Multiple choice questions - De Moivre's theorem and roots of unity

Year: Further Maths · 10

Question 1 $\left(\cos\frac{\pi}{8}+i\sin\frac{\pi}{8}\right)^4=$

- **A.** 1
- **B.** i
- **C.** -1
- **D.** $-i$

Question 2 $(1+i)^4=$

- **A.** 4
- **B.** -4
- **C.** $4i$
- **D.** $-4i$

Question 3 The number of distinct solutions of $z^5=1$ is:

- **A.** 1
- **B.** 4
- **C.** 5
- **D.** 10

Question 4 The solutions of $z^n=1$ lie:

- **A.** on a line
- **B.** on the unit circle, equally spaced
- **C.** inside the unit circle
- **D.** on the real axis

Question 5 If ω is a complex cube root of unity then $1+\omega+\omega^2=$

- **A.** 1
- **B.** -1
- **C.** 0
- **D.** 3

Question 6 $e^{i\pi}=$

- **A.** 1
- **B.** -1

- **C.** i
- **D.** $-i$

Question 7 If $z = \cos\theta + i\sin\theta$ then $z^3 + z^{-3} =$

- **A.** $2\cos 3\theta$
- **B.** $2i\sin 3\theta$
- **C.** $\cos 3\theta$
- **D.** $2\cos\theta$

Question 8 Solutions of $z^3 = 8$ have argument:

- **A.** $0,\ \pm\frac{2\pi}{3}$
- **B.** $0,\ \pm\frac{\pi}{3}$
- **C.** $\frac{\pi}{3}$ only
- **D.** $0,\ \pm\frac{\pi}{2}$

Question 9 The sum of the 7th roots of unity is:

- **A.** 1
- **B.** 7
- **C.** 0
- **D.** -1

Question 10 Which expression equals $\cos 3\theta$?

- **A.** $3\cos\theta$
- **B.** $4\cos^3\theta - 3\cos\theta$
- **C.** $3\cos\theta - 4\cos^3\theta$
- **D.** $\cos^3\theta$

Answer grid - De Moivre's theorem and roots of unity

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Question	Answer	Explanation
1	**B**	$\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}=i$.
2	**B**	$(\sqrt{2})^4(\cos\pi+i\sin\pi)=-4$.
3	**C**	An nth degree polynomial has n roots.
4	**B**	Modulus 1 and angles $2\pi k/n$.
5	**C**	The sum of the roots of $z^3-1=0$ is zero.
6	**B**	$\cos\pi+i\sin\pi=-1$.
7	**A**	$z^{-3}=\cos 3\theta-i\sin 3\theta$.
8	**A**	Arguments $2\pi k/3$.
9	**C**	Sum of roots of $z^7-1=0$ is 0.
10	**B**	From the real part of $(\cos\theta+i\sin\theta)^3$.