NDA 1 2025

LIVE

MATHS

COMPLEX NUMBERS

MCQS

NAVJYOTI SIR

Crack
EXAMS

27 Jan 2025 Live Classes Schedule

9:00AM	27 JANUARY 2025 DAILY DEFENCE UPDATES	DIVYANSHU SIR
10:00AM	27 JANUARY 2025 DAILY CURRENT AFFAIRS	RUBY MA'AM

SSB INTERVIEW LIVE CLASSES

9:30AM	MOCK PERSONAL INTERVIEWS	ANURADHA MA'AM

AFCAT 1 2025 LIVE CLASSES

12:30PM	REASONING - FIGURE ANALOGY	RUBY MA'AM
3:00PM	STATIC GK - AWARDS & HONOURS	DIVYANSHU SIR
4:30PM	ENGLISH - SYNONYMS - CLASS 2	ANURADHA MA'AM
5:30PM	MATHS - AVERAGE	NAVJYOTI SIR

NDA 1 2025 LIVE CLASSES

10:00AM	MATHS - COMPLEX NUMBERS	NAVJYOTI SIR
11:30AM	MEDIEVAL HISTORY - CLASS 2	RUBY MA'AM
1:00PM	PHYSICS - WAVES & SOUND	NAVJYOTI SIR
4:30PM	ENGLISH - SYNONYMS - CLASS 2	ANURADHA MA'AM

CDS 1 2025 LIVE CLASSES

11:30AM	MEDIEVAL HISTORY - CLASS 2	RUBY MA'AM
1:00PM	PHYSICS - WAVES & SOUND	NAVJYOTI SIR
4:30PM	ENGLISH - SYNONYMS - CLASS 2	ANURADHA MA'AM
5:30PM	MATHS - AVERAGE	NAVJYOTI SIR

If z is any complex number and $iz^3+z^2-z+i=0$, where $i=\sqrt{-1}$, then what is the value of $(|z|+1)^2$?

(a) 1

(b) 4

(c) 81

(d) 121

$z = i$,

$LHS = i(i)^3 + (i)^2 - i + i$

$i^4 + i^2 = 1 - 1 = 0 = RHS$

So, $z = i = 0 + 1i$

$|z| = \sqrt{0^2+1^2} = 1$

$(|z|+1)^2 = (1+1)^2 = 2^2 = 4$

If z is any complex number and $iz^3 + z^2 - z + i = 0$, where $i = \sqrt{-1}$, then what is the value of $(|z|+1)^2$?

(a) 1

(b) 4

(c) 81

(d) 121

Ans: (b)

Let z_1 and z_2 be two complex numbers such that $\left|\frac{z_1+z_2}{z_1-z_2}\right|=1$, then what is $Re\left(\frac{z_1}{z_2}\right)+1$ equal to ?

(a) –1

(b) 0

(c) 1

(d) 5

$$\frac{|z_1+z_2|}{|z_1-z_2|} = 1$$

$$|z_1+z_2|^2 = |z_1-z_2|^2$$

$$z_1 = a_1 + ib_1$$

$$z_2 = a_2 + ib_2$$

$$(a_1+a_2)^2 + (b_1+b_2)^2 = (a_1-a_2)^2 + (b_1-b_2)^2$$

$$2a_1a_2 + 2b_1b_2 = -2a_1a_2 - 2b_1b_2$$

$$4a_1a_2 = -4b_1b_2$$

$$4(a_1a_2 - b_1b_2) = 0 \Rightarrow \underline{a_1a_2 + b_1b_2 = 0}$$

$$\frac{z_1}{z_2} = \frac{a_1 + ib_1}{a_2 + ib_2} \times \frac{a_2 - ib_2}{a_2 - ib_2} = \frac{a_1 a_2 + b_1 b_2 + i(\quad)}{a_2^2 + b_2^2}$$

$$Re\left(\frac{z_1}{z_2}\right) = \frac{a_1 a_2 + b_1 b_2}{a_2^2 + b_2^2} = \frac{0}{a_2^2 + b_2^2} = 0$$

$$Re\left(\frac{z_1}{z_2}\right) + 1 = 0 + 1 = 1$$

Let z_1 and z_2 be two complex numbers such that $\left|\frac{z_1+z_2}{z_1-z_2}\right|=1$, then what is $Re\left(\frac{z_1}{z_2}\right)+1$ equal to ?

(a) -1

(b) 0

(c) 1

(d) 5

Ans: (c)

If $\omega \neq 1$ is a cube root of unity, then what is $(1+\omega-\omega^2)^{100}+(1-\omega+\omega^2)^{100}$ equal to? **(PYQ)**

(a) $2^{100}\omega^2$

(b) $2^{100}\omega$

(c) 2^{100}

(d) -2^{100}

$$(1+\omega-\omega^2)^{100}+(1-\omega+\omega^2)^{100}$$

$$(-\omega^2-\omega^2)^{100}+(1+\omega^2-\omega)^{100}$$

$$(-2\omega^2)^{100}+(-\omega-\omega)^{100}$$

$$(-2)^{100}\omega^{200}+(-2)^{100}(\omega)^{100}$$

$$2^{100}\left(\omega^{200}+\omega^{100}\right)=2^{100}\left(\omega^2+\omega^1\right)=2^{100}(-1)=-2^{100}$$

(#) $1+\omega+\omega^2=0$

$\omega^{3r}=1$

$\omega^{3r+1}=\omega^1=\omega$

$\omega^{3r+2}=\omega^2=\omega^2$

If $\omega \neq 1$ is a cube root of unity, then what is $(1+\omega-\omega^2)^{100}+(1-\omega+\omega^2)^{100}$ equal to? **(PYQ)**

(a) $2^{100}\omega^2$

(b) $2^{100}\omega$

(c) 2^{100}

(d) -2^{100}

Ans: (d)

If x, y and z are the cube roots of unity, then what is the value of $xy + yz + zx$?

(a) 0

(b) 1

(c) 2

(d) 3

(PYQ)

$x = 1$; $y = \omega$; $z = \omega^2$

$1 \cdot \omega + \omega \cdot \omega^2 + \omega^2 \cdot 1$

$\omega + \omega^3 + \omega^2$

$\omega + 1 + \omega^2$ (Sum of cube roots)

$= 0$

NDA 1 2025 – Revision – Maths - Complex Numbers

If x, y and z are the cube roots of unity, then what is the value of $xy + yz + zx$?

(a) 0

(b) 1

(c) 2

(d) 3

(PYQ)

Ans: (a)

Q) Let z_1 and z_2 be two non-zero complex numbers such that

$$|z_1| = |z_2| = \left|\frac{1}{z_1} + \frac{1}{z_2}\right| = 2$$

What is the value of $|z_1 + z_2|$?

(a) 8 (b) 4

(c) 2 (d) 1

$$\left|\frac{z_1}{z_2}\right| = \frac{|z_1|}{|z_2|}$$

$$|z_1 z_2| = |z_1||z_2|$$

$$\left|\frac{z_2 + z_1}{z_1 z_2}\right| = 2$$

$$\frac{|z_1 + z_2|}{|z_1||z_2|} = 2 \Rightarrow \frac{|z_1 + z_2|}{2 \times 2} = 2 \Rightarrow |z_1 + z_2| = 2 \times 2 \times 2 = 8$$

Q) Let z_1 and z_2 be two non-zero complex numbers such that

$$|z_1| = |z_2| = \left|\frac{1}{z_1} + \frac{1}{z_2}\right| = 2$$

What is the value of $|z_1 + z_2|$?

(a) 8 (b) 4

(c) 2 (d) 1

Ans: (a)

Q) What is one of the values of $\sqrt{i}+\sqrt{-i}$?

(a) $\sqrt{2}$ (b) 0

(c) $\pm\frac{1+i}{\sqrt{2}}$ (d) $\pm\frac{1-i}{\sqrt{2}}$

$i = \frac{(1+i)^2}{2}$ $-i = \frac{(1-i)^2}{2}$

$\sqrt{i} = \frac{1+i}{\sqrt{2}}$; $\sqrt{-i} = \frac{1-i}{\sqrt{2}}$

$\sqrt{i}+\sqrt{-i}$

$\frac{1+i}{\sqrt{2}} + \frac{1-i}{\sqrt{2}}$

$= \frac{2}{\sqrt{2}} = \sqrt{2}$

Q) What is one of the values of $\sqrt{i}+\sqrt{-i}$?

(a) $\sqrt{2}$

(b) 0

(c) $\pm\frac{1+i}{\sqrt{2}}$

(d) $\pm\frac{1-i}{\sqrt{2}}$

Ans: (a)

Q) If $1, \omega, \omega^2$ are the three cube roots of unity, then what is $\dfrac{(a\omega^6 + b\omega^4 + c\omega^2)}{(b + c\omega^{10} + a\omega^8)}$ equal to?

(a) $\dfrac{a}{b}$ (b) b

(c) ω (d) ω^2

$$\frac{a\omega^6 + b\omega^4 + c\omega^2}{b + c\omega^{10} + a\omega^8}$$

$$\frac{a + b\omega + c\omega^2}{b + c\omega + a\omega^2}$$

$\omega^{3r} = 1$

$\omega^{3r+1} = \omega^1 = \omega$

$\omega^{3r+2} = \omega^2 = \omega^2$

$$\frac{1}{\omega^2} \times \frac{\omega^2(a + b\omega + c\omega^2)}{b + c\omega + a\omega^2} = \frac{1}{\omega^2} \times \left(\frac{a\omega^2 + b\omega^3 + c\omega^4}{a\omega^2 + b + c\omega}\right)$$

$$\frac{1}{\omega^2} \times \left(\frac{a\omega^2 + b\omega^3 + c\omega^4}{a\omega^2 + b + c\omega} \right)$$

$$= \frac{1}{\omega^2} \times \frac{(a\omega^2 + b + c\omega)}{(a\omega^2 + b + c\omega)}$$

$$= \frac{1}{\omega^2} = \omega$$

(imaginary cubic roots of unity, are reciprocal of each other) $\Rightarrow$ $\omega = \frac{1}{\omega^2}$; $\omega^2 = \frac{1}{\omega}$

Q) If $1, \omega, \omega^2$ are the three cube roots of unity, then what is $\frac{(a\omega^6 + b\omega^4 + c\omega^2)}{(b + c\omega^{10} + a\omega^8)}$ equal to?

(a) $\frac{a}{b}$ (b) b

(c) ω (d) ω^2

Ans: (c)

Q) If $\alpha = \frac{1+i\sqrt{3}}{2}$, then what is the value of $1 + \alpha^8 + \alpha^{16} + \alpha^{24} + \alpha^{32}$?

(a) 0 (b) 1

(c) $-\omega$ (d) $-\omega^2$

$\alpha = \omega$,

$1 + \omega^8 + \omega^{16} + \omega^{24} + \omega^{32}$

$1 + \omega^2 + \omega + 1 + \omega^2$

$2 + 2\omega^2 + \omega$

$2(1+\omega^2) + \omega = -2\omega + \omega = -\omega$

$\omega = \frac{-1 + \sqrt{3}i}{2}$

$\omega^2 = \frac{-1 - \sqrt{3}i}{2}$

Q) If $\alpha = \frac{1+i\sqrt{3}}{2}$, then what is the value of $1 + \alpha^8 + \alpha^{16} + \alpha^{24} + \alpha^{32}$?

(a) 0

(b) 1

(c) $-\omega$

(d) $-\omega^2$

Ans: (c)

Q) What is $i^{1000} + i^{1001} + i^{1002} + i^{1003}$ equal to (where $i = \sqrt{-1}$)?

(a) 0 (b) i

(c) –i (d) 1

$i^{1000}(1 + i + i^2 + i^3)$

$(1 + i - 1 - i)$

$i^{1000}(0) = 0$

(sum of consecutive four powers of i' terms = 0.)

Q) What is $i^{1000} + i^{1001} + i^{1002} + i^{1003}$ equal to (where $i = \sqrt{-1}$)?

(a) 0
(b) i
(c) –i
(d) 1

Ans: (a)

What is the value of the sum

$$\sum_{n=1}^{20} (i^{n-1} + i^n + i^{n+1})$$

where $i = \sqrt{-1}$?

$$(i^0 + i^1 + i^2 + \dots i^{19}) + (i^1 + i^2 + \dots i^{20}) + (i^2 + i^3 + \dots i^{21})$$

$$0 \qquad 0 \qquad 0$$

$$= 0 + 0 + 0 = 0$$

(a) $-2i$

(b) 0

(c) 1

(d) $2i$

Q) $\left(i^{39} + \frac{1}{i^{69}}\right) = ?$

a) 0
b) 2i
c) −2i
d) 1 − i

$i^{39} + i^{-69}$

$i^{3} + i^{-1}$

$-i + \frac{1}{i}$

$= (-i) + (-i) = -2i$

$i^{4r} = 1$

$i^{4r+1} = i^{1} = i$

$i^{4r+2} = i^{2} = -1$

$i^{4r+3} = i^{3} = -i$

Q) $\left(i^{39}+\frac{1}{i^{69}}\right)=?$

a) 0

b) 2i

c) $-2i$

d) $1-i$

Ans: (c)

Q) What is the square root of the complex number $-5+12i$?

(a) $2-3i$ (b) $2+3i$

(c) $-2+3i$ (d) $\sqrt{-5}+\sqrt{12i}$

$\sqrt{-5+12i} = a+ib$

$a^2-b^2=-5$

$2ab=12$

$(a^2+b^2)^2=(a^2-b^2)^2+(2ab)^2$

$(a^2+b^2)^2=(-5)^2+(12)^2$

$a^2+b^2=13$

$(+)$ $a^2-b^2=-5$

$2a^2=8$

$a^2=4$

$a=\pm 2$

$(-)$ $a^2+b^2=13$

$2b^2=18$

$b^2=9$

$b=\pm 3$

$2+3i$

$-2-3i$ ✓

Q) What is the square root of the complex number $-5+12i$?

(a) $2-3i$ (b) $2+3i$

(c) $-2+3i$ (d) $\sqrt{-5}+\sqrt{12i}$

Ans: (b)

Q) If α and β are the roots of $x^2 + x + 1 = 0$, then what is $\sum_{j=0}^{3}(\alpha^j + \beta^j)$ equal to?

(a) 8 (b) 6
(c) 4 (d) 2

$x^2 + x + 1 = 0$

$\Rightarrow x = \omega$ and $x = \omega^2$ (roots)

$x = \omega \Rightarrow (\alpha)$, $x = \omega^2 \Rightarrow (\beta)$

$$\sum_{j=0}^{3}(\alpha^j + \beta^j) = (\alpha^0 + \beta^0) + (\alpha^1 + \beta^1) + (\alpha^2 + \beta^2) + (\alpha^3 + \beta^3)$$

$$= 2 + (\omega + \omega^2) + (\omega^2 + \omega^4) + (\omega^3 + \omega^6)$$

$$= 2 + (-1) + (-1) + (1+1) = 2$$

Q)If α and β are the roots of $x^2 + x + 1 = 0$, then what is $\sum_{j=0}^{3}(\alpha^j + \beta^j)$ equal to?

(a) 8 (b) 6

(c) 4 (d) 2

Ans: (d)

Q) The modulus and principal argument of the complex number $\frac{1+2i}{1-(1-i)^2}$ are respectively

(a) 1, 0 (b) 1, 1 (c) 2, 0 (d) 2, 1

$$z = \frac{1+2i}{1+2i} = 1$$

$$\text{modulus} = |z| = \sqrt{1^2+0^2} = 1$$

$$\text{argument} \Rightarrow \cos\theta = \frac{a}{|z|} \qquad \sin\theta = \frac{b}{|z|}$$

$$\left.\begin{matrix}\cos\theta = 1 \\ \sin\theta = 0\end{matrix}\right\} \theta = 0^\circ \text{ (argument)}$$

Q) The modulus and principal argument of the complex number $\frac{1+2i}{1-(1-i)^2}$ are respectively

(a) 1, 0 (b) 1, 1 (c) 2, 0 (d) 2, 1

Ans: (a)

Q) If z is a complex number such that $z + z^{-1} = 1$, then what is the value of $z^{99} + z^{-99}$?

(a) 1 (b) –1

(c) 2 (d) –2

$z + z^{-1} = 1$

$z + \frac{1}{z} = 1$

$z^2 + 1 - z = 0$

$z^2 - z + 1 = 0$

$z = -\omega$

$z = -\omega^2$

} Roots

$z^{99} + z^{-99}$

$(-\omega)^{99} + (-\omega)^{-99}$

$-\omega^{99} + \frac{1}{-\omega^{99}}$

$= -1 - 1 = -2$

Q) If z is a complex number such that $z + z^{-1} = 1$, then what is the value of $z^{99} + z^{-99}$?

(a) 1 (b) –1

(c) 2 (d) –2

Ans: (d)

Q) Consider the following statements

I. $(\omega^{10} + 1)^7 + \omega = 0$

II. $(\omega^{105} + 1)^{10} = p^{10}$ for some prime number p, where $\omega \neq 1$

Which of the above statement(s) is/are correct?

a) Only I

b) Only II

c) Both I & II

d) Neither I nor II

Q) Consider the following statements

I. $(\omega^{10} + 1)^7 + \omega = 0$

II. $(\omega^{105} + 1)^{10} = p^{10}$ for some prime number p, where $\omega \neq 1$

Which of the above statement(s) is/are correct?

a) Only I

b) Only II

c) Both I & II

d) Neither I nor II

Ans: (b)

Q) If $y = \cos\theta + i\sin\theta$, then the value of $y + \frac{1}{y}$ is

a) $2\cos\theta$

b) $2\sin\theta$

c) $2\operatorname{cosec}\theta$

d) $2\tan\theta$

Q) If $y = \cos\theta + i\sin\theta$, then the value of $y + \frac{1}{y}$ is

a) $2\cos\theta$

b) $2\sin\theta$

c) $2\operatorname{cosec}\theta$

d) $2\tan\theta$

Ans: (a)

Q) If $A=\{x\in Z: x^3-1=0\}$ and $B=\{x\in Z: x^2+x+1=0\}$, where Z is set of complex numbers, then what is $A\cap B$ equal to ?

(a) Null set

(b) $\left\{\frac{-1+\sqrt{3}\,i}{2}, \frac{-1-\sqrt{3}\,i}{2}\right\}$

(c) $\left\{\frac{-1+\sqrt{3}\,i}{4}, \frac{-1-\sqrt{3}\,i}{4}\right\}$

(d) $\left\{\frac{1+\sqrt{3}i}{2}, \frac{1-\sqrt{3}\,i}{2}\right\}$

Q) If $A=\{x \in Z : x^3-1=0\}$ and $B=\{x \in Z : x^2+x+1=0\}$, where Z is set of complex numbers, then what is $A \cap B$ equal to ?

(a) Null set

(b) $\left\{\frac{-1+\sqrt{3}\,i}{2}, \frac{-1-\sqrt{3}\,i}{2}\right\}$

(c) $\left\{\frac{-1+\sqrt{3}\,i}{4}, \frac{-1-\sqrt{3}\,i}{4}\right\}$

(d) $\left\{\frac{1+\sqrt{3}i}{2}, \frac{1-\sqrt{3}\,i}{2}\right\}$

Ans: (b)

Q) Which one of the following is correct in respect of the cube roots of unity?

(a) They are collinear

(b) They lie on a circle of radius $\sqrt{3}$

(c) They form an equilateral triangle

(d) None of the above

Q) Which one of the following is correct in respect of the cube roots of unity?

(a) They are collinear

(b) They lie on a circle of radius $\sqrt{3}$

(c) They form an equilateral triangle

(d) None of the above

Ans: (c)

Q) If $z = \left(\frac{\sqrt{3}}{2}+\frac{i}{2}\right)^{107} + \left(\frac{\sqrt{3}}{2}-\frac{i}{2}\right)^{107}$, then what is the imaginary part of z equal to?

(a) 0

(b) $\frac{1}{2}$

(c) $\frac{\sqrt{3}}{2}$

(d) 1

Q) If $z = \left(\frac{\sqrt{3}}{2}+\frac{i}{2}\right)^{107} + \left(\frac{\sqrt{3}}{2}-\frac{i}{2}\right)^{107}$, then what is the imaginary part of z equal to?

(a) 0

(b) $\frac{1}{2}$

(c) $\frac{\sqrt{3}}{2}$

(d) 1

Ans: (a)

Q) Let $z = i^3(1 + i)$ be a complex number. What is its argument?

(a) π

(b) $\frac{\pi}{4}$

(c) $-\frac{\pi}{4}$

(d) $\frac{5\pi}{4}$

Q) Let $z = i^3(1 + i)$ be a complex number. What is its argument?

(a) π

(b) $\frac{\pi}{4}$

(c) $-\frac{\pi}{4}$

(d) $\frac{5\pi}{4}$

Ans: (c)

Q) If $1, \omega, \omega^2$ are the cube roots of unity, then the value of $(1+\omega)(1+\omega^2)(1+\omega^4)(1+\omega^8)$ is

(a) -1 (b) 0

(c) 1 (d) 2

Q) If $1, \omega, \omega^2$ are the cube roots of unity, then the value of $(1+\omega)(1+\omega^2)(1+\omega^4)(1+\omega^8)$ is

(a) -1 (b) 0

(c) 1 (d) 2

Ans: (c)

Q) If $z^2 + z + 1 = 0$, where z is complex number, then the value of

$$\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\left(z^3+\frac{1}{z^3}\right)^2+\ldots\ldots\ldots+\left(z^6+\frac{1}{z^6}\right)^2 \text{ is}$$

(a) 18 (b) 54

(c) 6 (d) 12

Q) If $z^2 + z + 1 = 0$, where z is complex number, then the value of

$$\left(z+\frac{1}{z}\right)^2+\left(z^2+\frac{1}{z^2}\right)^2+\left(z^3+\frac{1}{z^3}\right)^2+.....+\left(z^6+\frac{1}{z^6}\right)^2 \text{ is}$$

(a) 18 (b) 54
(c) 6 (d) 12

Ans: (d)

NDA 1 2025

LIVE

MATHS

ANALYTICAL GEOMETRY 2D - 1

MCQS

NAVJYOTI SIR

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