lektion1

October 10, 2019

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1 Lektion 1

[1]:
```
from sympy import *
init_printing()
```

1.1 Einfache Arithmetik

[2]:
```
2+2
```

[2]: 4

[3]:
```
2*3
```

[3]: 6

[4]:
```
2**3
```

[4]: 8

[5]:
```
1/3
```

[5]: 0.3333333333333333

[6]:
```
1/0
```

```
---------------------------------------------------------------------------

ZeroDivisionError                         Traceback (most recent call last)

<ipython-input-6-9e1622b385b6> in <module>
----> 1 1/0
```

```
ZeroDivisionError: division by zero
```

1.2 Gleitkommazahlen Rechnen mit vielen Nachkommastellen

[7]:
```
3*(1/3)
```

[7]: 1.0

[8]:
```
3**100 * (1/3)**100
```

[8]: 0.9999999999999944

[9]:
```
drittel = Rational(1,3)  # rationale Zahl
drittel
```

[9]: $\frac{1}{3}$

[10]:
```
3**100 * drittel**100
```

[10]: 1

[11]:
```
3**100
```

[11]: 515377520732011331036461129765621272702107522001

1.2.1 Achtung

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

[19]: 0.0

[20]:
```
(1/3)**1000 * 3**1000
```

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

<ipython-input-20-25b92f497fe9> in <module>
----> 1 (1/3)**1000 * 3**1000


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

1.2.2 Kreiszahl π

[21]:
```
pi
```

[21]: π

[22]:
```
N(pi,200) #200 Stellen von pi
```

[22]: 3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211

[23]:
```
print(N(pi,200))
```

```
3.1415926535897932384626433832795028841971693993751058209749445923078164062862089986280348253421170679821480865132823066470938446095505822317253594081284811174502841027019385211055596446229489549303820
```

1.2.3 `N` wandelt Zahlen in Kommazahlen um

[24]:
```python
N(1/3,100)   # was geht hier schief?
```

[24]: 0.333333333333333314829616256247390992939472198486328125

[25]:
```python
N(Rational(1,3),200)
```

[25]: 0.3333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333

[26]:
```python
N(Rational(1,3),200)**1000 * 3**1000
```

[26]: 1.0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000

1.3 Sympifizierung

[27]:
```python
3
```

[27]: 3

[28]:
```python
S(3)
```

[28]: 3

[29]:
```python
type(3)
```

[29]: `int`

[30]:
```python
type(S(3))
```

[30]: `sympy.core.numbers.Integer`

[31]:
```python
type(S(1)/3)
```

[31]: `sympy.core.numbers.Rational`

[32]:
```python
x = S('x')
```

[33]:
```python
type(x)
```

[33]: `sympy.core.symbol.Symbol`

[34]:
```python
y = S('y')
y
```

[34]: y

[35]:
```python
f = (x+y)**2
f
```

[35]: $(x+y)^2$

[36]:
```python
x = 5
```

[37]:
```python
f
```

[37]: $(x+y)^2$

[38]:
```
x
```

[38]: 5

[39]:
```
f.atoms()
```

[39]: $\{2, x, y\}$

1.4 Einfache Funktionen

[40]:
```
sqrt(81)
```

[40]: 9

[41]:
```
sqrt(-81)
```

[41]: $9i$

[42]:
```
sqrt(234.)
```

[42]: 15.2970585407784

[43]:
```
sqrt(9*y**2)
```

[43]: $3\sqrt{y^2}$

[44]:
```
factorial(5)
```

[44]: 120

[45]:
```
factorial(170)
```

[45]: $72574156153079989673967282111292631147169916812964513765435777989005618434017061578523507492426l$

[46]:
```
sin(pi)
```

[46]: 0

[47]:
```
cos(pi)
```

[47]: -1

[48]:
```
tan(pi/2)
```

[48]: $\tilde{\infty}$

[49]:
```
print(tan(pi/2))
```

```
zoo
```

[50]:
```
?zoo
```

[51]:
```
alpha = Symbol('alpha')
alpha
```

[51]: α

[52]:
```
exp(1)
```

[52]: e

[53]:
```
log(exp(1))
```

[53]: 1

[54]:
```
abs(-1)
```

[54]: 1

1.5 Vereinfachungen

[55]:
```
x = Symbol("x")
x
```

[55]: x

[56]:
```
y = Symbol("y")
y
```

[56]: y

[57]:
```
f = (x-y)*(x+y)
f
```

[57]: $(x-y)(x+y)$

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

[58]: $x^2 - y^2$

[59]:
```
expand(f)
```

[59]: $x^2 - y^2$

[60]:
```
f.expand().factor()
```

[60]: $(x-y)(x+y)$

[61]:
```
g = (x**2 -y**2)/(x-y)
g
```

[61]: $\frac{x^2 - y^2}{x - y}$

[62]:
```
g.ratsimp()
```

[62]: $x + y$

[63]:
```
g.simplify()
```

[63]: $x + y$

[64]:
```
h = x*x**y
h
```

[64]: xx^y

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

[65]: x^{y+1}

[66]:
```
h.powsimp().expand()
```

[66]: xx^y

[67]:
```
f = (sin(2*x)+cos(x))/ (( (sin(2*x)**2)-cos(x)**2) *(sin(2*x)-cos(x)))
f
```

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

[68]:
```
f.simplify()
```

[68]:
$$\frac{1}{\left(2\sin\left(x\right)-1\right)^{2}\cos^{2}\left(x\right)}$$

[69]:
```
f.trigsimp()
```

[69]:
$$\frac{1}{\left(2\sin\left(x\right)-1\right)^{2}\cos^{2}\left(x\right)}$$

[70]:
```
f.expand()
```

[70]:
$$\frac{\sin\left(2x\right)}{\sin^{3}\left(2x\right)-\sin^{2}\left(2x\right)\cos\left(x\right)-\sin\left(2x\right)\cos^{2}\left(x\right)+\cos^{3}\left(x\right)}+\frac{\cos\left(x\right)}{\sin^{3}\left(2x\right)-\sin^{2}\left(2x\right)\cos\left(x\right)-\sin\left(2x\right)\cos^{2}\left(x\right)+c}$$

[71]:
```
f.expand(numer=True,trig=True).factor()
```

[71]:
$$\frac{\left(2\sin\left(x\right)+1\right)\cos\left(x\right)}{\left(-\sin\left(2x\right)+\cos\left(x\right)\right)^{2}\left(\sin\left(2x\right)+\cos\left(x\right)\right)}$$

[72]:
```
f.expand(gibtsnicht=True)
```

[72]:
$$\frac{\sin\left(2x\right)}{\sin^{3}\left(2x\right)-\sin^{2}\left(2x\right)\cos\left(x\right)-\sin\left(2x\right)\cos^{2}\left(x\right)+\cos^{3}\left(x\right)}+\frac{\cos\left(x\right)}{\sin^{3}\left(2x\right)-\sin^{2}\left(2x\right)\cos\left(x\right)-\sin\left(2x\right)\cos^{2}\left(x\right)+c}$$