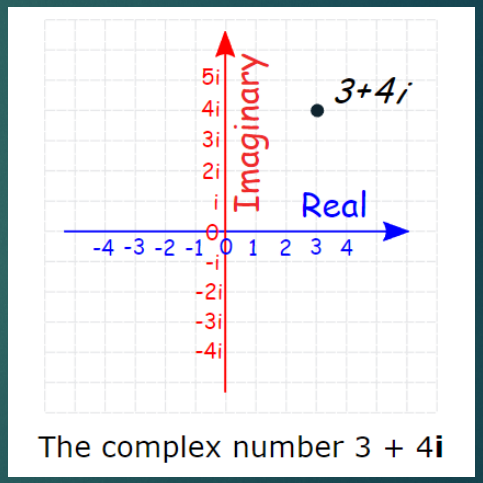
Homework 001

COMPLEX IS NOT COMPLICATED ☺

Complex Number

- A Complex Number is a combination of a **Real Number (a)** and an **Imaginary Number(b*i*)**
  - a + b*i*, where $i = \sqrt{-1}$

https://www.mathsisfun.com/numbers/complex-numbers.html



The complex number 3 + 4**i**

Complex Number

- We could + - * / 2 Complex Number
- To add two complex numbers we add each part separately:

$$(a+bi) + (c+di) = (a+c) + (b+d)i$$

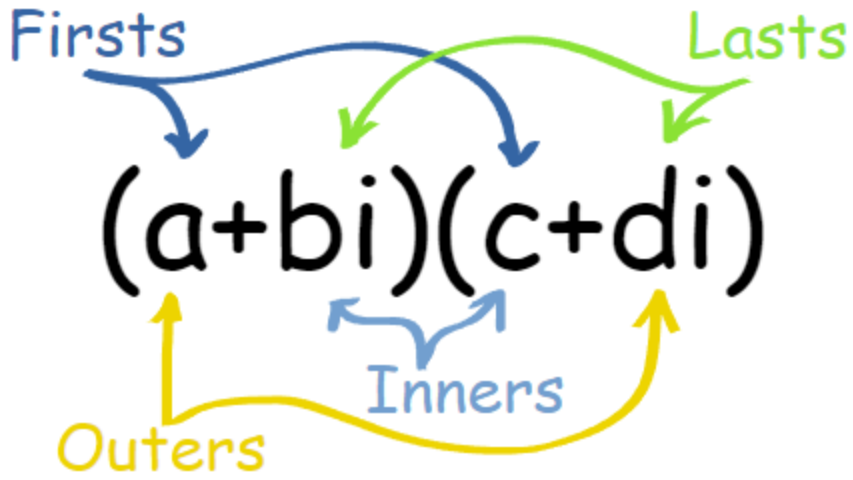
Example: add the complex numbers **3 + 2*i*** and **1 + 7*i***

- add the real numbers, and
- add the imaginary numbers:

$$(3 + 2i) + (1 + 7i)$$
$$= 3 + 1 + (2 + 7)i$$
$$= (4 + 9i)$$

Complex Number

- To multiply complex numbers: **Each part of the first complex number** gets multiplied by **each part of the second complex number**

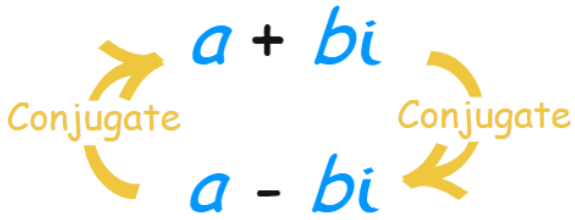


- Firsts: **a × c**
- Outers: **a × d*i***
- Inners: **b*i* × c**
- Lasts: **b*i* × d*i***

$$(a+bi)(c+di) = ac + adi + bci + bdi^2$$

Complex Number

- A conjugate is where we change the sign in the middle like this:



A conjugate is often written with a bar over it:

Example:

$$\overline{5 - 3\mathbf{i}} = 5 + 3\mathbf{i}$$

Complex Number

- The conjugate is used to help complex division.
- The trick is to **multiply both top and bottom** by the **conjugate of the bottom**.

Example: Do this Division:

$$\frac{2 + 3\mathbf{i}}{4 - 5\mathbf{i}}$$

Multiply top and bottom by the conjugate of $4 - 5\mathbf{i}$:

$$\frac{2 + 3\mathbf{i}}{4 - 5\mathbf{i}} \times \frac{4 + 5\mathbf{i}}{4 + 5\mathbf{i}} = \frac{8 + 10\mathbf{i} + 12\mathbf{i} + 15\mathbf{i}^2}{16 + 20\mathbf{i} - 20\mathbf{i} - 25\mathbf{i}^2}$$

Now remember that $\mathbf{i}^2 = -1$, so:

$$= \frac{8 + 10\mathbf{i} + 12\mathbf{i} - 15}{16 + 20\mathbf{i} - 20\mathbf{i} + 25}$$

Add Like Terms (and notice how on the bottom $20\mathbf{i} - 20\mathbf{i}$ cancels out!):

$$\frac{2 + 3\mathbf{i}}{4 - 5\mathbf{i}}$$

Multiply top and bottom by the conjugate of $4 - 5\mathbf{i}$:

$$\frac{2 + 3\mathbf{i}}{4 - 5\mathbf{i}} \times \frac{4 + 5\mathbf{i}}{4 + 5\mathbf{i}} = \frac{8 + 10\mathbf{i} + 12\mathbf{i} + 15\mathbf{i}^2}{16 + 20\mathbf{i} - 20\mathbf{i} - 25\mathbf{i}^2}$$

Now remember that $\mathbf{i}^2 = -1$, so:

$$= \frac{8 + 10\mathbf{i} + 12\mathbf{i} - 15}{16 + 20\mathbf{i} - 20\mathbf{i} + 25}$$

Add Like Terms (and notice how on the bottom $20\mathbf{i} - 20\mathbf{i}$ cancels out!):

$$= \frac{-7 + 22\mathbf{i}}{41}$$

We should then put the answer back into $a + b\mathbf{i}$ form:

$$= \frac{-7}{41} + \frac{22}{41}\mathbf{i}$$

DONE!

Notes/Reference

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- 106hw1_complex.pptx
  - This slides
- 106hw1_main.cpp
  - Driver program
- Complex Numbers (notes).pdf
  - A reference document of using complex number
- https://www.symbolab.com/solver/complex-numbers-calculator/
  - A online calculator of complex number

The requirements

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- Please design your own class **NComplex** to fulfill all challenge in the driver program (106hw1_main.cpp).
- Include:
  - Constructor and Data structure
  - Set/Get a complex number, include set(), getREAL(), getIMAGINARY()
  - add(const NComplex &right), minus(…), multiply(…), divide(…) and conjugate().
  - Please check the driver program for more detail

The requirements

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- Make sure the code could be compile with TA's driver program.
  - If we can't compile your code, you get **0** point too.
- Please use s1234567_NComplex.h and s1234567_NComplex.cpp as your file names.
  - Replace s1234567 by your own student ID.
  - And upload **ONLY** these 2 files.
  - If you try to upload another files (for example *.sln or others), you get **0** point.