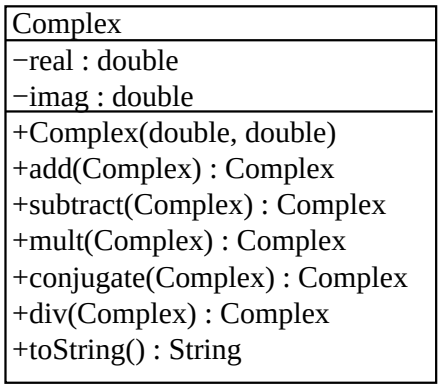
Exercise 4:

Summary: You implement a basic pocket calculator for complex numbers. It should be capable of adding, subtracting, multiplying and dividing complex numbers. It reads in the complex numbers and the mathematical operators from the console and prints the result on the console.

Task 1: Implement Complex (4 points)

Complex numbers are represented by instances of this class.

It has two instance variables. One double for the real part and one double for the imaginary part of the complex number, which are initialized in the constructor *Complex(double real, double imag).*



The instance method *Complex add(Complex arg)* adds *arg* to the number by adding up the real parts of both numbers and by adding up both imaginary parts. The result is returned.

The instance method *Complex subtract(Complex arg)* subtracts the real part of *arg* from the real part of the number and it subtracts the imaginary part of *arg* from the imaginary part of the number.

The instance method *mult(Complex arg)* multiplies *arg* to the number and returns the result. Two complex numbers $n_1 = x_1 + iy_1$ and $n_2 = x_2 + iy_2$ are multipled as $(x_1 + iy_1)(x_2 + iy_2) = x_1x_2 - y_1y_2 + i(x_2y_1 + x_1y_2)$. The result $n_{result} = n_1 * n_2 = x_{result} + iy_{result}$ is given by $x_{result} = x_1x_2 - y_1y_2$ and $y_{result} = x_2y_1 + x_1y_2$.

The instance method *Complex conjugate()* returns the complex conjugate of the number (the imaginary part is multipled with -1).

The instance method *div(Complex arg)* divides the number by *arg.* If you have two complex numbers n_1 and n_2, you compute the fraction n_1/n_2 by multiplying the numerator and the denominator by the complex conjugate n_2^* giving $(n_1n_2^*)/(n_2n_2^*)$. $c = n_2n_2^*$ is real-valued and we can divide the real part of $n_1n_2^*$ by c and do the same for the imaginary part.

toString() returns *real* + " + i * " + *imag*

Task 2: Implement Exercise (6 points) You type in a complex number in the console and it is copied to a complex variable after pressing return. Complex numbers are typed in as *sign 1* " " *real part* " " *sign 2* " " *imaginary number* " " *imaginary part*. After pressing return you type in the algebraic operation +, -, /, * or =. If you type "=" then your program should print the final value of the complex number to the console and stop. A second complex number is read in otherwise. Depending on the algebraic operator you add it (+), subtract it (-) or multiply it (*) to the first number or you divide the first number by it (/). You repeat this by reading in another mathematical operation and another complex number until you press "=". It is a good idea to print also the complex numbers and the complex numbers and the result of the operation to the console.

An example is:

```
- 1 + i 2
The number is : -1.0 + i * 2.0
+
+ 1 - i 1
The number is : 1.0 + i * -1.0
The result is : 0.0 + i * 1.0
-
+ 1 + i 1
The number is : 1.0 + i * 1.0
The result is : -1.0 + i * 0.0
*
+ 0 + i 1
The number is : 0.0 + i * 1.0
The result is : -0.0 + i * -1.0
/
+ 7 - i 2
The number is : 7.0 + i * -2.0
The result is : 0.03773584905660377 + i * -0.1320754716981132
=
The result is : 0.03773584905660377 + i * -0.1320754716981132
```