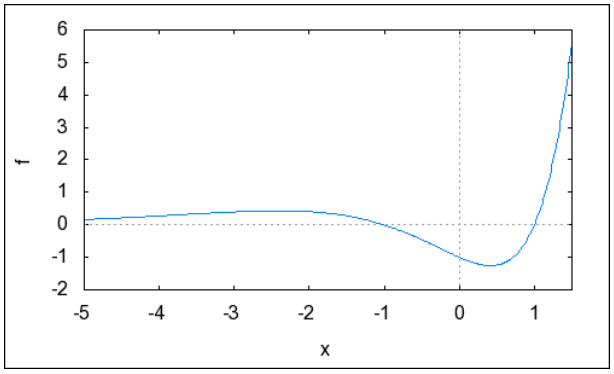
# Kurvendiskussion mit Maxima

```
(%i1)  f(x):=(x^2-1)*exp(x);
```
(%o1) $f(x) := \left(x^2-1\right)\exp(x)$

## 1 Graphische Darstellung

```
(%i2)  wxplot2d([f], [x,-5,1.5])$
```




## 2 Nullstellen

```
(%i3)  solve(f(x)=0, x);
```
(%o3) $[x=-1, x=1]$

## 3 Ableitungen

```
(%i4)  f1: diff(f(x),x,1);
       factor(f1);
```
(%o4) $\left(x^2-1\right)e^x+2\,x\,e^x$
(%o5) $\left(x^2+2\,x-1\right)e^x$

```
(%i6)  f2: diff(f(x),x,2);
       factor(f2);
```
(%o6) $\left(x^2-1\right)e^x+4\,x\,e^x+2\,e^x$
(%o7) $\left(x^2+4\,x+1\right)e^x$

```
(%i8)  f3: diff(f(x),x,3);
       factor(f3);
```
(%o8) $\left(x^2-1\right)e^x+6\,x\,e^x+6\,e^x$
(%o9) $(x+1)\,(x+5)\,e^x$

## 4 Lokale Extrema

```
(%i10) EW:solve(f1=0, x)$
       xE1:x,EW[1]; %,numer;
       xE2:x,EW[2]; %,numer;
```
(%o11) $-\sqrt{2}-1$
(%o12) $-2.414213562373095$
(%o13) $\sqrt{2}-1$
(%o14) 0.4142135623731

**Funktionswerte**

```
(%i15) f(xE1); f(xE1),numer;
```
(%o15) $\left(\left(-\sqrt{2}-1\right)^2-1\right)e^{-\sqrt{2}-1}$
(%o16) 0.43184316752297

```
(%i17) f(xE2); f(xE2),numer;
```
(%o17) $\left(\left(\sqrt{2}-1\right)^2-1\right)e^{\sqrt{2}-1}$
(%o18) $-1.253559564347306$

**Hinreichendes Kriterium**

```
(%i19) f2,x=xE1$ ratsimp(%);
       f2,x=xE2$ ratsimp(%);
```
(%o20) $-2^{\frac{3}{2}}\,e^{-\sqrt{2}-1}$
(%o22) $2^{\frac{3}{2}}\,e^{\sqrt{2}-1}$

## 5 Wendestellen

```
(%i23) WS:solve(f2=0, x)$
       xW1:x,WS[1];  %,numer;
       xW2:x,WS[2];  %,numer;
```
(%o24) $-\sqrt{3}-2$
(%o25) $-3.732050807568877$
(%o26) $\sqrt{3}-2$
(%o27) $-0.26794919243112$

**Funktionswerte**

```
(%i28) f(xW1); f(xW1),numer;
```
(%o28) $\left(\left(-\sqrt{3}-2\right)^2-1\right)e^{-\sqrt{3}-2}$
(%o29) 0.30954878138665

```
(%i30) f(xW2); f(xW2),numer;
```
(%o30) $\left(\left(\sqrt{3}-2\right)^2-1\right)e^{\sqrt{3}-2}$
(%o31) $-0.71002594705834$

**Hinreichendes Kriterium**

```
(%i32) f3,x=xW1$ ratsimp(%);
       f3,x=xW2$ ratsimp(%);
```
(%o33) $-2\sqrt{3}\,e^{-\sqrt{3}-2}$
(%o35) $2\sqrt{3}\,e^{\sqrt{3}-2}$

## 6 Verhalten im Unendlichen

```
(%i36) limit(f(x),x,-inf);
       limit(f(x),x,inf);
```
(%o36) 0
(%o37) $\infty$