Complex Numbers

```
>>> from sympy import *
>>> I ** 2
-1
>>> x = Symbol('x')
>>> solve(x**2+1, x)
[-I, I]
```

$$I = \sqrt{-1}$$

$$x^2 = -1.$$

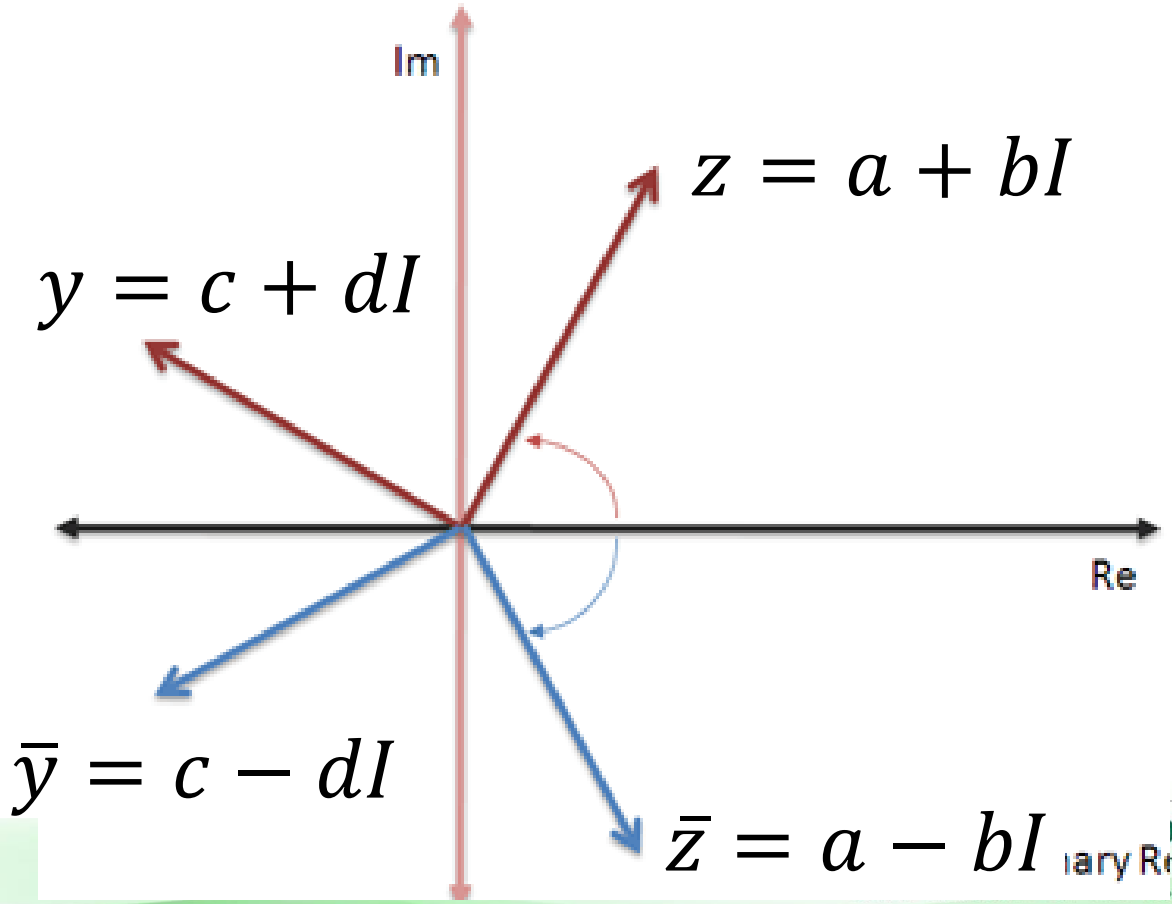
Complex Numbers

```
>>> z = 4 + 3*I
>>> z
4 + 3*I
>>> z = 4 + 3*i
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'i' is not defined
```

Complex Numbers

- For a complex numbe $z = a + bI$, the absolute value is defined as $|z| = \sqrt{a^2 + b^2}$, and the conjugate is defined as $\bar{z} = a - bI$

```
>>> z
4 + 3*I
>>> re(z)
4
>>> im(z)
3
>>> Abs(z)
5
>>> conjugate(z)
4 - 3*I
```



SymPy Variable Names

- You can use any name you want for a variable, but it's best to avoid the letters `E`, `I`, `O`, `P`, `S`, and `N` because they have special uses

SymPy Variable Names

- `E`: the base of the natural logarithm (sympy) and expectation (sympy.stats)
- `I`: the unit imaginary number
- `O`: big-O notation
- `P`(): probability
- `S`(): the sympify function
- `N`(): numeric approximations

Sympy Output in IDLE

- Sum

```
>>> expr = Sum(1/(x**2 + 2*x), (x, 1, 10))
>>> expr
  10
____
\
 \        1
  \    --------
  /      2
 /     x  + 2*x
/___,
x = 1
>>> expr.doit()
175
---
264
```

$$\frac{1}{1^2+2\cdot 1}+\frac{1}{2^2+2\cdot 2}+\ldots+\frac{1}{10^2+2\cdot 10}$$

Sympy Output in Jupyter Notebook

In [1]:

```
from sympy import *
init_printing(pretty_print=True)
x = Symbol('x')
expr = Sum(1/(x**2 + 2*x), (x, 1, 10))
expr
```

Out[1]:

$$\sum_{x=1}^{10} \frac{1}{x^2 + 2x}$$

In [2]:

```
expr.doit()
```

Out[2]:

$$\frac{175}{264}$$