Solutions

Q.1

dimensions.

$$L \equiv [M L^2 T^{-2} I^{-2}]$$

$$R \equiv [M^1 L^2 T^{-3} I^{-2}]$$

$$C \equiv [M^{-1} L^{-2} T^4 I^2]$$

$$f = [T^{-1}]$$

So $\frac{1}{RC} \equiv T^{-1} = f$

$\frac{R}{L} \equiv T^{-1} = f$

$\frac{1}{\sqrt{LC}} \equiv T^{-1} = f$

} So A, B, C

+0

Q.2.

time = 40 sec

no. of oscillation = 20

So $T = \frac{40}{20} = 2$ sec.

$\frac{\Delta T}{T} = \frac{1}{40}$

$\Delta T = \frac{2}{40} = 0.05$ sec

$\frac{\Delta g}{g} \times 100 = 2\frac{\Delta T}{T} \times 100 = 2 \times \frac{0.05}{2} \times 100$

$= 5\ \%$

} 80 A, C

Q.3

$\vec{A}+\vec{B}$ will be in plane of $\vec{A}$ & $\vec{B}$

$\vec{C}$ is out of plane so. $\vec{A}+\vec{B}+\vec{C}$ can't be zero.

so addition will be in between two plane

(A & B) and C

so (A, D)

Q.4.

$$|\vec{a}+\vec{b}| = |\vec{a}-\vec{b}|$$

$$\sqrt{a^2+b^2+2ab\cos\theta} = \sqrt{a^2+b^2-2ab\cos\theta}$$

so $\cos\theta = 0$

$\theta = \frac{\pi}{2} = 90^\circ$ option (B)

Q.5

$$|\vec{b}| = \sqrt{3^2+4^2} = 5$$

so Required vector = 5 (unit vector along $\vec{a}$)

$$= 5\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)$$

so option (A)

Q.6

$$I = \int \sin 2\theta \, d\theta$$

$$= -\cos 2\theta + C \longrightarrow \text{option (A)}$$

$$= -\left[\frac{2\cos^2\theta - 1}{2}\right] + C$$

now $\cos 2\theta = 2\cos^2\theta - 1$

or $\cos 2\theta = 1 - 2\sin^2\theta$

$$= -\cos^2\theta + \left(\frac{1}{2} + C\right)$$

$$= -\cos^2\theta + C \quad \text{option B}$$

$$= -(1 - \sin^2\theta) + C$$

$$= \sin^2\theta + C \quad \text{option C}$$

So (A, B, C)

Q.7

$$y = \frac{d}{dx} \ln(\sin^2 x)$$

chain rule.

$$y = \frac{1}{\sin^2 x} \cdot \frac{d}{dx}(\sin^2 x)$$

$$= \frac{2\sin x \cos x}{\sin^2 x} = \frac{2\cos x}{\sin x} = 2\cot x$$

$$= \frac{2}{\tan x}$$

So (B D)

Q.8

$$P = \frac{F}{A} \quad \text{— option (A)}$$

$$P \equiv \frac{F}{A} \cdot \frac{L}{L} = \frac{\text{Energy}}{\text{Volume}} \quad \text{— option B}$$

$$\frac{\text{Momentum}}{\text{Area time}} \equiv \frac{\text{mass velocity}}{\text{Area time}} = \frac{\text{mass acceleration}}{\text{Area}}$$

$$= \frac{\text{force}}{\text{Area}} = \text{Pressure}$$

— option C

So A, B, C

Matrix Match —

(i)

dimensionally —

$$GM_eM_s \equiv [M^1L^3T^{-2}]$$

$$\frac{3RT}{M} \equiv [L^2T^{-2}]$$

$$\frac{F^2}{q^2B^2} \equiv [L^2T^{-2}]$$

$$\frac{GM_e}{R_e} \equiv [L^2T^{-2}]$$

} these (3) are same dimensionaly

now column - II

(Volt) (Coulomb) meter $\equiv [M^1 L^3 T^{-2}]$

$(Kg)(meter)^3 (sec)^{-2} \equiv [M^1 L^3 T^{-2}]$

$(meter)^2 (sec)^{-2} \equiv [L^1 T^{-1}]^2 \equiv [L^2 T^{-2}]$

$(farad)(volt)^2 (Kg^{-1}) \equiv [L^2 T^{-2}]$

So A → P Q
B → R, S
C → R, S
D → R S
} option (A)

Matrix - 2

0.12345 → no. of singificant figure ≡ (5)

0.12100 → (5)

$\frac{47.23}{2.3}$ ≡ minimum of input ⇒ (2)

3×10^8 ≡ only (1)

So 1 → P
2 → P
3 → S
4 → R
} option (A)

Integer type

(Q.1) $E \propto m f^2 A^x$

$M^1 L^2 T^{-2} \propto M^1 T^{-2} L^x$

So $x = 2$

(Q.2) $Y = \dfrac{a^2 b^2}{c^3}$

$\dfrac{dx}{x} \times 100 = 2\dfrac{\Delta a}{a} \times 100 + 2\dfrac{\Delta b}{b} \times 100 + 3\dfrac{\Delta c}{c} \times 100$

$= 2 \times 1 + 2 \times 2 + 3 \times 1$

$= 9\ \%$

(Q.3) $I = \int_0^{\pi} \sin^2 x\, dx$

$= \int \dfrac{1 - \cos 2x}{2} dx$

$= \dfrac{1}{2}\int_0^{\pi} dx - \dfrac{1}{2}\int_0^{\pi} \cos 2x\, dx$

$= \dfrac{\pi}{2} - 0 = \dfrac{\pi}{2}$

So $A = 2$

Q.4.

$$(10)^2 = (8)^2 + (6)^2 + 2(8)(6)\cos\theta$$

$$\cos\theta = 0$$

$$\theta = 90^\circ = 10x$$

$$x = 9$$

Q.5

$$\vec{A} = 3\hat{i} + 4\hat{j} - 2\hat{k}$$
$$\vec{B} = 6\hat{i} + 8\hat{j} - P\hat{k}$$ } Parallel

So $\vec{B} = \lambda \vec{A}$

$$6\hat{i} + 8\hat{j} - P\hat{k} = \lambda(3\hat{i} + 4\hat{j} - 2\hat{k})$$

Compare $P = 4$

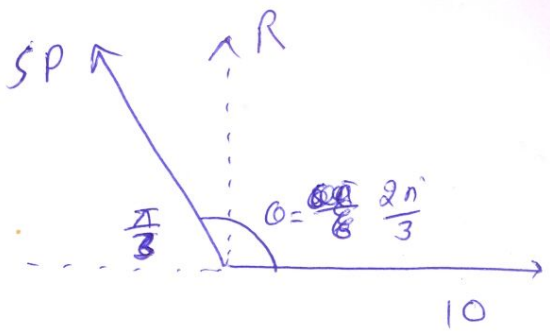
Q.6.

$$\frac{\Delta d}{d} \times 100 = \frac{dM}{M} \times 100 + 2\frac{\Delta R}{R} \times 100 + \frac{\Delta l}{l} \times 100$$

$$= \frac{0.003}{0.3} \times 100 + 2\left(\frac{0.5}{0.005} \times 100\right) + \frac{0.06}{6} \times 100$$

$$= 4\ \%$$

Q. 7



for Resultant 1 to 10

$$SP\cos\frac{\pi}{3} = 10$$

$$SP = 20$$

$$P = 4$$

Q. 8

$$\int_{-\infty}^{0} \frac{1}{1+e^{-x}}\,dx$$

$$= \int \frac{e^{x}}{1+e^{x}}\,dx$$

$$= \ln\left|1+e^{x}\right|\Big|_{-\infty}^{0}$$

$$= \ln 2 - \ln 1$$

$$I = \ln 2$$

So $A = 1$