MAPLE demo 02−06−07

Finding limits using MAPLE
(*e.g.* # 34,. *p.* 83)

> $f := x \rightarrow \dfrac{(x+2)}{sqrt(x^2+5)-3}$

$$f := x \rightarrow \frac{x+2}{\sqrt{x^2+5}-3}$$

>

Want to evaluate limit as x->-2

> $f(-2)$

```
Error, (in f) numeric exception: division by zero
```

> $f(-1)$

$$\frac{1}{\sqrt{6}-3}$$

> $f(-1.0)$

$$-1.816496582$$

> $evalf(f(-1))$

$$-1.816496582$$

> $f(-1.5)$

$$-1.626452118$$

```
> f(-1.9)
```

$$-1.521610290$$

```
> f(-1.95)
```

$$-1.510607790$$

```
> f(-1.99)
```

$$-1.502090835$$

```
> f(-1.999)
```

$$-1.500208529$$

```
> f(-3.)
```

$$-1.348331477$$

```
> f(-2.5)
```

$$-1.412022660$$

```
> f(-2.1)
```

$$-1.479895691$$

> $f(-2.05)$

$$-1.489768479$$

> $f(-2.01)$

$$-1.497924251$$

> $f(-2.001)$

$$-1.499792279$$

>

Numerical experiments suggest limit is -1.5

> $limit(f(x), x = -2)$

$$\frac{-3}{2}$$

>

Example #4, p. 81

> $g := x \to \frac{(sqrt(x^2 + 100) - 10)}{x^2}$

$$g := x \to \frac{\sqrt{x^2 + 100} - 10}{x^2}$$

>

Limit as x-->0.

```
> g(0)
```

```
Error, (in g) numeric exception: division by zero
```

```
> g(.00001)
```

$$0.$$

```
> g(-.00001)
```

$$0.$$

```
>
```

Limit is actually not =0.

```
> g(1.)
```

$$0.04987562000$$

```
> g(.5)
```

$$0.04996880000$$

```
> g(.2)
```

$$0.04999500000$$

```
> g(.1)
```

0
.04999900000

> $g(.05)$

0
.05000000000

> $g(.01)$

0
.05000000000

> $g(.005)$

0
.05000000000

> $g(.001)$

0
.05000000000

> $g(.0005)$

0
.04000000000

> $g(.0001)$

0
.

> $(.0001)^2$

$1.\ 10^{-8}$

> $\% + 100$

$$\begin{matrix} 1 \\ 00.0000000 \end{matrix}$$

> $sqrt(\%)$

$$\begin{matrix} 1 \\ 0.00000000 \end{matrix}$$

> $\%^2$

$$\begin{matrix} 1 \\ 00.0000000 \end{matrix}$$

> $sqrt(\%)$

$$\begin{matrix} 1 \\ 0.00000000 \end{matrix}$$

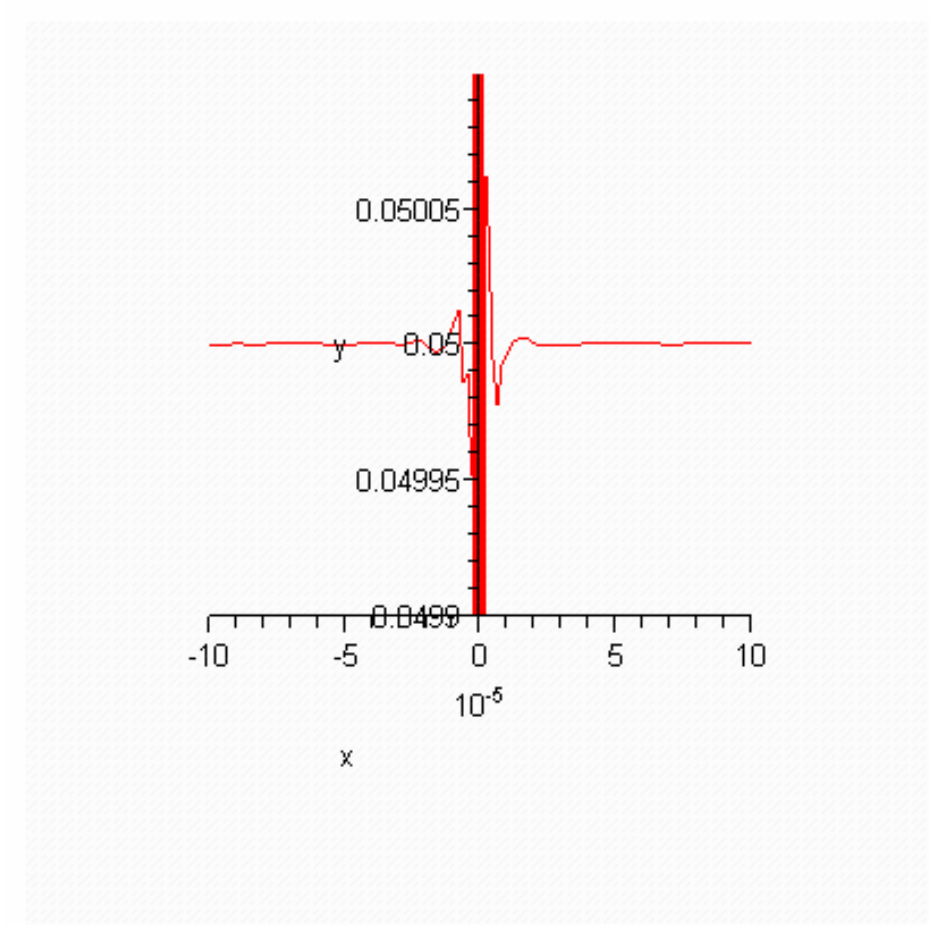
> $\ldots$

$$\begin{matrix} 0 \\ . \end{matrix}$$

> $\dfrac{\%}{(.0001)^2}$

$$\begin{matrix} 0 \\ . \end{matrix}$$

> $plot(g(x), x = -.0001 \ldots .0001, y = .0499 \ldots .0501)$



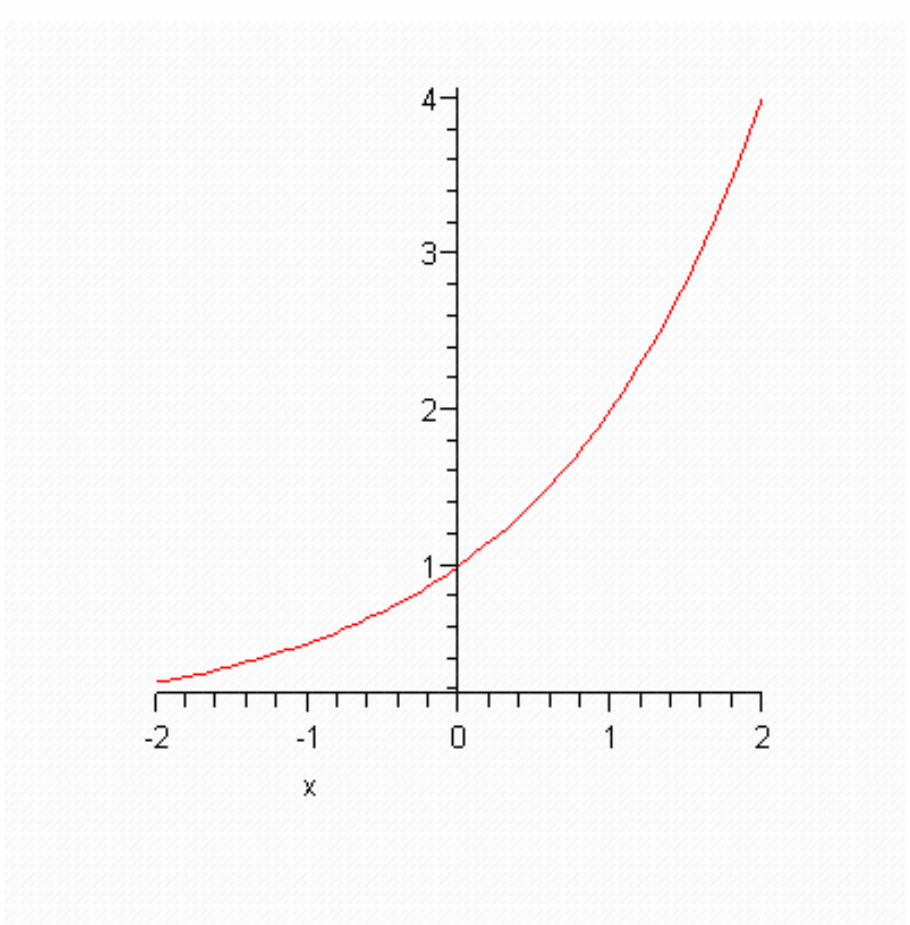
>

Graphs of exponential functions

> $f := x \to 2^x$

$$f := x \to 2^x$$

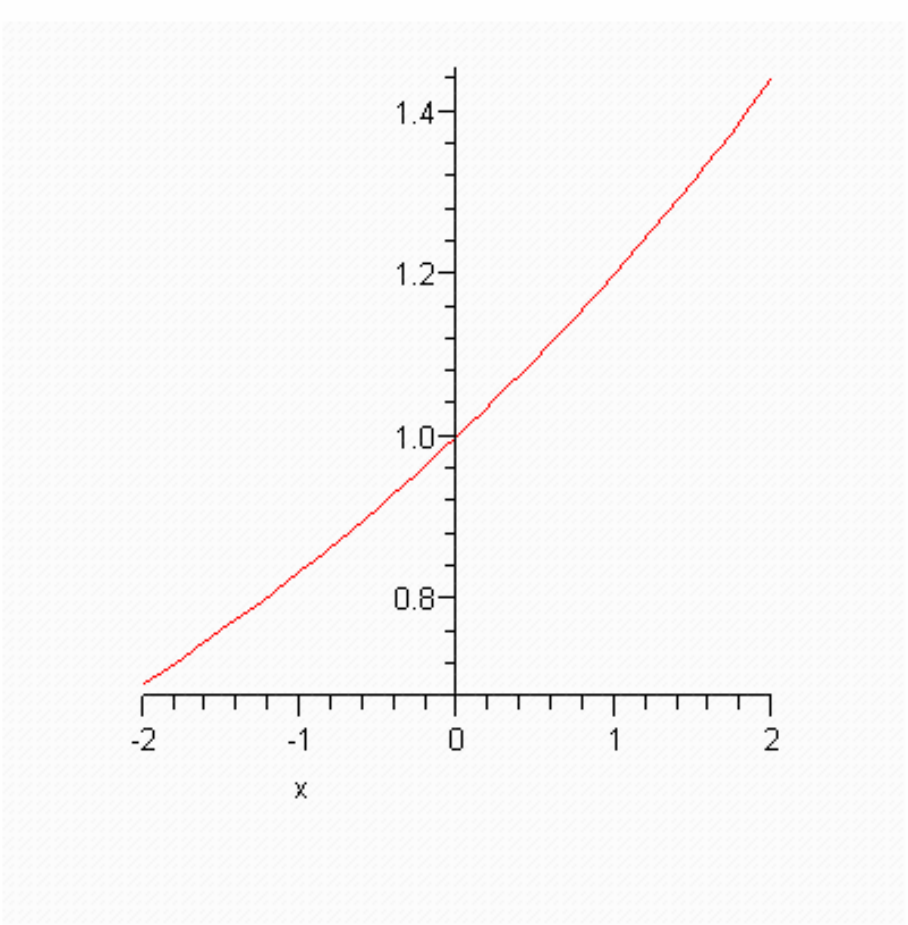
> $plot(f(x), x = -2..2);$



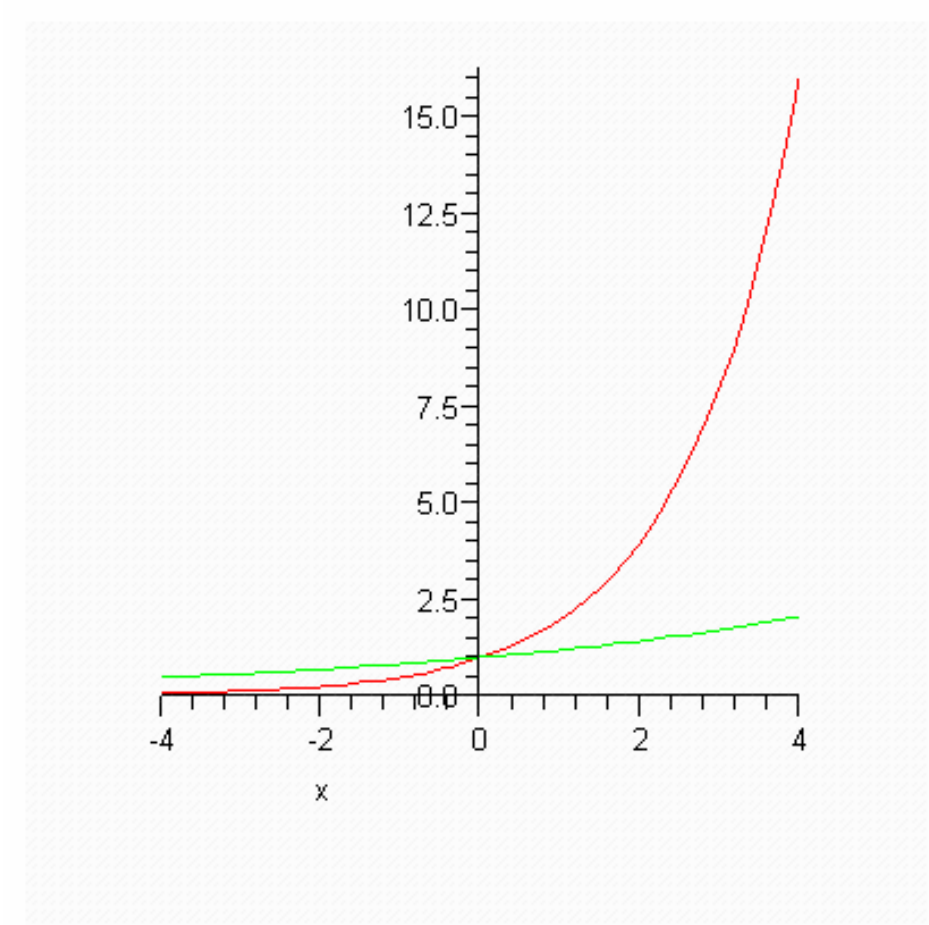
> $g := x \rightarrow 1.2^x$

$$g := x \rightarrow 1.2^x$$

> $plot(g(x), x = -2..2)$



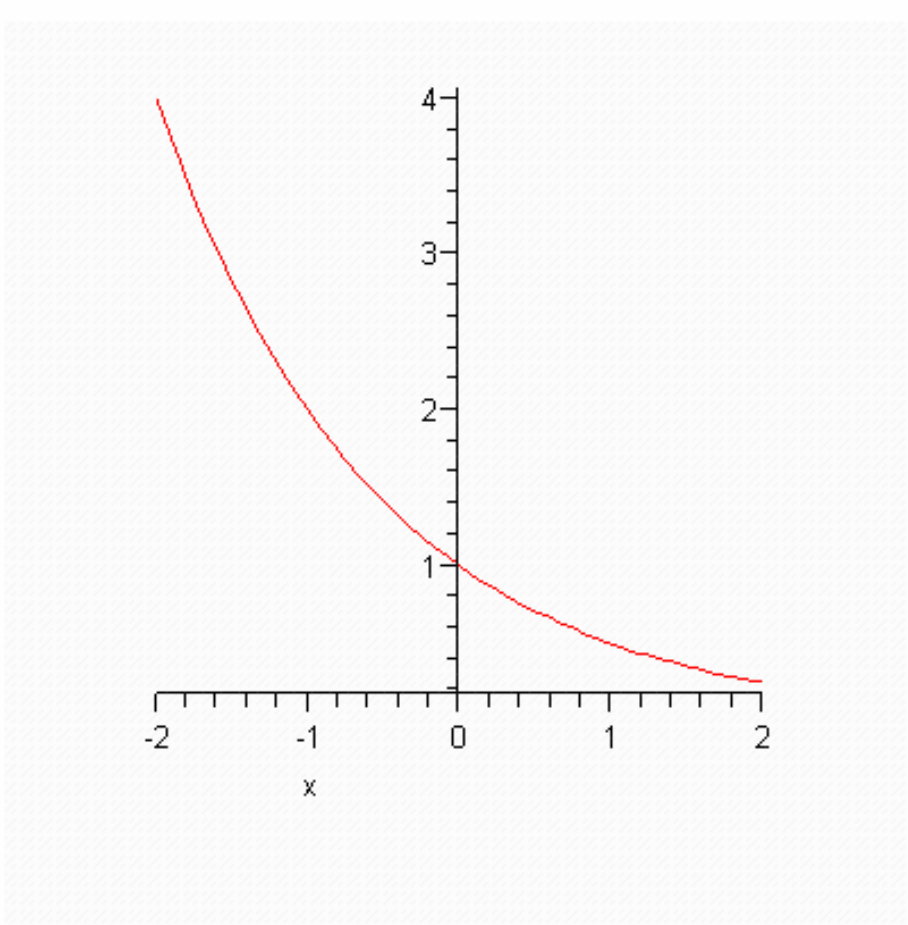
> $plot([f(x), g(x)], x = -4..4)$



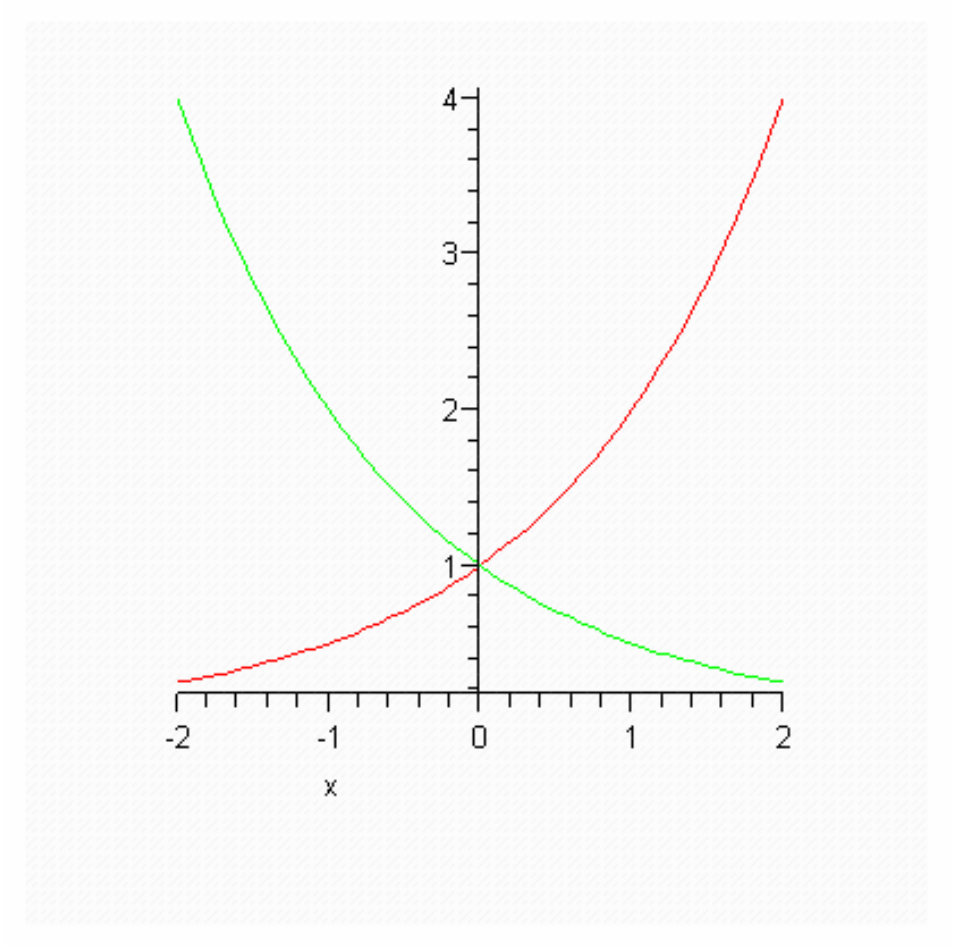
> $h := x \rightarrow (.5)^x$

$$h := x \rightarrow 0.5^x$$

> $plot(h(x), x = -2..2)$



> $plot([f(x), h(x)], x = -2..2)$



>

Example #60, p. 108. Evaluate limit as x-> infinity

> $g := x \to \dfrac{(-x^4)}{x^4 - 7 \cdot x^3 + 7 \cdot x^2 + 9}$

$$g := x \to -\frac{x^4}{x^4 - 7\,x^3 + 7\,x^2 + 9}$$

> $g(100)$

$$\frac{-100000000}{93070009}$$

> $g(500)$

$$\frac{-62500000000}{61626750009}$$

```
> g(1000)
```

$$\frac{-1000000000000}{993007000009}$$

```
> g(10000)
```

$$\frac{-10000000000000000}{9993000700000009}$$

```
> g(10000.)
```

$$-1.000700420$$

```
> g(-1000)
```

$$\frac{-1000000000000}{1007007000009}$$

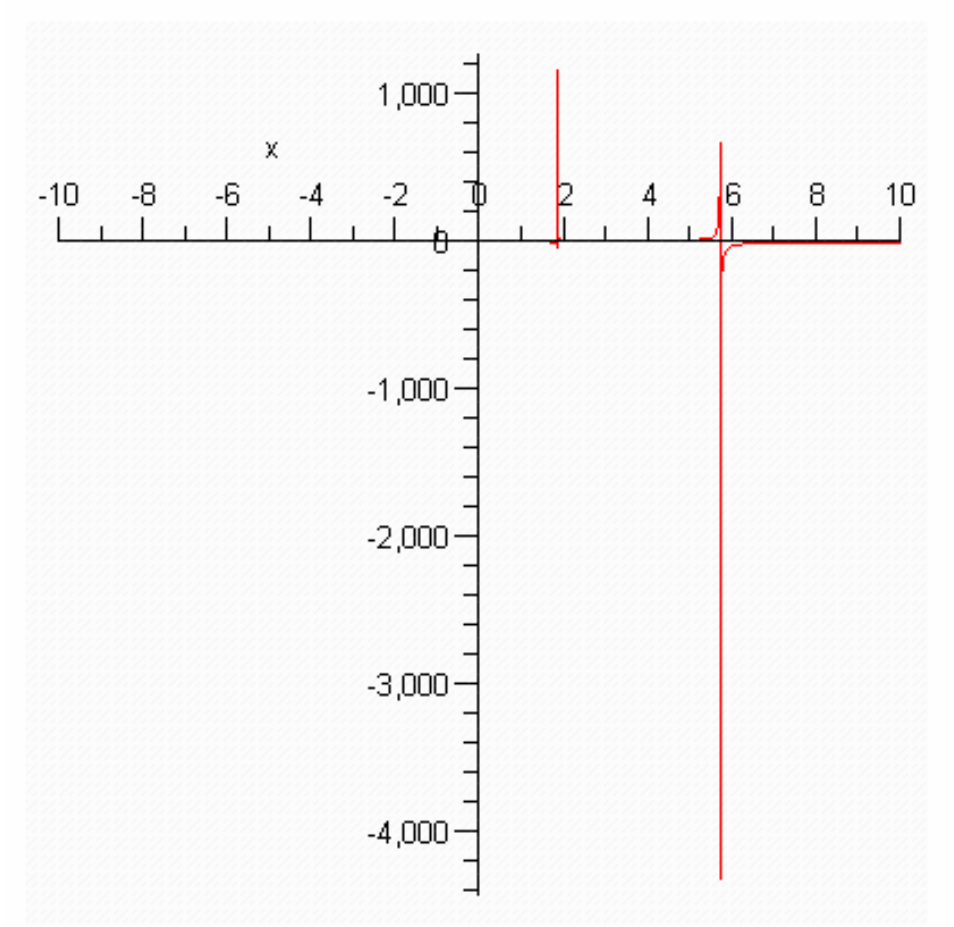
```
> g(-10000)
```

$$\frac{-10000000000000000}{10007000700000009}$$

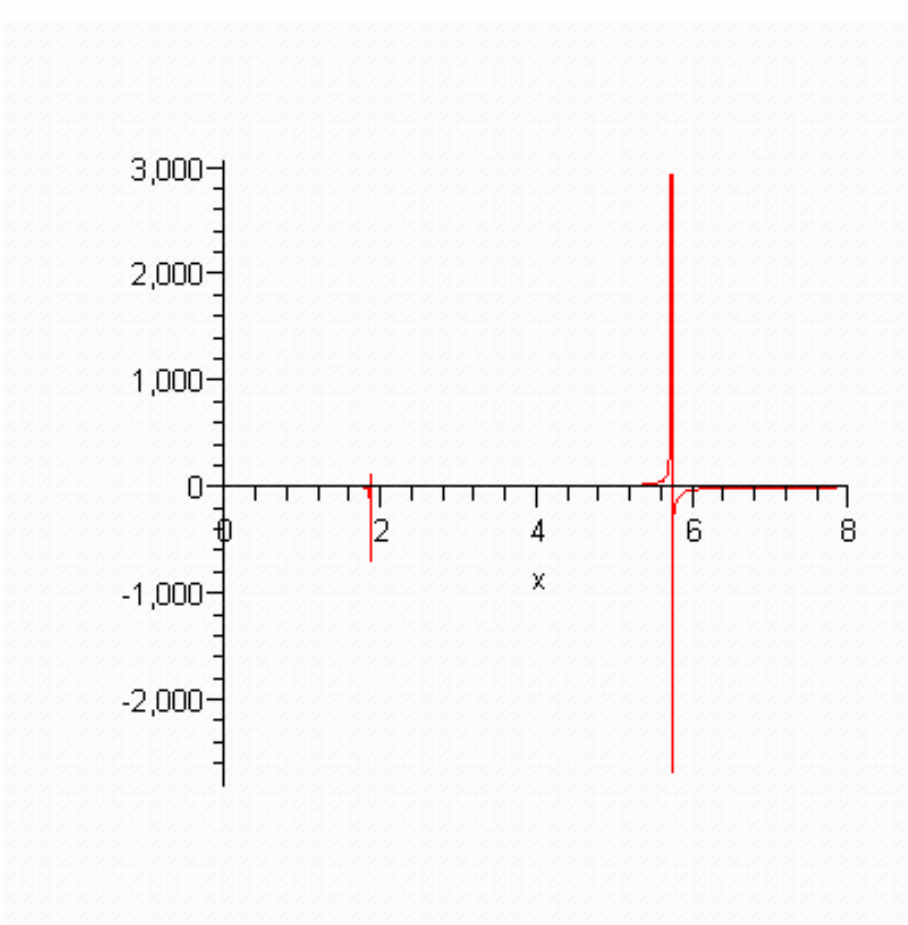
```
> g(-10000.)
```

$$-.9993004198$$

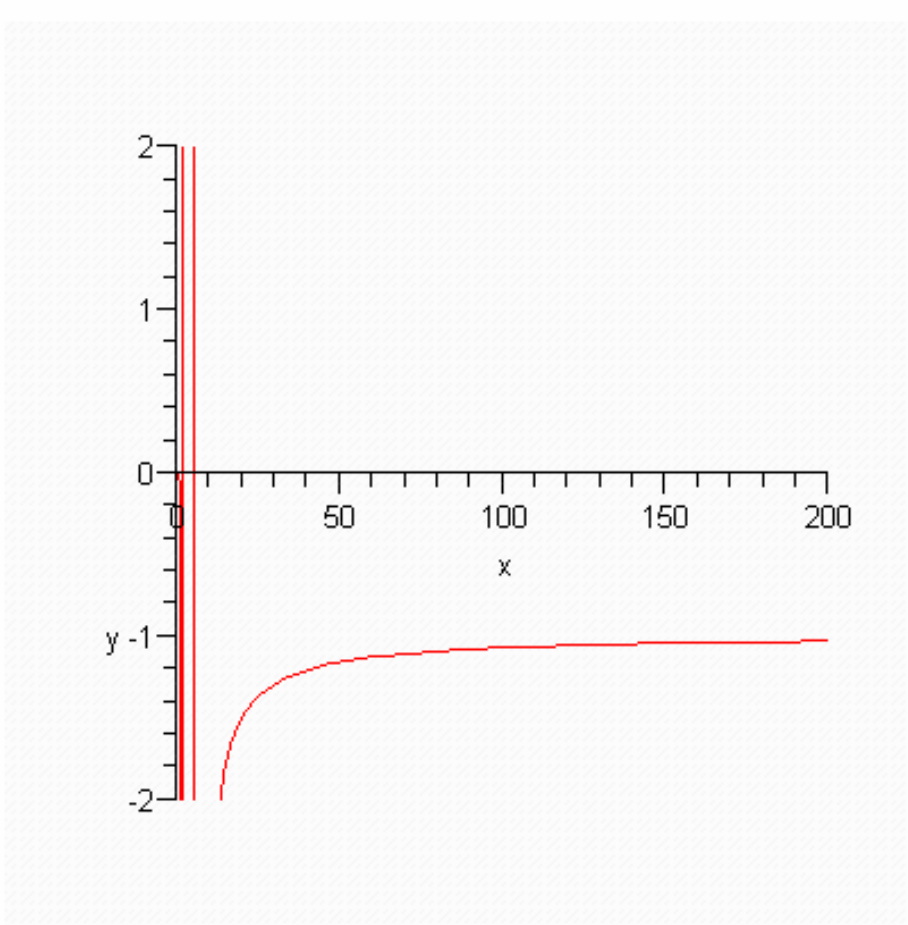
```
> plot(g(x), x)
```



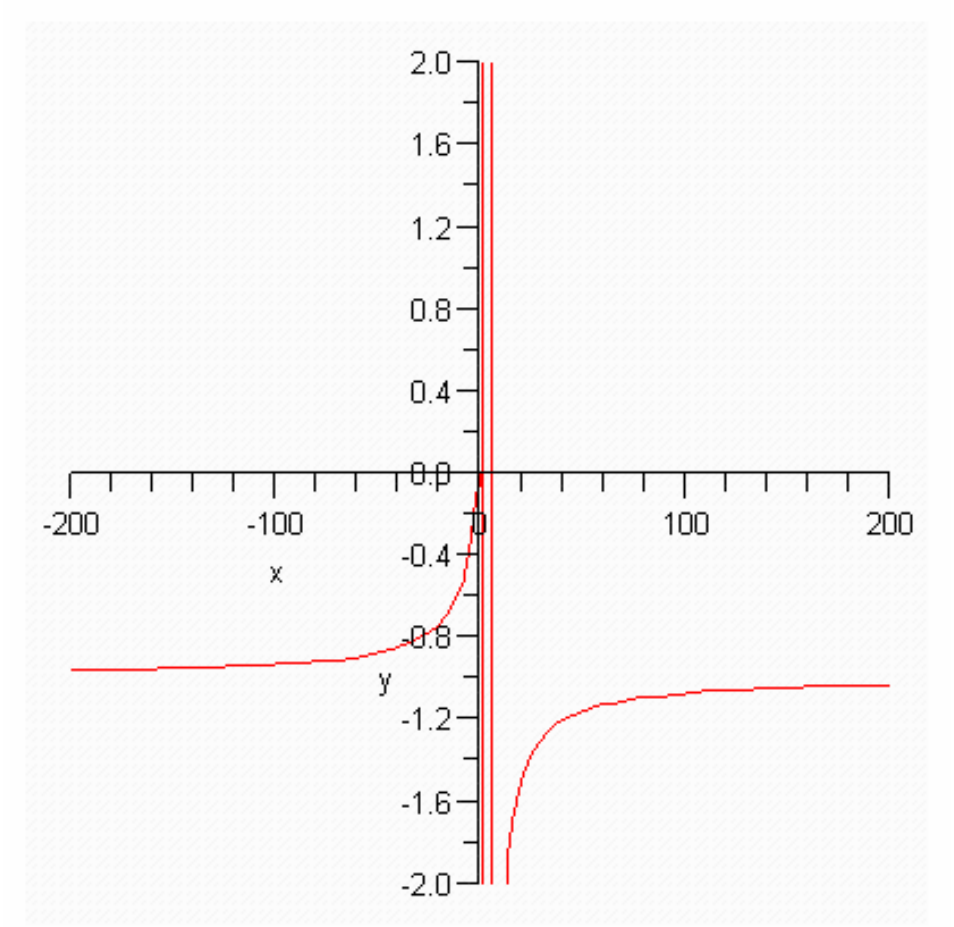
> $plot(g(x), x = 0..8)$



> $plot(g(x), x = 0..200, y = -2..2)$



> $plot(g(x), x = -200..200, y = -2..2)$



> $limit(g(x), x = infinity)$

$$-1$$

> $limit(g(x), x = -\infty)$

$$-1$$

>