

Chapter 8 / Example 9

Powers of complex numbers

- a** Given $\tan\left(\frac{\pi}{6}\right) = \frac{1}{\sqrt{3}}$ find the modulus and argument of $z = -\sqrt{3} - i$.
- b** Find an expression for z^n and hence find the smallest value of n for which $\text{Im}(z_n) = 0$ and for this value of n give z^n in Cartesian form.

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

Type $-\sqrt{3} - i$

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

Press **[ENTER]**.

$$|-\sqrt{3} - i| = 2$$

Press **[MATH]** ►► CMPLX 4:angle(

Type $-\sqrt{3} - i$ close the parentheses and press **[ENTER]**.

The argument is -2.62

To find the argument in terms of π , type π **[÷]** **[2nd]** **[(-)]** **[ANS]** and press **[ENTER]**.

The result is -1.2 , so the argument is $\pi \div (-1.2) = -\frac{5\pi}{6}$.

$$z^n = 2^n e^{-\frac{5\pi}{6}ni}$$

Press **[MODE]**.

Use the **[◀]** **[▶]** **[↑]** **[↓]** keys to place the cursor on SEQ in the Mode menu, and then press **[ENTER]** to highlight it.

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

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Press $[F1]$ $[Y=]$ to display the equation entry screen.

Press $[MATH]$ $[>]$ $[>]$ CMPLX 3:imag(

Type $2^n e^{-\frac{5\pi}{6}ni}$ and close the parentheses.

To type n press $[X,T,\Theta,n]$.

Plot1	Plot2	Plot3
nMin=1		
u(n)imag(2^n e ^{-5π/6 ni})		
u(nMin)=		
v(n)=		
v(nMin)=		
w(n)=		
w(nMin)=		

Press $[2nd]$ $[F5]$ [TABLE]

From the table, the smallest value of n for which

$$\text{imag}\left(2^n e^{-\frac{5\pi}{6}ni}\right) = 0 \text{ is } 6.$$

n	u(n)			
0	ERROR			
1	-1			
2	3.4641			
3	-8			
4	13.856			
5	-16			
6	0			
7	64			
8	-221.7			
9	512			
10	-886.8			

n=0

Press $[2nd]$ $[MODE]$ [QUIT]

Type $2^6 e^{-\frac{5\pi}{6}6i}$ and press $[ENTER]$.

$$2^6 e^{-\frac{5\pi}{6}6i} = -64$$

angle(-√3-i)	2
π/Ans	-2.617993878
2^6 e ^{-5π/6 * 6i}	-1.2
	-64