

Name \_\_\_\_\_

Key

Date \_\_\_\_\_ out of 23

In exercise 1-8, use DeMoivre's Theorem to find the indicated power of the complex number. Write answers in polar and in rectangular form. (2 points each)

1.  $[4(\cos 15^\circ + i \sin 15^\circ)]^3$

Polar:

$$\begin{aligned} & 64 \text{cis } 45^\circ \\ & 64(\sqrt{2}/2 + i\sqrt{2}/2) \end{aligned}$$

Rectangular:  $32\sqrt{2} + 32i\sqrt{2}$

3.  $[2(\cos 80^\circ + i \sin 80^\circ)]^3$

Polar:

$$\begin{aligned} & 8 \text{cis } 240^\circ \\ & 8(\cos 240^\circ + i \sin 240^\circ) \\ & 8(-\frac{1}{2} - \frac{\sqrt{3}}{2}i) \end{aligned}$$

Rectangular:  $-4 - 4\sqrt{3}i$

5.  $\left[ \frac{1}{2} \left( \cos \frac{\pi}{10} + i \sin \frac{\pi}{10} \right) \right]^5$

Polar:  $\left(\frac{1}{2}\right)^5 \text{cis } \frac{\pi}{2} = \frac{1}{32} \text{cis } \frac{\pi}{2}$   
 $\frac{1}{32}(0+i)$

Rectangular:  $\frac{1}{32}i$

7.  $\left[ \sqrt{3} \left( \cos \frac{5\pi}{18} + i \sin \frac{5\pi}{18} \right) \right]^6$

Polar:  $\sqrt{3}^6 \text{cis } 5\frac{\pi}{3} = 27 \text{cis } 5\frac{\pi}{3}$   
 $27(\cos 5\frac{\pi}{3} + i \sin 5\frac{\pi}{3})$

Rectangular:  $\frac{27}{2} - \frac{27\sqrt{3}}{2}i$

2.  $[2(\cos 10^\circ + i \sin 10^\circ)]^3$

Polar:

$$\begin{aligned} & 8 \text{cis } 30^\circ \\ & 8(\cos \frac{\pi}{6} + i \sin \frac{\pi}{6}) \\ & 8(\frac{\sqrt{3}}{2} + \frac{1}{2}i) \end{aligned}$$

Rectangular:  $4\sqrt{3} + 4i$

4.  $\left[ \frac{1}{2} \left( \cos \frac{\pi}{12} + i \sin \frac{\pi}{12} \right) \right]^6$

Polar:  $\left(\frac{1}{2}\right)^6 \text{cis } \frac{\pi}{2} = \frac{1}{64} \text{cis } \frac{\pi}{2}$   
 $\frac{1}{64}(0+i)$

Rectangular:  $\frac{1}{64}i$

6.  $\left[ \sqrt{2} \left( \cos \frac{5\pi}{6} + i \sin \frac{5\pi}{10} \right) \right]^4$

Polar:  $\sqrt{2}^4 \text{cis } \frac{\pi}{3} = 4 \text{cis } \frac{\pi}{3}$   
 $4(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3})$   
 $4(\frac{1}{2} + i\frac{\sqrt{3}}{2})$

Rectangular:  $2 + 2\sqrt{3}i$

8.  $\left[ \sqrt{3} \left( \cos \frac{5\pi}{7} + i \sin \frac{5\pi}{7} \right) \right]^6$  Use CALCULATOR.

Polar:  $\sqrt{3}^6 \text{cis } 30\frac{\pi}{7} = 27 \text{cis } \frac{30\pi}{7}$

calc

Rectangular:  $16.83 + 21.11i$

TRIG DeMoivre's Theorem Worksheet #1 Powers and Roots

In exercise 9, find all the complex roots. Write roots in polar form and in rectangular with the argument as an angle between 0 and  $360^\circ$ . (3 points)

- 9) Find the complex cube roots of  $27(\cos 270^\circ + i \sin 270^\circ)$

Polar Form:

$$27^{1/3} \text{cis } 90^\circ$$

$3 \text{cis } 90^\circ$

$3 \text{cis } 210^\circ$

$3 \text{cis } 330^\circ$

+  $360^\circ / 3$   
+  $120^\circ$

like a ROSE

Rectangular Form:

$3i$

$-\frac{3\sqrt{3}}{2} - \frac{3}{2}i$

$\frac{3\sqrt{3}}{2} - \frac{3}{2}i$

$$3(\cos 90^\circ + i \sin 90^\circ)$$

$$3(\cos 210^\circ + i \sin 210^\circ)$$

$$3(\cos 330^\circ + i \sin 330^\circ)$$

In exercise 10, find all the complex roots. Write roots in polar form and in rectangular with the argument as an angle between 0 and  $2\pi$ . (4 points)

- 10) Find the complex fourth roots of  $16(\cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3})$ .

$16^{1/4} \text{cis } \frac{\pi}{3}$  ✓  $-8 - 8\sqrt{3}i$

Polar Form:

$2 \text{cis } \frac{\pi}{3}$

$2 \text{cis } \frac{5\pi}{4}$

$2 \text{cis } \frac{4\pi}{3}$

$2 \text{cis } \frac{11\pi}{6}$

$\frac{\pi}{3} + \frac{\pi}{2} = \frac{2\pi}{6} + \frac{3\pi}{6}$

Rectangular Form:

$1 + \sqrt{3}i$

$-1 - \sqrt{3}i$

$-\sqrt{3} + i$

$\sqrt{3} - i$

$$2(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3})$$

$$2(\frac{1}{2} + \frac{\sqrt{3}}{2}i)$$

$$2(\cos \frac{5\pi}{6} + i \sin \frac{5\pi}{6})$$

$$2(-\frac{\sqrt{3}}{2} + \frac{1}{2}i)$$