LESSON MAKER PRO

Complex Plane Paths

Move 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."

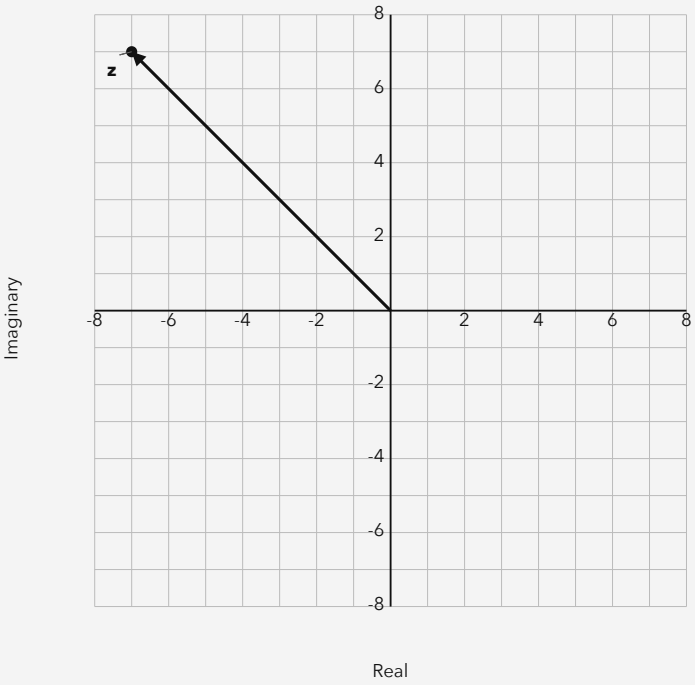
NAME _____ DATE _____

TWO FORMS, ONE NUMBER

A complex number a + bi matches the point (a, b) on the complex plane. For a nonzero number, r = sqrt(a² + b²), and choose an angle θ whose cosine is a/r and whose sine is b/r. Write polar form as r(cos θ + i sin θ).

WORKED EXAMPLE

Write z = -7 + 7i in polar form. The radius points from the origin to z; measure argument counterclockwise from the positive real axis.



1. The point is (-7, 7).
2. r = sqrt((-7)² + 7²) = sqrt(98) = 7sqrt(2).
3. The point is in Quadrant II with reference angle 45°, so θ = 135°.

Answer: 7sqrt(2)(cos 135° + i sin 135°)

PRACTICE 5 problems

1 Write z = 3 + 3i in polar form.

ANSWER _____

2 Write z = -4i in polar form.

ANSWER _____

3 Write 6(cos 150° + i sin 150°) in rectangular form.

ANSWER _____

4 Write 8(cos 60° + i sin 60°) in rectangular form and as a point.

ANSWER _____

_____

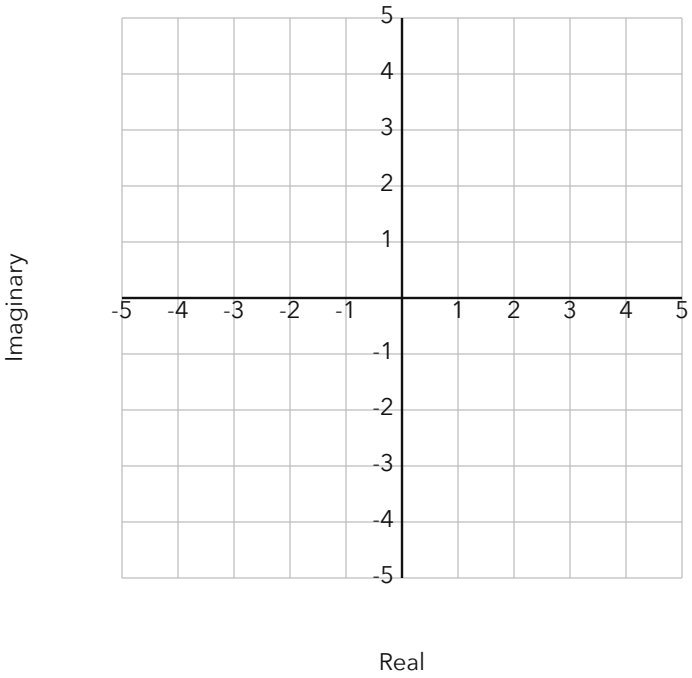
5 For z = -5 + 5i, give its point and its polar form.

ANSWER _____

_____

APPLY IT Show your work

1 A video game stores a player's 2D movement as z = -2sqrt(3) + 2i. Write the movement as a point and in polar form. Plot the point, draw its radius, and mark the counterclockwise argument from the positive real axis.



2 A robotics club records a sensor direction as 12(cos 210° + i sin 210°). Write the direction in rectangular form and as a point.

CHALLENGE One step up

A camera filter uses z = -8 - 8i. Write a polar form with 0° ≤ θ < 360°. Then list every angle θ with 0° ≤ θ < 720° that represents the same number.

ANSWER KEY

Complex Plane Paths

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write z = 3 + 3i in polar form.	**3sqrt(2)(cos 45° + i sin 45°)**
2	Write z = -4i in polar form.	**4(cos 270° + i sin 270°)**
3	Write 6(cos 150° + i sin 150°) in rectangular form.	**-3sqrt(3) + 3i**
4	Write 8(cos 60° + i sin 60°) in rectangular form and as a point.	**4 + 4sqrt(3)i; (4, 4sqrt(3))**
5	For z = -5 + 5i, give its point and its polar form.	**(-5, 5); 5sqrt(2)(cos 135° + i sin 135°)**

PART 2 · APPLY IT

1. **(-2sqrt(3), 2); 4(cos 150° + i sin 150°) Plot approximately (−3.464,2), with radius 4 and argument 150°.** Use the real part and imaginary part for the point. The magnitude is 4, and the point is in Quadrant II with angle 150°.
2. **-6sqrt(3) - 6i; (-6sqrt(3), -6)** Multiply 12 by cos 210° and by sin 210°. Both coordinates are negative because 210° is in Quadrant III.

CHALLENGE

8sqrt(2)(cos 225° + i sin 225°); θ = 225°, 585°

Accept equivalent polar angles that differ by multiples of 360°. Accept -90° instead of 270° for problem 2. Check actual plotting, radius and angle marking; accept a reasonable approximate plot with exact values retained in the written rectangular/polar forms.