GO COUGARS!

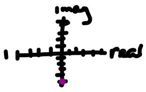
p 478 **Homework Questions**

In Exercises 1–6, plot the complex number and find its absolute value.

5. $6 - 7i$

In Exercises 11–30, represent the complex number graphically, and find the trigonometric form of the number.

11. $3 - 3i$
13. $\sqrt{3} + i$
15. $-2(1 + \sqrt{3}i)$
17. $-5i$
19. $-7 + 4i$



$0 - 5i$

$r = \sqrt{0^2 + (-5)^2} = 5$

$\tan\theta = \frac{-5}{0}$

$\theta = \frac{3\pi}{2}$

$5\cos\frac{3\pi}{2} + 5\sin\frac{3\pi}{2}$

In Exercises 31–40, represent the complex number graphically, and find the standard form of the number.

31. $3(\cos 120° + i \sin 120°)$

37. $8\left(\cos\frac{\pi}{2} + i \sin\frac{\pi}{2}\right)$

39. $3[\cos(18° 45') + i \sin(18° 45')]$

In Exercises 47–58, perform the operation and leave the result in trigonometric form.

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

49. $\left[\frac{5}{3}(\cos 140° + i \sin 140°)\right]\left[\frac{2}{3}(\cos 60° + i \sin 60°)\right]$

$\frac{10}{9}(\cos(140+60), i\sin(140+60))$

$\frac{10}{9}\cos 200 + \frac{10}{9} i \sin 200$

53. $\dfrac{\cos 50° + i \sin 50°}{\cos 20° + i \sin 20°}$

57. $\dfrac{12(\cos 52° + i \sin 52°)}{3(\cos 110° + i \sin 110°)}$

$52 - 110$

$-58 + 360$

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In Exercises 59–66, (a) write the trigonometric forms of the complex numbers, (b) perform the indicated operation using the trigonometric forms, and (c) perform the indicated operation using the standard forms, and check your result with that of part (b).

59. $(2 + 2i)(1 - i)$

63. $\dfrac{3 + 4i}{1 - \sqrt{3}i}$

65. $\dfrac{5}{2 + 3i}$

a) turn 5 & 2+3i into trig forms

b) apply the quotient rule

c) simplify by mult by conjugate

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6.5 day 2 - Powers of Complex Numbers

DeMoivre's Theorem

Powers of Complex Numbers

Roots of Complex Numbers

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Powers of Complex Numbers

$$z = r(\cos\theta + i\sin\theta)$$

$$z^2 = r(\cos\theta + i\sin\theta)\,r(\cos\theta + i\sin\theta)$$
$$= r^2(\cos 2\theta + i\sin 2\theta)$$

$$z^3 = r^2(\cos 2\theta + i\sin 2\theta)\,r(\cos\theta + i\sin\theta)$$
$$r^3(\cos 3\theta + i\sin 3\theta)$$

$$z^n$$

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DeMoivres' Theorem

$$z^n = [r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$$

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Find $(1+i)^6$

QI

1: turn $1+i$ into complex trig form

a: find $r = \sqrt{1^2+1^2} = \sqrt{2}$

b: find $\theta \Rightarrow \tan\theta = \frac{1}{1}$

$\tan\theta = 1$

$\theta = \frac{\pi}{4}$

c: $\sqrt{2}\cos\frac{\pi}{4} + i\sqrt{2}\sin\frac{\pi}{4}$

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

$\sqrt{2}^6\left(\cos 6\left(\frac{\pi}{4}\right) + i\sin 6\left(\frac{\pi}{4}\right)\right)$

$8\left(\cos\frac{6\pi}{4} + i\sin\frac{6\pi}{4}\right)$

$8\left(\cos\frac{3\pi}{2} + i\sin\frac{3\pi}{2}\right)$

$8(0-i)$

$-8i$

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You try!

Find $(1-\sqrt{3}i)^5$

$r = 2$

$\theta = \frac{5\pi}{3}$

$z^5 = 2^5\left(\cos\frac{25\pi}{3} + i\sin\frac{25\pi}{3}\right)$

$32\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$

$32\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)$

$16 + 16i\sqrt{3}$

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Roots of Complex Numbers

Remember! Cube Roots

$x^3 - 1 = 0$

$(x-1)(x^2+x+1)$

$x=1 \quad x = \frac{-1 \pm \sqrt{3}i}{2}$

Find the 3rd roots of 1

- write 1 as a complex number in trig form

$1+0i \quad r=\sqrt{1^2+0^2}=1$

$\tan\theta = \frac{0}{1}$

$\theta = 0, \cancel{\pi}$

$1(\cos 0 + i\sin 0)$

- use DeMoivre's to find the first root

$1+0i = 1 \quad (1+0i)^{\frac{1}{3}} = 1^{\frac{1}{3}}(\cos\frac{1}{3}(0) + i\sin\frac{1}{3}(0))$

- add $\frac{2\pi}{\#of roots}$ to the simplified angle above twice to get the remaining roots

$+\frac{2\pi}{3} \quad (1+0i)^{\frac{1}{3}} = 1\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right)$

$= -\frac{1}{2} + i\frac{\sqrt{3}}{2}$ 2nd 3rd root

$\frac{2\pi}{3} + \frac{2\pi}{3} \quad 1\left(\cos\frac{4\pi}{3} + i\sin\frac{4\pi}{3}\right)$

$-\frac{1}{2} - i\frac{\sqrt{3}}{2}$ 3rd 3rd root

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Find the 1st 5 roots of 1+*i*

$1+i$ in complex trig form

$r=\sqrt{2} \quad \tan\theta = 1 \quad Q\,1$

$\theta = \frac{\pi}{4}$

$(1+i)^{\frac{1}{5}} = \sqrt{2}^{\frac{1}{5}}\left(\cos\frac{1}{5}\left(\frac{\pi}{4}\right) + i\sin\frac{1}{5}\left(\frac{\pi}{4}\right)\right)$

$(2^{\frac{1}{2}})^{\frac{1}{5}} \quad 2^{\frac{1}{10}}$

$\sqrt[10]{2}\left(\cos\frac{\pi}{20} + i\sin\frac{\pi}{20}\right)$ 1st root

add $\frac{2\pi}{5}$

$\sqrt[10]{2}\left(\cos\frac{9\pi}{20} + i\sin\frac{9\pi}{20}\right)$ 2nd root

$\frac{\pi}{20} + \frac{2\pi}{5}$

$\sqrt[10]{2}\left(\cos\frac{17\pi}{20} + i\sin\frac{17\pi}{20}\right)$ 3rd root

$\frac{9\pi}{20} + \frac{8\pi}{20}$

$\sqrt[10]{2}\left(\cos\frac{25\pi}{20} + i\sin\frac{25\pi}{20}\right)$ 4th root

$\sqrt[10]{2}\left(\cos\frac{33\pi}{20} + i\sin\frac{33\pi}{20}\right)$ 5th root

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HOMEWORK

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Aug 29-6:38 AM