LESSON MAKER PRO

Complex Plane Moves

Switch between rectangular and polar forms.

HIGH SCHOOL · MA.912.NSO.2.5

MA.912.NSO.2.5 "Represent complex numbers on the complex plane in rectangular and polar forms."

NAME _____ DATE _____

TWO VIEWS OF Z

For z = a + bi, the distance from the origin is r = sqrt(a^2 + b^2). Write polar form as r(cos(theta) + i sin(theta)), choosing theta from the signs of a and b. To return to rectangular form, use a = r cos(theta) and b = r sin(theta).

WORKED EXAMPLE

Write z = 7 + 24i in polar form.

1. a = 7 and b = 24.
2. r = sqrt(7^2 + 24^2) = sqrt(625) = 25.
3. The point is in Quadrant I, so theta = tan^-1(24/7).
4. Write z = 25(cos(theta) + i sin(theta)).

Answer: 25(cos(tan^-1(24/7)) + i sin(tan^-1(24/7)))

PRACTICE 6 problems

1 Write z = -sqrt(3) + i in polar form. Use 0 <= theta < 2pi.

ANSWER _____

2 Write z = -3 - 3i in polar form.

ANSWER _____

3 Write 4(cos(pi/6) + i sin(pi/6)) in rectangular form.

ANSWER _____

4 Write 6(cos(pi/3) + i sin(pi/3)) in rectangular form.

ANSWER _____

5 A point on the complex plane has coordinates (0, -7). Write its complex number in rectangular form and polar form.

ANSWER _____

6 Write z = 3sqrt(3) - 3i in polar form.

ANSWER _____

APPLY IT Show your work

1 In a robotics scrimmage, a team records its robot's displacement from the start as z = -6 + 6sqrt(3)i, where the real axis measures east-west movement and the imaginary axis measures north-south movement. Write the displacement in polar form.

WORK SPACE

ANSWER _____

2 A student animating a game uses the polar movement vector 8(cos(7pi/6) + i sin(7pi/6)). Write the movement vector in rectangular form.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Write all polar forms of z = -2sqrt(3) + 2i using a positive radius. Let k represent any integer.

_____

_____

ANSWER KEY

Complex Plane Moves

HIGH SCHOOL · MA.912.NSO.2.5

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write z = -sqrt(3) + i in polar form. Use 0 <= theta < 2pi.	**2(cos(5pi/6) + i sin(5pi/6))**
2	Write z = -3 - 3i in polar form.	**3sqrt(2)(cos(5pi/4) + i sin(5pi/4))**
3	Write 4(cos(pi/6) + i sin(pi/6)) in rectangular form.	**2sqrt(3) + 2i**
4	Write 6(cos(pi/3) + i sin(pi/3)) in rectangular form.	**3 + 3sqrt(3)i**
5	A point on the complex plane has coordinates (0, -7). Write its complex number in rectangular form and polar form.	**Rectangular: -7i. Polar: 7(cos(3pi/2) + i sin(3pi/2)).**
6	Write z = 3sqrt(3) - 3i in polar form.	**6(cos(11pi/6) + i sin(11pi/6))**

PART 2 · APPLY IT

1. **12(cos(2pi/3) + i sin(2pi/3))** Find r = sqrt((-6)^2 + (6sqrt(3))^2) = 12. The point is in Quadrant II with reference angle pi/3, so theta = 2pi/3.
2. **-4sqrt(3) - 4i** Use a = 8 cos(7pi/6) and b = 8 sin(7pi/6). The cosine is -sqrt(3)/2 and the sine is -1/2.

CHALLENGE

4(cos(5pi/6 + 2pi k) + i sin(5pi/6 + 2pi k)), where k is any integer. The radius is 4, and the Quadrant II reference angle is pi/6.

Accept equivalent polar angles that differ by 2pi k when the radius is positive. Accept equivalent exact rectangular forms, including terms written in a different order.