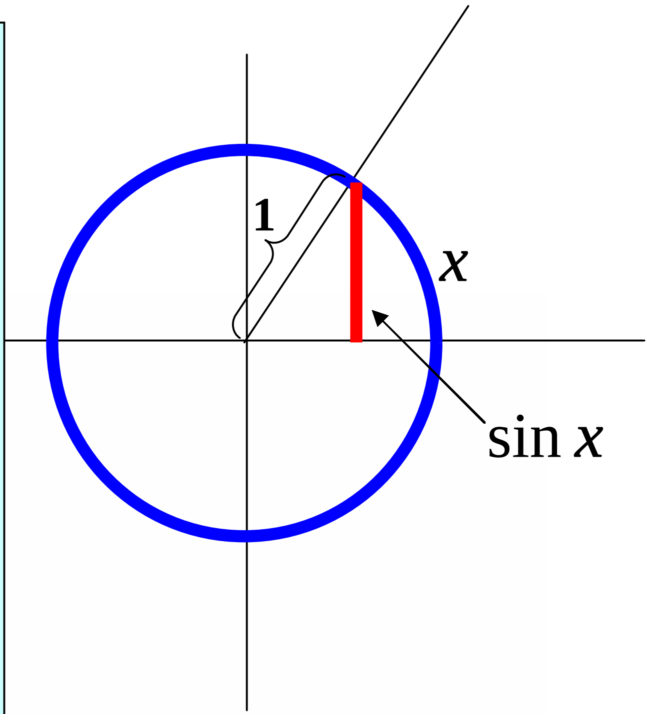
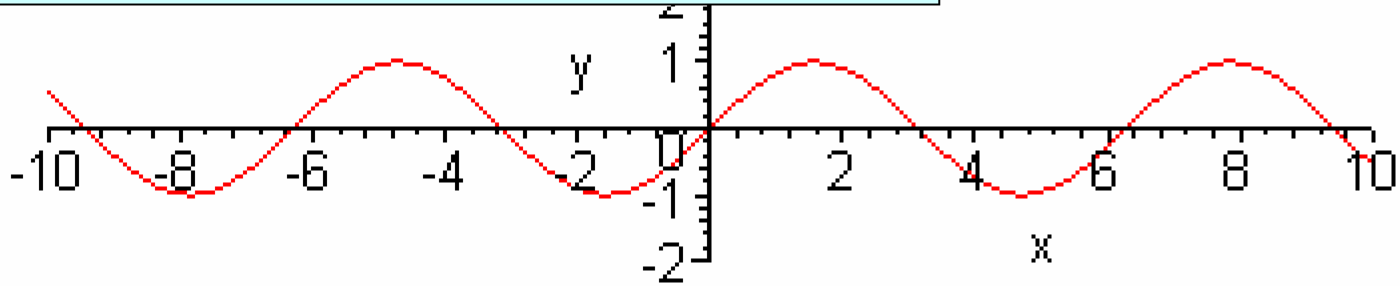
The sine

The sine function written as sin(*x*) or just sin *x* is geometrically defined as demonstrated by the figure to the right where *x* is the length of the arc.

Its basic domain is (0, 2π), which is extended over the entire *x*-axis so that the function becomes periodic.

Its range is (-1,1).





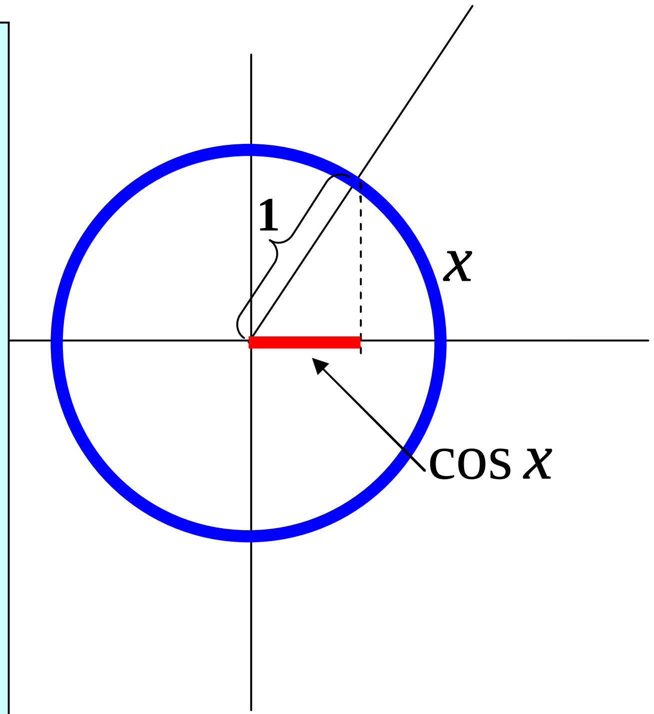
sin *x* is an odd, periodic function with 2π as the least period

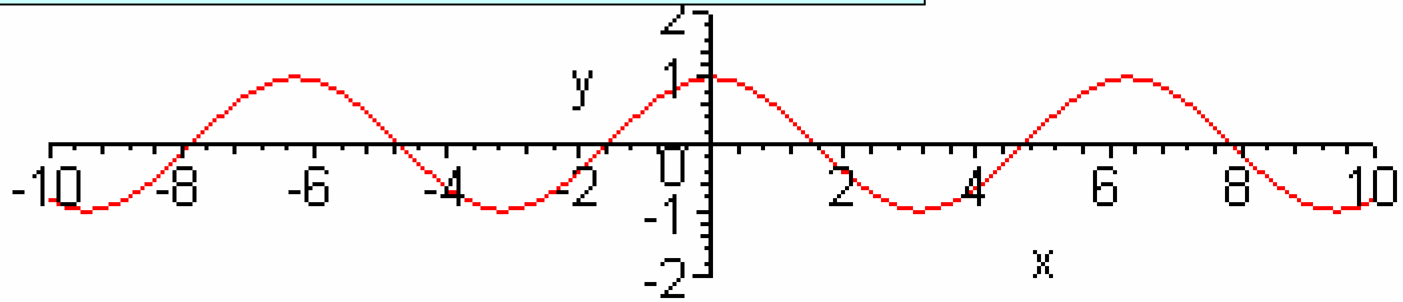
The cosine

The cosine function written as cos(*x*) or just cos *x* is geometrically defined as demonstrated by the figure to the right where *x* is the length of the arc

Its basic domain is (0, 2π), which is extended over the entire *x*-axis so that the function becomes periodic.

Its range is (-1,1).

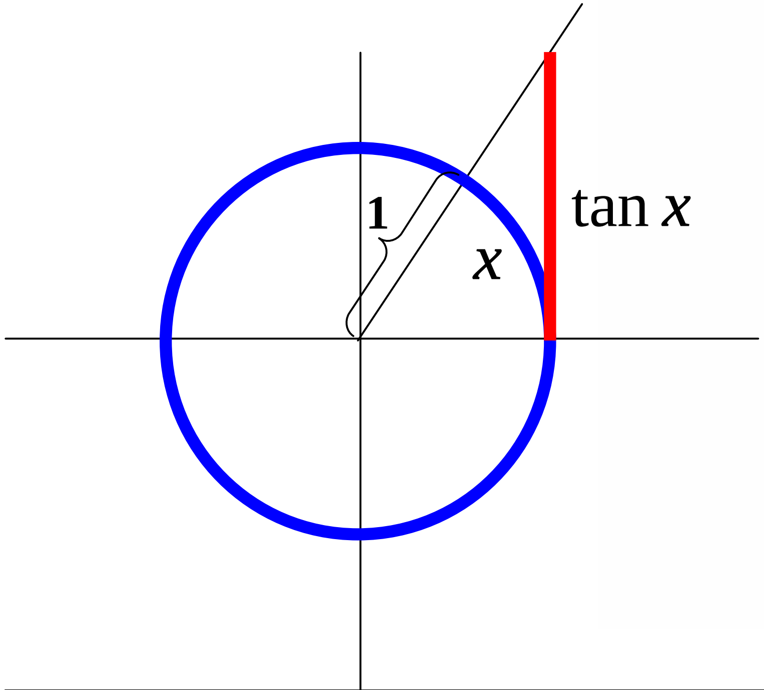


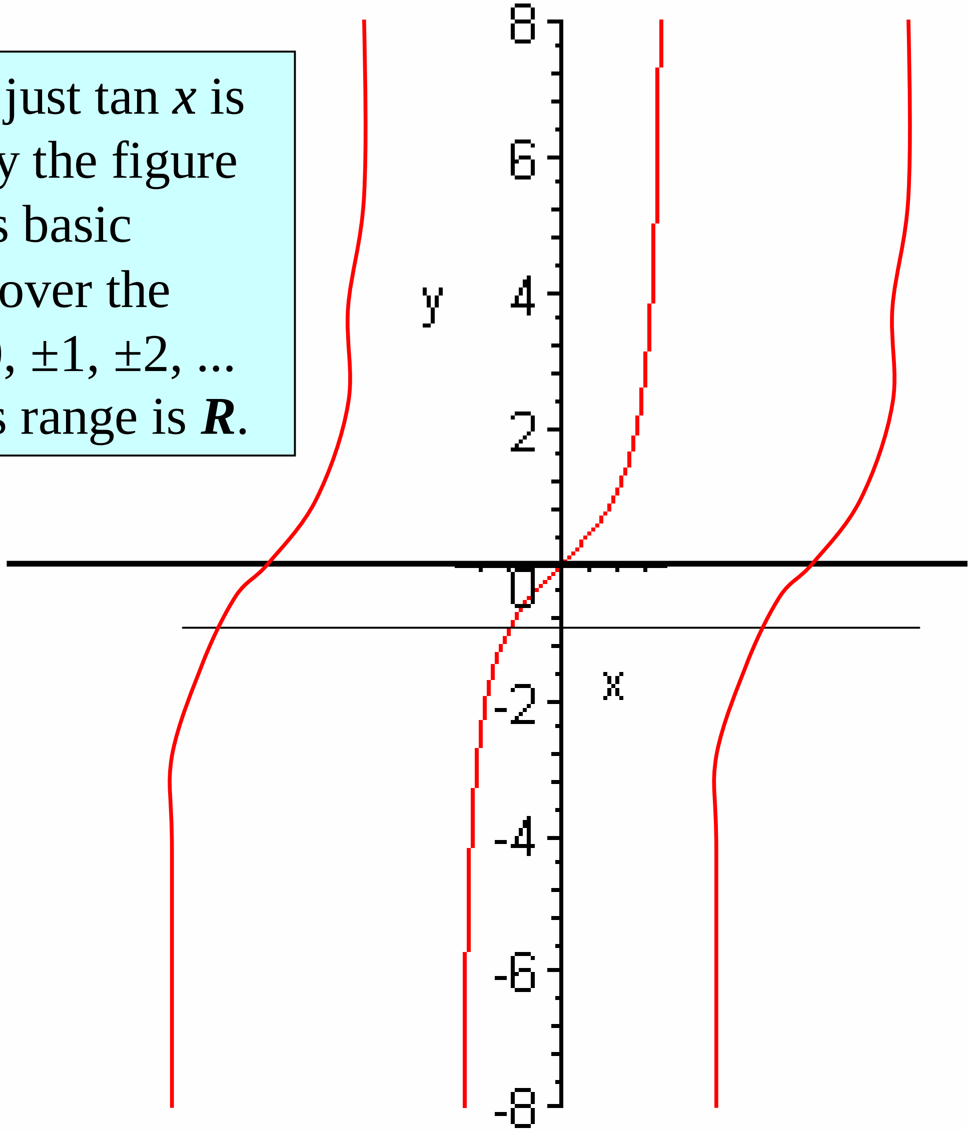


cos *x* is an even, periodic function with 2π as the least period

The tangent

The tangent function written as tan(*x*) or just tan *x* is geometrically defined as demonstrated by the figure below where *x* is the length of the arc. Its basic domain is $(-\pi/2, \pi/2)$, which is extended over the entire *x*-axis except at $x = \pi/2 + k\pi$, $k = 0, \pm 1, \pm 2, \ldots$ so that the function becomes periodic. Its range is ***R***.

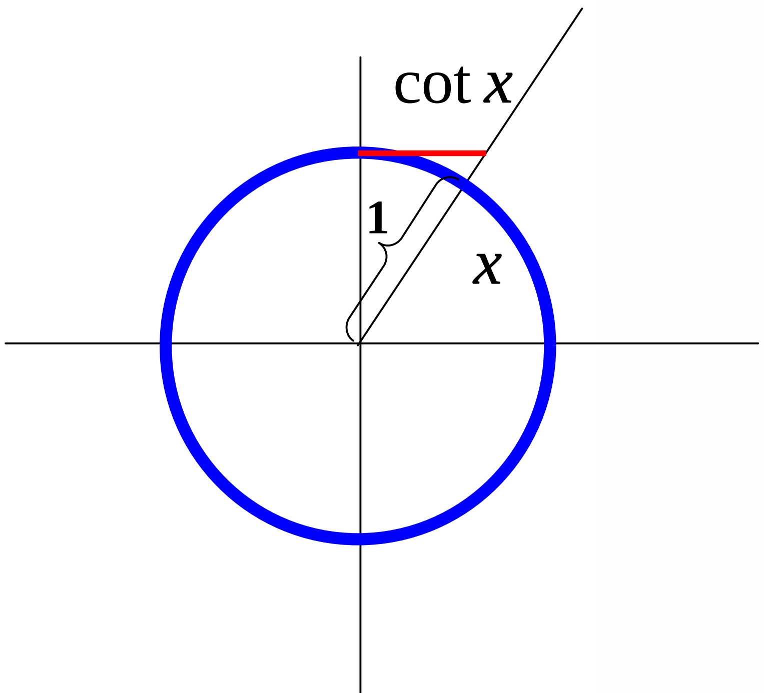


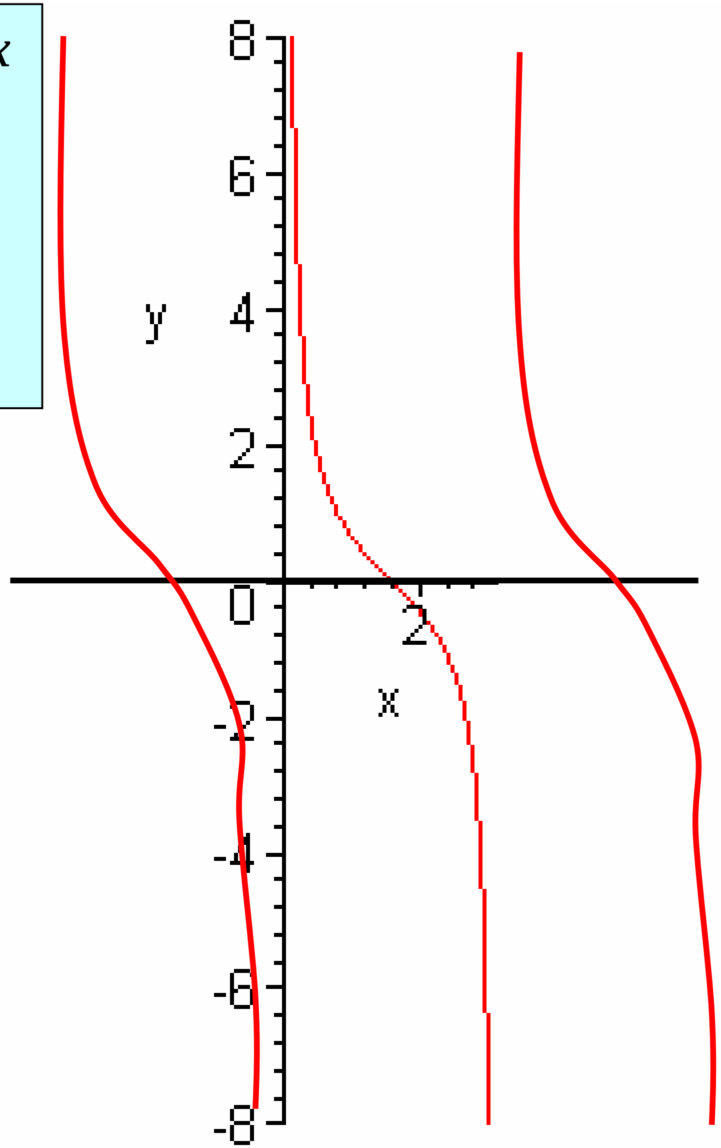


tan *x* is an odd, periodic function with π as the least period

The cotangent

The cotangent function written as cot(x) or just cot x is geometrically defined as demonstrated by the figure below where x is the length of the arc. Its basic domain is (0, π), which is extended over the entire x-axis except at $k\pi$, x = 0, ±1, ±2 , ... so that the function becomes periodic. Its range is ***R***.





cot x is an odd, periodic function with π as the least period

When the argument of a trigonometric function is viewed as an angle, its value may be given in degrees where $\pi = 180^o$

Here are some useful values of trigonometric functions:

	0	p/**6**	p/**4**	p/**3**	p/**2**
	0º	**30º**	**45º**	**60º**	**90º**
$\sin x$	0	$1/2$	$\sqrt{2}/2$	$\sqrt{3}/2$	1
$\cos x$	1	$\sqrt{3}/2$	$\sqrt{2}/2$	$1/2$	0
$\tan x$	0	$\sqrt{3}/3$	1	$\sqrt{3}$	∞
$\cot x$	∞	$\sqrt{3}$	1	$\sqrt{3}/3$	0

Some useful trigonometric formulas:

$$\tan x = \frac{\sin x}{\cos x}$$

$$\cot x = \frac{\cos x}{\sin x}$$

$$\sin x = \sqrt{1 - \cos^2 x}$$

$$\cos x = \sqrt{1 - \sin^2 x}$$

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

$$\cot(x \pm y) = \frac{\cot x \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin 2x = 2 \sin x \cos x$$

$$\cos 2x = \cos^2 x - \sin^2 x$$

$$\tan 2x = \frac{2 \tan x}{1 - \tan^2 x}$$

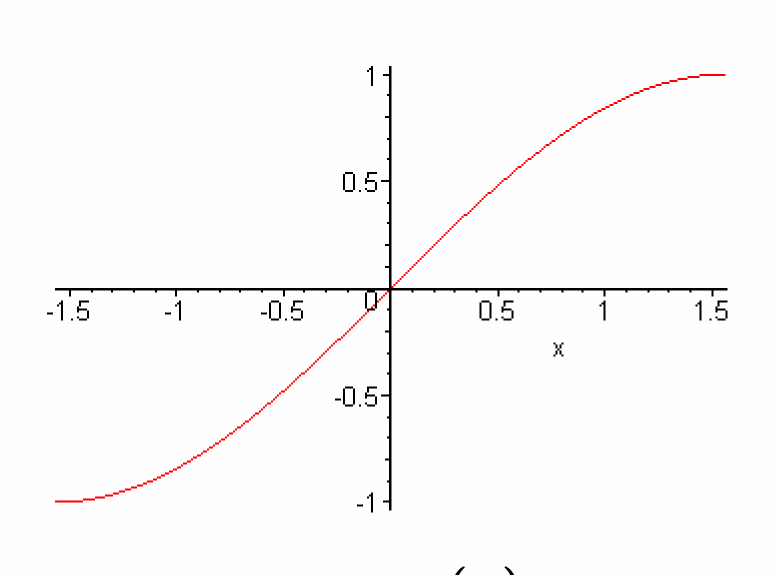
$$\sin^2 x = \frac{1 - \cos 2x}{2} \qquad \cos^2 x = \frac{1 + \cos 2x}{2}$$

$$\cot 2x = \frac{\cot^2 x - 1}{2 \cot x}$$

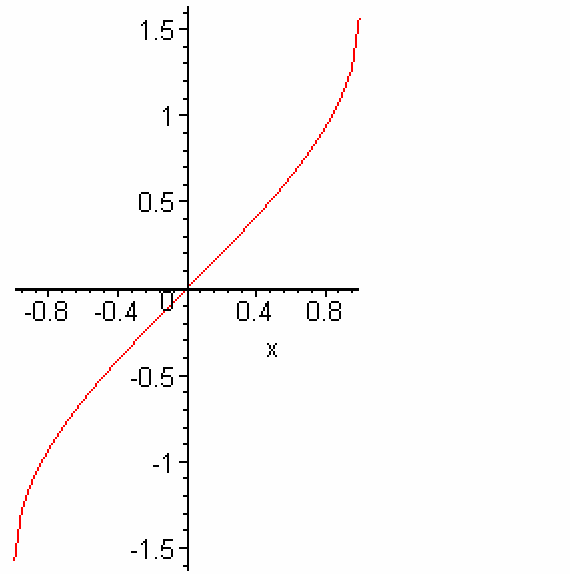
The inverse sine

$f(x) = \arcsin x$ Sometimes called the ***arc sine*** function

When inverting the sine function, we have to restrict ourselves to the domain $(-p/2, p/2]$ where sin(x) is one-to-one. Then $R(f)$ = $(-p/2, p/2]$ and $D(f)$ = [-1,1].



$y = \sin(x)$



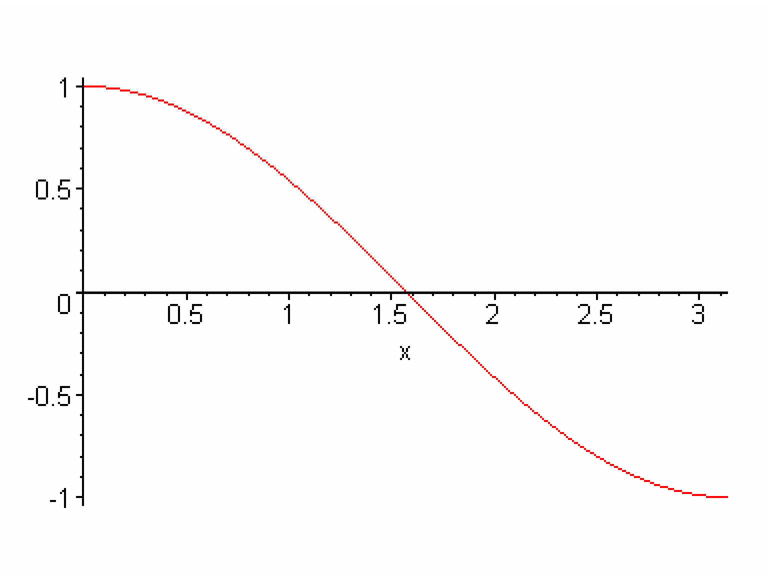
$y = \arcsin x$

The inverse cosine

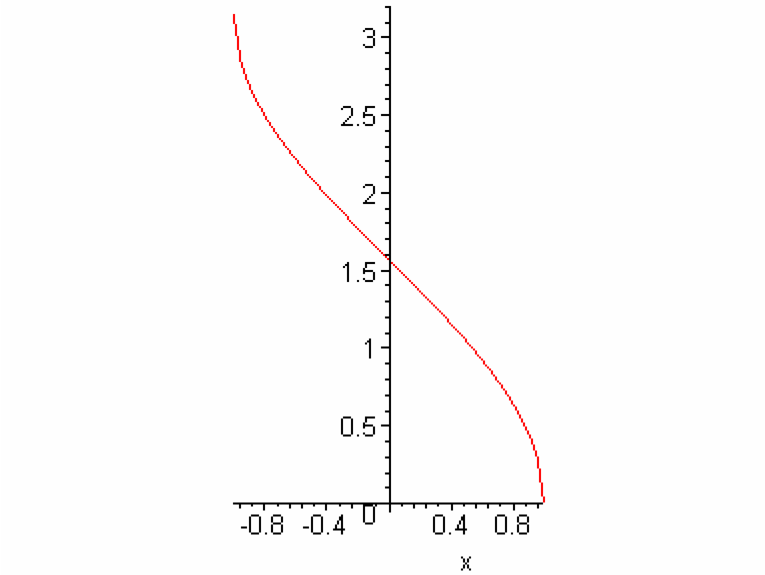
$f(x) = \arccos x$ Sometimes called the ***arc cosine*** function

When inverting the cosine function, we have to restrict ourselves to the domain $(0,p]$ where cos(x) is one-to-one.

Then $R(f) = (0,p]$ and $D(f)$ = [-1,1].



$y = \cos(x)$



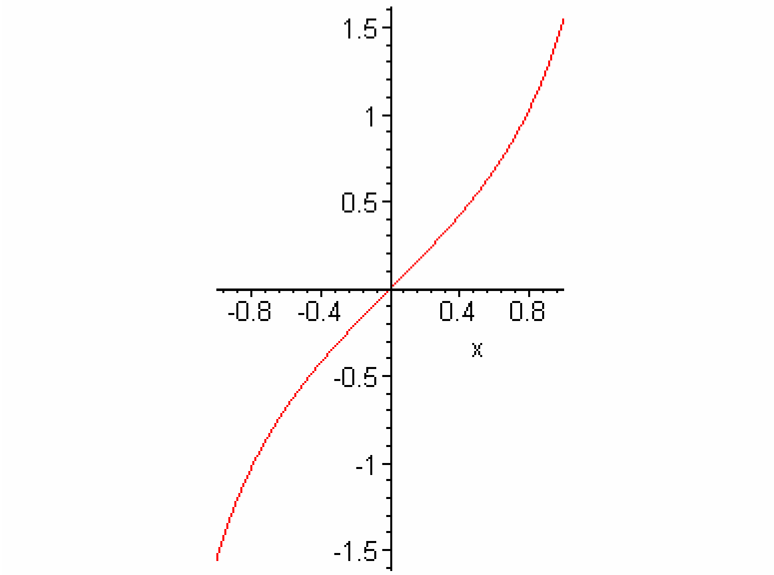
$y = \arccos x$

The inverse tangent

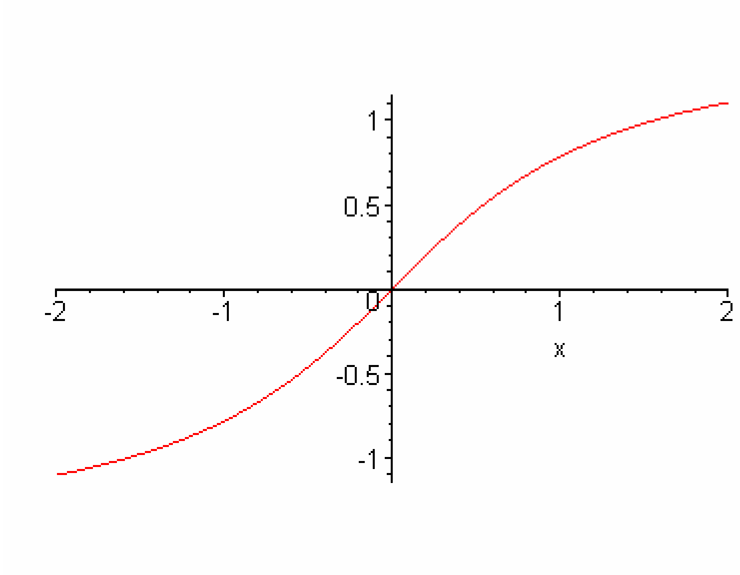
$f(x) = \arctan x$ Sometimes called the ***arc tangent*** function

When inverting the tangent function, we have to restrict ourselves to the domain $(-p/2; p/2)$ where tan(x) is one-to-one.

Then $R(f) = (-p/2; p/2)$ and $D(f) = (-\infty; \infty)$



$y = \tan(x)$



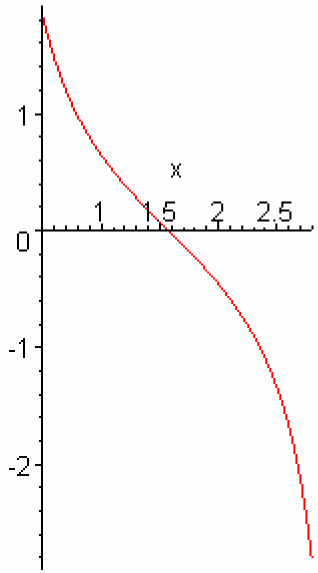
$y = \arctan x$

The inverse cotangent

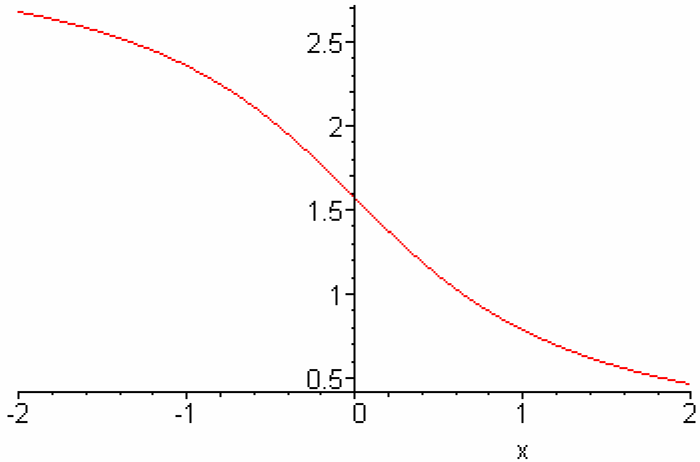
$f(x) = \operatorname{arc}\cot x$ Sometimes called the ***arc cotangent*** function

When inverting the cotangent function, we have to restrict ourselves to the domain $(0;p)$ where tan(x) is one-to-one.

Then $R(f)$ = $(0;p)$ and $D(f) = (-\infty;\infty)$



$y = \cot(x)$



$y = \operatorname{arc}\cot x$