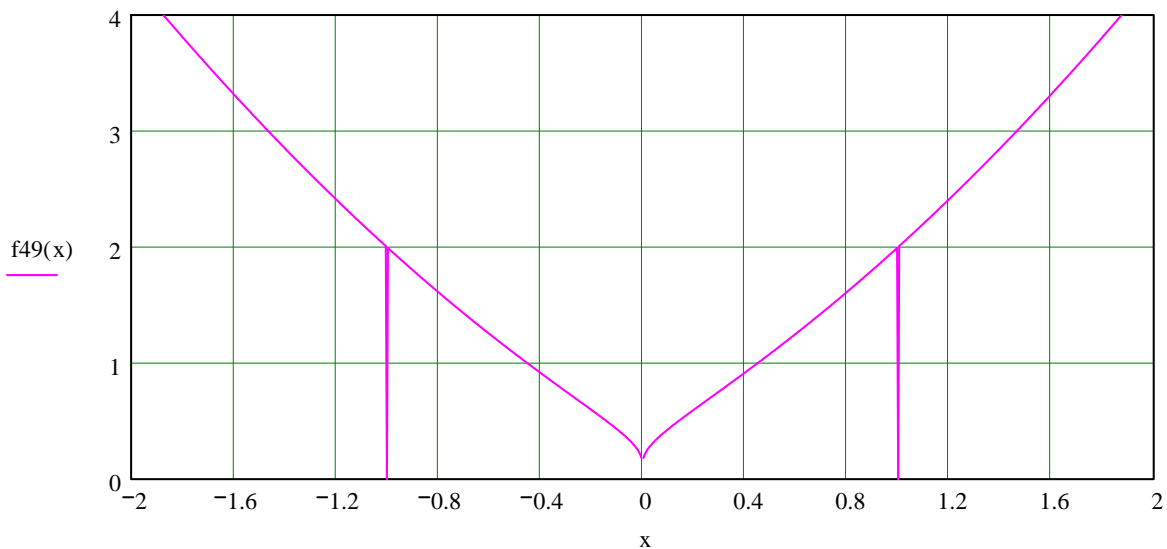
$$f_{45}(x) := \ln(|x|) \cdot \sin\left(\frac{1}{x}\right)$$



$$f_{46}(x) := \frac{x}{\ln(1+x)}$$



$$f_{49}(x) := \frac{x^2 - 1}{\ln(|x|)}$$



$$\lim_{x \rightarrow 0} \frac{a \sin(x) - \sin(x)}{x^3} \rightarrow \frac{1}{3}$$

$$\lim_{x \rightarrow 0} \frac{a \sin(x) + \sin(x) - 2 \cdot x}{x^3} \rightarrow 0 \quad \lim_{x \rightarrow 0} \frac{a \sin(x) + \sin(x) - 2 \cdot x}{x^4} \rightarrow 0 \quad \lim_{x \rightarrow 0} \frac{a \sin(x) + \sin(x) - 2 \cdot x}{x^5} \rightarrow \frac{1}{12}$$

$$\lim_{x \rightarrow 0} \frac{a \tan(x) - \tan(x)}{x^3} \rightarrow \frac{-2}{3}$$

$$\lim_{x \rightarrow 0} \frac{\sin(1-x) - 2 \sin(1) + \sin(1+x)}{x^2} \rightarrow -\sin(1)$$

$$1 + x^2 \text{ converts to the series } 1 + 1 \cdot x^2$$

$$(1+x)^{-1} \text{ converts to the series } 1 - 1 \cdot x + 1 \cdot x^2 - 1 \cdot x^3 + 1 \cdot x^4 - 1 \cdot x^5 + O(x^6)$$

$$\frac{\sqrt{1-x} - 1}{x} \text{ converts to the series } \frac{-1}{2} - \frac{1}{8} \cdot x - \frac{1}{16} \cdot x^2 - \frac{5}{128} \cdot x^3 - \frac{7}{256} \cdot x^4 + O(x^5)$$

$$\frac{\sqrt[3]{1+x}-1}{x} \quad \text{converts to the series} \quad \frac{1}{3} - \frac{1}{9} \cdot x + \frac{5}{81} \cdot x^2 - \frac{10}{243} \cdot x^3 + \frac{22}{729} \cdot x^4 + O(x^5)$$

$$\frac{\ln(1+x)}{x} \quad \text{converts to the series} \quad 1 - \frac{1}{2} \cdot x + \frac{1}{3} \cdot x^2 - \frac{1}{4} \cdot x^3 + \frac{1}{5} \cdot x^4 + O(x^5)$$

$$\frac{\sin(x)}{x} \quad \text{converts to the series} \quad 1 - \frac{1}{6} \cdot x^2 + \frac{1}{120} \cdot x^4 + O(x^5)$$

$$\frac{e^x - 1}{x} \quad \text{converts to the series} \quad 1 + \frac{1}{2} \cdot x + \frac{1}{6} \cdot x^2 + \frac{1}{24} \cdot x^3 + \frac{1}{120} \cdot x^4 + O(x^5)$$