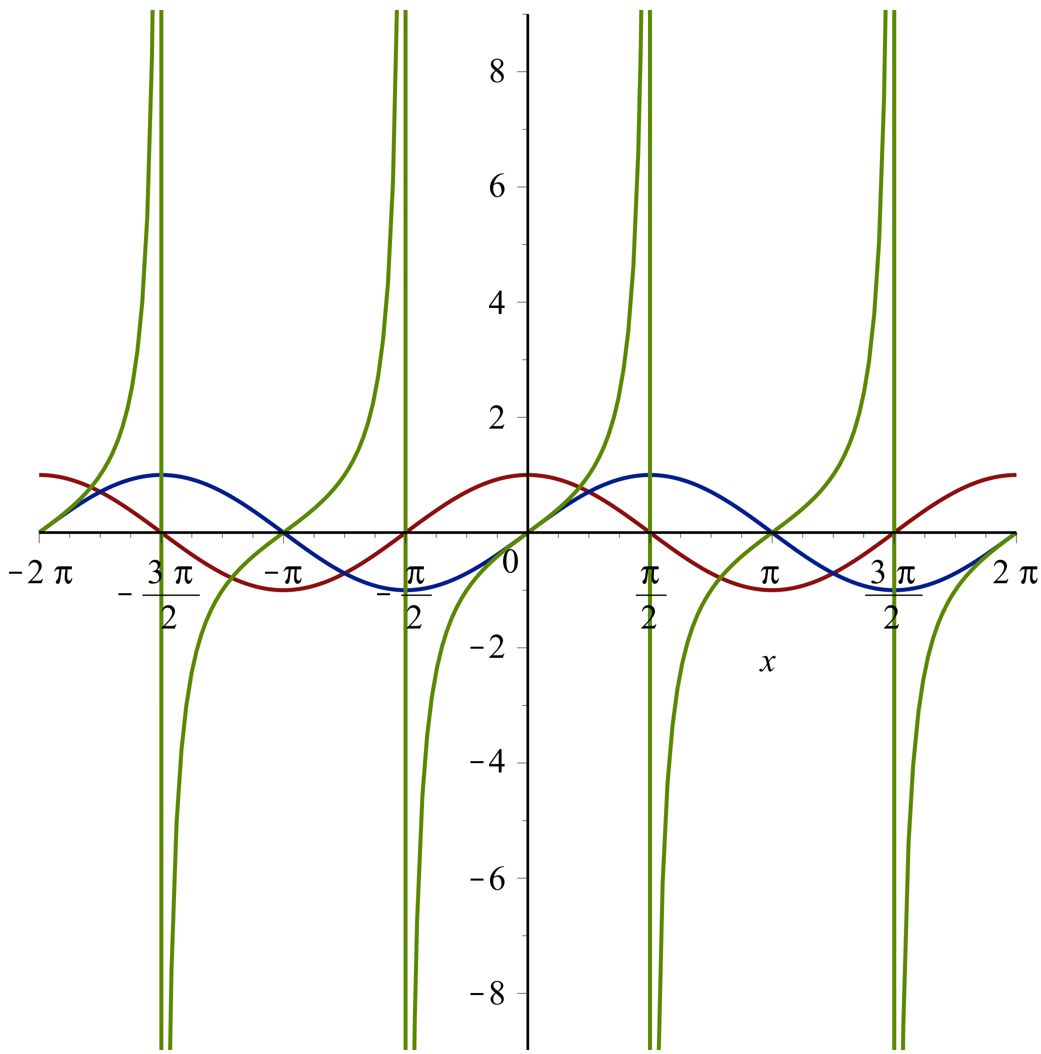
The basic trigonometric functions and their inverses

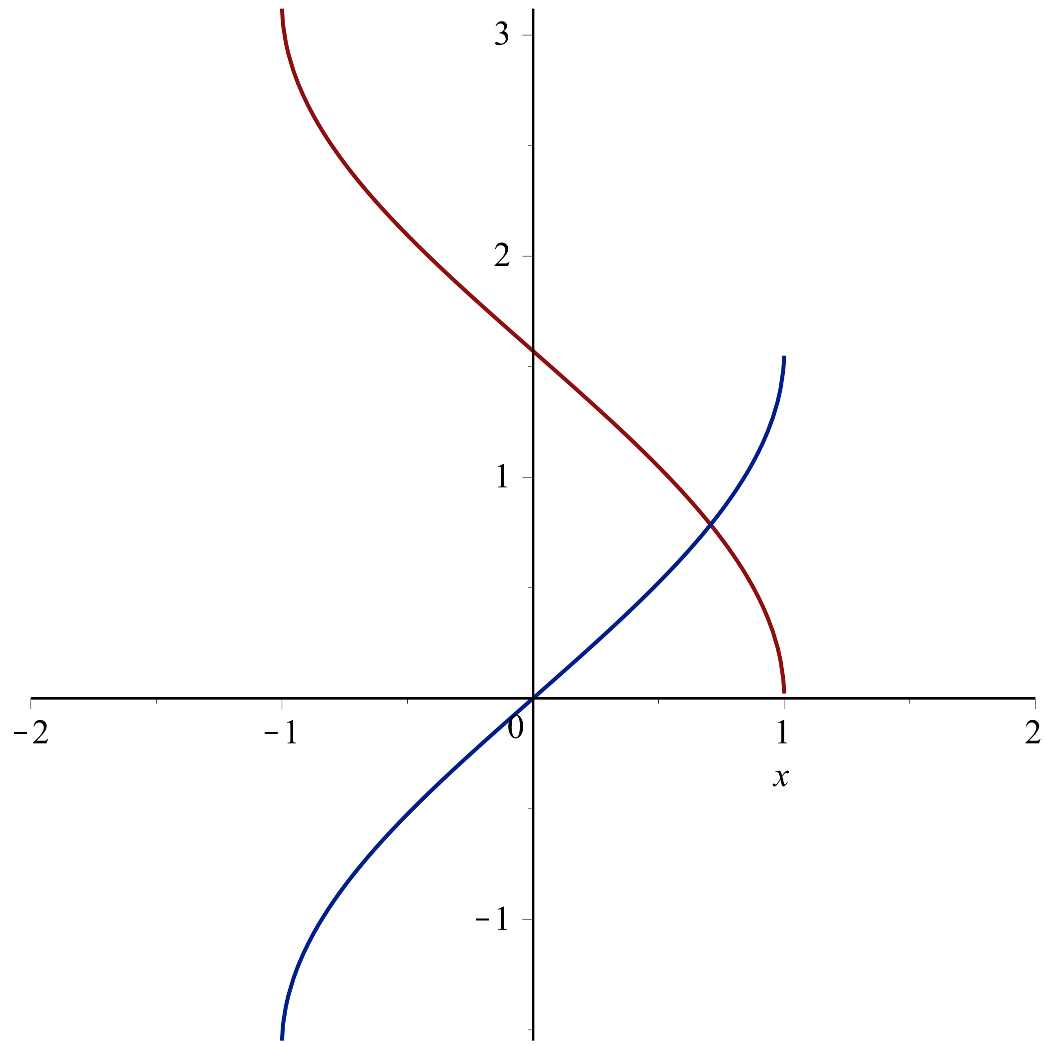
The standard trigonometric functions *sin*, *cos* and *tan* can be visualised together using the **plot** command. Note the vertical asymptotes (points of discontinuity) for the *tan* function wherever *cos* is zero.

$plot([\cos(x), \sin(x), \tan(x)], x);$



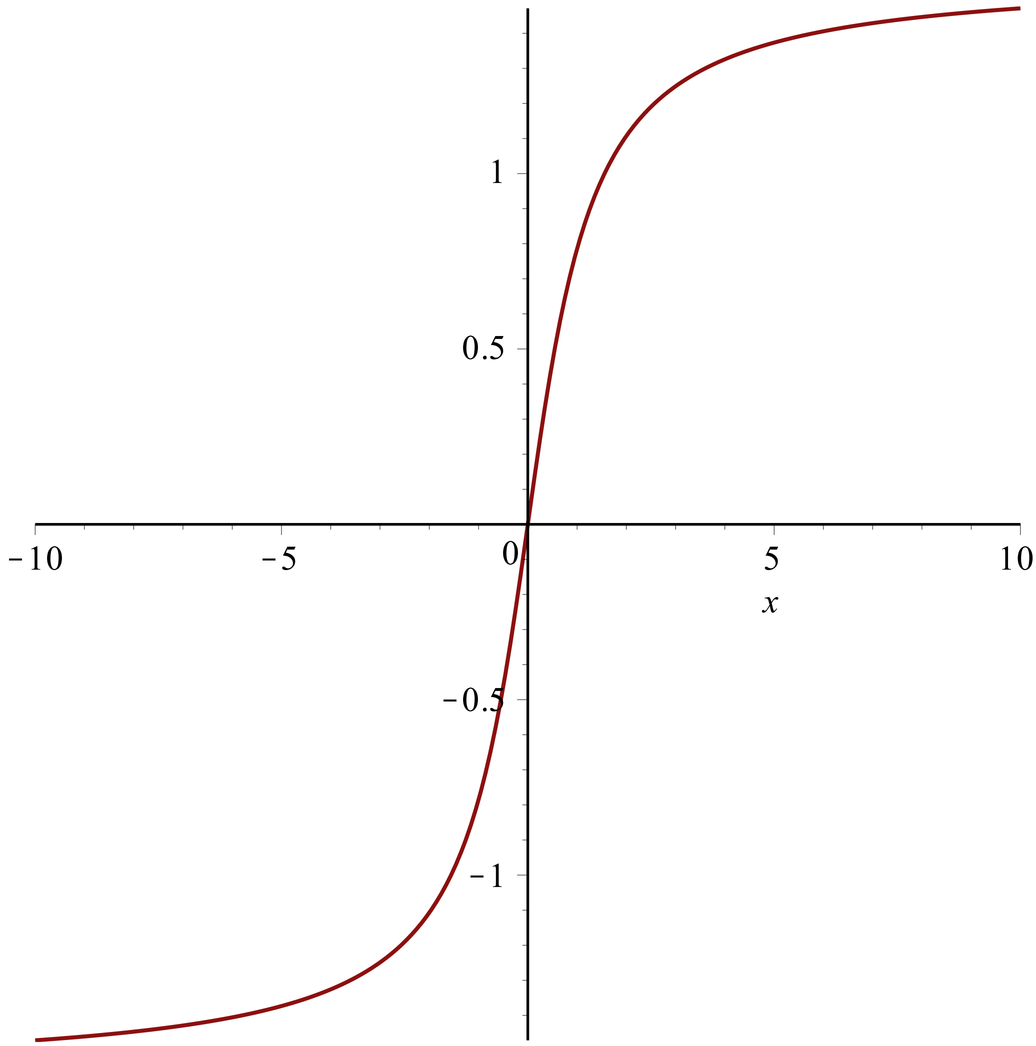
The inverse functions *arcsin* and *arccos* are defined only on the interval [−1, 1] (think through why they look as they do).

$plot([\arccos(x), \arcsin(x)], x = -2 ..2);$



Arctan, the inverse of *tan*, is however defined on the whole real line . Note also the limits at infinity.

plot(arctan(*x*), *x*); *limit*(arctan(*x*), *x* = *infinity*); *limit*(arctan(*x*), *x* =− *infinity*);



$$\frac{1}{2}\pi$$

$$-\frac{1}{2}\pi \tag{1}$$

Note that the derivative of arcsin,

diff(arcsin(*x*), *x*);

$$\frac{1}{\sqrt{1-x^2}} \tag{2}$$

can be obtained from the fact that $\sin^2 y + \cos^2 y = 1$. Just let $y = \arcsin(x)$. Since $\sin(\arcsin(x)) = x$, we have $x^2 + (\cos(\arcsin(x)))^2 = 1$, so that

$\cos(\arcsin(x));$

$$\sqrt{1-x^2} \quad (3)$$

Differentiating $sin(arcsin(x)) = x$ using the chain rule gives $cos(arcsin(x)) \cdot (arcsin(x))' = 1$. Therefore, $(arcsin(x))' = \frac{1}{cos(arcsin(x))} = \frac{1}{\sqrt{1-x^2}}$.