KD Campus

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PLOT NO. 2 SSI, OPP METRO PILLAR 150, GT KARNAL ROAD, JAHANGIRPURI, DELHI: 110033

NDA MATHS MOCK TEST - 170 (SOLUTION)

1. (B) $I = \int x \cos x \, dx$

$I = x\int \cos x \, dx - \int \left\{ \frac{d}{dx}(x) . \int \cos x \, dx \right\} dx$

$I = x.\sin x - \int 1 .\sin x \, dx$

$I = x.\sin x + \cos x + c$

2. (C) Let $y = x.ln\cos x$

On differentiating w.r.t. 'x'

$\frac{dy}{dx} = x \times \frac{(-\sin x)}{\cos x} + \ln\cos x \times 1$

$\frac{dy}{dx} = -x.\tan x + \ln\cos x$

3. (B) $\begin{vmatrix} 1 & 6 & \pi \\ \log_e e & 6 & \sqrt{7} \\ \log_5 5 & \log_2 64 & e \end{vmatrix}$

$\Rightarrow \begin{vmatrix} 1 & 6 & \pi \\ 1 & 6 & \sqrt{7} \\ 1 & 6 & e \end{vmatrix}$

$\Rightarrow 6\begin{vmatrix} 1 & 1 & \pi \\ 1 & 1 & \sqrt{7} \\ 1 & 1 & e \end{vmatrix} = 0$ [$\because$ two columns are idential.]

4. (A) We know that

$C_0 + C_1x + C_2x^2 + \ldots C_{n-1}x^{n-1} + C_nx^n = (1+x)^n$ ...(i)

Multiply by x

$\Rightarrow C_0x + C_1x^2 + \ldots C_{n-1}x^n + C_nx^{n+1} = x(1+x)^n$

On differentiating both side w.r.t. 'x'

$\Rightarrow C_0 + 2C_1x + 3C_2x^2 + \ldots + nC_{n-1}x^{n-1} + (n+1)C_nx^n$

$= nx(1+x)^{n-1} + (1+x)^n.1$

On putting $x = 1$

$\Rightarrow C_0 + 2C_1 + 3C_2 + \ldots + nC_{n-1} + (n+1)C_n = n.2^{n-1} + 2^n$

$\Rightarrow C_0 + 2C_1 + 3C_2 + \ldots + nC_{n-1} + (n+1)C_n$

$= 2^{n-1}[n+2]$

5. (B) $\lim_{x\to 0} \frac{\log_5(1+x)}{x}$ $\left(\frac{0}{0}\right)$ Form

$\Rightarrow \lim_{x\to 0} \frac{\log_e(1+x)}{x\log_e 5}$ $\left(\because \log_a b = \frac{\log_e b}{\log_e a}\right)$

$\Rightarrow \frac{1}{\log_e 5} \lim_{x\to 0} \frac{\log_e(1+x)}{x}$

$\Rightarrow \log_5 e$

$\left(\because \lim_{x\to 0} \frac{\log_e(1+x)}{x} = 1 \text{ and } \log_a b = \frac{1}{\log_b a}\right)$

6. (A) $[x^3 + 1] = (x+1)(x^2 - x + 1)$

$[x^3 + 1] = (x+1)(x+\omega)(x+\omega^2)$

7. (A) $I = \int x\cdot e^{x^2}\log x \, dx + \int \frac{e^{x^2}}{2x} dx$

$I = \frac{1}{2}\int 2x\cdot e^{x^2}\log x \, dx + \int \frac{e^{x^2}}{2x} dx$

$I = \frac{1}{2}\left[\log x\cdot\int 2x e^{x^2} dx - \int\left\{\frac{d}{dx}(\log x)\int 2x\cdot e^{x^2} dx\right\} dx\right]$

$+ \int \frac{e^{x^2}}{2x} dx$

$I = \frac{1}{2}\left[(\log x)e^{x^2} - \int \frac{1}{x}\cdot e^{x^2} dx\right] + \int \frac{e^{x^2}}{2x} dx$

$I = \frac{1}{2} e^{x^2}\cdot\log x - \int \frac{e^{x^2}}{2x} dx + \int \frac{e^{x^2}}{2x} dx + c$

$I = \frac{1}{2} e^{x^2}\cdot\log x + c$

8. (D) $10! \times C(19,11) = k.P(19,8)$

$10! \times \frac{19!}{11!\,8!} = k.\frac{19!}{11!}$

$\frac{10!}{8!} = k \Rightarrow k = 90$

9. (B) $\lim_{x\to\pi/4} \frac{(1-\tan x)(1+\sin 2x)}{(1+\tan x)(\pi - 4x)}$ $\left[\frac{0}{0}\right]$ form

by L-Hospital's Rule

$\Rightarrow \lim_{x\to\pi/4} \frac{(1-\tan x)(2\cos 2x) + (1+\sin 2x)(-\sec^2 x)}{(1+\tan x)(-4) + (\pi - 4x)(\sec^2 x)}$

$\Rightarrow \frac{\left(1-\tan\frac{\pi}{4}\right)\left(2\cos\frac{\pi}{2}\right) + \left(1+\sin\frac{\pi}{2}\right)\left(-\sec^2\frac{\pi}{4}\right)}{\left(1+\tan\frac{\pi}{4}\right)(-4) + (\pi - \pi)\sec^2\frac{\pi}{4}}$

$\Rightarrow \frac{0 + 2(-2)}{2(-4) + 0} = \frac{-4}{-8} = \frac{1}{2}$

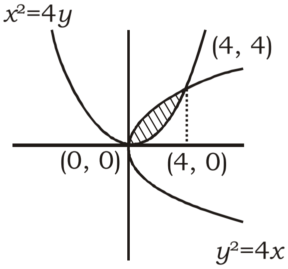
10. (B) differential equation

$$y^2 = x\left(\frac{dy}{dx}\right)^2 - \frac{3}{\frac{dy}{dx}}$$

$$y^2\frac{dy}{dx} = x\left(\frac{dy}{dx}\right)^3 - 3$$

Hence order = 1 and degree = 3

11. (C) $x^2=4y$



$y_1 \Rightarrow y = 2\sqrt{x}$ and $y_2 \Rightarrow y = \frac{x^2}{4}$

The required Area = $\int_0^4 (y_1 - y_2)\,dx$

$$= \int_0^4\left(2\sqrt{x} - \frac{x^2}{4}\right)dx$$

$$= \left[2\times\frac{x^{\frac{3}{2}}}{\frac{3}{2}} - \frac{x^3}{4\times 3}\right]_0^4$$

$$= \left[\frac{4}{3}\times(4)^{\frac{3}{2}} - \frac{1}{12}(4)^3\right]$$

$$= \frac{37}{3} - \frac{16}{3}$$

$$= \frac{16}{3} \text{ sq. unit}$$

12. (C) Let $a - ib = \sqrt{4 - 8\sqrt{6}i}$

On squaring both side w.r.t. 'x'

$(a^2 - b^2) - 2abi = 4 - 8\sqrt{6}$ ...(i)

$(a^2 + b^2)^2 = (a^2 - b^2)^2 + 4a^2b^2$

$(a^2 + b^2) = 16 + 384$

$a^2 + b^2 = 20$ ...(ii)

$2a^2 = 24$

$2b^2 = 16$

$a^2 = 12$

$b^2 = 8$

$a = \pm 2\sqrt{3}, b = \pm 2\sqrt{2}$

Square root of $(4-8\sqrt{6}i) = \pm(2\sqrt{3} - 2\sqrt{2}i)$

13. (D) Three-digit numbers

9	10	10

$= 9\times 10\times 10 = 900$

'0'can't put here

14. (B) $\frac{dy}{dx} + 4y = \frac{dx}{dy}$

$$\frac{dy}{dx} + 4y = \frac{1}{\frac{dy}{dx}}$$

$$\left(\frac{dy}{dx}\right)^2 + 4y\frac{dy}{dx} = 1$$

order = 1 and degree = 2

15. (D) Let A and B be the events that X and Y qualify the examination respectively,

We have, $P(A) = 0.05$, $P(B) = 0.10$ and $P(A\cap B) = 0.02$,

then P(only one of A and B will qualify the examination) = $P(A\cap \overline{B}) + P(B\cap \overline{A})$

$= P(A) - P(A\cap B) + P(B) - P(A\cap B)$

$= P(A) + P(B) - 2P(A\cap B)$

$= 0.05 + 0.1 - 2(0.02)$

$= 0.15 - 0.04 = 0.11$

16. (C) Let X and Y are two persons and they hit a target with the probability A and B respectively.

$\therefore\ P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$

P(Probability of hitting the target by any one X or Y)

$\Rightarrow P(A\cap \overline{B}) + P(\overline{A}\cap B)$

$\Rightarrow P(A).P(\overline{B}) + P(\overline{A}).P(B)$

$\Rightarrow \frac{1}{3}\times\frac{3}{4} + \frac{2}{3}\times\frac{1}{4} = \frac{1}{4} + \frac{1}{6} = \frac{5}{12}$

17. (C) Given that $\sin x.\cos x = \frac{1}{2}$

$\Rightarrow 2\sin x.\cos x = 1$

$\Rightarrow \sin 2x = \sin 90$

$\Rightarrow 2x = 90 \Rightarrow x = 45$

Now, $\sec^n x + \text{cosec}^n x$

$\Rightarrow (\sec 45)^n + (\text{cosec} 45)^n$

$\Rightarrow \left(\sqrt{2}\right)^n + \left(\sqrt{2}\right)^n = 2^{\frac{n+2}{2}}$

18. (B) $y = \text{cosec}(\tan^{-1}x)$

On differentiating both side w.r.t. 'x'

$$\frac{dy}{dx} = -\text{cosec}(\tan^{-1}x).\cot(\tan^{-1}x).\frac{1}{1+x^2}$$

$$\left(\frac{dy}{dx}\right)_{\text{at } x=1} = -\text{cosec}\left(\frac{\pi}{4}\right)\cot\left(\frac{\pi}{4}\right).\frac{1}{2}$$

$$\left(\frac{dy}{dx}\right)_{\text{at } x=1} = -\frac{\sqrt{2}\times 1}{2} = \frac{-1}{\sqrt{2}}$$

19. (A) $z = 1 - \cos\frac{\pi}{3} - i\sin\frac{\pi}{3}$

$$z = 2\sin^2\frac{\pi}{6} - i.\ 2\sin\frac{\pi}{6}.\cos\frac{\pi}{6}$$

$$z = 2\sin\frac{\pi}{6}\left[\sin\frac{\pi}{6} - i\cos\frac{\pi}{6}\right]$$

$$z = 2\times\frac{1}{2}\left[\frac{1}{2} - i\frac{\sqrt{3}}{2}\right]$$

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

Now, $\arg(z) = \tan^{-1}\left(\frac{-\sqrt{3}/2}{1/2}\right)$

$$= \tan^{-1}\left(-\sqrt{3}\right)$$

$$= \tan^{-1}\left(-\tan\frac{\pi}{3}\right)$$

$$= \tan^{-1}\left[\tan\left(-\frac{\pi}{3}\right)\right] = \frac{-\pi}{3}$$

20. (A) $y = e^{2x}(a\sin x - b\cos x)$ ....(i)

On differentiating both side w.r.t. 'x'

$$\frac{dy}{dx} = e^{2x}(a\cos x + b\sin x) + 2(a\sin x - b\cos x)\,e^{2x}$$

$$\frac{dy}{dx} = e^{2x}\ (a\cos x + b\sin x) + 2y \quad ..(ii)$$

Again, differentiating

$$\frac{d^2y}{dx^2} = e^{2x}(-a\sin x + b\cos x)$$

$$+2(a\cos x + b\sin x)\ e^{2x} + 2\frac{dy}{dx}$$

$$\frac{d^2y}{dx^2} = -e^{2x}(a\sin x - \text{b}\cos x) + 2e^{2x}(a\cos x +$$

$$b\sin x) + \frac{2dy}{dx}$$

$$\frac{d^2y}{dx^2} = -y + 2\left(\frac{dy}{dx} - 2y\right) + \frac{2dy}{dx}$$

$$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 5y = 0$$

21. (B) $z = 1 + \cos\frac{\pi}{12} + i\sin\frac{\pi}{12}$

$$z = 2\cos^2\frac{\pi}{24} + i\times 2\sin\frac{\pi}{24}.\cos\frac{\pi}{24}$$

$$z = 2\cos\frac{\pi}{24}\left[\cos\frac{\pi}{24} + i\sin\frac{\pi}{24}\right]$$

$$|z| = 2\cos\frac{\pi}{24}$$

22. (C) $y = x^3 + e^{2x}$

On differentiating w.r.t. 'x'

$$\frac{dy}{dx} = 3x^2 + 2e^{2x}$$

again, differentiating w.r.t. 'x'

$$\frac{d^2y}{dx^2} = 3\times 2x + 2.e^{2x}\times 2$$

$$\frac{d^2y}{dx^2} = 6x + 4.e^{2x}$$

23. (C) Vectors $3\hat{i} + \hat{j} + \lambda\hat{k}$, $3\hat{i} - \hat{j} + 2\hat{k}$ and $\hat{i} + \hat{j} - 4\hat{k}$ are coplanar, then

$$\begin{vmatrix} 3 & 1 & \lambda \\ 3 & -1 & 2 \\ 1 & 1 & -4 \end{vmatrix} = 0$$

$3(4-2) - 1(-12-2) + \lambda(3+1) = 0$

$6 + 14 + 4\lambda = 0 \Rightarrow \lambda = -5$

24. (C) $\begin{vmatrix} 1 & 2 & 3 \\ 0 & 1 & 0 \\ -1 & -4 & 2+x \end{vmatrix} = 15$

$\Rightarrow 1(2+x) - 2(0) + 3(1) = 15$

$\Rightarrow x + 5 = 15 \Rightarrow x = 10$

25. (A) $\because \alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$

Also, $\alpha + h + \beta + h = -\frac{q}{p}$

$$\Rightarrow \alpha + \beta + 2h = -\frac{q}{p}$$

$$\Rightarrow 2h = -\frac{q}{p} + \frac{b}{a} \qquad \left(\because \alpha + \beta = -\frac{b}{a}\right)$$

$$\Rightarrow h = \frac{1}{2}\left[\frac{b}{a} - \frac{q}{p}\right]$$

26. (A) A.T.Q.

$2a = 4 \times 2b \Rightarrow a = 4b$

Now, $e = \sqrt{1-\frac{b^2}{a^2}}$

$\Rightarrow e = \sqrt{1-\frac{b^2}{16b^2}} \Rightarrow e = \frac{\sqrt{15}}{4}$

27. (C) Let $I = \int_{-\pi/2}^{\pi/2} \frac{\sin^3 x}{\cos x} dx$

$I = 0$ [$\because$ Function is an odd.]

28. (C) Probability of selecting Rohan $P(R) = \frac{2}{5}$

and $P(\overline{R}) = 1-\frac{2}{5} = \frac{3}{5}$

probability of selecting Sumit $P(S) = \frac{1}{4}$

$P(\overline{S}) = 1-\frac{1}{4} = \frac{3}{4}$

Probability of one of them is selected

$= \frac{2}{5}\times\frac{3}{4}+\frac{3}{5}\times\frac{1}{4} \Rightarrow \frac{6}{20}+\frac{3}{20} = \frac{9}{20}$

29. (C) $I = \int e^x\left(1-\frac{\sin 2x}{2}\right)\text{cosec}^2 x\, dx$

$I = \int e^x.\text{cosec}^2 x\, dx - \int \frac{e^x.\sin 2x}{2}.\text{cosec}^2 x\, dx$

$I = \int e^x.\text{cosec}^2 x\, dx - \int e^x \frac{2\sin x.\cos x}{2.\sin^2 x} dx$

$I = \int e^x.\text{cosec}^2 x\, dx - \int e^x.\cot x\, dx$

$I = -\int e^x(\cot x \neg \cos ec^2 x)\, dx]$

$I = -e^x.\cot x + c$

$\left[\because \int e^x\left(f(x)+f'(x)\right)dx = e^x.f(x)+c\right]$

30. (A) The no. of triangle required $= {}^{13}C_3 - {}^{5}C_3$

$= 286 - 10$

$= 276$

31. (D) $\frac{\sin^2\frac{3A}{2}}{\sin^2\frac{A}{2}} - \frac{\cos^2\frac{3A}{2}}{\cos^2\frac{A}{2}}$

$\Rightarrow \left(\frac{\sin\frac{3A}{2}}{\sin\frac{A}{2}}\right)^2 - \left(\frac{\cos\frac{3A}{2}}{\cos\frac{A}{2}}\right)^2$

$\Rightarrow \left(\frac{3\sin\frac{A}{2}-4\sin^3\frac{A}{2}}{\sin\frac{A}{2}}\right)^2 - \left(\frac{4\cos^3\frac{A}{2}-3\cos\frac{A}{2}}{\cos\frac{A}{2}}\right)^2$

$\Rightarrow \left(3-4\sin^2\frac{A}{2}\right)^2 - \left(4\cos^2\frac{A}{2}-3\right)^2$

$\Rightarrow 9 + 16\sin^4\frac{A}{2} - 24\sin^2\frac{A}{2} - 16\cos^4\frac{A}{2} -$

$9 + 24\cos^2\frac{A}{2}$

$\Rightarrow 16\sin^4\frac{A}{2} - 16\cos^4\frac{A}{2}$

$-24\left(\sin^2\frac{A}{2}-\cos^2\frac{A}{2}\right)$

$\Rightarrow 16\left(\sin^2\frac{A}{2}+\cos^2\frac{A}{2}\right)\left(\sin^2\frac{A}{2}-\cos^2\frac{A}{2}\right)$

$-24\left(\sin^2\frac{A}{2}-\cos^2\frac{A}{2}\right)$

$\Rightarrow \left(\sin^2\frac{A}{2}-\cos^2\frac{A}{2}\right)(16-24)$

$\Rightarrow 8\cos A$

32. (A) We know that

$C_0 + C_1 x + C_2 x^2 + \ldots C_{n-1} x^{n-1} + C_n x^n = (1+x)^n$ ...(i)

replace $x \to \frac{1}{x}$

$C_0 + \frac{C_1}{x} + \frac{C_2}{x^2} + \ldots + \frac{C_n}{x^n} = \left(1+\frac{1}{x}\right)^n$

multiply by x

$C_0 x + C_1 + \frac{C_2}{x} + \frac{C_3}{x^2} + \ldots + \frac{C_n}{x^{n-1}} = \frac{x(x+1)^n}{x^n}$ ...(ii)

From equation (i) and (ii)

Coefficient of x^0 in $(x+1)^n . \frac{x(x+1)^n}{x^n}$

$= C_0C_1 + C_1C_2 + \ldots + C_{n-1}C_n$

Coefficient of x^{n-1} in $(1+x)^{2n}$

$= C_0C_1 + C_1C_2 + \ldots + C_{n-1}C_n \; {}^{2n}C_{n-1}$

$= C_0C_1 + C_1C_2 + \ldots + C_{n-1}C_n$

$C_0C_1 + C_1C_2 + \ldots + C_{n-1}C_n = \frac{(2n)!}{(n-1)!(n+1)!}$

33. (A) $x = a(\theta.\cos\theta - \sin\theta)$

$\frac{dx}{d\theta} = a[\theta(-\sin\theta) + \cos\theta.1 - \cos\theta]$

$\frac{dx}{d\theta} = -a\theta.\sin\theta$

and $y = a(\cos\theta + \theta.\sin\theta)$

$\frac{dx}{d\theta} = a(-\sin\theta + \theta.\cos\theta + \sin\theta.1)$

$\frac{dy}{d\theta} = a\theta.\cos\theta$

then $\frac{dy}{dx} = \frac{dy}{d\theta} \times \frac{d\theta}{dx}$

$\frac{dy}{dx} = a\theta.\cos\theta \times \left(\frac{-1}{a\theta.\sin\theta}\right)$

$\frac{dy}{dx} = -\cot\theta$

$\frac{d^2y}{dx^2} = -(-\text{cosec}^2\theta).\frac{d\theta}{dx}$

$\frac{d^2y}{dx^2} = \text{cosec}^2\theta.\left(\frac{-1}{a\theta.\sin\theta}\right) = \frac{-\text{cosec}^3\theta}{a\theta}$

34. (A) Let $y = 6^{73}$

taking log both side

$\log_{10}y = 73 \log_{10}6$

$\log_{10}y = 73 \times 0.778$

$\log_{10}y = 56.794$

No. of digits = 56 +1 = 57

35. (C) The no. of subsets of A = ${}^{10}C_2$

$= \frac{10 \times 9}{2} = 45$

36. (A) A.T.Q,

$m[a + (m-1)d] = n[a + (n-1)d]$

$\Rightarrow am + (m^2 - m)d = an + (n^2 - n)d$

$\Rightarrow a(m - n) = d(n^2 - n - m^2 + m)$

$\Rightarrow a(m - n) = d(m - n)[1 - m - n]$

$\Rightarrow a - d(1 - m - n) = 0$

$\Rightarrow a + (m + n - 1)d = 0$

Hence, $(m + n)^{th}$ term = 0

37. (C) Let $I = \int_0^\pi \frac{\phi\left(\frac{x}{2}\right)}{\phi\left(\frac{x}{2}\right) + \phi\left(\frac{\pi - x}{2}\right)} dx$ ...(i)

$I = \int_0^\pi \frac{\phi\left(\frac{\pi - x}{2}\right)}{\phi\left(\frac{\pi - x}{2}\right) + \phi\left(\frac{x}{2}\right)} dx$ ...(ii)

from eq(i) and eq(ii)

$2I = \int_0^\pi \frac{\phi\left(\frac{x}{2}\right) + \phi\left(\frac{\pi - x}{2}\right)}{\phi\left(\frac{x}{2}\right) + \phi\left(\frac{\pi - x}{2}\right)} dx$

$2I = \int_0^\pi 1.dx$

$2I = [x]_0^\pi$

$2I = \pi - 0 \Rightarrow I = \frac{\pi}{2}$

38. (A) given that

$\log_5 2, \log_5(3^x - 1)$ and $\log_5(5\times3^x - 13)$ are in A.P,

then $2\log_5(3^x - 1) = \log_5 2 + \log_5(5\times3^x - 13)$

$\Rightarrow \log_5(3^x - 1)^2 = \log_5\{2(5\times3^x - 13)\}$

$\Rightarrow (3^x)^2 + 1 - 2\times3^x = 10\times3^x - 26$

$\Rightarrow (3^x)^2 - 12\times3^x + 27 = 0$

$\Rightarrow (3^x - 9)(3^x - 3) = 0$

$3^x = 9$ or $3^x = 3$

$x = 2$ $x = 1$

39. (A) $x + iy = \frac{1}{3 - \cos\theta - i\sin\theta}$

$x + iy = \frac{3 - \cos\theta + i\sin\theta}{(3 - \cos\theta)^2 + \sin^2\theta}$

$x + iy = \frac{3 - \cos\theta + i\sin\theta}{10 - 6\cos\theta}$

On Comparing

$x = \frac{3 - \cos\theta}{10 - 6\cos\theta}$ and $y = \frac{\sin\theta}{10 - 6\cos\theta}$

Now, $(2x - 1)(4x - 1)$

$\Rightarrow \left[2\times\frac{3 - \cos\theta}{10 - 6\cos\theta} - 1\right]\left[4\times\frac{3 - \cos\theta}{10 - 6\cos\theta} - 1\right]$

$\Rightarrow \left[\frac{3 - \cos\theta}{5 - 3\cos\theta} - 1\right]\left[\frac{6 - 2\cos\theta}{5 - 3\cos\theta} - 1\right]$

$\Rightarrow \frac{-2(1 + \cos\theta)}{5 - 3\cos\theta} \times \frac{1 + \cos\theta}{5 - 3\cos\theta}$

$\Rightarrow \frac{-2\sin^2\theta}{(5 - 3\cos\theta)^2}$

$\Rightarrow \frac{-2\times4\sin^2\theta}{(10 - 6\cos\theta)^2} \Rightarrow -8y^2$

40. (A) Let $y = \ln(x + \sin x)$

On differentiating both side w.r.t. 'x'

$\frac{dy}{dx} = \frac{1 + \cos x}{x + \sin x}$

41. (D) $\lim_{x\to 3} \dfrac{4^{\frac{x}{2}} - 8}{2^{2x} - 64}$

$\left[\dfrac{0}{0}\right]$ Form

by L-Hospital's Rule

$\Rightarrow \lim_{x\to 3} \dfrac{\frac{1}{2}\times 4^{\frac{x}{2}} \log 4 - 0}{2^{2x}\times 2\times \log 2 - 0}$

$\Rightarrow \lim_{x\to 3} \dfrac{2^{x}\times \frac{1}{2}\times 2\log 2}{2^{2x}\times 2\log 2}$

$\Rightarrow \dfrac{1}{2} \times \dfrac{2^3}{2^6} = \dfrac{1}{16}$

42. (A) Ellipse $\dfrac{x^2}{\lambda^2} + \dfrac{y^2}{25}$ where $\lambda > 5$

$e^2 = 1 + \dfrac{25}{\lambda^2} \Rightarrow e = \dfrac{\sqrt{\lambda^2+25}}{\lambda}$

foci = $\pm (ae, 0) = \pm \left(\sqrt{\lambda^2+25}, 0\right)$

hyperbola $\dfrac{x^2}{25} - \dfrac{y^2}{36} = 1$

$e^2 = 1 + \dfrac{36}{25} \Rightarrow e = \dfrac{\sqrt{61}}{5}$

foci = $\pm (ae, 0) = \pm \left(\sqrt{61}, 0\right)$

then

$\sqrt{\lambda^2+25} = \sqrt{61} \Rightarrow \lambda^2 = 36$

43. (A) $A = \{1, 2, 3, 4, 6, 7, 9\}$

no. of elements = 7

then

No. of subsets of A = $2^7 = 128$

44. (C) Given that $f(x) = \dfrac{1}{\sqrt{32 - x^2}}$

$f'(x) = \dfrac{(-2x)}{2(32-x^2)^{\frac{3}{2}}} = \dfrac{x}{(32-x^2)^{\frac{3}{2}}}$

then $\lim_{x\to 4} \dfrac{f(4) - f(x)}{x^2 - 16}$ $\left[\dfrac{0}{0}\right]$ Form

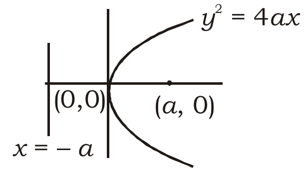
by L-Hospitals' Rule

$\Rightarrow \lim_{x\to 4} \dfrac{-f'(x)}{2x}$

$\Rightarrow \lim_{x\to 4} \dfrac{-\left(\dfrac{x}{(32-x^2)^{\frac{3}{2}}}\right)}{2x}$

$\Rightarrow -\dfrac{1}{2(32-16)^{\frac{3}{2}}} = -\dfrac{1}{128}$

45. (A) Hence point on the parabola $y^2 = 4ax$ nearest to the focus has its abscissa $x = 0$



46. (A) $I = \int e^x.\sin x\, dx$ ...(i)

$I = \sin x \int e^x\, dx - \int\left\{\dfrac{d}{dx}(\sin x).\int e^x.dx\right\} dx$

$I = (\sin x).e^x - \int \cos x\, .e^x\, dx + 2c$

$I = e^x.\sin x - \left[\cos x \int e^x dx - \int\left\{\dfrac{d}{dx}(\cos x).\int e^x dx\right\} dx\right]$ $+2c$

$I = e^x \sin x - \left[\cos x\, e^x - \int(-\sin x)e^x dx\right] + 2c$

$I = e^x \sin x - \cos x.e^x - \int \sin x.e^x\, dx + 2c$

$I = e^x \sin x - \cos x.e^x - I + 2c$ [from eq. (i)]

$2I = e^x \sin x - \cos x.e^x + c$

$I = \dfrac{\sin x - \cos x}{2}.e^x + c$

47. (A) $I = \int_0^1 \sqrt{\dfrac{1+x}{1-x}}\, dx$

$I = \int_0^1 \sqrt{\dfrac{1+x}{1-x}\times\dfrac{1+x}{1+x}}\, dx$

$I = \int_0^1 \dfrac{1+x}{\sqrt{1-x^2}}\, dx$

$I = \int_0^1 \dfrac{1}{\sqrt{1-x^2}}\, dx + \int_0^1 \dfrac{x}{\sqrt{1-x^2}}\, dx$

Let $1 - x^2 = t$ When $x\to 0$, $t\to 1$

$-2x\, dx = dt$

$x\to 1$, $t\to 0$

$xdx = \dfrac{-1}{2}\, dt$

$I = [\sin^{-1}x]_0^1 - \dfrac{1}{2}\int_1^0 \dfrac{dt}{\sqrt{t}}$

$I = \sin^{-1}1 - \sin^{-1}0 - \dfrac{1}{2}\left[\dfrac{t^{\frac{-1}{2}+1}}{\frac{-1}{2}+1}\right]_1^0$

$I = \dfrac{\pi}{2} - 0 - [0 - (1)^{1/2}]$

$I = \dfrac{\pi}{2} + 1$

48. (B) $\{x / x^2 + 2 = 0, x \in R\}$

49. (A) $I = \int_0^1 \frac{x^8}{\sqrt{1-x^6}}\, dx$

$I = \int_0^1 \frac{x^6 . x^2}{\sqrt{1-(x^3)^2}}\, dx$

Let $x^3 = \sin\theta$ when $x \to 0$, $\theta = 0$

$3x^2.dx = \cos\theta . d\theta$ $x \to 1, \theta = \frac{\pi}{2}$

$x^2.dx = \frac{1}{3}\cos\theta . d\theta$

$I = \int_0^{\pi/2} \frac{1}{3} \frac{\sin^2\theta . \cos\theta . d\theta}{\sqrt{1-\sin^2\theta}}$

$I = \frac{1}{3}\int_0^{\pi/2} \sin^2\theta . d\theta$

$I = \frac{1}{3}\int_0^{\pi/2} \frac{1-\cos 2\theta}{2}\, d\theta$

$I = \frac{1}{6}\left[\theta - \frac{\sin 2\theta}{2}\right]_0^{\pi/2}$

$I = \frac{1}{6}\left[\frac{\pi}{2} - 0\right) = \frac{\pi}{12}$

50. (B) $y = a^{x+a^{x+a^{x+a^{x+ \ldots\ldots\infty}}}}$

$y = a^{x+y}$

On differentiating both side w.r.t. 'x'

$\frac{dy}{dx} = a^{x+y}. \log_e a\left(1 + \frac{dy}{dx}\right)$

$\frac{dy}{dx} = y.\log_e a\left(1 + \frac{dy}{dx}\right)$ from eq.(*i*)

$(1 - y\log_e a)\frac{dy}{dx} = y.\log_e a$

$\frac{dy}{dx} = \frac{y\log_e a}{1 - y\log_e a}$

51. (A) In ΔABC, $AB(c) = 5$ cm, $BC(a) = 12$ cm, $CAB(b) = 13$cm

$s = \frac{5+12+13}{2} = 15$

$\tan\frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$

$\tan\frac{A}{2} = \sqrt{\frac{2\times 10}{15\times 3}} \Rightarrow \tan\frac{A}{2} = \frac{2}{3}$

$\tan\left(2\times\frac{A}{4}\right) = \frac{2\tan\frac{A}{4}}{1-\tan^2\frac{A}{4}}$

$\frac{2}{3} = \frac{2\tan\frac{A}{4}}{1-\tan^2\frac{A}{4}}$

$\tan^2\frac{A}{4} + 3\tan\frac{A}{4} - 1 = 0$

$\tan\frac{A}{4} = \frac{-3\pm\sqrt{13}}{2}$

Hence $\tan\frac{A}{4} = \frac{\sqrt{13}-3}{2}$

52. (A) $I = \int \tan^{-1}(\cot x + \operatorname{cosec} x)dx$

$I = \int \tan^{-1}\left(\frac{\cos x}{\sin x} + \frac{1}{\sin x}\right)dx$

$I = \int \tan^{-1}\left(\frac{2\cos^2\frac{x}{2}}{2\sin\frac{x}{2}.\cos\frac{x}{2}}\right)dx$

$I = \int \tan^{-1}\left(\cot\frac{x}{2}\right)dx$

$I = \int \tan^{-1}\left[\tan\left(\frac{\pi}{2}-\frac{x}{2}\right)\right]dx$

$I = \int\left(\frac{\pi}{2}-\frac{x}{2}\right)dx$

$I = \frac{\pi}{2}x - \frac{x^2}{4} + c$

53. (D) $y = x\, lnx + \frac{e^x}{x}$

On differentiating both side w.r.t. 'x'

$\frac{dy}{dx} = x.\frac{1}{x} + lnx.1 + e^x\left(\frac{-1}{x^2}\right) + \frac{1}{x}.e^x$

$\frac{dy}{dx} = 1 + lnx - \frac{e^x}{x^2} + \frac{e^x}{x}$

$\left(\frac{dy}{dx}\right)_{at x=1} = 1 + ln1 - \frac{e^1}{1} + \frac{e^1}{1} = 1$

54. (C) Given that

$x + y = 25$ ...(i)

A.T.Q.

$A = x^3y^2$

$\Rightarrow A = x^3(25 - x)^2$

$\Rightarrow A = 625x^3 + x^5 - 50x^4$

On differentiating both side w.r.t. 'x'

$\Rightarrow \frac{dA}{dx} = 1875x^2 + 5x^4 - 200x^3$ ...(i)

again, differentiating

$\Rightarrow \frac{d^2A}{dx^2} = 3750x + 20x^3 - 600x^2$ ...(ii)

for maxima and minima

$\frac{dA}{dx} = 0$

$\Rightarrow 1875x^2 + 5x^4 - 200x^3 = 0$

$\Rightarrow 5x^2(x^2 - 40x + 375) = 0$

$\Rightarrow x^2(x - 25)(x - 15) = 0$

$\Rightarrow x = 0, 15, 25$

from eq. (ii)

$\left(\frac{d^2A}{dx^2}\right)_{\text{at } x=15} = 3750\times15+20\times15^3-600\times(15)^2$

$= -11250$ (maxima)

$\left(\frac{d^2A}{dx^2}\right)_{\text{at } x=25} = 3750\times25+20(25)^3-600\times(25)^2$

$= 31250$ (minima)

for maximum value, $x = 15$ and $y = 10$

55. (B) $f(x) = \log_e\left(\frac{1+x}{1-x}\right)$ and $g(x) = \frac{3x+x^2}{1+3x^2}$

Now, $gof\left(\frac{e-1}{e+1}\right) = g\left[f\left(\frac{e-1}{e+1}\right)\right]$ ...(i)

$\Rightarrow gof\left(\frac{e-1}{e+1}\right) = g\left[\log_e\left(\frac{1+\frac{e-1}{e+1}}{1-\frac{e-1}{e+1}}\right)\right]$

$\Rightarrow gof\left(\frac{e-1}{e+1}\right) = g\left[\log_e\left(\frac{e+1+e-1}{e+1-e+1}\right)\right]$

$\Rightarrow gof\left(\frac{e-1}{e+1}\right) = g\left[\log_e\left(\frac{2e}{2}\right)\right]$

$\Rightarrow gof\left(\frac{e-1}{e+1}\right) = g[\log_e e]$

$\Rightarrow gof\left[\frac{e-1}{e+1}\right] = g(1)$

$\Rightarrow gof\left[\frac{e-1}{e+1}\right] = \frac{3(1)+(1)^2}{1+3(1)}$

$\Rightarrow gof\left[\frac{e-1}{e+1}\right] = \frac{3+1}{1+3} = 1$

56. (C) Planes

$x + 2y - z = 7$ and $-x + y - 2z = 9$

Angle between the Planes

$\cos\theta = \frac{1\times(-1)+2\times1+(-1)(-2)}{\sqrt{1^2+(-2)^2+(-1)^2}\sqrt{(-1)^2+1^2+(-2)^2}}$

$\cos\theta = \frac{3}{\sqrt{6}\sqrt{6}}$

$\cos\theta = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{3}$

57. (A) Word " STILL"

No. of words start with 'I' = $\frac{4!}{2!} = 12$

No. of words start with 'L' = $4! = 24$

No. of words start with 'SI' = $\frac{3!}{2!} = 3$

No. of words start with 'SL' $\rightarrow 3! = 6$

word 'STILL' $\rightarrow 1$

Position of word 'STILL' = 12 + 24 + 3 + 6 + 1

= 46th

58. (B) **Statement I**

for any three coplanar vectors a, b and c

$(a \times b).c = 0$

Statement I is incorrect.

Statement II

L.H.S. = $x.\{(y+z)\times(x+y+z)\}$

$= x.\{y\times x + y\times y + y\times z + z\times x + z\times y + z\times z\}$

$= x.\{y\times x + y\times z + z\times x - y\times z\}$

$= x.\{y\times x + z\times x\}$

$= x.(y\times x) + x.(z\times x)$

$0 + 0 = 0$ = R.H.S.

Statement II is correct.

59. (A) $\frac{1-\tan 32^\circ.\tan 205^\circ}{\tan 212^\circ - \cot 115^\circ}$

$\Rightarrow \frac{1-\tan 32^\circ.\tan(180+25^\circ)}{\tan(180+32^\circ)-\cot(90+25^\circ)}$

$\Rightarrow \frac{1-\tan 32^\circ.\tan 25^\circ}{\tan 32^\circ+\tan 25^\circ}$

$\Rightarrow \frac{1}{\tan(32+25^\circ)} = \cot 57 = \tan 33^\circ$

60. (C) $\left(\sqrt{3}+1\right)^5 = {}^5C_0\left(\sqrt{3}\right)^5 + {}^5C_1\left(\sqrt{3}\right)^4 + ... + {}^5C_5$

and $\left(\sqrt{3}-1\right)^5 = {}^5C_0\left(\sqrt{3}\right)^5 - {}^5C_1\left(\sqrt{3}\right)^4 + ..- {}^5C_5$

Now, $\left(\sqrt{3}-1\right)^5 + \left(\sqrt{3}-1\right)^5$

$\Rightarrow 2\left[{}^5C_0\left(\sqrt{3}\right)^5 + {}^5C_2\left(\sqrt{3}\right)^3 + {}^5C_4\left(\sqrt{3}\right)^1\right]$

$\Rightarrow 2\left[9\sqrt{3} + 10\times 3\sqrt{3} + 5\sqrt{3}\right] = 88\sqrt{3}$

61. (C) $f(x) = \begin{cases} \dfrac{x-\sin x}{x^2}, & x \neq 0 \\ \lambda \quad , & x = 0 \end{cases}$ is continuous

at $x = 0$, then

$\lim_{x\to 0^-} f(x) = f(0)$

$\lim_{x\to 0} \dfrac{x-\sin x}{x^2} = \lambda$

by L-Hospital's Rule

$\lim_{x\to 0} \dfrac{1-\cos x}{2x} = \lambda$

by L-Hospital's Rule

$\lim_{x\to 0} \dfrac{+\sin x}{2} = \lambda \Rightarrow \lambda = 0$

62. (C) $I = \dfrac{\sin x}{\sin x + \cos x}\, dx$ ...(i)

$I = \int_0^{\frac{\pi}{2}} \dfrac{\sin\left(\frac{\pi}{2}-x\right)}{\sin\left(\frac{\pi}{2}-x\right)+\cos\left(\frac{\pi}{2}-x\right)}\, dx$

$I = \dfrac{\cos x}{\cos x + \sin x}\, dx$ ...(ii)

from equation (i) and equation (ii)

$I + I = \int_2^{\frac{\pi}{2}} 1\,.dx$

$2I = [x]_0^{\frac{\pi}{2}}$

$2I = \dfrac{\pi}{2} \Rightarrow I = \dfrac{\pi}{4}$

63. (A) $I = \int e^x \dfrac{2x-1}{(2x+1)^2}\, dx$

$I = \int e^x \left(\dfrac{1}{2x+1} - \dfrac{2}{(2x+1)^2}\right) dx$

$I = e^x \times \dfrac{1}{2x+1} + c$

$I = \dfrac{e^x}{(2x+1)} + c$

64. (D) Let $y = \tan^{-1}\sqrt{\dfrac{1-\cos 2x}{1+\cos 2x}}$

$\Rightarrow y = \tan^{-1}\sqrt{\dfrac{2\sin^2 x}{2\cos^2 x}}$

$\Rightarrow y = \tan^{-1}(\tan x)$

$\Rightarrow y = x$

On differentiating both side w.r.t 'x'

$\Rightarrow \dfrac{dy}{dx} = 1$

65. (A) Differential equation

$\sin\left(\dfrac{dy}{dx}\right) - a = 0$

$\Rightarrow \sin\dfrac{dy}{dx} = a$

$\Rightarrow \dfrac{dy}{dx} = \sin^{-1}a$

$\Rightarrow dy = \sin^{-1}a\, dx$

Integrating both side

$\Rightarrow \int dy = \int \sin^{-1}a\, dx + c$

$\Rightarrow y = x\sin^{-1}a + c$

66. (D) $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 2$ and $|\vec{a}+\vec{b}| = 2\sqrt{3}$

Now,

$|\vec{a}+\vec{b}|^2 + |\vec{a}-\vec{b}|^2 = 2[|\vec{a}|^2 + |\vec{b}|^2]$

$\Rightarrow (2\sqrt{3})^2 + |\vec{a}-\vec{b}|^2 = 2[(\sqrt{3})^2 + (2)^2]$

$\Rightarrow 12 + |\vec{a}-\vec{b}|^2 = 2[3+4]$

$\Rightarrow 12 + |\vec{a}-\vec{b}|^2 = 14$

$\Rightarrow |\vec{a}-\vec{b}|^2 = 2 \Rightarrow |\vec{a}-\vec{b}| = \sqrt{2}$

67. (A) $({}^{15}C_1 - {}^7C_1) + ({}^{15}C_2 - {}^7C_2) + ... + ({}^{15}C_7 - {}^7C_7)$

$\Rightarrow (1 + {}^{15}C_1 + {}^{15}C_2 + {}^{15}C_3 .... {}^{15}C_7) - (1 + {}^7C_1 + {}^7C_2 + {}^7C_3 .... {}^7C_7)$

$\Rightarrow ({}^{15}C_0 + {}^{15}C_1 + {}^{15}C_2 + {}^{15}C_3 .... {}^{15}C_7) - ({}^7C_0 + {}^7C_1 + {}^7C_2 .... {}^7C_7)$

$\Rightarrow \dfrac{(1+1)^{15}}{2} - (1+1)^7$

$\therefore [(1+x)^n = {}^nC_0 + {}^nC_1 + {}^nC_2 .... {}^nC_n]$

$\Rightarrow \dfrac{2^{15}}{2} - 2^7 \Rightarrow 2^{14} - 2^7$

68. (C) given that

$7^7 + 7\times7^6\times3^1 + 21\times7^5\times3^2 ....+3^7$

$= k \times 2^5 \times 5^6$ ....(i)

We know that

$(x + a)^n = {}^nC_0\, x^n + {}^nC_1\, x^{n-1} a + ... {}^nC_n\, a^n$

On putting $x = 7$, $a = 3$, $n = 7$

$(7 + 3)^7 = {}^7C_0\, 7^7 + {}^7C_1\, 7^6 \times 3 + ... + {}^7C_7\, 3^7$

$10^7 = 7^7+7\times7^6\times3^1+21\times7^5\times3^2.........+3^7$

On comparing with eq.(i)

$k \times 2^5\times5^6 = 10^7$

$k \times 2^5\times5^6 = 2^7\times5^7 \Rightarrow k = 20$

69. (B) $\lim_{x \to 1} \frac{\log_5(2-x)}{1-x}$ $\left[\frac{0}{0}\right]$ form

by L- Hospital's Rule

$\Rightarrow \lim_{x \to 1} \frac{\frac{-1}{2-x}\log_5 e}{-1}$

$\Rightarrow \frac{\log_5 e}{2-1} = \log_5 e$

70. (C) **Short method :**

Curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$

Area $= \frac{a^2}{6}$

Now, given that

Curve $\sqrt{x} + \sqrt{y} = \sqrt{3}$

Then Area $= \frac{(3)^2}{6} = \frac{3}{2}$ sq. unit

71. (B) Let $a + ib = \sqrt{(4 + 6\sqrt{5}i)}$

On squaring both side

$(a^2 - b^2) + 2abi = 4 + 6\sqrt{5}\, i$

On comparing

$a^2 - b^2 = 4$ and $2ab = 6\sqrt{5}$ ...(i)

$(a^2 + b^2)^2 = 16 + 180$

$a^2 + b^2 = 14$ ...(ii)

from eq. (i) and eq. (ii)

$a = \pm 3$

$b = \pm \sqrt{5}$

Square root of $(4 + 6\sqrt{5}\, i)$ is $\pm (3 + \sqrt{5}\, i)$.

72. (B) In the expansion of $\left(x - \frac{1}{2\sqrt{x}}\right)^7$

$T_{r+1} = {}^7C_r\, (x)^{7-r} \left(\frac{-1}{2\sqrt{x}}\right)^r$

$= {}^7C_r \left(\frac{-1}{2}\right)^r x^{7-\frac{3r}{2}}$

Then

$7 - \frac{3r}{2} = 1$

$\frac{3r}{2} = 6 \Rightarrow r = 4$

Coefficient of $x = {}^7C_4 \left(\frac{-1}{2}\right)^4$

$= \frac{7!}{4!3!} \times \frac{1}{16} = \frac{35}{16}$

73. (A) Let $y = 5^{61}$

taking log both side

$\log_{10} y = 61 \log_{10} 5$

$\log_{10} y = 61 \times 0.699$

$\log_{10} y = 42.639$

No. of digits = 42 + 1 = 43

74. (B) $\lim_{x\to0} \frac{3^x - 1}{\sqrt{3+x} - \sqrt{3}}$

$\left[\frac{0}{0}\right]$ Form

by L - Hospital's Rule

$\Rightarrow \lim_{x\to0} \frac{3^x - 1}{\sqrt{3+x} - \sqrt{3}}$

$\Rightarrow \lim_{x\to0} \frac{3^x \log 3 - 0}{\frac{1}{2\sqrt{3+x}} - 0}$

$\Rightarrow \lim_{x\to0} 2\log3\, \sqrt{3+x}\, .3^x$

$\Rightarrow 2(\log3)\sqrt{3}\,.1 = 2\sqrt{3}\log3$

75. (B) $\frac{\left[1 + \left(i^5\right)^{4n-1}\right]^{4n+1}}{\left[1 + \left(i^5\right)^{4n+1}\right]^{4n-1}}$

$\Rightarrow \frac{\left[1 + (i)^{4n-1}\right]^{4n+1}}{\left[1 + (i)^{4n+1}\right]^{4n-1}} \Rightarrow \frac{\left[1 + i^{-1}\right]^{4n+1}}{\left[1 + i\right]^{4n-1}}$

$\Rightarrow \frac{\left[1 + \frac{1}{i}\right]^{4n+1}}{[1+i]^{4n-1}} \Rightarrow \frac{[1+i]^{4n+1}}{[1+i]^{4n-1} . i^{4n+1}}$

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

76. (B) $\int_1^2 \left\{k^2 + (1-k)x + 2x^3\right\} dx \le 10$

$\Rightarrow \left[k^2 x + (1-k)\frac{x^2}{2} + \frac{2x^4}{4}\right]_1^2 \le 10$

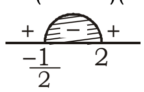
$\Rightarrow (2k^2+(1-k)\times 2+8) - \left(k^2 + (1-k)\times\frac{1}{2} + \frac{1}{2}\right) \le 10$

$\Rightarrow k^2 - \frac{3k}{2} + 9 \le 10$

$\Rightarrow 2k^2 - 3k + 18 \le 20$

$\Rightarrow 2k^2 - 3k - 2 \le 0$

$\Rightarrow (2k+1)(k-2) \le 0$



Hence $\frac{-1}{2} \le k \le 2$

77. (C) $\lim_{x\to\infty}\left[\frac{x^2+4x+5}{x^2+x+5}\right]^x \Rightarrow \lim_{x\to\infty}\left[\frac{1+\frac{4}{x}+\frac{5}{x^2}}{1+\frac{1}{x}+\frac{5}{x^2}}\right]^x$

We know that,

$\lim_{x\to\infty}[f(x)]^{g(x)} = e^{\lim_{x\to\infty}[f(x)-1]g(x)}$

$\Rightarrow e^{\lim_{x\to\infty}\left[\frac{x^2+4x+5}{x^2+x+5}-1\right]x} \Rightarrow e^{\lim_{x\to\infty}\left[\frac{3x}{x^2+x+5}\right]x}$

$\Rightarrow e^{\lim_{x\to\infty}\left[\frac{3x^2}{x^2+x+5}\right]} \Rightarrow e^{\lim_{x\to\infty}\left[\frac{3}{1+\frac{1}{x}+\frac{5}{x^2}}\right]} = e^3$

78. (A)

79. (B) $\sin^{-1}\frac{8}{17} + \tan^{-1}\frac{3}{4}$

$\Rightarrow \tan^{-1}\frac{8}{15} + \tan^{-1}\frac{3}{4}$

$\Rightarrow \tan^{-1}\left[\frac{\frac{8}{15}+\frac{3}{4}}{1-\frac{8}{15}\times\frac{3}{4}}\right]$

$\Rightarrow \tan^{-1}\left[\frac{32+45}{60-24}\right] = \tan^{-1}\left(\frac{77}{36}\right)$

80. (A) Distance between circumcentre and incentre = $\sqrt{R(R-2r)}$

81. (C) $A = \begin{bmatrix}1 & 0 & 2\\ 3 & -1 & 4\\ 0 & 2 & -1\end{bmatrix}$ and B = $\begin{bmatrix}4 & 3 & 0\\ -1 & 2 & 3\\ 0 & -1 & 5\end{bmatrix}$

$AB = \begin{bmatrix}1 & 0 & 2\\ 3 & -1 & 4\\ 0 & 2 & -1\end{bmatrix}\begin{bmatrix}4 & 3 & 0\\ -1 & 2 & 3\\ 0 & -1 & 5\end{bmatrix}$

$AB = \begin{bmatrix}4 & 1 & 10\\ 13 & 3 & 17\\ -2 & 5 & 1\end{bmatrix}$

det = 4(3 − 85) − 1(13 + 34) +10(65 + 6)
= − 328 − 47 + 710 = 335

82. (B) Standard deviation

83. (C) $f(x) = \sqrt{24+x^2}$

$f'(x) = \frac{1}{2}\times\frac{1}{\sqrt{24+x^2}}\times 2x = \frac{x}{\sqrt{24+x^2}}$

then

$\lim_{x\to 1}\frac{f(x)-f(1)}{x-1}$

$\left[\frac{0}{0}\right]$ Form

by L-Hospital's Rule

$\Rightarrow \lim_{x\to 1}\frac{f'(x)-0}{1-0}$

$\Rightarrow \lim_{x\to 1}\frac{x}{\sqrt{24+x^2}} = \frac{1}{\sqrt{24+1}} = \frac{1}{5}$

84. (D) $\cos\frac{\pi}{24} > \tan\frac{\pi}{24} > \sin\frac{\pi}{24}$

85. (D) I. If $\cot\theta = x$,

then $x + \frac{1}{x} = \cot\theta + \frac{1}{\cot\theta}$

$\Rightarrow x + \frac{1}{x} = \frac{\cos\theta}{\sin\theta} + \frac{\sin\theta}{\cos\theta}$

$\Rightarrow x + \frac{1}{x} = \frac{\cos^2\theta+\sin^2\theta}{\sin\theta.\cos\theta}$

$\Rightarrow x + \frac{1}{x} = \frac{1}{\sin\theta.\cos\theta} = \text{cosece}\theta.\sec\theta$

∴ Statement I is correct.

II. If $x + \frac{1}{x} = \sin\theta$,

then $\left(x+\frac{1}{x}\right)^2 = \sin^2\theta$

$\Rightarrow x^2 + \frac{1}{x^2} + 2 = \sin^2\theta$

$\Rightarrow x^2 + \frac{1}{x^2} = \sin^2\theta - 2$

∴ Statement II is correct.

III. If $x = p\sec\theta$ and $y = q\tan\theta$,

then $x^2q^2 - y^2p^2 = p^2q^2\sec^2\theta - p^2q^2\tan^2\theta$

$\Rightarrow x^2q^2 - y^2p^2 = p^2q^2(\sec^2\theta - \tan^2\theta)$

$\Rightarrow x^2q^2 - y^2p^2 = p^2q^2$

∴ Statement III is correct.

IV. Maximum value of $(\cos\theta - \sqrt{3}\sin\theta)$

$= \sqrt{1^2 + \left(-\sqrt{3}\right)^2} = 2$

Statement IV is incorrect.

∴ Only I, II and III are correct.

86. (C) Let $z = \dfrac{(1-2i)(2+i)}{1-i}$

$\Rightarrow z = \dfrac{4-3i}{1-i} \times \dfrac{1+i}{1+i}$

$\Rightarrow z = \dfrac{4-3i+4i-3i^2}{1-i^2}$

$\Rightarrow z = \dfrac{7+i}{2}$

Now, $\arg(z) = \tan^{-1}\left(\dfrac{\frac{1}{2}}{\frac{7}{2}}\right)$

$\Rightarrow \arg(z) = \tan^{-1}\left(\dfrac{1}{7}\right)$

87. (C) $x = \dfrac{a(1+t^2)}{1-t^2}$

$\Rightarrow \dfrac{dx}{dt} = a\left[\dfrac{(1-t^2)(2t)-(1+t^2)(-2t)}{(1-t^2)^2}\right]$

$\Rightarrow \dfrac{dx}{dt} = a\left[\dfrac{4t}{(1-t^2)^2}\right]$

and $y = \left[\dfrac{4at}{1-t^2}\right]$

$\Rightarrow \dfrac{dy}{dt} = 4a\left[\dfrac{(1-t^2).1-t(-2t)}{(1-t^2)^2}\right] = \dfrac{4a(1+t^2)}{(1-t^2)^2}$

Now, $\dfrac{dy}{dx} = \dfrac{dy}{dt} \times \dfrac{dt}{dx}$

$\Rightarrow \dfrac{dy}{dx} = \dfrac{4a(1+t^2)}{(1-t^2)^2} \times \dfrac{(1-t^2)^2}{4at}$

$\Rightarrow \dfrac{dy}{dx} = \dfrac{1+t^2}{t}$ ...(i)

Given that $x = \dfrac{a(1+t^2)}{1-t^2}$, $y = \dfrac{4at}{1-t^2}$

Now, $\dfrac{x}{y} = \dfrac{1+t^2}{4t}$

from eq(i)

$\dfrac{dy}{dx} = \dfrac{4x}{y}$

88. (C) $\dfrac{\sin(x+y)}{\sin(x-y)} = \dfrac{a+b}{a-b}$

by Componendo & Dividendo Rule

$\Rightarrow \dfrac{\sin(x+y)+\sin(x-y)}{\sin(x+y)-\sin(x-y)} = \dfrac{a+b+a-b}{a+b-a+b}$

$\Rightarrow \dfrac{2\sin x.\cos y}{2\cos x.\sin y} = \dfrac{2a}{2b}$

$\Rightarrow \dfrac{\tan x}{\tan y} = \dfrac{a}{b} \Rightarrow \dfrac{\tan y}{\tan x} = \dfrac{b}{a}$

89. (D) given that $A = B \cap C$

Now, (U– (U– (U– (U– (U – A)))))

$\Rightarrow$ (U– (U– (U– (U – A'))))

$\Rightarrow$ (U– (U– (U – A)))

$\Rightarrow$ (U– (U – A'))

$\Rightarrow$ (U – A) = A' = $(B \cap C)'$ = $(B' \cup C')$

90. (D) Minimum value of $(20\sin\theta + 21\cos\theta)$

$= -\sqrt{(20)^2+(21)^2}$

$= -\sqrt{400+441} = -29$

Now, min. value of $29 + 20\sin\theta + 21\cos\theta$

$= 29 - 29 = 0$

91. (B) $f(x) = \dfrac{1}{\sqrt{x+\sqrt{3x-1}}} + \dfrac{1}{\sqrt{x-\sqrt{3x-1}}}$

$f(3) = \dfrac{1}{\sqrt{3+2\sqrt{2}}} + \dfrac{1}{\sqrt{3-2\sqrt{2}}}$

$f(3) = \dfrac{1}{\sqrt{(\sqrt{2}+1)^2}} + \dfrac{1}{\sqrt{(\sqrt{2}-1)^2}}$

$f(3) = \dfrac{1}{\sqrt{2}+1} + \dfrac{1}{\sqrt{2}-1}$

$f(3) = \dfrac{\sqrt{2}-1+\sqrt{2}+1}{(\sqrt{2}+1)(\sqrt{2}-1)} = 2\sqrt{2}$

92. (C) Differential equation

$\dfrac{dy}{dx} - \dfrac{y}{x^2} = 2.e^{\frac{-1}{x}}$

On comparing with general equation

$P = -\dfrac{1}{x^2}$ and $Q = 2.e^{\frac{-1}{x}}$

I.F. $= e^{\int P.dx}$

$= e^{\int -\frac{1}{x^2}dx} = e^{\frac{1}{x}}$

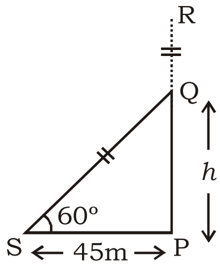
Solution of differential equation

$y \times$ I.F. $= \int Q \times$ I.F. dx

$y \times e^{\frac{1}{x}} = \int 2.e^{\frac{-1}{x}}.e^{\frac{1}{x}}dx$

$y \times e^{\frac{1}{x}} = 2x + c$

93. (A)



We know that QR = QS

Let PQ = h m

In ΔPSQ :

$\tan 60° = \frac{PQ}{PS}$

$\sqrt{3} = \frac{h}{45} \Rightarrow h = 45\sqrt{3}$ ...(i)

$\sin 60° = \frac{PQ}{QS}$

$\frac{\sqrt{3}}{2} = \frac{h}{QS} \Rightarrow \frac{\sqrt{3}}{2} = \frac{45\sqrt{3}}{QS}$

QR = QS = 90

Length of a tree = PQ + QR

$= 45\sqrt{3} + 90$

$= 45(\sqrt{3} + 2)$ m

94. (A) $\sin x \frac{dy}{dx} + y \cos x = e^x$

$\Rightarrow \frac{dy}{dx} + y\cot x = e^x.\text{cosec}x$

On comparing with general equation

$P = \cot x$,

$Q = e^x.\text{cosec}x$

I.F. $= e^{\int P dx}$

$= e^{\int \cot x dx} = e^{\log \sin x} = \sin x$

Solution of differential equation

$y \times I.F. = \int Q \times \text{I.F.} dx$

$\Rightarrow y \times \sin x = \int e^x .\text{cosec}x.\sin x\, dx$

$\Rightarrow y \sin x = \int e^x dx$

$\Rightarrow y \sin x = e^x + c$

95. (C) Let $\vec{v} = \lambda \left(\frac{\hat{i}+\hat{j}}{\sqrt{2}} + \frac{\hat{j}+\hat{k}}{\sqrt{2}} + \frac{\hat{k}+\hat{i}}{\sqrt{2}} \right)$

$\Rightarrow \vec{v} = \frac{\lambda}{\sqrt{2}} [2\hat{i} + 2\hat{j} + 2\hat{k}]$ ...(i)

$\Rightarrow |\vec{v}|^2 = \frac{\lambda^2}{2} (4 + 4 + 4)$

$\Rightarrow 16 = \frac{\lambda^2}{2} \times 12$ $[\because |\vec{v}| = 4]$

$\Rightarrow \lambda^2 = \frac{8}{3} \Rightarrow \lambda = \frac{2\sqrt{2}}{\sqrt{3}}$

From eq(i)

$\vec{v} = \frac{2\sqrt{2}}{\sqrt{3}\sqrt{2}} (2\hat{i} + 2\hat{j} + 2\hat{k})$

$\Rightarrow \vec{v} = \frac{4}{\sqrt{3}} (\hat{i} + \hat{j} + \hat{k})$

96. (B) Differential equation

$\frac{dy}{dx} + \frac{1+y^2}{1+x^2} = 0$

$\Rightarrow \frac{dy}{dx} = -\frac{1+y^2}{1+x^2}$

$\Rightarrow \frac{dy}{1+y^2} = \frac{-dx}{1+x^2}$

On integrating

$\Rightarrow \tan^{-1} y = -\tan^{-1} x + c$

$\Rightarrow \tan^{-1} y + \tan^{-1} x = c$

$\Rightarrow \tan^{-1}\left(\frac{x+y}{1-xy}\right) = c$

$\Rightarrow \frac{x+y}{1-xy} = \tan c$

$\Rightarrow \frac{x+y}{1-xy} = C$

$\Rightarrow \frac{x+y}{1-xy} = C \Rightarrow x + y = C(1 - xy)$

97. (A) **Statement I :-**

Given that, $\tan\theta = x \Rightarrow \cot\theta = \frac{1}{x}$

Now,

$\Rightarrow x - \frac{1}{x} = \tan\theta - \cot\theta$

$\Rightarrow x - \frac{1}{x} = \frac{\sin\theta}{\cos\theta} - \frac{\cos\theta}{\sin\theta}$

$\Rightarrow x - \frac{1}{x} = \frac{\sin^2\theta - \cos^2\theta}{\sin\theta.\cos\theta}$

$\Rightarrow x - \frac{1}{x} = \frac{-2(\cos^2\theta - \sin^2\theta)}{2\sin\theta.\cos\theta}$

$\Rightarrow x - \frac{1}{x} = \frac{-2\cos 2\theta}{\sin 2\theta}$

$\Rightarrow x - \frac{1}{x} = -2\cot 2\theta$

Statement I is incorrect.

Statement II:-

$\Rightarrow x - \frac{1}{x} = \sqrt{2}\tan\theta$

$\Rightarrow x^2 + \frac{1}{x^2} = \left(\sqrt{2}\tan\theta\right)^2 + 2$

$\Rightarrow x^2 + \frac{1}{x^2} = 2\tan^2\theta + 2$

$\Rightarrow x^2 + \frac{1}{x^2} = 2\left(1+\tan^2\theta\right) = 2\sec^2\theta$

Statement II is correct.

Statement III :-

Given that $x = m\cos\theta$ and $y = n\sin\theta$

Now, $(nx)^2+(my)^2 = (mn\cos\theta)^2+(mn\sin\theta)^2$

$\Rightarrow (nx)^2+(my)^2 = (mn)^2(\cos^2\theta + \sin^2\theta)^2$

$\Rightarrow (nx)^2+(my)^2 = (mn)^2$

Statement III is correct.

Statement IV :-

max. value of $7\sin\theta + 25\cos\theta = \sqrt{(7)^2+(24)^2}$

max. value of $7\sin\theta + 25\cos\theta = \sqrt{49+576}$

max. value of $7\sin\theta + 25\cos\theta = \sqrt{625} = 25$

Statement IV is incorrect.

98. (A) sides of polygon (n) = 26

No. of diagonals = $\frac{n(n-3)}{2}$

$= \frac{26\times 23}{2} = 299$

99. (D) Given line

$\frac{x}{2} + \frac{y}{5} = 1$

$5x + 2y = 10$

Slope $m_1 = \frac{-5}{2}$

Slope of perpendicular line $m_2 = \frac{-1}{m_1} = \frac{2}{5}$

100. (C) **Statement I**

L.H.S. = $(\omega^2+1+2\omega)^6$

$= (-\omega+2\omega)^6 \quad [\because 1+\omega+\omega^2 = 0]$

$= \omega^6 = 1$ = R.H.S.

Statment I is correct.

Statement II is also correct.

101. (A) $\begin{vmatrix} x & 4 & 3 \\ 4 & x & 4 \\ 3 & 3 & x \end{vmatrix} = 0$

$x(x^2-12) - 4(4x-12) + 3(12-3x) = 0$

$x^3 - 12x - 16x + 48 + 36 - 9x = 0$

$x^3 - 37x + 84 = 0$

$(x-3)(x-4)(x+7) = 0$

third root = – 7

102. (B) at a line

103. (C) Word 'CONCLUSION'

Total Arrangement = $\frac{10!}{2!2!2!} = 453600$

(OUIO) CNCLSN

as one letter

Arrangement when vowels always come together = $\frac{7!}{2!\,2!} \times \frac{4!}{2!} = 15120$

Arrangement when vowels never come together = 453600 – 15120 = 438480

104. (B) $I = \int \cos^4 x\,.\sin x\, dx$

Let $\cos x = t$

$-\sin x\, dx = dt \Rightarrow \sin x\, dx = -dt$

$\Rightarrow I = -\int t^4 dt$

$\Rightarrow I = -\frac{t^5}{5} + c$

$\Rightarrow I = -\frac{\cos^5 x}{5} + c$

105. (B) $\int_{-2}^{2} |1-x^2|\, dx$

$\Rightarrow \int_{-2}^{-1}|1-x^2|\,dx + \int_{-1}^{1}|1-x^2|\,dx + \int_{1}^{2}|1-x^2|$

$\Rightarrow \int_{-2}^{-1}(x^2-1)\,dx + \int_{-1}^{1}(1-x^2)\,dx + \int_{1}^{2}(x^2-1)\,dx$

$\Rightarrow \left(\frac{x^3}{3}-x\right)_{-2}^{-1} + \left(x-\frac{x^3}{3}\right)_{-1}^{1} + \left(\frac{x^3}{3}-x\right)_{1}^{2}$

$\Rightarrow \left[\left(-\frac{1}{3}+1\right)-\left(-\frac{8}{3}+2\right)\right] + \left[\left(1-\frac{1}{3}\right)-\left(-1+\frac{1}{3}\right)\right]$

$+\left[\left(\frac{8}{3}-2\right)-\left(\frac{1}{3}-1\right)\right]$

$\Rightarrow \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3}$

$\Rightarrow 6 \times \frac{2}{3} = 4$

106. (C) $(A \cap \overline{B} \cap C)$

107. (D) Given that $f(x) = |3x-2|$, $g(x) = x - 3$

Now, $fog(x) = f[g(x)]$

$\Rightarrow fog(x) = f[x-3]$

$\Rightarrow fog(x) = |3(x-3)-2|$

$\Rightarrow fog(x) = |3x-9-2|$

$\Rightarrow fog(x) = |3x-11|$

$\Rightarrow fog(2) = |3\times 2 - 11| = 5$

108. (D) Let $f(x) = \dfrac{[x]}{x}$

L.H.L. $= \lim_{x \to 1^-} f(x) = \lim_{h \to 0} f(1-h)$

$= \lim_{h \to 0} \dfrac{[1-h]}{1-h}$

$= \lim_{h \to 0} \dfrac{0}{1-h} = 0$

R.H.L. $= \lim_{x \to 1^+} f(x) = \lim_{h \to 0} f(1+h)$

$= \lim_{h \to 0} \dfrac{[1+h]}{1+h}$

$= \lim_{h \to 0} \dfrac{1}{1+h}$

$= \dfrac{1}{1+0} = 1$

L.H.L $\neq$ R.H.L

Hence limit does not exist.

109. (A) Given that $2(l + b) = 80 \Rightarrow l + b = 40$

Now, Area (A) $= lb$

$A = l(40 - l)$

$A = 40l - l^2$

$\dfrac{dA}{dl} = 40 - 2l$

$\dfrac{d^2A}{dl^2} = -2$ (*maxima*)

for maxima and minima

$\dfrac{dA}{dl} = 0 \Rightarrow 40 - 2l = 0 \Rightarrow l = 20$

maxi. Area of a rectangle $= lb$

$= 20 \times 20 = 400$ sq.cm

110. (B) $2 \cdot {}^7C_r = {}^8C_{r+1}$

$2 \times \dfrac{7!}{r!(7-r)!} = \dfrac{8!}{(r+1)!(7-r)!}$

$2 \times \dfrac{7!}{r!} = \dfrac{8 \times 7!}{(r+1)r!}$

$r + 1 = 4 \Rightarrow r = 3$

111. (D) $I = \int e^{5\log x} (x^6 - 1)^{-2}\, dx$

$I = \int \dfrac{e^{\log x^5}}{(x^6-1)^2}\, dx$

$I = \int \dfrac{x^5}{(x^6-1)^2}\, dx$

$x^6 - 1 = t$

$6x^5 dx = dt \Rightarrow x^5 dx = \dfrac{1}{6} dt$

$I = \int \dfrac{1}{6} \dfrac{1}{t^2} \text{dt}$

$I = \dfrac{-1}{6t} + c \Rightarrow I = \dfrac{-1}{6(x^6-1)} + c$

112. (A) $I = \int_0^{1.5} [x^2]\, dx$

$= \int_0^1 [x^2]\, dx + \int_1^{\sqrt{2}} [x^2]\, dx + \int_{\sqrt{2}}^{1.5} [x^2]\, dx$

$= \int_0^1 0\,.dx + \int_1^{\sqrt{2}} 1.dx + \int_{\sqrt{2}}^{1.5} 2.dx$

$= 0 + [x]_1^{\sqrt{2}} + 2[x]_{\sqrt{2}}^{1.5}$

$= [\sqrt{2} - 1] + 2[1.5 - \sqrt{2}] = 2 - \sqrt{2}$

113. (A) cotA, cotB and cotC are in A.P.

then 2cotB = cotA + cotC

$\Rightarrow \dfrac{2\cos B}{\sin B} = \dfrac{\cos A}{\sin A} + \dfrac{\cos C}{\sin C}$

$\Rightarrow \dfrac{2\cos B}{\sin B} = \dfrac{\sin C.\cos A + \cos C.\sin A}{\sin A.\sin C}$

$\Rightarrow 2\cos B.\sin A.\sin C = \cos A.\sin B.\sin C + \sin A.\sin B.\cos C$

$\Rightarrow \cos B \sin A.\sin C - \cos A.\sin B.\sin C = \sin A.\sin B.\cos C - \cos B.\sin A.\sin C$

$\Rightarrow \sin C.\sin(A - B) = \sin A.\sin(B - C)$

$\Rightarrow \sin(A+B).\sin(A-B) = \sin(B+C).\sin(B-C)$

$\Rightarrow \sin^2 A - \sin^2 B = \sin^2 B - \sin^2 C$

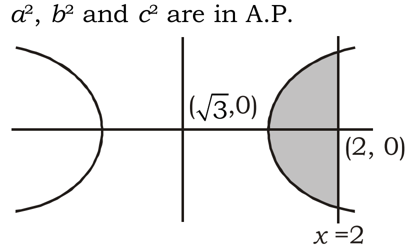
$\Rightarrow 2\sin^2 B = \sin^2 A + \sin^2 C$

$\Rightarrow 2b^2k^2 = a^2k^2 + c^2k^2$ [by Sine Rule]

$\Rightarrow 2b^2 = a^2 + c^2$

a^2, b^2 and c^2 are in A.P.

114. (B)



Curve

$y_1 \Rightarrow \sqrt{4x^2 - 12}$

and $x = 2$

Area $= 2\int_{\sqrt{3}}^{2} y_1 dx$

$= 2\int_{\sqrt{3}}^{2} \sqrt{4x^2 - 12}\, dx$

$= 2 \times 2\int_{\sqrt{3}}^{2} \sqrt{x^2 - (\sqrt{3})^2}\, dx$

$= 4\left[\frac{1}{2}x\sqrt{x^2-3} - \frac{(\sqrt{3})^2}{2}\log\left|x+\sqrt{x^2-3}\right|\right]_{\sqrt{3}}^{2}$

$= 4\left[1 - \frac{3}{2}\log 3 + \frac{3}{2}\log 3^{\frac{1}{2}}\right]$

$= 4\left[1 - \frac{3}{2}\log 3 + \frac{3}{4}\log 3\right]$

$= 4\left[1 - \frac{3}{4}\log 3\right]$

= (4 – 3log3) sq. unit.

115. (C) Equation of plane be $ax + by + cz + d = 0$
So, no. of arbitrary constants = 4(a,b,c,d)

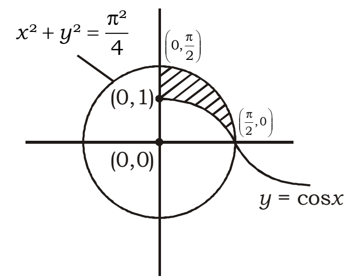
116. (C) $\frac{\log_{27} 3 \times \log_{16} 2}{\log_{64} 4}$

$\Rightarrow \frac{\frac{1}{\log_3 27} \times \frac{1}{\log_2 16}}{\frac{1}{\log_4 64}}$

$\Rightarrow \frac{\frac{1}{3\log_3 3} \times \frac{1}{4\log_2 2}}{\frac{1}{3\log_4 4}} \Rightarrow \frac{\frac{1}{3}\times\frac{1}{4}}{\frac{1}{3}} = \frac{1}{4}$

117. (C) $f(x) = x^3 + 2x^2 - 4x + 2$
$f'(x) = 3x^2 + 4x^2 - 4$
$f''(x) = 6x + 4$ ...(i)
for maxima and minima
$f'(x) = 0$
$\Rightarrow 3x^2 + 4x - 4 = 0$
$\Rightarrow (x + 2)(3x - 2) = 0$
$\Rightarrow x = -2,\ x = \frac{2}{3}$
from eq(ii)
$f''(-2) = 6(-2) + 4 = -8$ (maxima)
$f''\left(\frac{2}{3}\right) = 6 \times \left(\frac{2}{3}\right) + 4 = 8$ (minima)
The function $f(x)$ will attain minimum value at $x = \frac{2}{3}$.

118. (A)



$y_1 \Rightarrow y = \sqrt{\frac{\pi^2}{4} - x^2}$ and $y_2 \Rightarrow y = \cos x$

Area $= \int_0^{\pi/2} (y_1 - y_2)\,dx$

Area $= \int_0^{\pi/2} \left[\sqrt{\frac{\pi^2}{4} - x^2} - \cos x\right] dx$

Area $= \left[\frac{1}{2}x\sqrt{\frac{\pi^2}{4} - x^2} + \frac{1}{2}\times\frac{\pi^2}{4}\sin^{-1}\left(\frac{2x}{\pi}\right) - \sin x\right]_0^{\pi/2}$

Area $= (0 + \frac{\pi^2}{8}\sin^{-1}(1) - \sin\frac{\pi}{2}) - (0 + 0 + 0)$

Area $= \frac{\pi^2}{8} \times \frac{\pi}{2} - 1 = \left(\frac{\pi^3}{16} - 1\right)$ sq. unit

119. (A) $\frac{\cos 4x - 2\cos 3x + \cos 2x}{\sin 4x - \sin 2x}$

$\Rightarrow \frac{\cos 4x + \cos 2x - 2\cos 3x}{\sin 4x - \sin 2x}$

$\Rightarrow \frac{2\cos 3x.\cos x - 2\cos 3x}{2\cos 3x.\sin x}$

$\Rightarrow \frac{-2\cos 3x(1 - \cos x)}{2\cos 3x.\sin x}$

$\Rightarrow \frac{-2\sin^2\frac{x}{2}}{2.\sin\frac{x}{2}.\cos\frac{x}{2}} = -\tan\frac{x}{2}$

120. (C) Let $y = \sin^{-1}(\cos x^2)$

$y = \sin^{-1}\left[\sin\left(\frac{\pi}{2} - x^2\right)\right]$

$y = \frac{\pi}{2} - x^2$

On differentiating both side w.r.t. 'x'

$\frac{dy}{dx} = -2x$

NDA (MATHS) MOCK TEST - 170 (Answer Key)

1.	(B)	21.	(B)	41.	(D)	61.	(C)	81.	(C)	102.	(B)
2.	(C)	22.	(C)	42.	(A)	62.	(C)	82.	(B)	103.	(C)
3.	(B)	23.	(C)	43.	(A)	63.	(A)	83.	(C)	104.	(B)
4.	(A)	24.	(C)	44.	(C)	64.	(D)	84.	(D)	105.	(B)
5.	(B)	25.	(A)	45.	(A)	65.	(A)	85.	(D)	106.	(C)
6.	(A)	26.	(A)	46.	(A)	66.	(D)	86.	(C)	107.	(D)
7.	(A)	27.	(C)	47.	(A)	67.	(A)	87.	(C)	108.	(D)
8.	(D)	28.	(C)	48.	(B)	68.	(C)	88.	(C)	109.	(A)
9.	(B)	29.	(C)	49.	(A)	69.	(B)	89.	(D)	100.	(C)
10.	(B)	30.	(A)	50.	(B)	70.	(C)	90.	(D)	110.	(B)
11.	(C)	31.	(D)	51.	(A)	71.	(B)	91.	(B)	111.	(D)
12.	(C)	32.	(A)	52.	(A)	72.	(B)	92.	(C)	112.	(A)
13.	(D)	33.	(A)	53.	(D)	73.	(A)	93.	(A)	113.	(A)
14.	(B)	34.	(A)	54.	(C)	74.	(B)	94.	(A)	114.	(B)
15.	(D)	35.	(C)	55.	(B)	75.	(B)	95.	(C)	115.	(C)
16.	(C)	36.	(A)	56.	(C)	76.	(B)	96.	(B)	116.	(C)
17.	(C)	37.	(C)	57.	(A)	77.	(C)	97.	(A)	117.	(C)
18.	(B)	38.	(A)	58.	(B)	78.	(A)	98.	(A)	118.	(A)
19.	(A)	39.	(A)	59.	(A)	79.	(B)	99.	(D)	119.	(A)
20.	(A)	40.	(A)	60.	(C)	80.	(A)	101.	(A)	120.	(C)

Note:- If your opinion differs regarding any answer, please message the mock test and question number to 8860330003

Note:- Whatsapp with Mock Test No. and Question No. at 7053606571 for any of the doubts, also share your suggestions and experience of Sunday Mock

Note:- If you face any problem regarding result or marks scored, please contact 9313111777