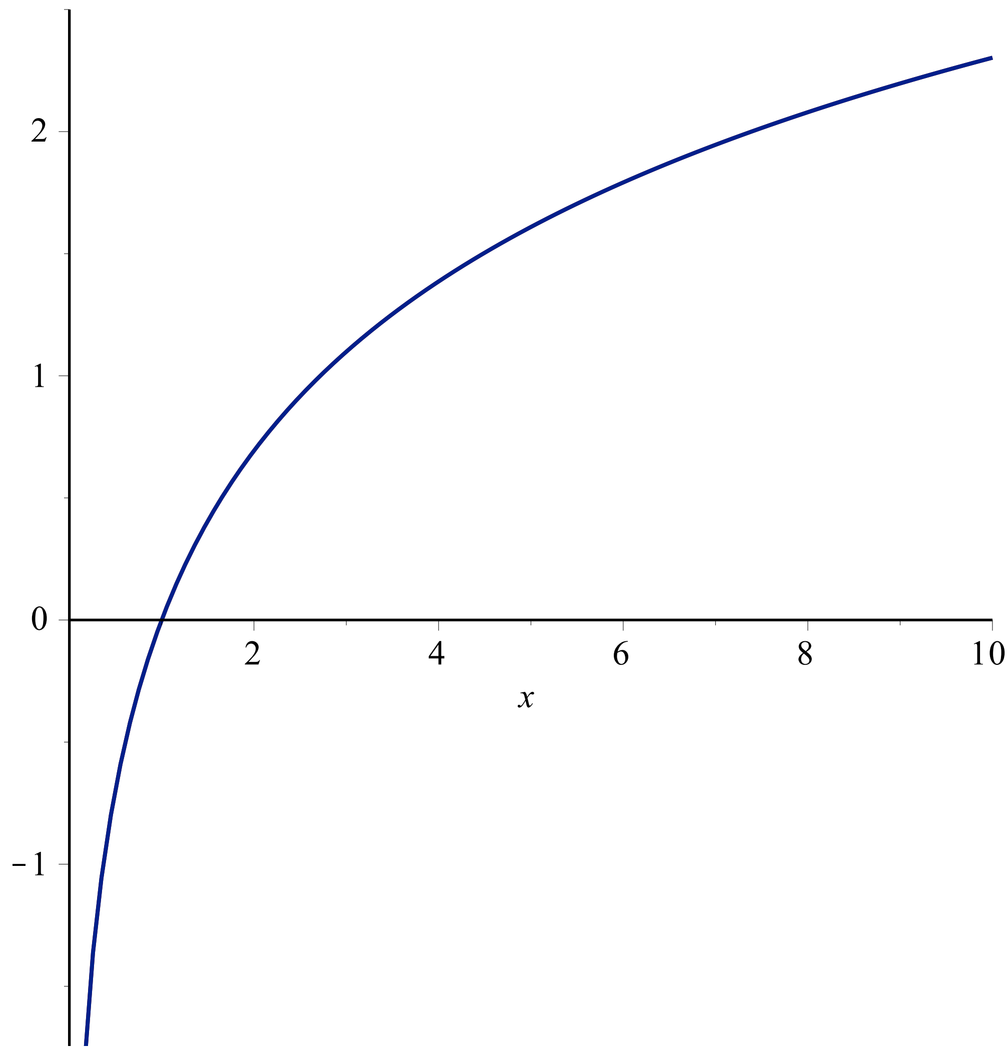
The logarithmic functions

The natural logarithmic function is encoded in Maple as both *ln* and *log*.

$plot([\ln(x), \log(x)], x);$



One may easily test that it is the inverse of the exponential function.

$\exp(\ln(x));$

$$x \quad (1)$$

A general logarithmic function, in base $a > 0$, may be expressed as $log[a]$, and Maple immediately translates this into an expression using the natural logarithm.

$\log[a](x);$

$$\frac{\ln(x)}{\ln(a)} \tag{2}$$

For example, one may want to calculate $log_3 5 - log_9\ 125$,

```
log[3](5) − log[9](125);
```

$$-\frac{1}{2}\frac{\ln(5)}{\ln(3)} \tag{3}$$

or something like $\dfrac{\ln(\pi)^{\left(\log_3(243)\right)}}{\ln\left(e\cdot\pi^2\right)}$,

$$\frac{\ln(\pi)^5}{\ln\left(e\,\pi^2\right)} \tag{4}$$

$$\frac{\ln(\pi)^{\left(\log_3(243)\right)}}{\ln\left(e\cdot\pi^2\right)};$$

$$\frac{\ln(\pi)^5}{\ln\left(e\,\pi^2\right)} \tag{5}$$

which we can **expand** into

expand(%);

$$\frac{\ln(\pi)^5}{2\ln(\pi)+\ln(e)} \tag{6}$$

Note also that just like the hyperbolic
and trigonometric functions may be epxressed using the exponential function,
their inverses can be expressed using the logarithmic function
(we use the **convert** command for this).

```
convert(arcsinh(x), ln);
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$$\ln\left(x+\sqrt{x^2+1}\right) \tag{7}$$