

Polar Form and Powers of Complex Numbers

Grade 12 – Precalculus math · Test · Standards: N-CN.B.4, N-CN.B.5, N-CN.B.6, N-CN.A.3

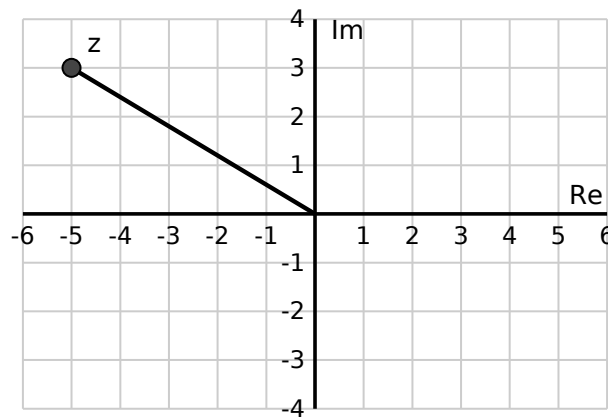
Name: _____ Date: _____ Class: _____

This 45-minute test has 9 questions worth 20 points. Show every step, give exact values unless told to round, and write polar answers with a clearly stated angle in degrees.

Standards: N-CN.B.4, N-CN.B.5, N-CN.B.6, N-CN.A.3 · **Level:** Grade 12 Precalculus

Time: 45 minutes · 9 questions · Total: 20 points · Calculator: as allowed by your teacher

Question 1 Reading the Plane (2 points)



The point z .

The figure shows the complex number z .

- Write z in the form $a + bi$ and find $|z|$. (1 point)
- Write the conjugate of z . (1 point)

Question 2 Rectangular to Polar (2 points)

Consider the number $-2\sqrt{2} + 2\sqrt{2}i$.

- Find its modulus. (1 point)
- Write it in polar form with $0^\circ \leq \theta < 360^\circ$. (1 point)

Question 3 Polar to Rectangular (2 points)

Write $10(\cos 210^\circ + i \sin 210^\circ)$ in the form $a + bi$. Give exact values.

Question 4 Product and Quotient (2 points)

Let $z_1 = 6(\cos 100^\circ + i \sin 100^\circ)$ and $z_2 = 3(\cos 40^\circ + i \sin 40^\circ)$. Write each result in polar form.

- a. $z_1 z_2$ (1 point)
- b. $z_1 \div z_2$ (1 point)

Question 5 Distance and Midpoint (2 points)

Find the distance between $-2 + 7i$ and $3 - i$, and the midpoint of the segment joining them.

Question 6 Using De Moivre (3 points)

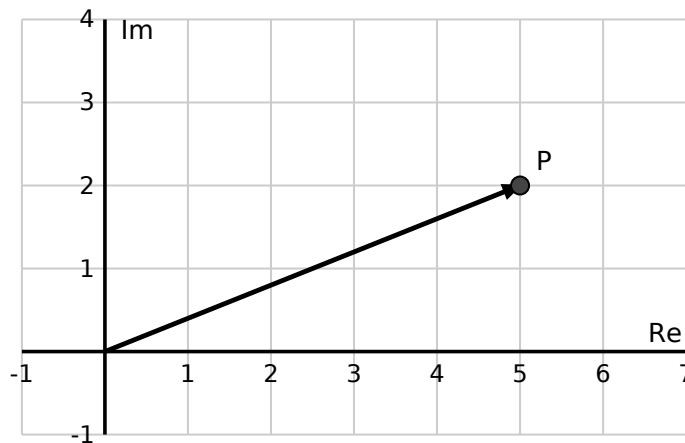
Use De Moivre's theorem.

- a. Evaluate $[3(\cos 12^\circ + i \sin 12^\circ)]^5$ in polar form. (1 point)
- b. Evaluate $(\sqrt{3} - i)^7$ in the form $a + bi$. Give exact values. (2 points)

Question 7 Cube Roots of -8 (3 points)

Find all three cube roots of -8 . Write each in the form $a + bi$.

Question 8 Scaling and Turning (2 points)



The point $P = 5 + 2i$.

The figure shows the point $P = 5 + 2i$. Multiplying P by $3i$ gives a new point Q .

- a. Find Q in the form $a + bi$. (1 point)
- b. Compare the distance of Q from the origin with the distance of P from the origin. (1 point)

Question 9 Modulus of a Product (2 points)

Let $z = 3 + i$ and $w = 1 - 4i$. Compute zw , then verify that $|zw| = |z| \cdot |w|$.