# Advanced Math

## 6-5

(Day 2)

## DeMoivre's Theorem

<u>DeMoivre's Theorem</u> :

if $z$ is a complex number and $n$ is a positive integer, then

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

power of modulus

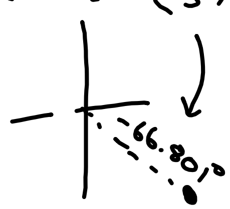
power times the argument

*1) $(3 - 7i)^5 = (\sqrt{58})^5[\cos(-334.007^\circ) + i\sin(-334.007^\circ)]$

Multiply by the power, in this case 5.

modulus $= \sqrt{3^2 + (-7)^2} = \sqrt{58}$

argument $= \tan^{-1}\left(\frac{-7}{3}\right) = -66.801^\circ$



$n$th Roots of Complex Numbers :

For a positive integer $n$, the complex number $z = r(\cos\theta + i\sin\theta)$ has exactly $n$ distinct roots given by

$$\sqrt[n]{r}\left(\cos\frac{\theta + 2\pi k}{n} + i\sin\frac{\theta + 2\pi k}{n}\right)$$

where $k = 0, 1, 2, \ldots, n - 1$

I never really use this formula. I know that there will be the same number of roots as the index. I divide the angle found with arctan() by the index. Then I add 360º/$n$ (index) and keep adding this angle until all the roots are found. (See next slide.)

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Find the following root:

*2) $\sqrt[4]{3-7i}$

mod: $\sqrt{58}$

$\theta = -66.801^\circ$

$4^{th}$ root, separated by $90^\circ$

$360^\circ/4 = 90^\circ$

root 1) $\sqrt[4]{\sqrt{58}}\left(\cos(-66.8^\circ) + i\sin(-66.8^\circ)\right) = .47 + 1.59i$

+90° +90°

2) $\sqrt[8]{58}\left(\cos 23.2^\circ + i\sin 23.2^\circ\right) = -1.59 + .47i$

+90° +90°

3) $\sqrt[8]{58}\left(\cos 113.2^\circ + i\sin 113.2^\circ\right) = -.47 - 1.59i$

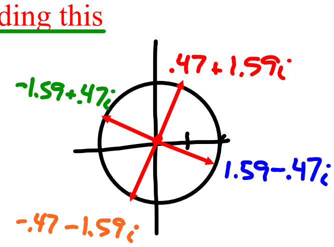
+90° +90°

4) $\sqrt[8]{58}\left(\cos 203.2^\circ + i\sin 203.2^\circ\right) = 1.59 - .47i$

Multiply these out to get the standard form.

I know that there will be the same number of roots as the index. I divide the angle found with arctan() by the index. Then I add 360º/$n$ (index) and keep adding this angle until all the roots are found.

$\sqrt[4]{\sqrt{58}} = \left(58^{\frac{1}{2}}\right)^{\frac{1}{4}} = 58^{\frac{1}{8}} = \sqrt[8]{58}$



Assignment:
pg. 563
70-80 even,
89-100 all.