

# Chapter 10 / Example 2

## Cartesian and polar form

Write the following complex numbers in polar form:

**a**  $4\sqrt{3} + 4i$     **b**  $-2 + 3i$     **c**  $-12 - 5i$     **d**  $4 - 2i$

Find the modulus and argument of  $4\sqrt{3} + 4i$ .

To enter the modulus function press **[math]** ► NUM 1:abs(.

Type  $4\sqrt{3} + 4i$  and press **[enter]**.

To enter  $i$  press **[2nd]** **[i]**.

$$|4\sqrt{3} + 4i| = 8.$$

$|4\sqrt{3}+4i|$   
.....8

Press **[math]** ►► CMPLX 4:angle(.

Type  $4\sqrt{3} + 4i$ , close the parentheses and press **[enter]**.

The argument is 0.524.

$|4\sqrt{3}+4i|$   
.....8  
angle( $4\sqrt{3}+4i$ )  
......5235987756

To find the argument in terms of  $\pi$ , type  $\pi$  **[÷]** **[2nd]** **[(-)]** **[ans]** and press **[enter]**.

The result is 6, so the argument is  $\frac{\pi}{6}$ .

$$\text{Hence } 4\sqrt{3} + 4i = 8e^{\frac{\pi}{6}i} = 8\text{cis}\frac{\pi}{6}.$$

$|4\sqrt{3}+4i|$   
.....8  
angle( $4\sqrt{3}+4i$ )  
......5235987756  
 $\pi/\text{Ans}$   
.....6

The TI-84 Plus C will find polar form directly.

Type  $-2 + 3i$ .

Press **[math]** ►► CMPLX 7:►Polar and press **[enter]**.

$$-2 + 3i = 3.61e^{2.16i} = 3.61\text{cis}2.16.$$

$-2+3i$ ►Polar  
.....3.605551275e<sup>2.15879893i</sup>

Chapter 10 / **Example 2****Cartesian and polar form**

If the GDC is set in degrees, the GDC attempts to give the number in polar form.

Press **[mode]**.

Use the **[◀]** **[▶]** **[▲]** **[▼]** keys to place the cursor on DEGREE in the Mode menu, and then press **[enter]** to highlight it.

Press **[2nd]** **[quit]** to return to the home screen.

MATHPRINT CLASSIC  
NORMAL SCI ENG  
FLOAT 0 1 2 3 4 5 6 7 8 9  
RADIAN DEGREE  
FUNCTION PARAMETRIC POLAR SEQ  
THICK DOT-THICK THIN DOT-THIN  
SEQUENTIAL SIMUL  
REAL a+bi re^(θi)  
FULL HORIZONTAL GRAPH-TABLE  
FRACTIONTYPE: n/d Un/d  
ANSWERS: AUTO DEC FRAC-APPROX  
GO TO 2ND FORMAT GRAPH: NO YES  
STAT DIAGNOSTICS: OFF ON  
SET CLOCK 09/07/18 8:28PM

Type  $-12 - 5i$ .

Press **[math]** **[>>]** CMPLX 7: **[>]** Polar and press **[enter]**.

The modulus of  $-12 - 5i$  is 13 and its argument is  $-157^\circ$ .

However, in Euler's form, the angle should be in radians, so the expression in the GDC is not correct.

-12-5i>Polar  
.....  
13e<sup>-157.3801351i</sup>

So, to convert a complex number from Cartesian to polar form, ensure that the GDC is in radian mode.

Type  $4 - 2i$ .

Press **[math]** **[>>]** CMPLX 7: **[>]** Polar and press **[enter]**.

$$4 - 2i = 4.47 e^{-0.464i} = 4.47 \text{cis} - 0.464.$$

The GDC will choose a principal value of the argument in the interval  $]-\pi, \pi]$  but some authors use  $[0, 2\pi[$ .

4-2i>Polar  
.....  
4.472135955e<sup>-.463647609i</sup>