lektion1

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1 Lektion 1

```
In [7]: from sympy import *
        init_printing()
```

1.1 Einfache Arithmetik

```
In [8]: 2+2
```

Out[8]:

4

```
In [9]: 2*3
```

Out[9]:

6

```
In [10]: 2**3
```

Out[10]:

8

```
In [11]: 1/3
```

Out[11]:

0.3333333333333333

```
In [12]: 1/0
```

```
---------------------------------------------------------------------------
ZeroDivisionError                         Traceback (most recent call last)
<ipython-input-12-9e1622b385b6> in <module>()
----> 1 1/0

ZeroDivisionError: division by zero
```

1.2 Gleitkommazahlen Rechnen mit vielen Nachkommastellen

```
In [13]: 3*(1/3)
```

Out[13]:

$$1.0$$

```
In [14]: 3**100 * (1/3)**100
```

Out[14]:

$$0.9999999999999944$$

```
In [15]: drittel = Rational(1,3)  # rationale Zahl
         drittel
```

Out[15]:

$$\frac{1}{3}$$

```
In [16]: 3**100 * drittel**100
```

Out[16]:

$$1$$

```
In [17]: 3**100
```

Out[17]:

$$515377520732011331036461129765621272702107522001$$

```
In [18]: (1/3)**1000
```

Out[18]:

$$0.0$$

In [19]: (1/3)**1000 * 3**1000

```
---------------------------------------------------------------------------
OverflowError                             Traceback (most recent call last)

<ipython-input-19-25b92f497fe9> in <module>()
----> 1 (1/3)**1000 * 3**1000


OverflowError: int too large to convert to float
```

In [20]: pi

Out[20]:

$$\pi$$

In [21]: N(pi,200)

Out[21]:

3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706

In [22]: print(N(pi,200))

```
3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211
```

In [23]: N(1/3,100)

Out[23]:

$$0.33333333333333333148296162562473909929394721984863281 25$$

In [24]: N(Rational(1,3),200)

Out[24]:

0.33333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333

In [25]: N(Rational(1,3),200)**1000 * 3**1000

Out[25]:

1.00000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

1.3 Sympifizierung

```
In [26]: 3
```

Out[26]:

$$3$$

```
In [27]: S(3)
```

Out[27]:

$$3$$

```
In [28]: type(3)
```

```
Out[28]: int
```

```
In [29]: type(S(3))
```

```
Out[29]: sympy.core.numbers.Integer
```

```
In [30]: type(S(1)/3)
```

```
Out[30]: sympy.core.numbers.Rational
```

```
In [31]: x = S('x')
```

```
In [32]: type(x)
```

```
Out[32]: sympy.core.symbol.Symbol
```

```
In [33]: y = S('y')
         y
```

Out[33]:

$$y$$

```
In [34]: f = (x+y)**2
         f
```

Out[34]:

$$(x+y)^2$$

```
In [35]: x = 5
```

```
In [36]: f
```

Out[36]:

$$(x+y)^2$$

In [37]: x

Out[37]:

$$5$$

In [38]: f.atoms()

Out[38]:

$$\{2, x, y\}$$

1.4 Einfache Funktionen

In [39]: sqrt(81)

Out[39]:

$$9$$

In [40]: sqrt(-81)

Out[40]:

$$9i$$

In [41]: sqrt(234.)

Out[41]:

$$15.2970585407784$$

In [42]: sqrt(9*y**2)

Out[42]:

$$3\sqrt{y^2}$$

In [43]: factorial(5)

Out[43]:

$$120$$

In [44]: factorial(170)

Out[44]:

$$725741561530799896739672821112926311471699168129645137654357779890056184340170615785235074924261745$$

In [45]: sin(pi)

Out[45]:

$$0$$

In [46]: cos(pi)

Out[46]:

$$-1$$

In [47]: tan(pi/2)

Out[47]:

$$\tilde{\infty}$$

In [48]: print(tan(pi/2))

```
zoo
```

In [49]: ?zoo

In [50]: alpha = Symbol('alpha')
alpha

Out[50]:

$$\alpha$$

In [51]: exp(1)

Out[51]:

$$e$$

In [52]: log(exp(1))

Out[52]:

$$1$$

In [53]: abs(-1)

Out[53]:

$$1$$

$$6$$

1.5 Vereinfachungen

```
In [54]: x = Symbol("x")
         x
```

Out[54]:

$$x$$

```
In [55]: y = Symbol("y")
         y
```

Out[55]:

$$y$$

```
In [56]: f = (x-y)*(x+y)
         f
```

Out[56]:

$$(x-y)\,(x+y)$$

```
In [57]: f.expand()
```

Out[57]:

$$x^2 - y^2$$

```
In [58]: expand(f)
```

Out[58]:

$$x^2 - y^2$$

```
In [59]: f.expand().factor()
```

Out[59]:

$$(x-y)\,(x+y)$$

```
In [60]: g = (x**2 -y**2)/(x-y)
         g
```

Out[60]:

$$\frac{x^2 - y^2}{x - y}$$

```
In [61]: g.ratsimp()
```

Out[61]:

$$x + y$$

In [62]:
```
g.simplify()
```

Out[62]:

$$x + y$$

In [63]:
```
h = x*x**y
h
```

Out[63]:

$$xx^{y}$$

In [64]:
```
h.powsimp()
```

Out[64]:

$$x^{y+1}$$

In [65]:
```
h.powsimp().expand()
```

Out[65]:

$$xx^{y}$$

In [66]:
```
f = (sin(2*x)+cos(x))/ (( (sin(2*x)**2)-cos(x)**2) *(sin(2*x)-cos(x)))
f
```

Out[66]:

$$\frac{\sin(2x) + \cos(x)}{(\sin(2x) - \cos(x))\left(\sin^2(2x) - \cos^2(x)\right)}$$

In [67]:
```
f.simplify()
```

Out[67]:

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

In [68]:
```
f.trigsimp()
```

Out[68]:

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

```
In [69]: f.expand()
```

Out[69]:

$$\frac{\sin(2x)}{\sin^3(2x) - \sin^2(2x)\cos(x) - \sin(2x)\cos^2(x) + \cos^3(x)} + \frac{\cos(x)}{\sin^3(2x) - \sin^2(2x)\cos(x) - \sin(2x)\cos^2(x) + \cos^3}$$

```
In [70]: f.expand(numer=True,trig=True).factor()
```

Out[70]:

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

```
In [71]: f.expand(gibtsnicht=True)
```

Out[71]:

$$\frac{\sin(2x)}{\sin^3(2x) - \sin^2(2x)\cos(x) - \sin(2x)\cos^2(x) + \cos^3(x)} + \frac{\cos(x)}{\sin^3(2x) - \sin^2(2x)\cos(x) - \sin(2x)\cos^2(x) + \cos^3}$$