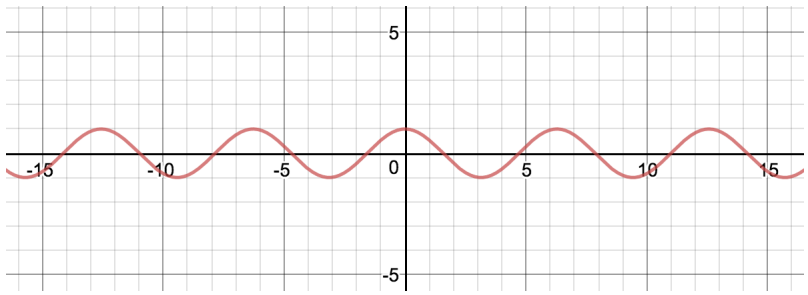
Help Notes: Trigonometric and hyperbolic function

27 octobre 2017

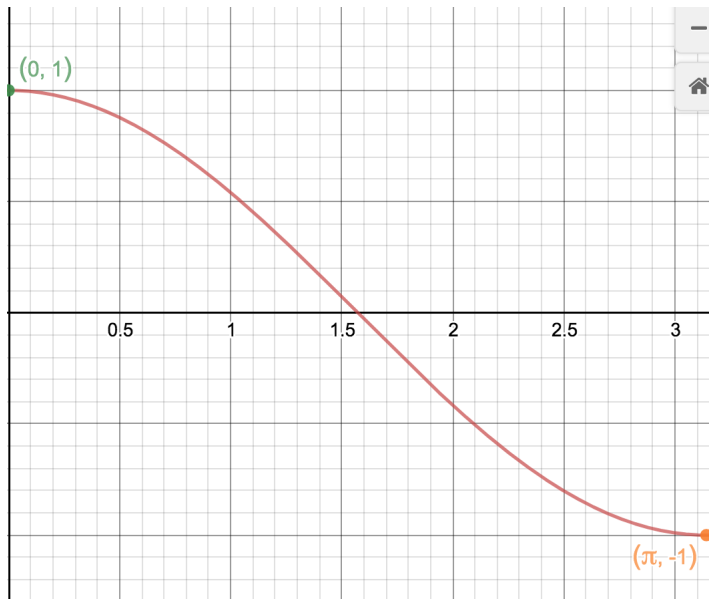
Function	Derivative	Domain	Range	Usefullimit
$cos(x)$	$-sin(x)$	$\mathbb{R}$	$[-1,1]$	$No\ limit\ at\ \infty\ and\ -\infty$
$sin(x)$	$cos(x)$	$\mathbb{R}$	$[-1,1]$	$No\ limit\ at\ \infty\ and\ -\infty$
$tan(x) = \frac{sin(x)}{cos(x)}$	$sec^2(x) = \frac{1}{cos^2(x)}$	$\{x \in \mathbb{R} : x \neq n\pi + \pi/2;$ $n\ is\ an\ integer\}$	$\mathbb{R}$	$lim_{x\to\pi/2^-} tan(x) = \infty,$ $lim_{x\to-\pi/2^+} tan(x) = -\infty,$
$sec(x) = \frac{1}{cos(x)}$	$sec(x)tan(x)$	$\{x \in \mathbb{R} : x \neq n\pi + \pi/2$ $n\ is\ an\ integer\}$	$(-\infty,-1) \cup (1,\infty)$	$No\ limit\ at\ \infty\ and\ -\infty$
$csc(x) = \frac{1}{sin(x)}$	$-csc(x)cot(x)$	$\{x \in \mathbb{R} : x \neq n\pi,$ $n\ is\ an\ integer\}$	$(-\infty,-1) \cup (1,\infty)$	$No\ limit\ at\ \infty\ and\ -\infty$
$cot(x) = \frac{1}{tan(x)}$	$-csc^2(x)$	$\{x \in \mathbb{R} : x \neq n\pi,$ $n\ is\ an\ integer\}$	$\mathbb{R}$	$lim_{x\to\pi^-} tan(x) = -\infty,$ $lim_{x\to0^+} tan(x) = \infty,$
$sin^{-1}(x) = arcsin(x)$	$\frac{1}{\sqrt{1-x^2}}$	$[-1,1]$	$[-\pi/2,\pi/2]$	
$cos^{-1}(x) = arccos(x)$	$-\frac{1}{\sqrt{1-x^2}}$	$[-1,1]$	$[0,\pi]$	
$tan^{-1}(x) = arctan(x)$	$\frac{1}{1+x^2}$	$\mathbb{R}$	$(-\pi/2,\pi/2)$	$lim_{x\to\infty} arctan(x) = \pi/2$ $lim_{x\to-\infty} arctan(x) = -\pi/2$
$sinh(x) = \frac{e^x-e^{-x}}{2}$	$cosh(x)$	$\mathbb{R}$	$\mathbb{R}$	$lim_{x\to\infty} sinh(x) = lim_{x\to-\infty} sinh(x) = \infty$
$cosh(x) = \frac{e^x+e^{-x}}{2}$	$sinh(x)$	$\mathbb{R}$	$\mathbb{R}$	$lim_{x\to\infty} sinh(x) = \infty$ $lim_{x\to-\infty} sinh(x) = -\infty$
$tanh(x) = \frac{sinh(x)}{cosh(x)} = \frac{e^x-e^{-x}}{e^x+e^{-x}}$	$sech^2(x)$	$\mathbb{R}$	$(-1,1)$	$lim_{x\to\infty} tanh(x) = 1$ $lim_{x\to-\infty} tanh(x) = -1$
$coth(x) = \frac{cosh(x)}{sinh(x)} = \frac{e^x+e^{-x}}{e^x-e^{-x}}$	$-csh^2(x)$	$(-\infty,0) \cup (0,\infty)$	$(-\infty,-1) \cup (1,\infty)$	$lim_{x\to\infty} coth(x) = 1$ $lim_{x\to-\infty} coth(x) = -1$ $lim_{x\to0^-} coth(x) = -\infty$ $lim_{x\to0^+} coth(x) = \infty$
$sech(x) = \frac{1}{sinh(x)} = \frac{2}{e^x-e^{-x}}$	$-sech(x)tanh(x)$	$(-\infty,0) \cup (0,\infty)$	$(-\infty,0) \cup (0,\infty)$	$lim_{x\to\infty} sech(x) = 0$ $lim_{x\to-\infty} sech(x) = 0$ $lim_{x\to0^-} sech(x) = -\infty$ $lim_{x\to0^+} sech(x) = \infty$
$csch(x) = \frac{1}{cosh(x)} = \frac{2}{e^x+e^{-x}}$	$-csch(x)coth(x)$	$\mathbb{R}$	$(0,1)$	$lim_{x\to\infty} coth(x) = 0$ $lim_{x\to-\infty} coth(x) = 0$
$sinh^{-1}(x) = arsinh(x)$ $= ln(x + \sqrt{x^2+1})$	$\frac{1}{\sqrt{x^2+1}}$	$\mathbb{R}$	$\mathbb{R}$	$lim_{x\to\infty} arcsinh(x) = \infty$ $lim_{x\to-\infty} arcsinh(x) = -\infty$
$cosh^{-1}(x) = arcosh(x)$ $= ln(x + \sqrt{x^2+1})$	$\frac{1}{\sqrt{x^2-1}}$	$[1,\infty)$	$[0,\infty)$	$lim_{x\to\infty} arccosh(x) = \infty$
$tanh^{-1}(x) = arctanh(x)$ $= 1/2ln\left(\frac{1+x}{1-x}\right)$	$\frac{1}{1-x^2}$	$(-1,1)$	$\mathbb{R}$	$lim_{x\to1} arctanh(x) = \infty$ $lim_{x\to-1} arctanh(x) = -\infty$

Graph of trigonometric and hyperbolic function

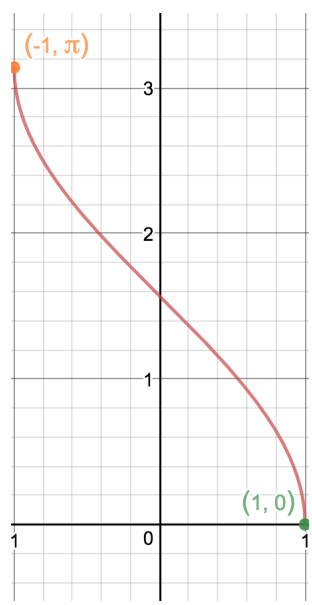
Graph of Cos function



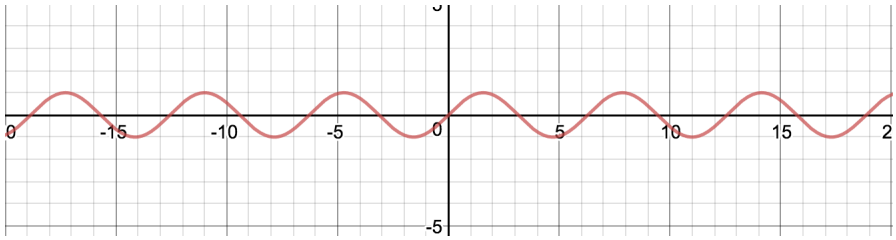
Zoom in into an interval where the cos function is bijective



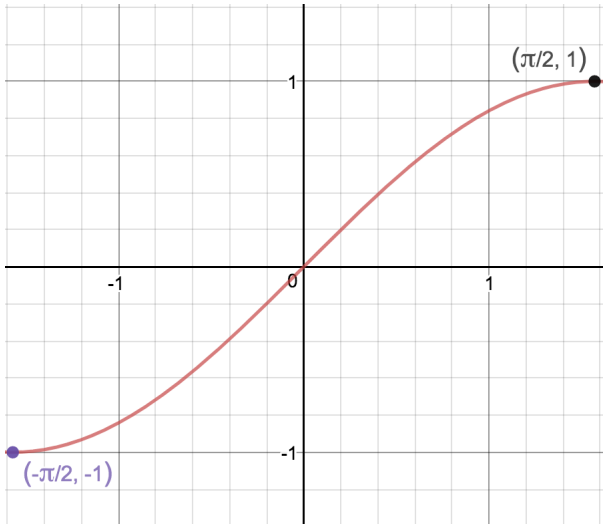
Graph of Arccos function



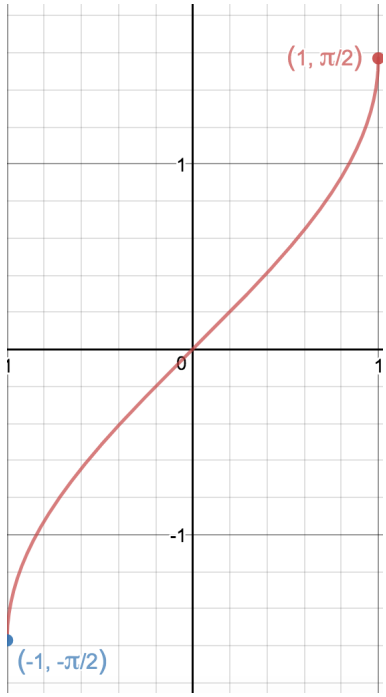
Graph of Sin function



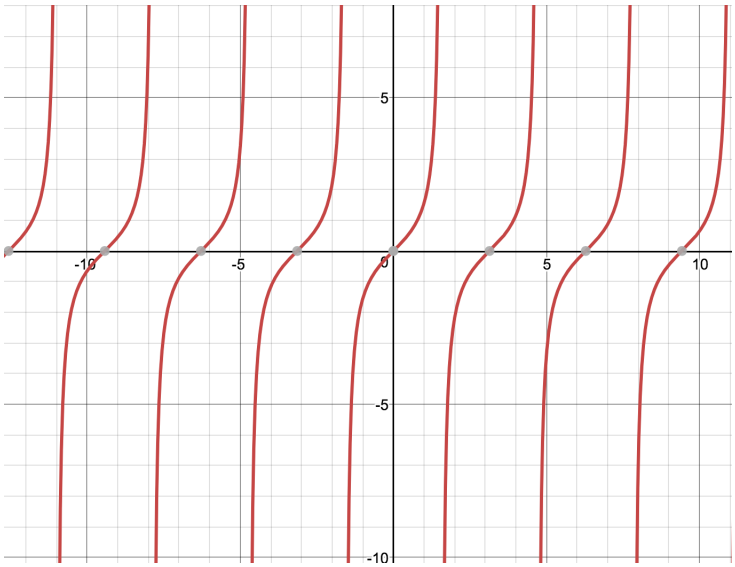
Zoom in into an interval where the sin function is bijective



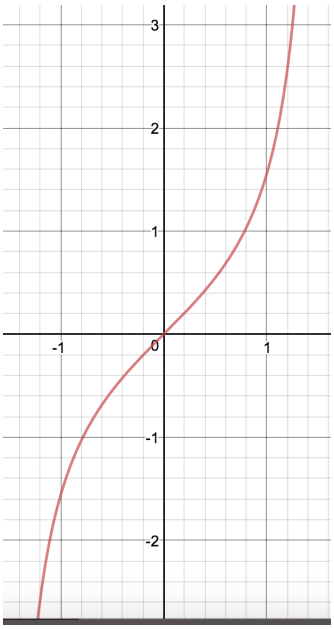
Graph of Arcsin function



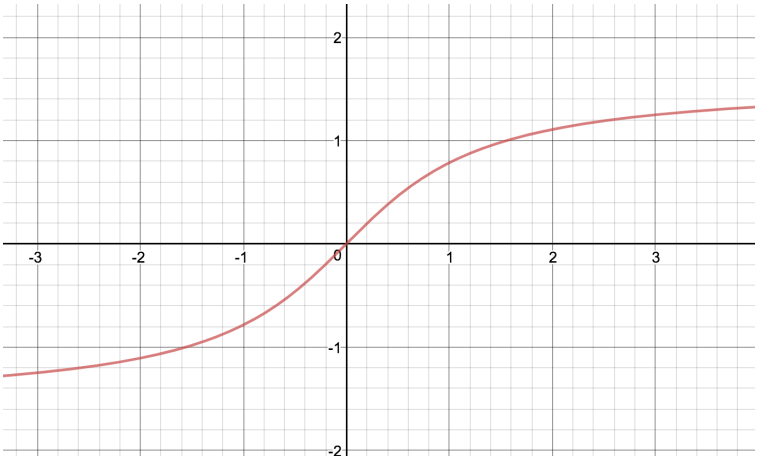
Graph of Tan function



Zoom in into an interval where the Tan function is bijective

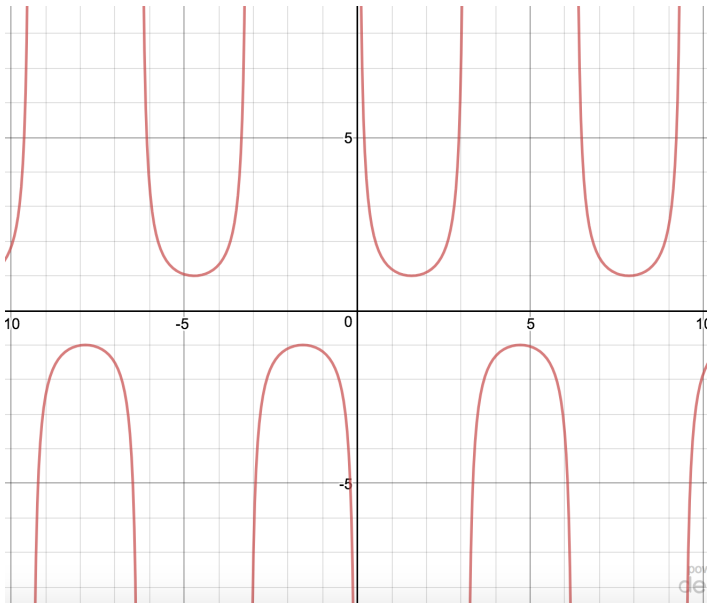


Graph of Arctan function

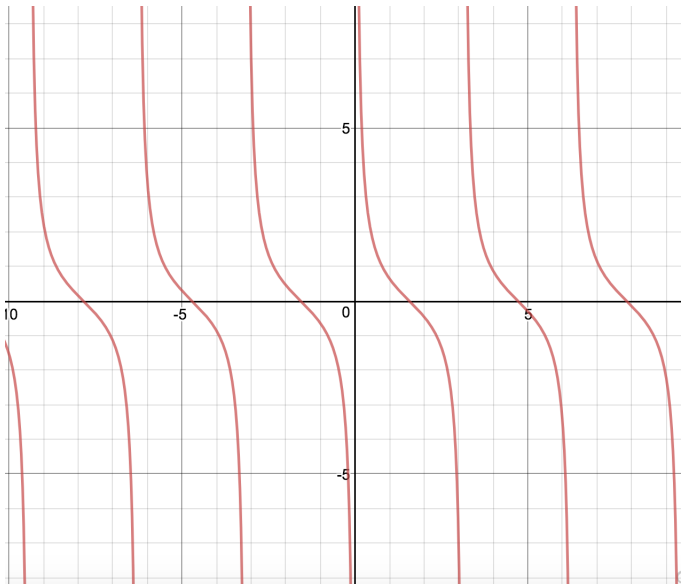


Graph of Sec function

Graph of Csc function

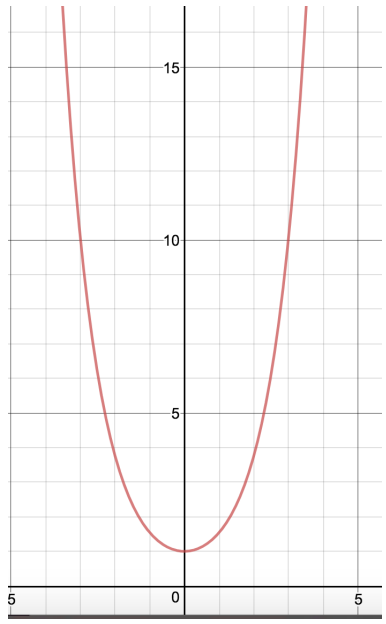


Graph of cot function

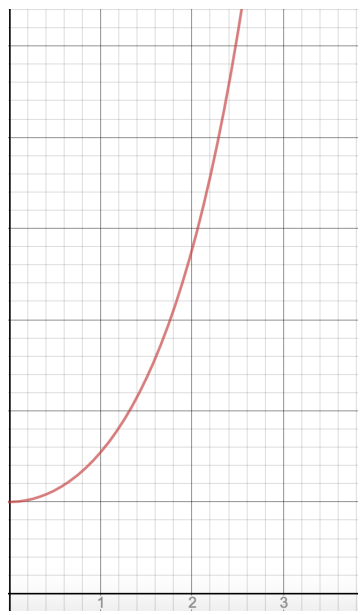


Hyperbolic function graphs

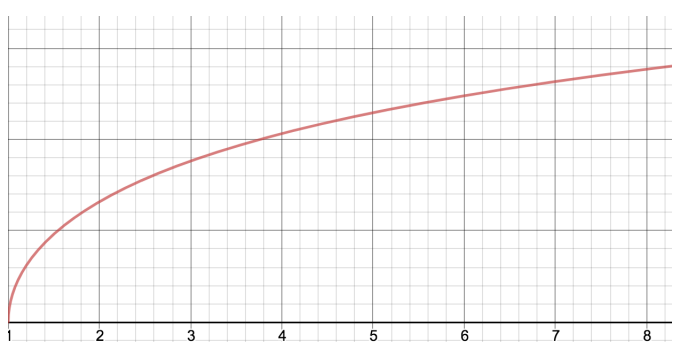
Graph of Cosh function



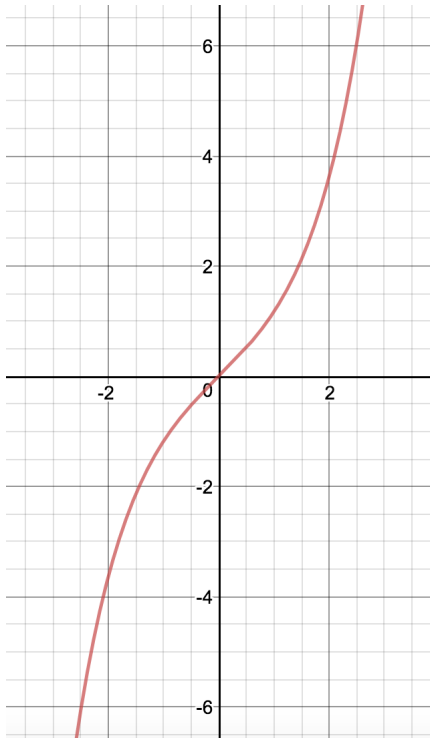
Zoom in into an interval where the Cosh function is bijective



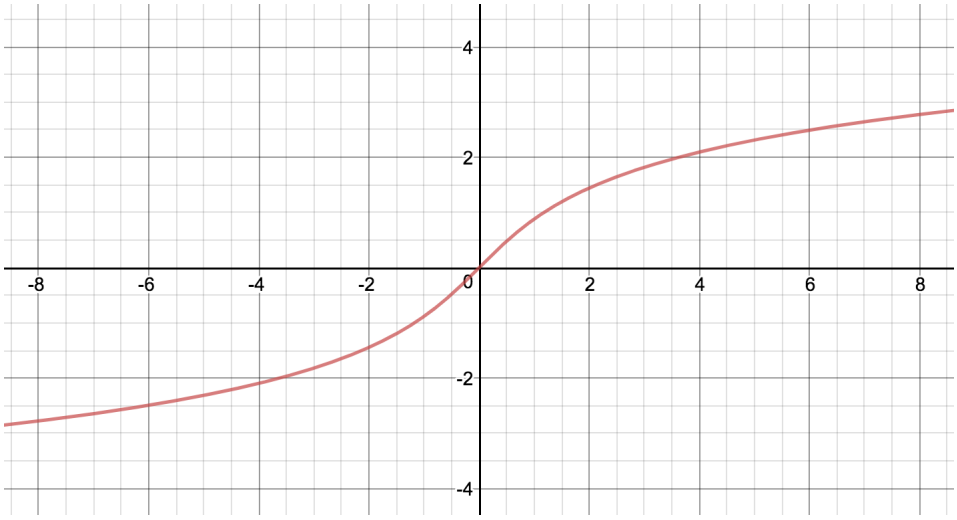
Graph of Arccosh function



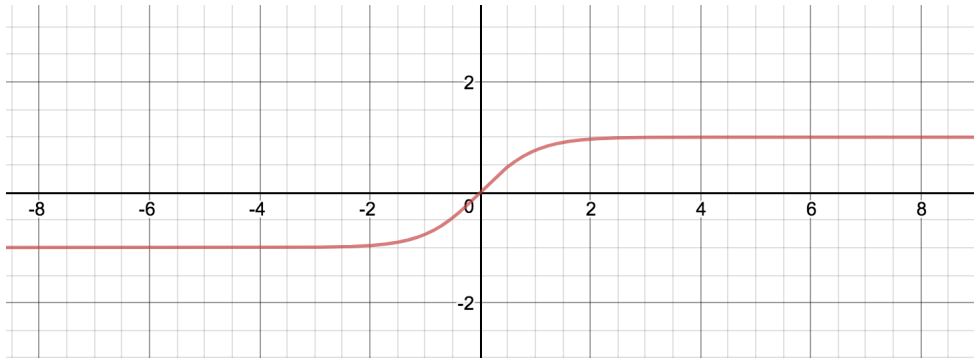
Graph of Sinh function already bijective over domain of definition so no need to zoom in



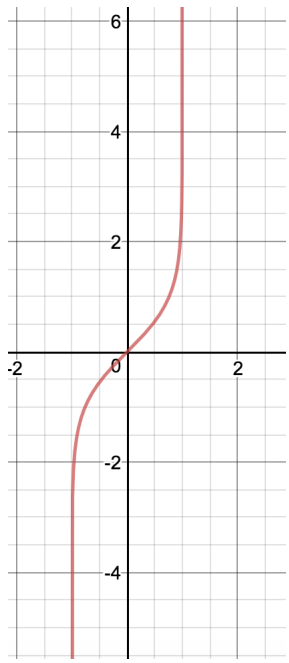
Graph of Arcsinh function



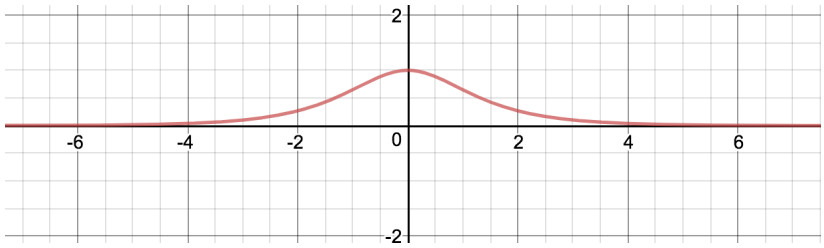
Graph of Tanh function already bijective over domain of definition so no need to zoom in



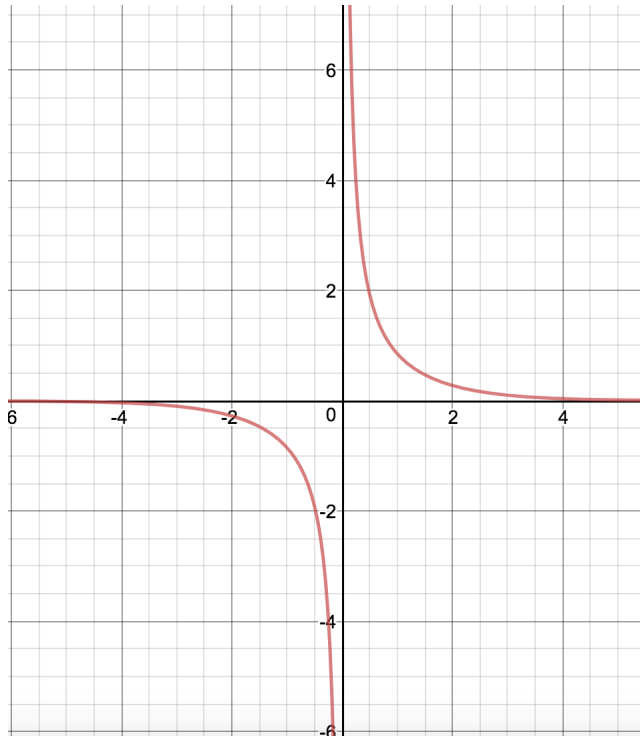
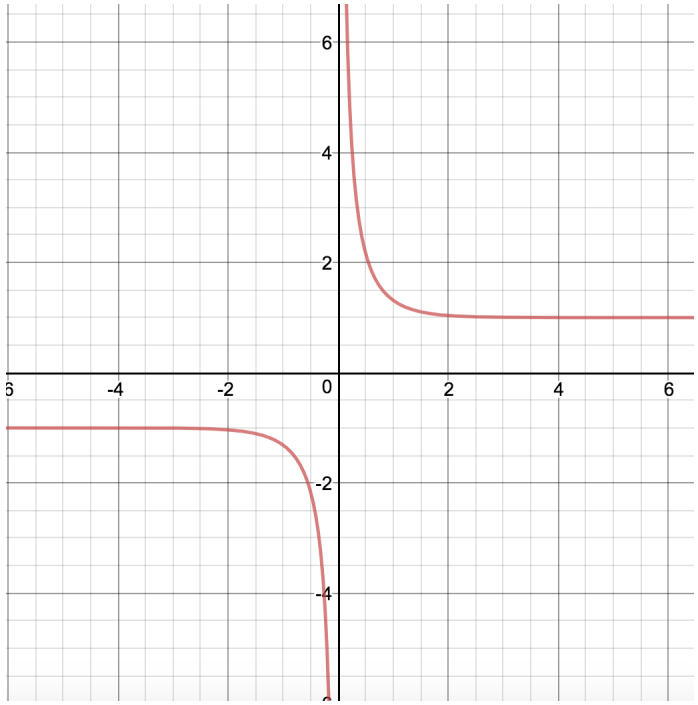
Graph of Arctanh function



Graph of Sech function



Graph of Csch function



Graph of Coth function