

Precalculus - Polar Form and De Moivre's Theorem - Quiz

Common Core N-CN.B.4, N-CN.B.5, N-CN.B.6 · maths-pdf.fr/en/

Name: _____ Class: _____ Date: ____/____/____

Pick the best answer for 10 questions on polar form, powers and roots of complex numbers.
Explanations point out typical errors, such as adding moduli.

Precalculus · Common Core State Standards: **N-CN.B.4, N-CN.B.5, N-CN.B.6**

Questions

Question 1

What is the modulus of $3-4i$?

- A. 5
- B. 7
- C. 1
- D. 25

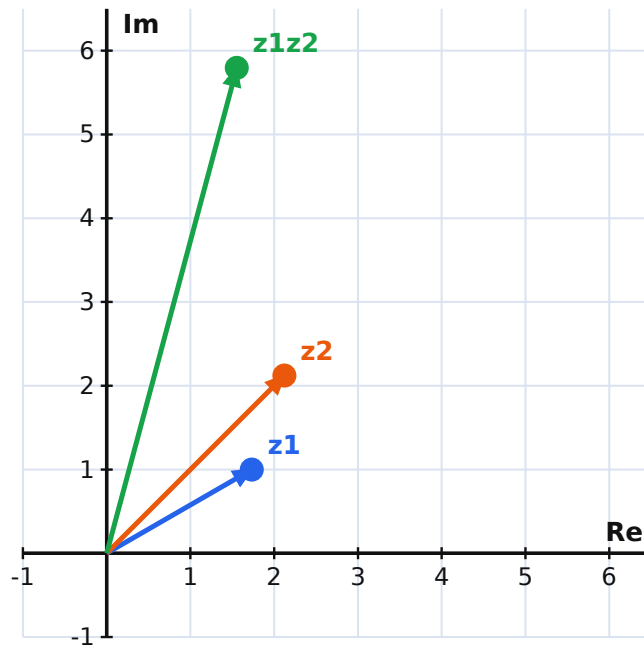
Question 2

Which is the polar form of i ?

- A. $\text{cis } 90^\circ$
- B. $\text{cis } 0^\circ$
- C. $\text{cis } 180^\circ$
- D. $\text{cis } 270^\circ$

Question 3

Multiply $2 \text{cis } 20^\circ$ and $5 \text{cis } 70^\circ$. The figure shows a similar product.

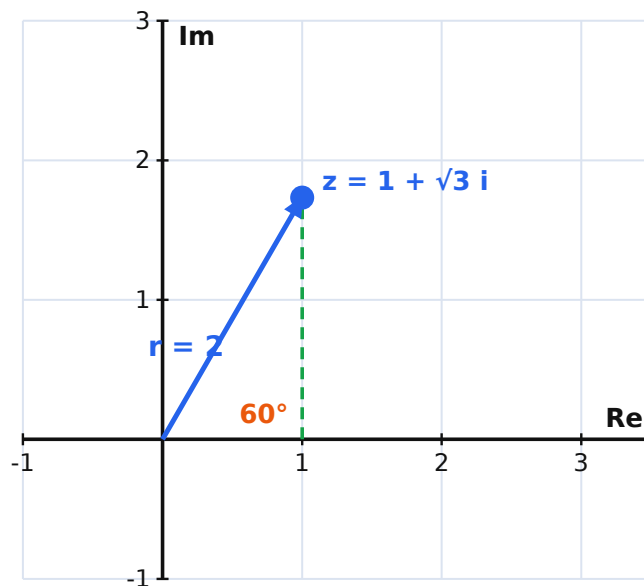


Product of two complex numbers.

- A. $10 \operatorname{cis} 1400^\circ$
- B. $10 \operatorname{cis} 90^\circ$
- C. $7 \operatorname{cis} 90^\circ$
- D. $10 \operatorname{cis} 50^\circ$

Question 4

The figure shows $z = 1 + \sqrt{3}i$. What is its argument?



Complex number z .

- A. 30°
- B. 60°
- C. 45°
- D. 120°

Question 5

Evaluate $(\operatorname{cis} 30^\circ)^6$.

- A. 1
- B. $\operatorname{cis} 36^\circ$
- C. -1
- D. i

Question 6

What is $(1+i)^2$ in polar form?

- A. $\sqrt{2} \operatorname{cis} 90^\circ$
- B. $2 \operatorname{cis} 45^\circ$
- C. $2 \operatorname{cis} 90^\circ$
- D. $\sqrt{2} \operatorname{cis} 45^\circ$

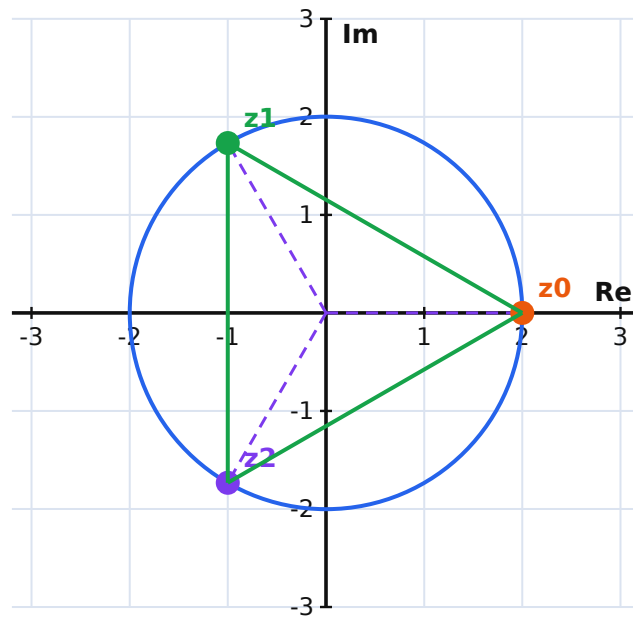
Question 7

How many distinct fifth roots does 32 have?

- A. 5
- B. 1
- C. 2
- D. 32

Question 8

The cube roots of 8 are plotted. What shape do they form?



Three roots.

- A. A right triangle
- B. A square
- C. A line segment
- D. An equilateral triangle

Question 9

Divide $8 \operatorname{cis} 150^\circ$ by $2 \operatorname{cis} 30^\circ$.

- A. $4 \operatorname{cis} 180^\circ$
- B. $16 \operatorname{cis} 120^\circ$
- C. $6 \operatorname{cis} 120^\circ$
- D. $4 \operatorname{cis} 120^\circ$

Question 10

Multiplying a complex number by $\operatorname{cis} 90^\circ$ does what?

- A. Rotates it 90° clockwise
- B. Rotates it 90° counterclockwise
- C. Doubles its modulus
- D. Reflects it over the real axis

Answers

1. **A** - $\sqrt{9 + 16} = 5$.
2. **A** - The point (0, 1) is straight up, at 90 degrees, with modulus 1.
3. **B** - Multiply moduli and add angles: $10 \operatorname{cis} 90$.
4. **B** - $\tan \theta = \sqrt{3}$, so the angle is 60 degrees.
5. **C** - De Moivre: $\operatorname{cis}(180 \text{ degrees}) = -1$.
6. **C** - $(\sqrt{2})^2 = 2$ and $2 \text{ times } 45 = 90$, which agrees with $(1 + i)^2 = 2i$.
7. **A** - Every nonzero complex number has exactly n distinct n th roots.
8. **D** - They are 120 degrees apart on a circle of radius 2, forming an equilateral triangle.
9. **D** - Divide moduli ($8/2 = 4$) and subtract angles ($150 - 30 = 120$).
10. **B** - The modulus stays the same, and the argument increases by 90 degrees.

Remember

- $z = a + bi = r(\cos \theta + i \sin \theta)$ with $r = \sqrt{a^2 + b^2}$ and $\tan \theta = b/a$.
- Product: multiply moduli, add arguments. Quotient: divide moduli, subtract arguments.
- De Moivre: $[r \operatorname{cis} \theta]^n = r^n \operatorname{cis}(n \theta)$.
- n th roots: $(r)^{1/n} \operatorname{cis}((\theta + 360 k)/n)$, $k = 0, \dots, n - 1$.
- The n roots form a regular n -gon on a circle of radius $r^{1/n}$.