Lösungen

1

a

```
D[ a4 x^4 + 2 x^3+ a2 x^2 + 5 x - 6, x]
```

$$5 + 2\,a2\,x + 6\,x^2 + 4\,a4\,x^3$$

b

```
D[Cos[x]-E^x+1/x,x]
```

$$-e^x - \frac{1}{x^2} - \text{Sin}[x]$$

c

```
D[Sin[x] Sqrt[x]-Log[Pi x],x]
```

$$-\frac{1}{x} + \sqrt{x}\,\text{Cos}[x] + \frac{\text{Sin}[x]}{2\sqrt{x}}$$

d

```
D[Sin[x] E^(-x)-x/Log[x],x]
```

$$e^{-x}\,\text{Cos}[x] + \frac{1}{\text{Log}[x]^2} - \frac{1}{\text{Log}[x]} - e^{-x}\,\text{Sin}[x]$$

e

```
D[Cos[2+ E^x] - E^(-x^2),x]
```

$$2\,e^{-x^2}\,x - e^x\,\text{Sin}[2 + e^x]$$

f

```
D[x^x,x]
```

$$x^x\,(1 + \text{Log}[x])$$

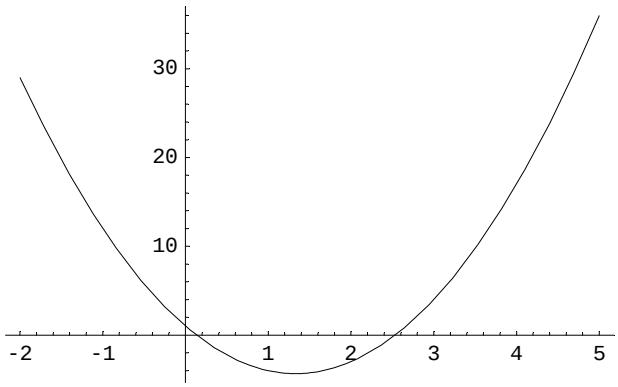
```
D[E^(Log[x] x),x]
```

$$x^x\ (1 + \text{Log}[x])$$

2

a

```
Plot[ 3 x^2 - 4 2 x + 1,{x,-2,5}];
```



b

```
sol1=Solve[3x^2-4 α x+1==0,{x}]//Flatten
```

$$\left\{x \to \frac{1}{3}\left(2\,\alpha - \sqrt{-3 + 4\,\alpha^2}\right),\ x \to \frac{1}{3}\left(2\,\alpha + \sqrt{-3 + 4\,\alpha^2}\right)\right\}$$

```
x1=x/.sol1[[1]]
```

$$\frac{1}{3}\left(2\,\alpha - \sqrt{-3 + 4\,\alpha^2}\right)$$

```
x2=x/.sol1[[2]]
```

$$\frac{1}{3}\left(2\,\alpha + \sqrt{-3 + 4\,\alpha^2}\right)$$

```
D[3 x^2-4 α x+1,x]==1
```

$$6\,x - 4\,\alpha == 1$$

```
q1=Evaluate[D[3 x^2-4 α x+1,x]==1/.x->x1]//Simplify
```

$$-2\sqrt{-3 + 4\,\alpha^2} == 1$$

```
q2=Evaluate[D[3 x^2-4 α x+1,x]==1/.x->x2]//Simplify
```

$$2\sqrt{-3 + 4\,\alpha^2} == 1$$

```
Solve[q2,{α}]
```

$$\left\{\left\{\alpha \to -\frac{\sqrt{13}}{4}\right\},\ \left\{\alpha \to \frac{\sqrt{13}}{4}\right\}\right\}$$

```
N[%]
```

$$\{\{\alpha \to -0.901388\}, \{\alpha \to 0.901388\}\}$$

c

```
D[x (3 x^2-4 α x+1),{x,2}]
```

$$6x + 2(6x - 4\alpha)$$

```
gleich = (D[x (3 x^2-4 α x+1),{x,2}]==0/.x->1/2)  //Simplify
```

$$8\alpha == 9$$

```
Solve[Evaluate[gleich],{α}]//Flatten
```

$$\left\{\alpha \to \frac{9}{8}\right\}$$

```
N[%]
```

$$\{\alpha \to 1.125\}$$

3

a

```
Limit[1/Sin[x]-1/x,x->0]
```

$$0$$

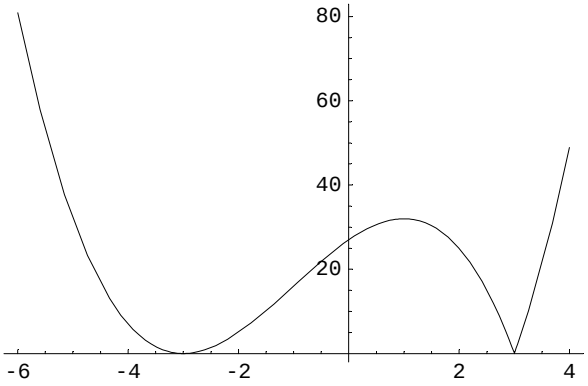
b

```
Limit[(x-1)(Log[x-1])+(x^2-1)/(x^3-1),x->1]
```

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

4

```
Plot[Abs[(x^2-9)(x+3)],{x,-6,4}];
```



Extrema bei Nullstellen sowie dort wo die Ableitung Null ist. Ebenso am Rande (ablesbar am Intervall).

```
Solve[(x^2-9)(x+3)==0,{x}]//Flatten
```

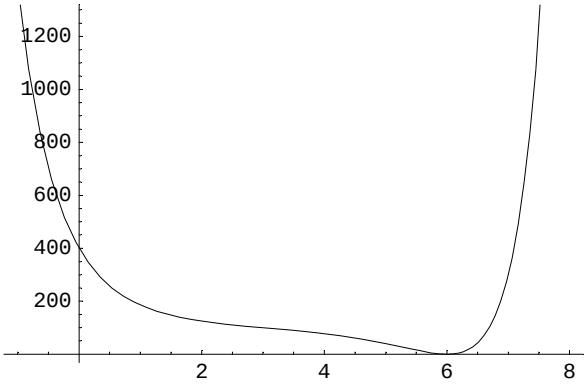
```
{x → -3, x → -3, x → 3}
```

```
Solve[Evaluate[D[(x^2-9)(x+3),x]==0],{x}]//Flatten
```

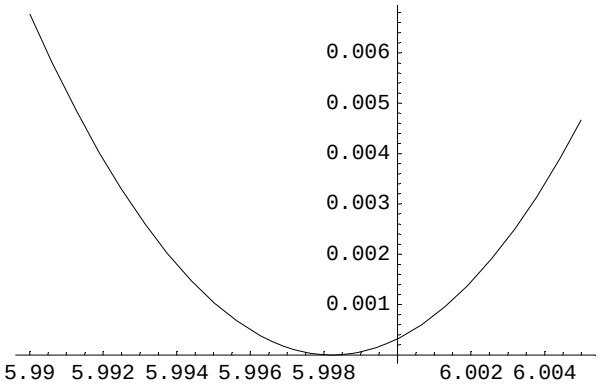
```
{x → -3, x → 1}
```

5

```
Plot[(Sinh[x-3]-10)^2,{x,-1,8}];
```



```
Plot[(Sinh[x-3]-10)^2,{x,5.99,6.005}];
```




```
D[(Sinh[x-3]-10)^2,x]
```

```
2 Cosh[3 - x] (-10 - Sinh[3 - x])
```

```
Solve[Evaluate[D[(Sinh[x-3]-10)^2,x]==0],{x}]//Flatten//N
```

```
{x → 3. - 1.5708 i, x → 3. + 1.5708 i, x → 0.00177705 + 3.14159 i, x → 5.99822}
```

Extrema: Gültiger Wert: x 5.99822. Ebenso Randestrema (ablesbar am Intervall).

Exakte Rechnung (Achtung, sehr grosser Output!):

```
(* Exakte Rechnung (Achtung, sehr grosser Output!): *)
Solve[Evaluate[D[(Sinh[x-3]-10)^2,x]==0],{x}]//Flatten//N
```

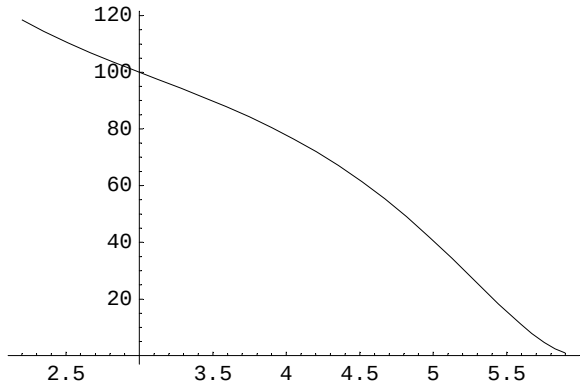
```
D[(Sinh[x-3]-10)^2,{x,2}]
```

```
2 Cosh[3 - x]^2 - 2 (-10 - Sinh[3 - x]) Sinh[3 - x]
```

```
Solve[Evaluate[D[(Sinh[x-3]-10)^2,{x,2}]==0],{x}]//Flatten//N//Chop
```

```
{x → 0.707781 - 3.14159 i, x → 3.10191, x → 2.89809 + 3.14159 i, x → 5.29222}
```

```
Plot[(Sinh[x-3]-10)^2,{x, 2.2, 5.9}];
```



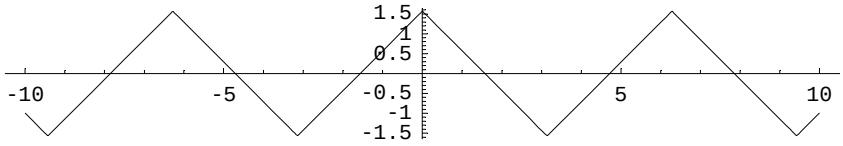
Wendepunkte: x 3.10191, x 5.29222

Exakte Rechnung (Achtung, sehr grosser Output!):

```
(* Exakte Rechnung (Achtung, sehr grosser Output!): *)
Solve[Evaluate[D[(Sinh[x-3]-10)^2,{x,2}]==0],{x}]//Flatten
```

6

```
Plot[ArcSin[Cos[x]], {x, -10, 10}, AspectRatio → Automatic];
```




```
Plot[Evaluate[D[ArcSin[Cos[x]], x]], {x, -10, 10}, AspectRatio → Automatic];
```