

# Complex numbers

chapter

3

## Section 3.7 Polar form of a complex number

PROJECT MATHS  
**Text & Tests 6**

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3. Express each of the following complex numbers in polar form.

(i)  $1 + i$

(ii)  $\sqrt{3} + i$

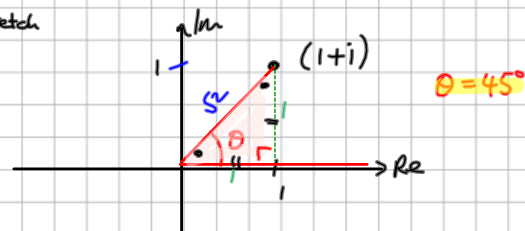
$r = ?$  (modulus)  
 $\theta = ?$  (argument)

$r = \sqrt{a^2 + b^2}$

Polar form:  
 $r(\cos \theta + i \sin \theta)$

$r = \sqrt{1^2 + 1^2} \Rightarrow r = \sqrt{2}$        $\sqrt{2} \approx 1.4$

sketch



$1 + i = \sqrt{2} (\cos 45^\circ + i \sin 45^\circ)$

3. Express each of the following complex numbers in polar form.

(i)  $1 + i$       (ii)  $\sqrt{3} + i$        $\sqrt{3} \approx 1.4$

$r = ?$       (modulus)       $r = \sqrt{a^2 + b^2} = \sqrt{\sqrt{3}^2 + 1^2} = \sqrt{3+1} = \sqrt{4} = 2$        $r = 2$   
 $\theta = ?$

Polar form  $r \text{cis} \theta$

Sketch  $\tan^{-1} \theta = \frac{1}{\sqrt{3}}$   
 $\theta = \tan^{-1}(\frac{1}{\sqrt{3}})$   
 $\theta = 30^\circ$

$\sqrt{3} + i = 2 \text{cis} 30^\circ$

6. Express each of the following in polar form:

(i)  $2i = 0 + 2i$

(ii)  $-3 - \sqrt{3}i$

(iii)  $\frac{2}{-1 + i}$

(i)  $r = ?$        $r = \sqrt{a^2 + b^2}$        $r = \sqrt{0^2 + 2^2} = \sqrt{4} = 2$   
 $\theta = ?$       argument

Polar:  $r \text{cis} \theta$

Sketch  $\theta = 90^\circ$

$2i = 2 \text{cis} 90^\circ$   
 RECTANGULAR      POLAR

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(ii)  $r = ?$        $r = \sqrt{a^2 + b^2}$        $r = \sqrt{(-3)^2 + (-\sqrt{3})^2} = \sqrt{9+3} = \sqrt{12} = 2\sqrt{3}$   
 $\theta = ?$       argument

Polar:  $r \text{cis} \theta$

$\sqrt{3} \approx 1.7$

Sketch  $\alpha = \tan^{-1}(\frac{\sqrt{3}}{3}) = 30^\circ$   
 $\theta = 180 + 30 = 210^\circ$

$-3 - \sqrt{3}i = 2\sqrt{3} \text{cis} 210^\circ$