

```

> f:=exp(a*x)*cos(x-a);
      f:=e(ax)cos(x-a)
> taylor(f,x=a,4);
e(a2)+e(a2)a(x-a)+\left(-\frac{1}{2}e(a2)+\frac{1}{2}e(a2)a2\right)(x-a)2+
\left(-\frac{1}{2}e(a2)a+\frac{1}{6}e(a2)a3\right)(x-a)3+O((x-a)4)
> f:=exp(x);
      f:=ex
> taylor(f,x=0,7);
1+x+\frac{1}{2}x2+\frac{1}{6}x3+\frac{1}{24}x4+\frac{1}{120}x5+\frac{1}{720}x6+O(x7)
> coeff(%,x,4);
      \frac{1}{24}
> convert(taylor(f,x,7),polynom);
1+x+\frac{1}{2}x2+\frac{1}{6}x3+\frac{1}{24}x4+\frac{1}{120}x5+\frac{1}{720}x6
> tp:=n->convert(taylor(f,x,n),polynom);
      tp:=n->convert(taylor(f,x,n),polynom)
> tp(7);
1+x+\frac{1}{2}x2+\frac{1}{6}x3+\frac{1}{24}x4+\frac{1}{120}x5+\frac{1}{720}x6
> tp(3);

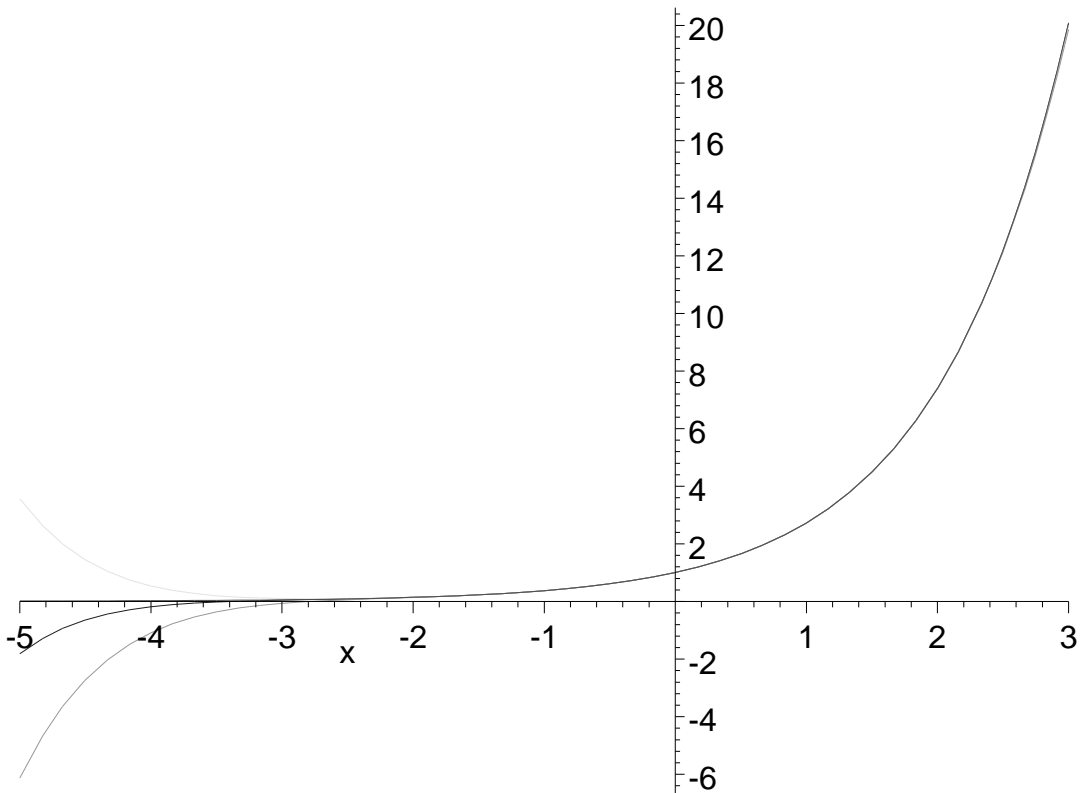
```

$$1 + x + \frac{1}{2}x^2$$

```
> seq(sin(j), j=1..3);
```

```
sin(1), sin(2), sin(3)
```

```
> plot({f, seq(tp(j), j=8..10)}, x=-5..3);
```



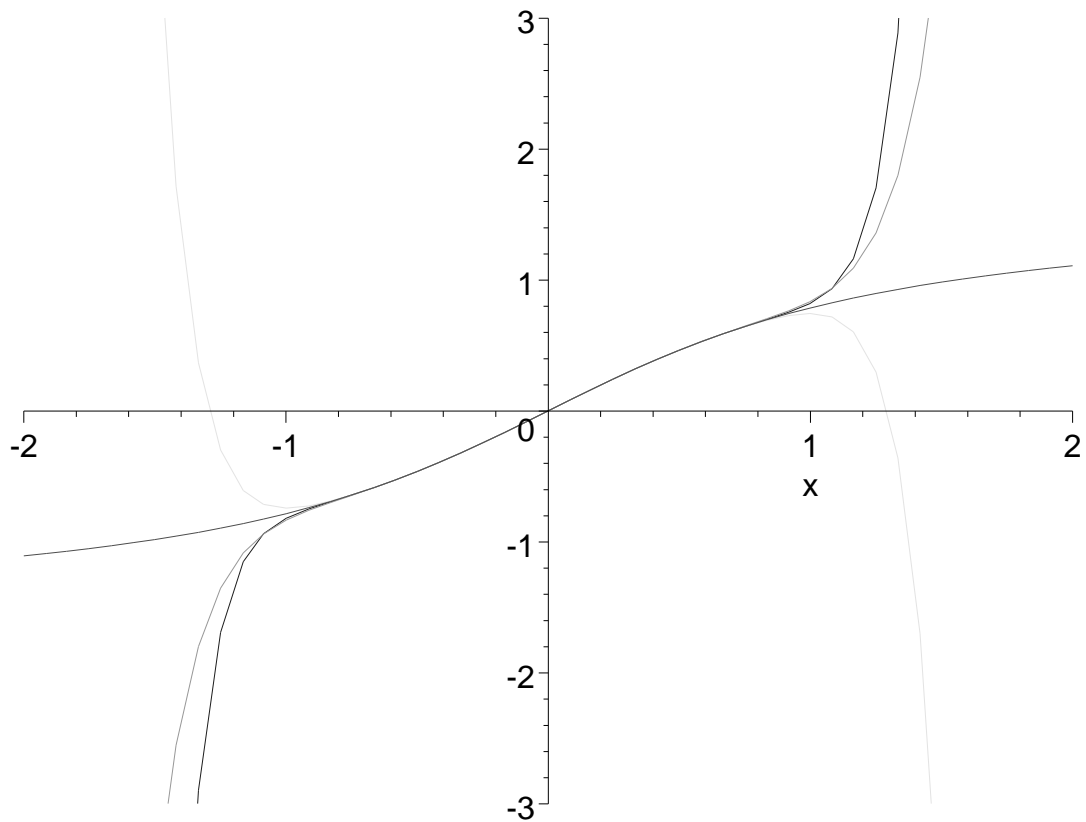
```
> f:=arctan(x);
```

```
f:= arctan(x)
```

```
> tp:=n->convert(taylor(f,x,n),polynom);
```

```
tp := n → convert(taylor(f, x, n), polynom)
```

```
> plot({f, seq(tp(j), j=10..15)}, x=-2..2, -3..3)
;
```



```
> f:=exp(sqrt(x));
```

$$f := e^{(\sqrt{x})}$$

```
> taylor(f,x);
```

Error, does not have a taylor expansion, try series()

```
> series(f,x);
```

$$\begin{aligned}
 &1 + \sqrt{x} + \frac{1}{2}x + \frac{1}{6}x^{(3/2)} + \frac{1}{24}x^2 + \frac{1}{120}x^{(5/2)} + \frac{1}{720}x^3 + \frac{1}{5040}x^{(7/2)} \\
 &+ \frac{1}{40320}x^4 + \frac{1}{362880}x^{(9/2)} + \frac{1}{3628800}x^5 + \frac{1}{39916800}x^{(11/2)} \\
 &+ O(x^6)
 \end{aligned}$$

```
> f:=int(exp(cos(t)),t=0..x);
```

$$f := \int_0^x e^{\cos(t)} dt$$

```
> taylor(f,x=0,8);
```

$$e x - \frac{1}{6} e x^3 + \frac{1}{30} e x^5 - \frac{31}{5040} e x^7 + O(x^9)$$

```
> f:=int(exp(cos(x*t))/t,t=1..2);
```

$$f := \int_1^2 \frac{e^{\cos(xt)}}{t} dt$$

```
> taylor(f,x=0,4);
```

$$\ln(2) e - \frac{3}{4} e x^2 + O(x^4)$$

```
> diff(f,x);
```

$$\frac{e^{(2 \cos(x))^2 - 1} - e^{\cos(x)}}{x}$$

```
> f:=int(exp(cos(x*t))/t,t=1..x);
```

$$f := \int_1^x \frac{e^{\cos(xt)}}{t} dt$$

```
> taylor(f,x);
```

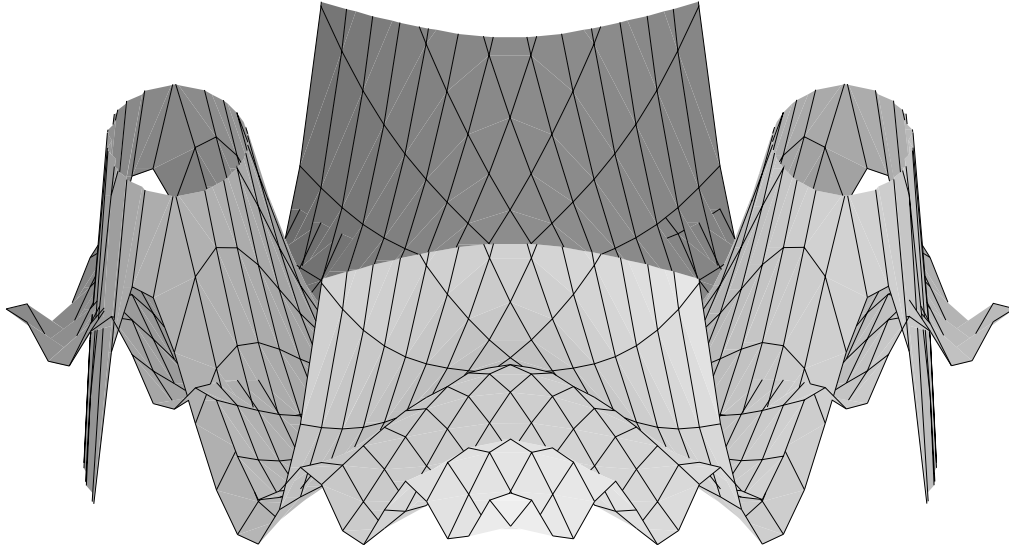
```
Error, (in series/int) not implemented yet
```

```
> f:=-cos(x*y)+cos(x-y);
```

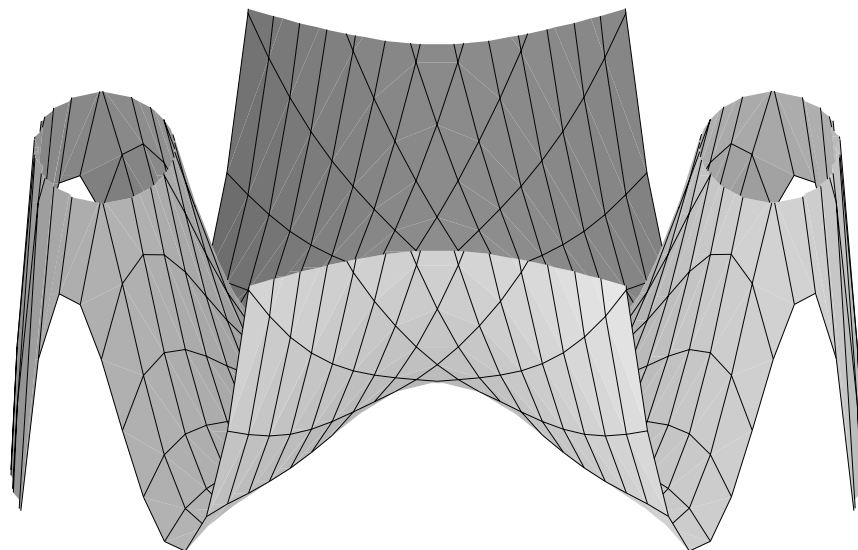
```

      f := -cos(x y) + cos(x - y)
> readlib(mttaylor);
      proc() ... end
> mt := mttaylor(f, [x, y], 8);
mt := -\frac{1}{2}x^2 + xy - \frac{1}{2}y^2 + \frac{1}{24}x^4 - \frac{1}{6}yx^3 + \frac{3}{4}x^2y^2 - \frac{1}{6}y^3x + \frac{1}{24}y^4
      - \frac{1}{720}x^6 + \frac{1}{120}yx^5 - \frac{1}{48}y^2x^4 + \frac{1}{36}x^3y^3 - \frac{1}{48}y^4x^2 + \frac{1}{120}y^5x
      - \frac{1}{720}y^6
> plot3d({f, mt}, x=-4..4, y=-4..4, view=-4..6);

```



```
> plot3d({mt}, x=-4..4, y=-4..4, view=-4..6);
```



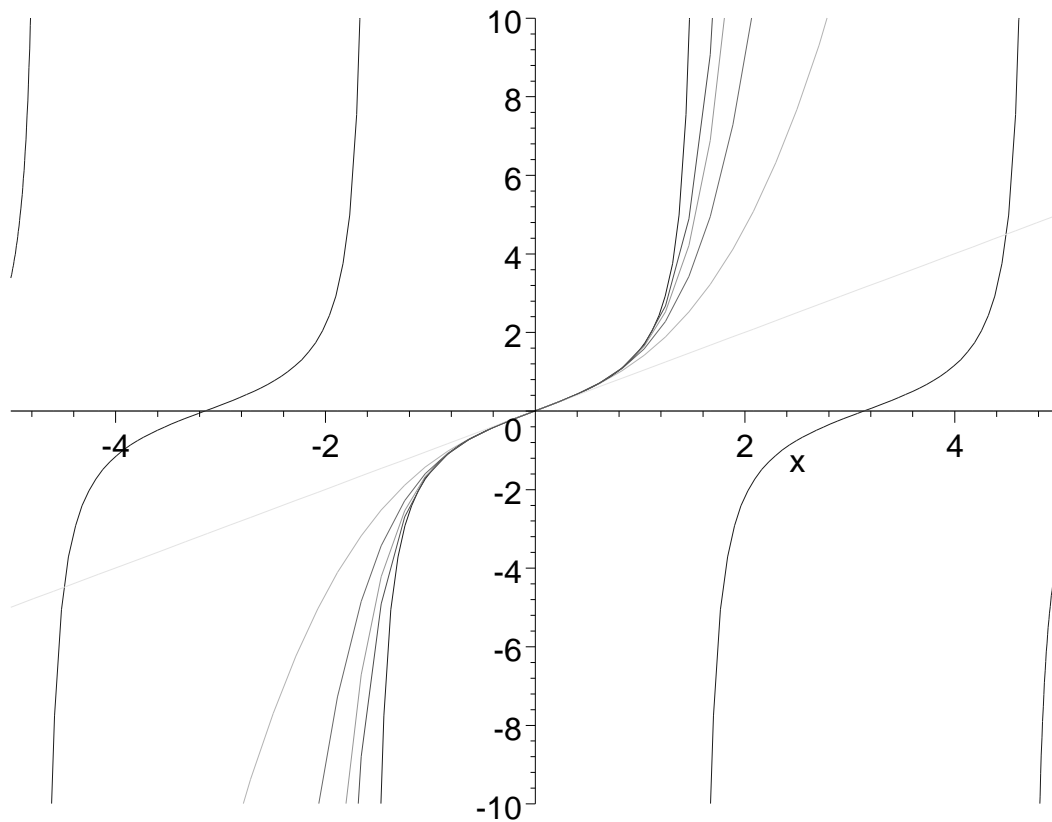
```
> tp:=n->convert(taylor(tan(x),x,n),polynom);
```

```
tp := n → convert(taylor(tan(x), x, n), polynom)
```

```
> tp(15);
```

$$x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \frac{17}{315}x^7 + \frac{62}{2835}x^9 + \frac{1382}{155925}x^{11} + \frac{21844}{6081075}x^{13}$$

```
> plot({tan(x), seq(tp(n), n=1..10)}, x=-5..5, -1
0..10, discontin=true);
```



```
> tp(10);
```

$$x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \frac{17}{315}x^7 + \frac{62}{2835}x^9$$

```
> taylor(tan(x), x, 10);
```

$$x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \frac{17}{315}x^7 + \frac{62}{2835}x^9 + O(x^{11})$$

```
> convert(%, ratpoly, 5, 3);
```


$$\frac{-\frac{1}{630}x^5 - \frac{1}{14}x^3 + x}{1 - \frac{17}{42}x^2}$$

```
> series(%, x=0, 10);
```

$$x + \frac{1}{3}x^3 + \frac{2}{15}x^5 + \frac{17}{315}x^7 + \frac{289}{13230}x^9 + O(x^{11})$$

```
> pade := (m, n) -> convert(series(tan(x), x, n+m+1), ratpoly, m, n);
```

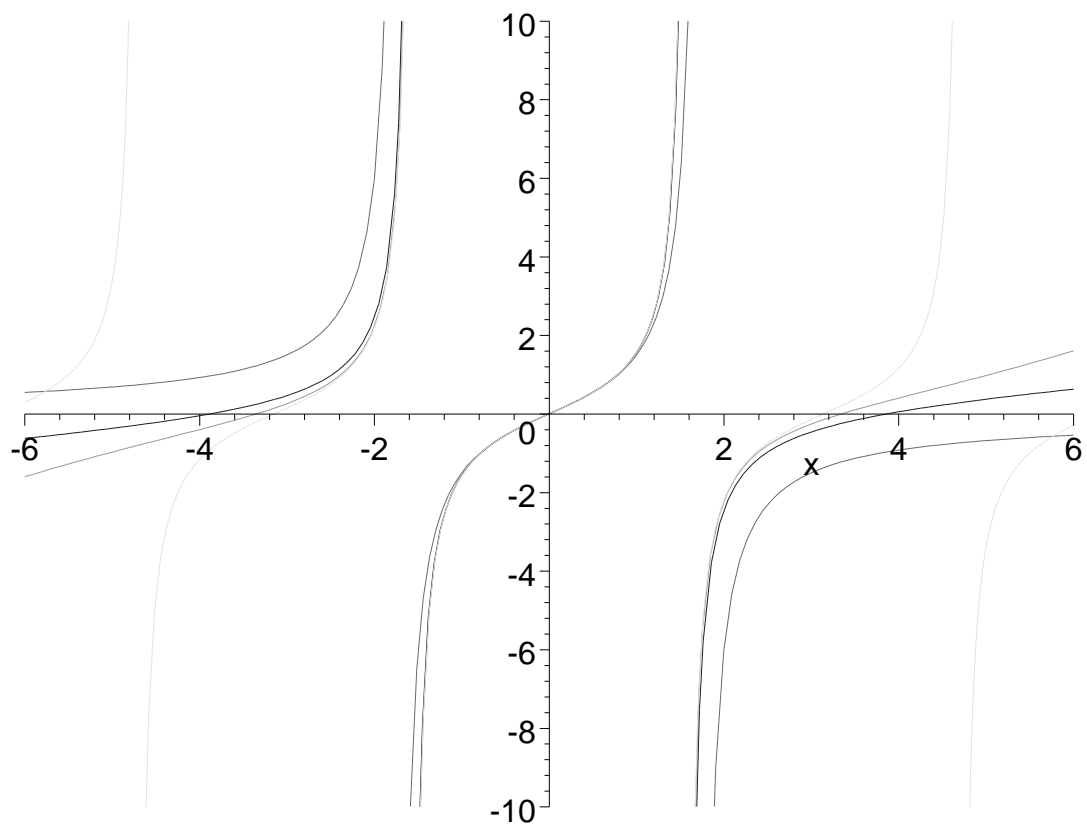
pade :=

$(m, n) \rightarrow \text{convert}(\text{series}(\tan(x), x, n + m + 1), \text{ratpoly}, m, n)$

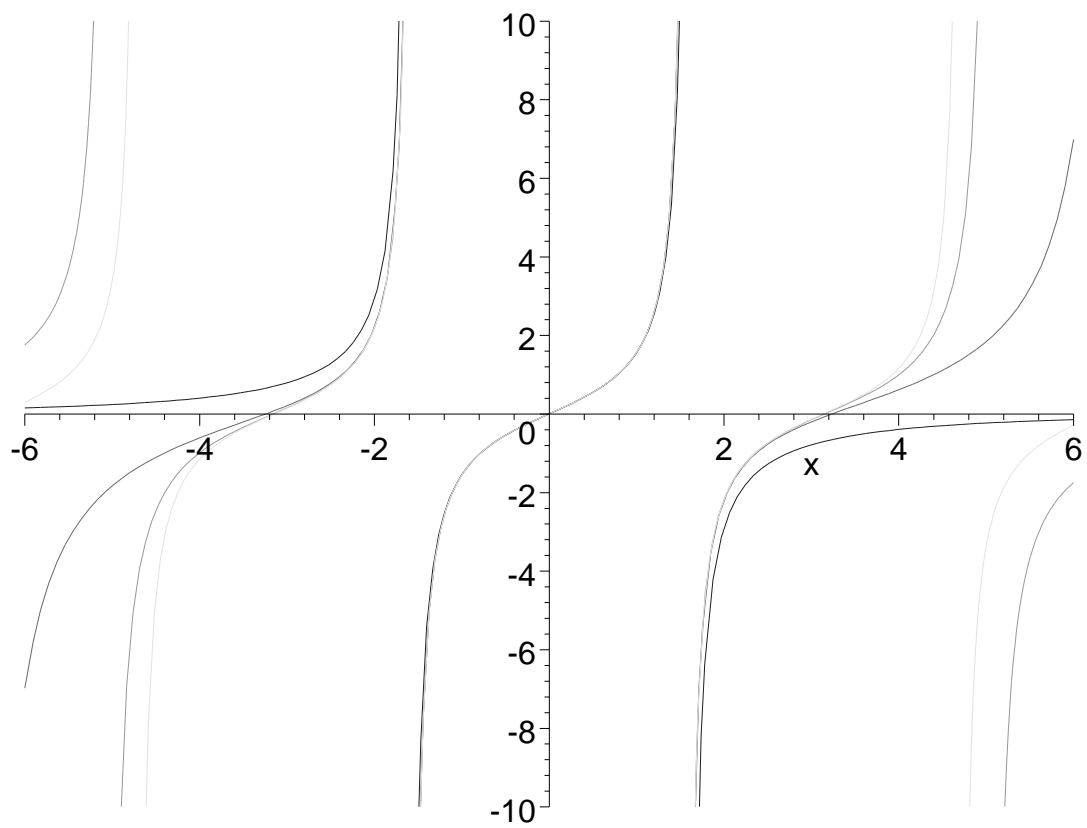
```
> pade(5, 3);
```

$$\frac{-\frac{1}{630}x^5 - \frac{1}{14}x^3 + x}{1 - \frac{17}{42}x^2}$$

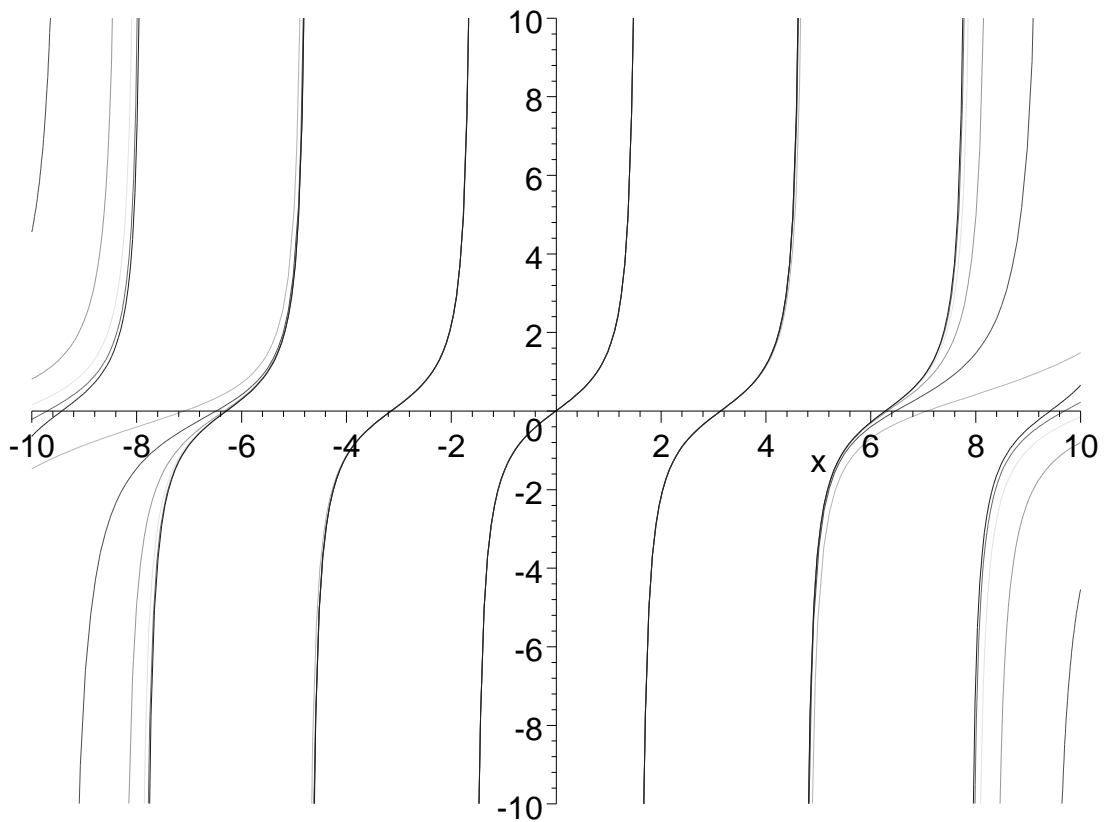
```
> plot({tan(x), seq(pade(n, 2), n=1..5)}, x=-6..6, -10..10, discontinuous=true);
```



```
> plot({tan(x), seq(pade(n, 4), n=1..5)}, x=-6..6  
, -10..10, discontin=true);
```



```
> plot({tan(x), seq(pade(n, n), n=6..10)}, x=-10.  
.10, -10..10, discontin=true);
```



```
> f:=abs(x);
```

$$f := |x|$$

```
> a:=n->int(f*cos(n*x), x=-Pi..Pi)/Pi;
```

$$a := n \rightarrow \frac{\int_{-\pi}^{\pi} f \cos(n x) dx}{\pi}$$

```
> b:=n->int(f*sin(n*x), x=-Pi..Pi)/Pi;
```

$$b := n \rightarrow \frac{\int_{-\pi}^{\pi} f \sin(n x) dx}{\pi}$$

> a(3);

$$-\frac{4}{9} \frac{1}{\pi}$$

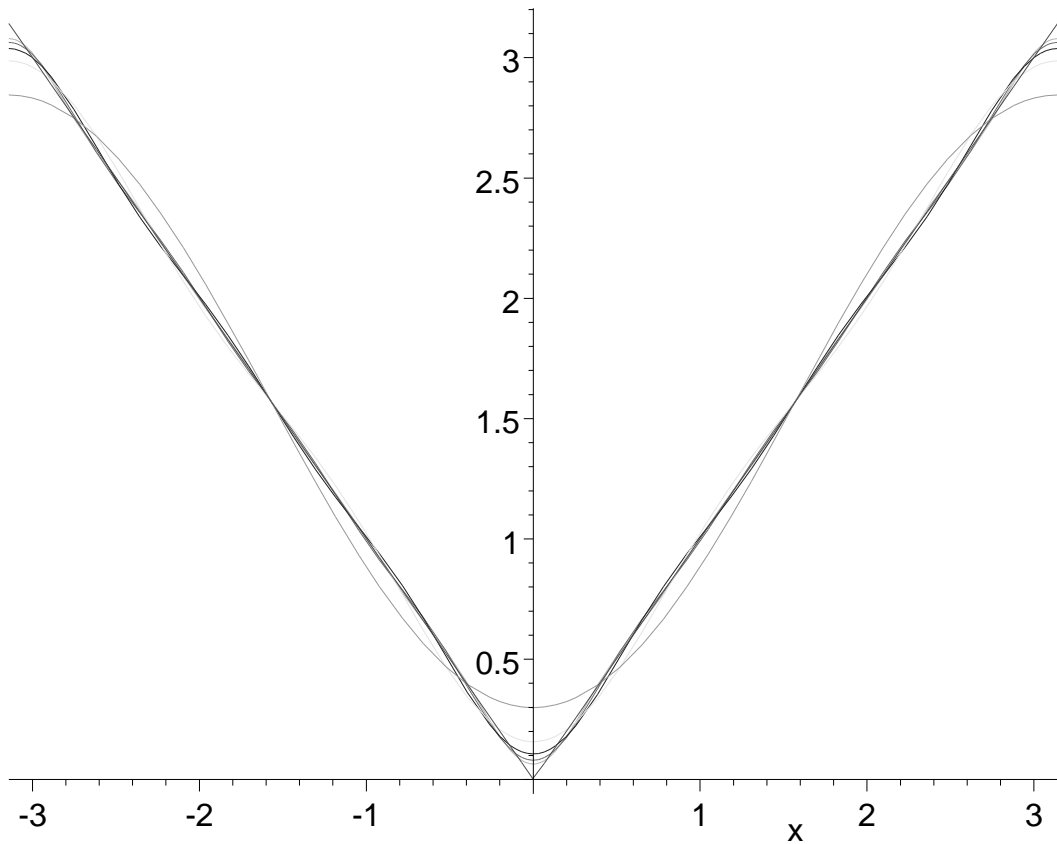
> fourier:=n->a(0)/2+sum(a(k)*cos(k*x)+b(k)*sin(k*x),k=1..n);

$$fourier := n \rightarrow \frac{1}{2} a(0) + \left(\sum_{k=1}^n (a(k) \cos(k x) + b(k) \sin(k x)) \right)$$

> fourier(3);

$$\frac{1}{2} \pi - 4 \frac{\cos(x)}{\pi} - \frac{4}{9} \frac{\cos(3 x)}{\pi}$$

> plot({f, seq(fourier(j), j=1..10)}, x=-Pi..Pi);



>

> f:=signum(x);

$f := \text{signum}(x)$

> a:=n->int(f*cos(n*x), x=-Pi..Pi)/Pi;

$$a := n \rightarrow \frac{\int_{-\pi}^{\pi} f \cos(n x) dx}{\pi}$$

>

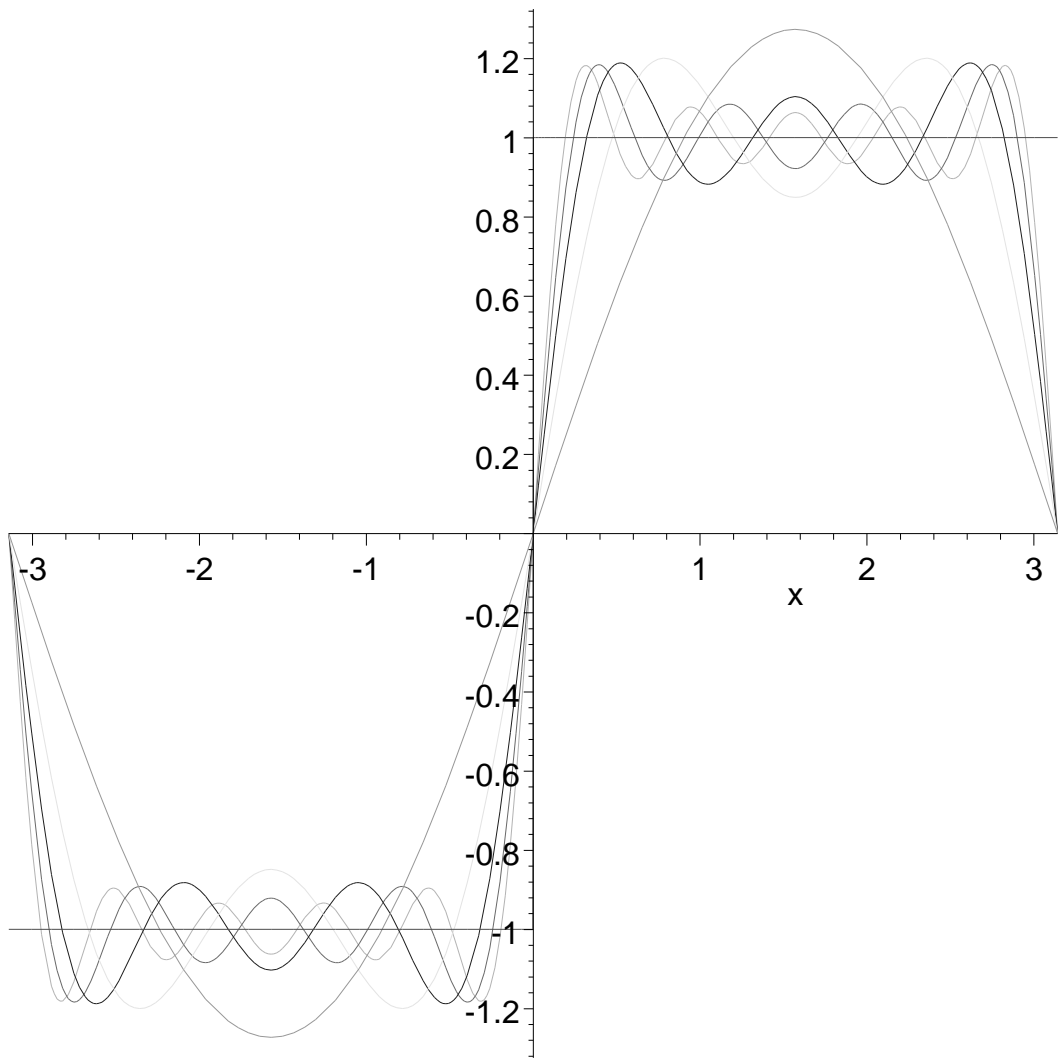
> b:=n->int(f*sin(n*x), x=-Pi..Pi)/Pi;

$$b := n \rightarrow \frac{\int_{-\pi}^{\pi} f \sin(n x) dx}{\pi}$$

```
> fourier:=n->a(0)/2+sum(a(k)*cos(k*x)+b(k)*sin(k*x),k=1..n);
```

$$fourier := n \rightarrow \frac{1}{2} a(0) + \left(\sum_{k=1}^n (a(k) \cos(k x) + b(k) \sin(k x)) \right)$$

```
> plot({f,seq(fourier(j),j=1..10)},x=-Pi..Pi)
;
```



[>