

Question 11

Select the option which is the sinusoidal function of period $2\pi/\omega$ whose phasor is $2e^{2\pi i/3}$.

Options

- A $-\sqrt{3}\cos\omega t - \sin\omega t$ B $-\sqrt{3}\cos\omega t + \sin\omega t$
 C $-\cos\omega t - \sqrt{3}\sin\omega t$ D $-\cos\omega t + \sqrt{3}\sin\omega t$
 E $\cos\omega t - \sqrt{3}\sin\omega t$ F $\cos\omega t + \sqrt{3}\sin\omega t$
 G $\sqrt{3}\cos\omega t - \sin\omega t$ H $\sqrt{3}\cos\omega t + \sin\omega t$

$$2\left(\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3}\right) = -\cos\omega t + \sqrt{3}\sin\omega t = -1 + i\sqrt{3}$$

$$2e^{2\pi i/3} e^{i\omega t} = (-1 + i\sqrt{3})e^{i\omega t} = (-1 + i\sqrt{3})(\cos\omega t + i\sin\omega t) = -\cos\omega t - \sqrt{3}\sin\omega t$$

Question 12

Choose the option which is an expression for the general solution of the recurrence relation

$$u_{r+1} = -2\sqrt{3}u_r - 4u_{r-1}$$

Options

- A $u_n = 2^n (A \cos \frac{1}{6}n\pi + B \sin \frac{1}{6}n\pi)$ B $u_n = 2^n (A \cos \frac{1}{3}n\pi + B \sin \frac{1}{3}n\pi)$
 C $u_n = 2^n (A \cos \frac{2}{3}n\pi + B \sin \frac{2}{3}n\pi)$ D $u_n = 2^n (A \cos \frac{5}{6}n\pi + B \sin \frac{5}{6}n\pi)$
 E $u_n = 4^n (A \cos \frac{1}{6}n\pi + B \sin \frac{1}{6}n\pi)$ F $u_n = 4^n (A \cos \frac{1}{3}n\pi + B \sin \frac{1}{3}n\pi)$
 G $u_n = 4^n (A \cos \frac{2}{3}n\pi + B \sin \frac{2}{3}n\pi)$ H $u_n = 4^n (A \cos \frac{5}{6}n\pi + B \sin \frac{5}{6}n\pi)$

$$2\cos(\omega t + 120^\circ) = 2\cos\omega t \cos 120^\circ - \sin\omega t \sin 120^\circ = -\cos\omega t - \sqrt{3}\sin\omega t$$

$$\cos\phi = \frac{-1}{2}$$

$$x^2 + 2\sqrt{3}x + 4 = 0$$

$$x = -2\sqrt{3} \pm \sqrt{4}$$

$$= -\sqrt{3} + i, -\sqrt{3} - i$$

Unit 6

$$u_n = A(\sqrt{3} + i)^n + B(-\sqrt{3} - i)^n = A(2^n \cos \frac{5\pi n}{6} - \sin \frac{5\pi n}{6}) + B(2^n (\cos \frac{5\pi n}{6} - \sin \frac{5\pi n}{6})) = 2^n ((A+B)\cos \frac{5\pi n}{6} + (A-B)\sin \frac{5\pi n}{6})$$

Questions 13 to 16

For each of the following differential equations, select the option which gives an expression for its general solution.

G 13 $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 0$

$$\lambda^2 - 6\lambda + 9 = (\lambda - 3)^2 \quad y = Ae^{3x} + Bxe^{3x}$$

H 14 $\frac{d^2y}{dx^2} + 9y = 0$

$$\lambda^2 + 9 = 0 \quad \lambda = \pm 3i \quad y = A\sin 3x + B\cos 3x$$

E 15 $\frac{d^2y}{dx^2} - 9y = 0$

$$\lambda^2 - 9 = 0 \quad \lambda = \pm 3 \quad y = Ae^{3x} + Be^{-3x}$$

C 16 $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} = 0$

$$\lambda^2 + 3\lambda = 0 \Rightarrow \lambda = -3, 0 \quad y = A + Be^{-3x}$$

Options for Questions 13 to 16

- A $y = Ae^{-3x}$ B $y = Ae^{3x}$
 C $y = A + Be^{-3x}$ D $y = A + Be^{3x}$
 E $y = Ae^{-3x} + Be^{3x}$ F $y = Ae^{-3x} + Bxe^{-3x}$
 G $y = Ae^{3x} + Bxe^{3x}$ H $y = A \cos 3x + B \sin 3x$