

Trig 9.6

Graph complex numbers in the complex plane

Convert complex numbers from polar to rectangular form

Convert complex numbers from rectangular to polar form

complex number

$$x \ y$$
$$2 + 5i$$

complex plane (Argand plane)

absolute value (modulus, distance, magnitude)

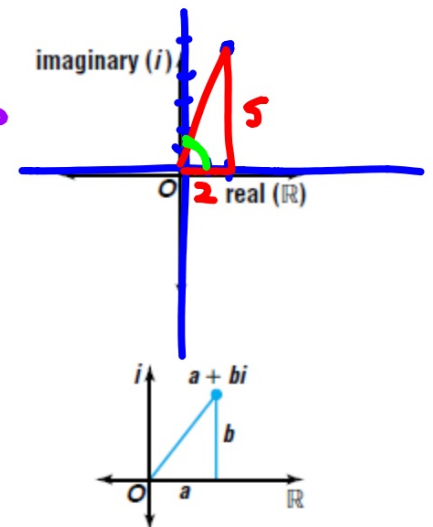
$$\sqrt{29}$$

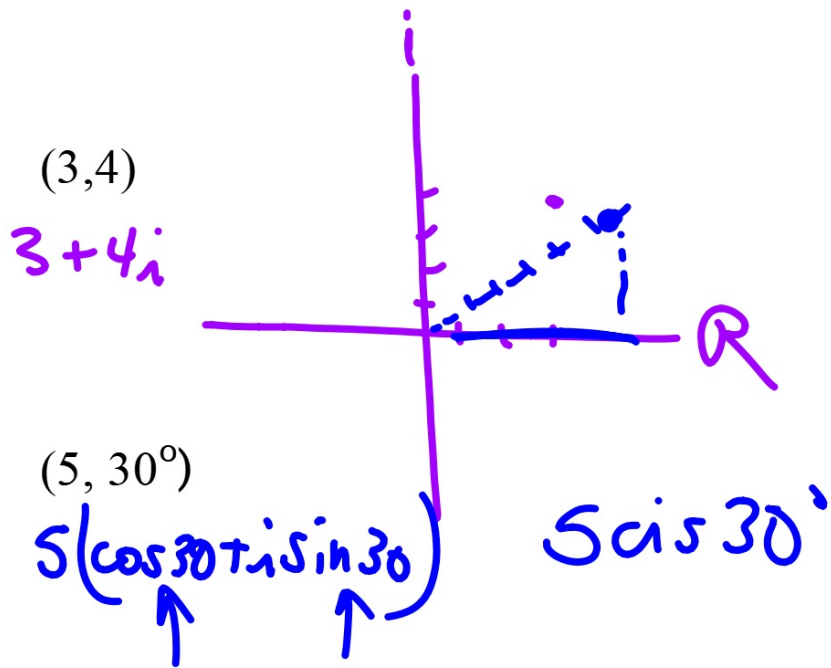
amplitude (argument, angle)

$$\tan \theta = \frac{5}{2} \quad 68^\circ$$

cis

whiteboards





$$3 + 4i$$

$$9 + 4 = \sqrt{13}$$

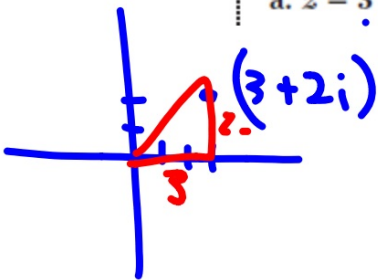
$z =$

Absolute Value
of a Complex
Number

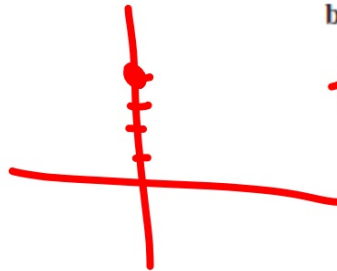
If $z = a + bi$, then $|z| = \sqrt{a^2 + b^2}$.

Examples 2 Graph each number in the complex plane and find its absolute value.

a. $z = 3 + 2i$



b. $z = 4i$



$$z = 0 + 4i$$

$$0 + 16 = 4^2$$

Graph each number in the complex plane and find its absolute value.

6. $-2 - i$

$z = \sqrt{5}$

7. $1 + \sqrt{2}i$



$1 + 2 =$

$\sqrt{5} \cos 207 + i \sin 207$

$\sqrt{5} \operatorname{cis} 207$

$$z = a + bi$$

**Polar Form of
a Complex
Number**

The polar form or trigonometric form of the complex number $a + bi$ is

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

$r(\cos \theta + i \sin \theta)$ is often abbreviated as $\text{cis } \theta$.

$\text{cis } \theta$

Could be radians or degrees
Same procedure as polar-rect.
(just not real)

$(-3, 4)$ $(5, 127^\circ)$

$r \operatorname{cis} \theta$

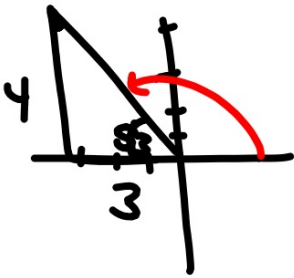
4 Express each complex number in polar form.

a. $-3 + 4i$

$5 \operatorname{cis} 127^\circ$

$$\tan^{-1}\left(\frac{4}{3}\right)$$

b. $1 + \sqrt{3}i$



If not in Q1 will use reference angle (always sketch first)



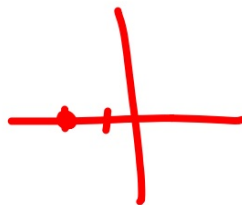
Express each complex number in polar form.

8. $2 - 2i$

9. $4 + 5i$

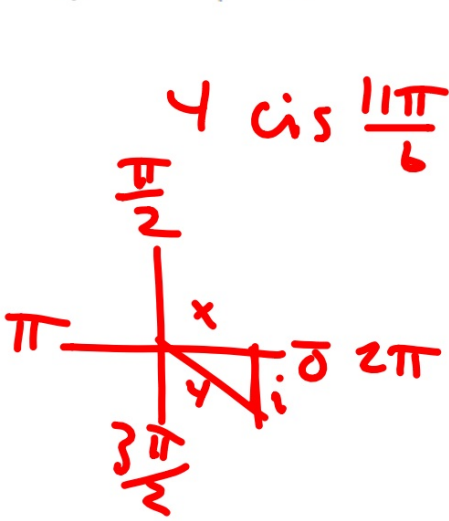
10. $-2 + 0i$

$2.8 \text{ cis } 315^\circ$



cis

5 Graph $4\left(\cos \frac{11\pi}{6} + i \sin \frac{11\pi}{6}\right)$. Then express it in rectangular form.



$$4 \operatorname{cis} \frac{11\pi}{6}$$

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

$$x = 4 \cos \frac{11\pi}{6} = 2\sqrt{3}$$

$$4 \cdot \frac{\sqrt{3}}{2}$$

$$y = 4 \sin \frac{11\pi}{6} = -2$$

$$4 \cdot \frac{1}{2}$$

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

degrees or radians???

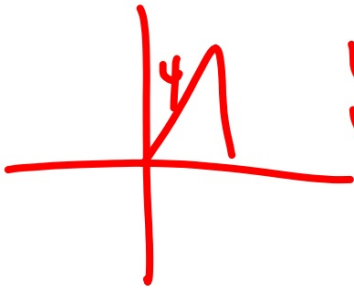
Graph each complex number. Then express it in rectangular form.

11. $4\left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}\right)$ 12. $2(\cos 3 + i \sin 3)$ 13. $\frac{3}{2}(\cos 2\pi + i \sin 2\pi)$

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

$$4 \cos \frac{\pi}{3} \quad x = 4 \cdot \frac{1}{2} = 2$$

$$y = 4 \cdot \frac{\sqrt{3}}{2} = 2\sqrt{3}$$



$$(x-2) \left(\underbrace{\hspace{10em}} \right) = 0$$

$$(x-2)(x-5-i)(x-5+i) = 0$$

$$\underline{x} = 2 \quad \underline{x} = 5+i \quad \underline{x} = 5-i$$

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