Dies ist eine kleine Demonstration dessen, was *Mathematica* kann.

```
(* 1. beliebig genaue Darstellung der Kreiszahl  π  ,
hier auf 200 Stellen:  *)
```

```
N[Pi, 200]
```

```
3.14159265358979323846264338327950288419716939937510582097494459230781640628620\
 89986280348253421170679821480865132823066470938446095505822317253594081284811\
 1174502841027019385211055596446229489549303820
```

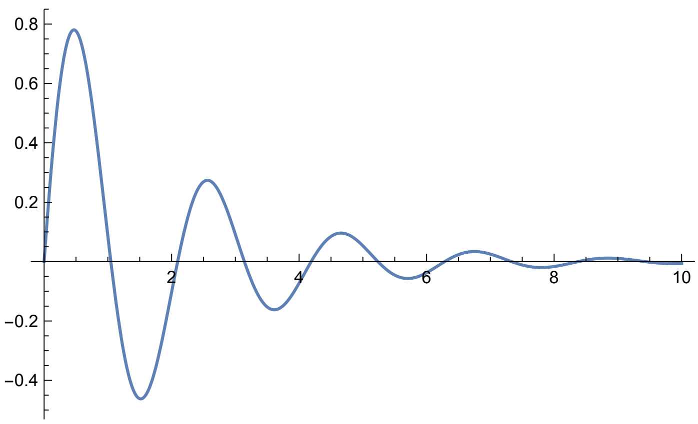
```
(* 2. Darstellung sehr großer ganzer Zahlen, hier die Fakultät von 100 : *)
```

```
100 !
```

```
93 326 215 443 944 152 681 699 238 856 266 700 490 715 968 264 381 621 468 592 963 895 217 \
 599 993 229 915 608 941 463 976 156 518 286 253 697 920 827 223 758 251 185 210 916 864 000 \
 000 000 000 000 000 000 000
```

```
(* 3. Graphische Darstellung von Funktionen, hier eine gedämpfte Schwingung *)
```

```
Plot[Exp[-0.5 x] Sin[3 x], {x, 0, 10}, PlotRange → All]
```




```
(* 4. Lösen einer quadratischen Gleichung;
      anschließend numerische Werte & Probe durch Zeichnung: *)
```

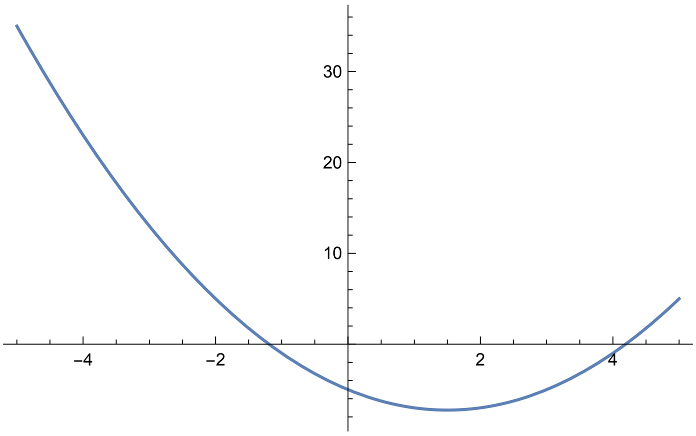
```
Solve[x^2 - 3 x - 5 == 0]
```

$$\left\{\left\{x \to \frac{1}{2}\left(3-\sqrt{29}\right)\right\}, \left\{x \to \frac{1}{2}\left(3+\sqrt{29}\right)\right\}\right\}$$

```
% // N
```

```
{{x → -1.19258}, {x → 4.19258}}
```

```
Plot[x^2 - 3 x - 5, {x, -5, 5}]
```




```
(* Gleichungen höheren Grades, hier mit komplexen Lösungen: *)

ls = Solve[x^4 + 8 x - 9 == 0]
```

$$\left\{\{x \to 1\}, \left\{x \to -\frac{1}{3} - \left(\left(1 + i\sqrt{3}\right)\left(-59 + 9\sqrt{43}\right)^{1/3}\right) \Big/ \left(3 \times 2^{2/3}\right) + \frac{1 - i\sqrt{3}}{3\left(2\left(-59 + 9\sqrt{43}\right)\right)^{1/3}}\right\},\right.$$

$$\left\{x \to -\frac{1}{3} - \left(\left(1 - i\sqrt{3}\right)\left(-59 + 9\sqrt{43}\right)^{1/3}\right) \Big/ \left(3 \times 2^{2/3}\right) + \frac{1 + i\sqrt{3}}{3\left(2\left(-59 + 9\sqrt{43}\right)\right)^{1/3}}\right\},$$

$$\left.\left\{x \to \frac{1}{3}\left(-1 - \frac{2^{2/3}}{\left(-59 + 9\sqrt{43}\right)^{1/3}} + \left(2\left(-59 + 9\sqrt{43}\right)\right)^{1/3}\right)\right\}\right\}$$

```
ls // N
```

$\{\{x \to 1.\}, \{x \to 0.642737 - 1.87745\, i\}, \{x \to 0.642737 + 1.87745\, i\}, \{x \to -2.28547\}\}$

```
ls = Solve[x^5 + 8 x - 9 == 0]
```

$$\Big\{\{x\to 1\},\ \Big\{x\to -\frac{1}{4}+\frac{1}{4}\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}-\frac{1}{2}\sqrt{\left(-\frac{5}{6}-106\Big/\left(3\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}\right)-\frac{1}{3}\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}-5\Big/\left(2\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}\right)\right)}\Big\},$$

$$\Big\{x\to -\frac{1}{4}+\frac{1}{4}\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}+\frac{1}{2}\sqrt{\left(-\frac{5}{6}-106\Big/\left(3\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}\right)-\frac{1}{3}\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}-5\Big/\left(2\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}\right)\right)}\Big\},$$

$$\Big\{x\to -\frac{1}{4}-\frac{1}{4}\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}-\frac{1}{2}\sqrt{\left(-\frac{5}{6}-106\Big/\left(3\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}\right)-\frac{1}{3}\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+5\Big/\left(2\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}\right)\right)}\Big\},$$

$$\Big\{x\to -\frac{1}{4}-\frac{1}{4}\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}+\frac{1}{2}\sqrt{\left(-\frac{5}{6}-106\Big/\left(3\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}\right)-\frac{1}{3}\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+5\Big/\left(2\sqrt{\left(\frac{1}{3}\left(-5+424\Big/\left(\frac{1}{2}\left(-385+3\,i\sqrt{512871}\right)\right)^{1/3}+2\times 2^{2/3}\left(-385+3\,i\sqrt{512871}\right)^{1/3}\right)\right)}\right)\right)}\Big\}\Big\}$$

```
ls // N
```

$\{\{x\to 1.\},\ \{x\to 0.902651-1.33291\,i\},\ \{x\to 0.902651+1.33291\,i\},$
$\{x\to -1.40265-1.22701\,i\},\ \{x\to -1.40265+1.22701\,i\}\}$

```
(* auch "harte Nüsse" werden geknackt: *)
```

```
ls = Solve[x^5 + 8 x - 7 == 0]
```

$\{\{x \to \text{Root}[-7 + 8 \#1 + \#1^5 \&, 1]\}, \{x \to \text{Root}[-7 + 8 \#1 + \#1^5 \&, 2]\}, \{x \to \text{Root}[-7 + 8 \#1 + \#1^5 \&, 3]\}, \{x \to \text{Root}[-7 + 8 \#1 + \#1^5 \&, 4]\}, \{x \to \text{Root}[-7 + 8 \#1 + \#1^5 \&, 5]\}\}$

```
ls // N
```

$\{\{x \to 0.826726\}, \{x \to -1.36453 - 1.21571\, i\}, \{x \to -1.36453 + 1.21571\, i\}, \{x \to 0.951165 - 1.27689\, i\}, \{x \to 0.951165 + 1.27689\, i\}\}$

```
(* 5. Vereinfachen eines Ausdrucks *)

ausdruck = (u + v - (u^2 + v^2) / (u + v - u * v / (u + v))) * (u^3 - v^3) / (u^2 - v^2)
```

$$\frac{\left(u^3 - v^3\right)\left(u + v - \frac{u^2+v^2}{u+v-\frac{u\,v}{u+v}}\right)}{u^2 - v^2}$$

```
Simplify[ausdruck]
```

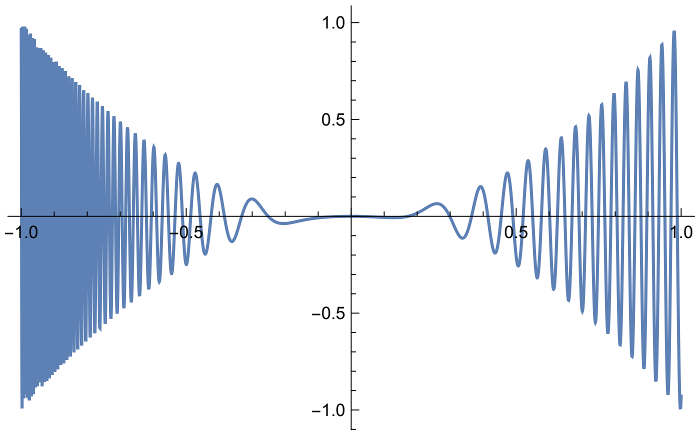
$u\,v$

```
(* 6. Berechnung der Ableitung einer Funktion *)

f[x_] = x^2 * Sin[Exp[-x^3 + 5]]
```

$x^2 \,\text{Sin}\left[e^{5-x^3}\right]$

```
Plot[f[x], {x, -1, 1}]
```




```
f'[x]
```

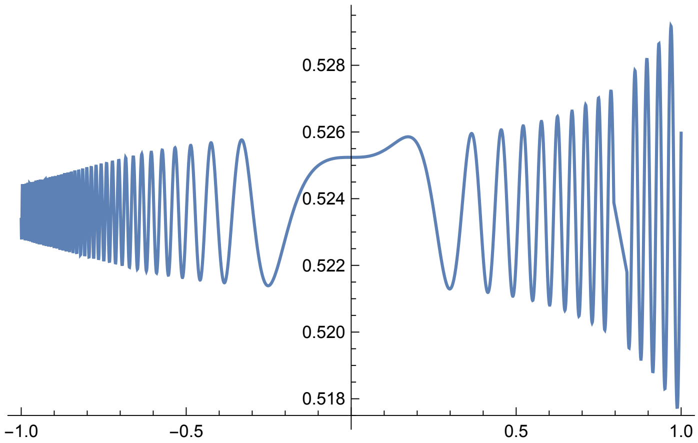
$-3\, e^{5-x^3} x^4 \,\text{Cos}\left[e^{5-x^3}\right] + 2\, x \,\text{Sin}\left[e^{5-x^3}\right]$

```
(* 7. Integration dieser Funktion *)
```

$\int \mathbf{f[x]}\, \mathbb{d}\mathbf{x}$

$-\frac{1}{3}\,\texttt{SinIntegral}\left[e^{5-x^3}\right]$

$\mathbf{Plot}\left[\frac{1}{3}\,\mathbf{SinIntegral}\left[e^{5-x^3}\right],\ \{x,\ -1,\ 1\}\right]$




```
(* 8. Lösen einer Differentialgleichung *)
DSolve[{ y'[x] - 5 y[x] == 0 , y[0] == 2 } , y[x], x]
```

$\{\{y[x] \to 2\, e^{5\,x}\}\}$