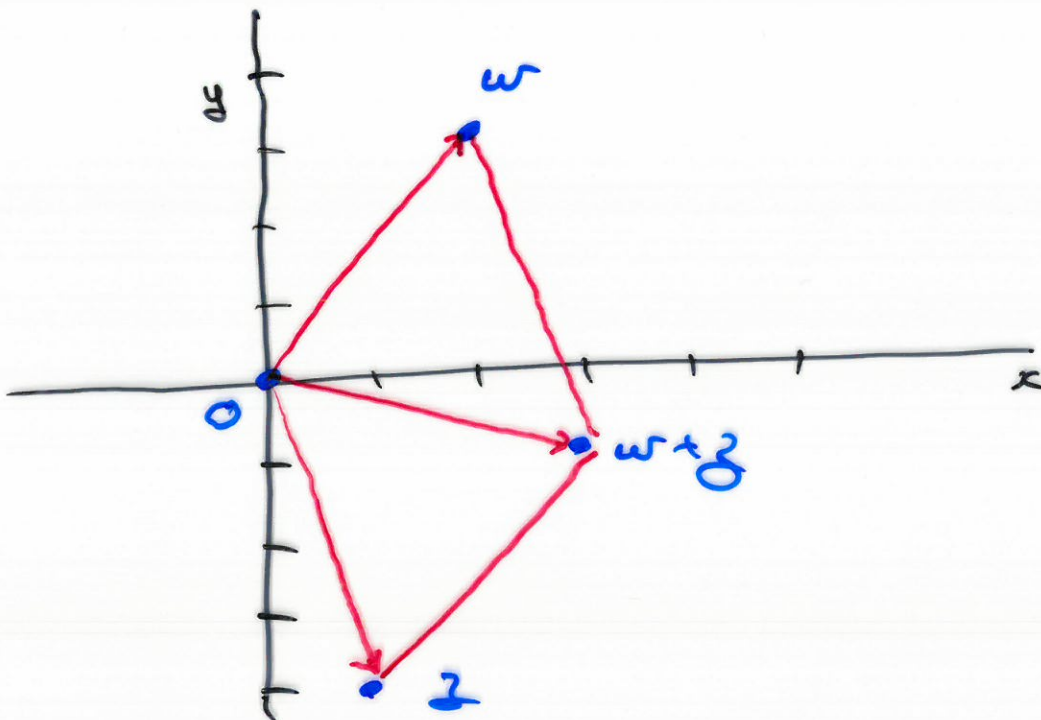


Division of complex numbers

$$\begin{aligned}\frac{2+3i}{1-4i} &= \frac{(2+3i)(1+4i)}{(1-4i)(1+4i)} \\&= \frac{2+12i+3i+12i^2}{1+4i-4i-16i^2} \\&= \frac{-10+15i}{17} \\&= -\frac{10}{17} + i\frac{15}{17}\end{aligned}$$

Graphical representation of addition

$$\underbrace{(2+3i)}_w + \underbrace{(1-4i)}_z = \underbrace{3-i}_{w+z}$$



The numbers $0, z, w, z+w$ are the vertices of a parallelogram. The arrow $0 \rightarrow w+z$ is the diagonal of the parallelogram.

Modulus & argument

For $z = x + iy$ we define the Modulus to be

$$|z| = \sqrt{x^2 + y^2}$$

Problem For $z = 4 - 3i$ find $|z|$.

Solⁿ

$$|z| = \sqrt{4^2 + (-3)^2} = \sqrt{25} = 5.$$

Problem For $z = \frac{1+i}{1-i}$ find $|z|$.

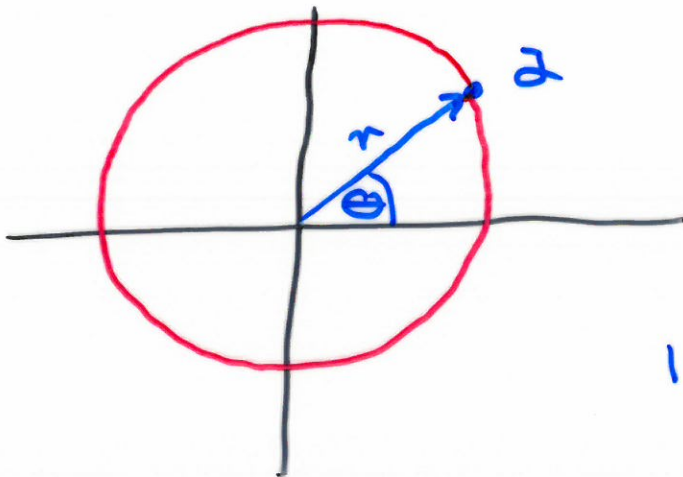
Soln $z = \frac{(1+i)(1+i)}{(1-i)(1+i)}$

$$= \frac{1+2i+i^2}{1-i^2}$$

$$= \frac{2i}{2}$$

$$= i$$

So $|z| = \sqrt{0^2+1^2} = 1$



$|z| =$ length of
ray from 0
to z
 $= r$.

Defn The argument of $z = x+iy$ is

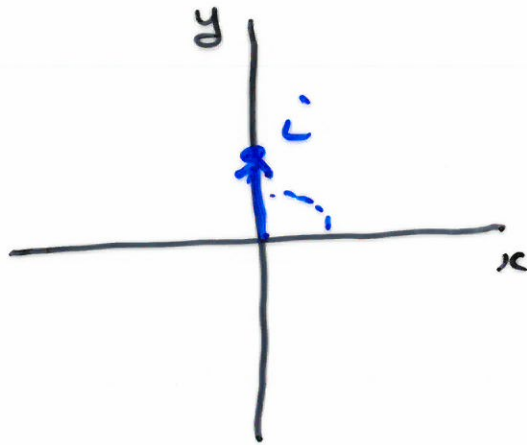
$$\text{Arg}(z) = \theta$$

where θ is the angle between real axis and the ray from 0 to z .

Problem

For $z = i$ determine $\text{Arg}(z)$.

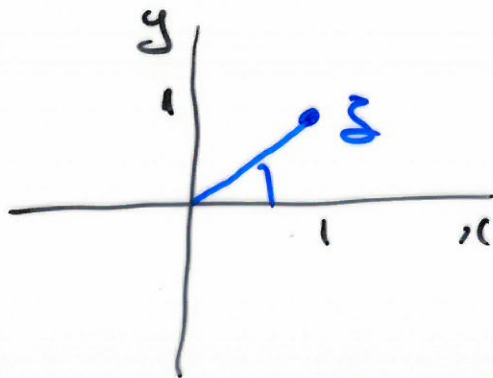
Soln



$$\text{Arg}(i) = 90^\circ = \frac{\pi}{2} \text{ rad}$$

Problem For $z = 1+i$ find $\text{Arg}(z)$.

Soln



$$\text{Arg}(z) = 45^\circ = \frac{\pi}{4} \text{ rad.}$$

Theorem For any two complex numbers w, z we have

$$|wz| = |w| \cdot |z|$$

and

$$\text{Arg}(wz) = \text{Arg}(w) + \text{Arg}(z) .$$

NAME	ID	MA135	MA160
MALGORZATA SIKORA	14104189	+	
Rebecca Donoghue	15718135	+	+
CHIKA OMITA	15736825		
JACEK SZUMSKI	14102325	+	
Cormac Buckley	15534413		+
Conor Redington	15332311		+
Alice Hayes	15343221	+	
Eoghan Hennelly	15480908	24915121	Not + on record
Jesse Wood	15100665		+
Kern Casade	14102730		+
Tora Young	14260417	+	
Saadh Kearing	15575543	+	
Philip Mae Loidh	15387951		+
Eamonn Hannon	15310091		+
Joanne Eko	14506467	+	
Alan Fahy	14104204		+
Stephen O'Brien	15455232	+	
Enma Moran	15478872	+	
Sarah Davies	15321951	+	+
Aisling Ward	15309706	+	
Clara Mc Ellistrain	15449179		*
Karen Butler	15356656	+	
Amber Byrne	15337266	+	
Meghem Clarke	15724121	X	
Shanna Clarke	15587383	X	
Lauren McHarry	15475582	X	X
Gregorz Baluszka	15432788		
MERYEM CREHAN	14103934		✓
Seán Kelly	15331711	X	
Adelough Hyland	15525283	✓	
Aine McPhillip	15361926	✓	

061 AM

281 AM

MA 135

MA 160

Stephen Treacy

15337336

Daniel Regan

15511417

Mark Harrington

15488702

Jonatas Petruschus

14102632

Edward Dunne

15532577

Kirstin Collins

13362936

Shannon Smith

15421948

✓

✓
✓
✓