LEADER TEST SERIES / JOINT PACKAGE COURSE

TARGET : JEE (MAIN)

Test Type : **ALL INDIA OPEN TEST** (MAJOR) Test Pattern : JEE-Main

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	3	1	1	3	4	3	2	4	2	1	1	1	4	1	2	2	1	1	2	4
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	3	4	1	3	1	1	3	3	3	2	4	1	1	3	3	4	2	3	1	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	2	4	4	1	1	2	4	1	1	3	3	1	1	3	4	4	3	2	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	3	2	4	4	1	4	1	2	1	4	2	2	1	3	1	4	1	2	1	1
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	4	4	1	4	4	2	3	2	3	4										

HINT – SHEET

SECTION-I

1. Ans. (3)

Sol. Force between two magnetic dipoles parallel to each.

$$= \vec{F}_{ab} = \frac{3\mu_0}{2\pi r^4}(\vec{m}_a \vec{m}_b)\hat{r}$$

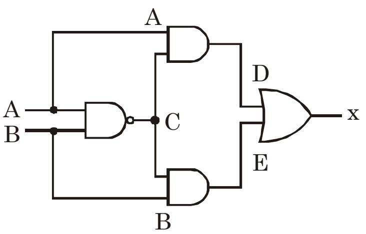
$$|\vec{F}| = mg$$

$$\therefore \frac{3\mu_0}{2\pi r^4}(m_b m_a) = mg$$

$$r = \left(\frac{3\mu_0 m^2}{2\pi mg}\right)^{1/4}$$

2. Ans. (1)

Sol.



First we consider the output C of the NAND gate :

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

Next we consider the state D which is the output of an AND gate operating on A and C:

A	B	C	D
0	0	1	0
0	1	1	0
1	0	1	1
1	1	0	0

Similarly, E is the output of an AND gate operating on B and C:

A	B	C	D	E
0	0	1	0	0
0	1	1	0	1
1	0	1	1	0
1	1	0	0	0

Finally, the output X is the result of an OR gate operating on D and E:

A	B	C	D	E	X
0	0	1	0	0	0
0	1	1	0	1	1
1	0	1	1	0	1
1	1	0	0	0	0

We recognise this as the exclusive-or (XOR) function.

3. Ans. (1)

Sol. On displasing cylinder by x. Net force on cylinders

$F_N = \rho_1 xsg + \rho_2 xsg = 2ma = (\rho_1 + \rho_2)xsg$

$$\vec{a} = -\left(\frac{\rho_1+\rho_2}{\rho_0}\right)\frac{sg}{2v}\vec{x}$$

$$\omega = \sqrt{\left(\frac{\rho_1+\rho_2}{\rho_0}\right)\frac{sg}{2v}}$$

$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\left(\frac{\rho_0}{\rho_1+\rho_2}\right)\frac{2v}{sg}}$$

4. Ans. (3)

Sol. Reyleigh's criterion for the angular $\Delta\theta$ of a circular aperture of diameter $\Delta >> \lambda$ gives

$$\Delta\theta = 1.22\frac{\lambda}{D}$$

and for two objects at distance z separated by s the agular separation is

$$\Delta\theta = \frac{s}{z} \text{ (provided z << z).}$$

Combining these two expressions gives

$$D = 1.22\frac{\lambda z}{s}$$

5. Ans. (4)

6. Ans. (3)

Sol. Force is developed due to property of liquid called surface tension.

7. Ans. (2)

8. Ans. (4)

Sol. $v_0 = \sqrt{\frac{GM}{R}}$

For satellite launches with velocity $\frac{v_0}{2}$

TE = KE + PE

$$= -\frac{GMm}{R} + \frac{1}{2}m\left(\frac{v_0}{2}\right)^2$$

$$= -mv_0^2 + \frac{1}{8}mv_0^2 = -\frac{7}{8}mv_0^2$$

By energy conservation

$(TE)_i = (TE)_f$

$$-\frac{7}{8}mv_0^2 = -\frac{GMm}{R_1} + \frac{1}{2}mv_1^2$$

Since at lowest distance velocity is along tangential direction again.

$\therefore\ L_i = L_f$

$$\frac{mv_0R}{2} = mv_1R_1$$

$$v_1 = \frac{Rv_0}{2R_1}$$

$$-\frac{7}{8}v_0^2 = -\frac{Rv_0^2}{R_1} + \frac{1}{2}\left(\frac{RV_0}{2R_1}\right)^2$$

$-8RR_1 + R^2 = -7R_1^2$

$(7R_1 - R)(R_1 - R) = 0$

$R_1 = R_1\ R/7$

$\therefore$ Lowest point is $R_1 = R/7$

9. Ans. (2)

Sol. By considiring L – R circuit

$$I = I_0 e^{-\frac{Rt}{L}}$$

Where $R = \frac{\rho(2\pi r)}{\ell d}$ and $L = \frac{\mu_0 \pi r^2}{\ell}$

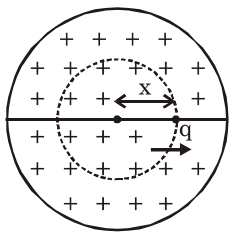
10. Ans. (1)

Sol. By dimensional analysis.

11. Ans. (1)

Sol. Charge q executes SHM along diameter about centre as mean position.

$$\vec{F}_q = \frac{-kqQ\vec{x}}{R^3}$$



$$T = 2\pi\sqrt{\frac{4\pi\varepsilon_0 mR^3}{qQ}}$$

Time taken to move from centre to boundry

$$= \frac{T}{4} = \frac{\pi}{2}\sqrt{\frac{4\pi\varepsilon_0 mR^3}{qQ}}$$

12. Ans. (1)

Sol. $n_0 = \frac{1}{2\ell}\sqrt{\frac{T}{\mu}}$

$4d^2\mu n_0^2 = T$

frequency of oscillation is same as that of A.C.

13. Ans. (4)

Sol. Image distance is 30 cm

$\frac{1}{F} = \frac{1}{f} + \frac{1}{f}$

$\frac{1}{30} = \frac{2}{f}$

$f = 60$ cm

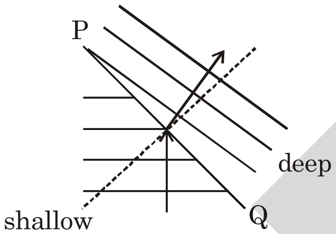
As optical axis shifts down by (y – x) for second lens

$m = \frac{y-x-1}{y-x}$

$y = 4.5$cm

14. Ans. (1)

Sol. In deep region wave bend towards normal and wavefront is perpendicular to wavefront.



15. Ans. (2)

Sol. $V_{RL} = i_0 \times \sqrt{\omega^2 L^2 + R^2}$

$= \frac{V_0}{\sqrt{\left(\omega L - \frac{1}{\omega C}\right)^2 + R^2}} \times \sqrt{\omega^2 L^2 + R^2}$

$\omega = 0$, $\quad V_{RL} \propto V_0 \times \omega C$

$V_C = i_0 \times \frac{1}{\omega C}$

$\omega = \infty \quad V_{RL} = V_0$

$= \frac{V_0}{\sqrt{(\omega^2 LC - 1)^2 + \omega^2 R^2 C^2}}$

$\omega = 0$

$V_C = \frac{V_0}{\omega}\sqrt{LC}$

$\omega = \infty$

16. Ans. (2)

Sol. $f_B = \frac{c}{c+u} f_A < f_A$

Heard by A $f'_B = \frac{c-u}{c} f_B = \frac{c-u}{c+u} f_A < f_A$

17. Ans. (1)

Sol. $\frac{x}{2} = \frac{\ell}{1-\ell}$

$\frac{2}{x} = \frac{\ell + 0.2}{1-(\ell+0.2)} = \frac{\ell+0.2}{0.8-\ell}$

$\frac{\ell(\ell+0.2)}{(1-\ell)(0.8-\ell)} = 1$

$\ell^2 + 0.2\,\ell = 0.8 + \ell^2 - 0.8\,\ell - \ell$

$2\ell = 0.8$

$\ell = 0.4$ m

$\frac{x}{2} = \frac{0.4}{0.6} \Rightarrow x = \frac{4}{3}$

$\frac{2}{x} = \frac{\ell - 0.2}{1-(\ell-0.2)} = \frac{\ell-0.2}{1.2-\ell}$

$1 = \frac{\ell(\ell-0.2)}{(1-\ell)(1.2-\ell)}$

$\ell^2 - 0.2\,\ell = 1.2 + \ell^2 - 2.2\,\ell$

$2\ell = 1.2$

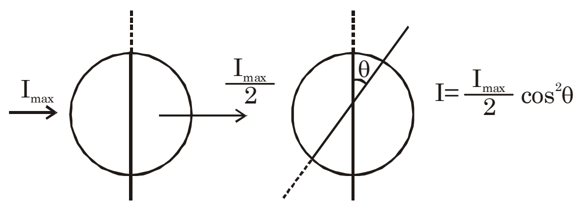
$\ell = 0.6$

$\Rightarrow x = \frac{2 \times 0.6}{0.4} = 3\Omega$

18. Ans. (1)

Sol. By maulas law

$I = I_0\cos^2\theta$ θ is the angle between two axis of polaroid.



Third polaroids maches (90–θ) with II[nd] polaroids

$I = \frac{I_{max}}{2}\sin^2 2\theta \Rightarrow \frac{I_{max}}{16}[1 - \cos 4\theta]$

$I = \frac{I_{max}}{16}[1 - \cos 4\omega t]$

19. Ans. (2)

Sol. $f = \dfrac{m_e q_e^4}{8h^3\varepsilon_0^2}\left(\dfrac{3}{4}\right)(z-1)^2$

$\sqrt{f} = \sqrt{\dfrac{3}{4}\left(\dfrac{m_e q_e^4}{8h^3\varepsilon_0^2}\right)}(z-1)$

$a = \sqrt{\dfrac{3}{4}\dfrac{m_e q_3^4}{8h^3\varepsilon_0^2}}$ and b = 1

Both a and b are constant and independent of target material.

20. Ans. (4)

Sol. With increase in frequency stopping potential increases in magnitude and with decreases in intensity saturation current decreases.

21. Ans. (3)

22. Ans. (4)

Sol. y = mx + C

$\ell nA = 2.6 - \dfrac{t}{10}$

$A = e^{2.6}\, e^{-t/10} = 12e^{-t/10}$

23. Ans. (1)

24. Ans. (3)

Sol. $\phi = \vec{B}.\vec{A}$

and, $E_{induced} = -\dfrac{d\phi}{dt} = -Bvd$

Also, $F = i\vec{dl} \times \vec{B}$

Now, $e = E - E_{induced}$

$e = E - Bvd$

$i_{total} = i + i_{ind}$

$i_{total} = \dfrac{E - Bvd}{R}$

Therefore $F = \left(\dfrac{E - Bvd}{R}\right)Bd$

$m\dfrac{dv}{dt} = \left(\dfrac{E - Bvd}{R}\right)Bd$

$\dfrac{mR}{Bd}\int_0^v \dfrac{dv}{E - Bvd} = \int_0^t dt$

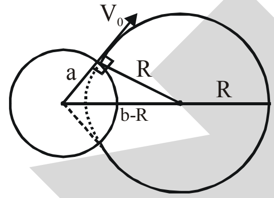
$-\dfrac{mR}{B^2d^2}\left[\ell n(E - Bvd)\right]_0^v = t$

$\ell n\left(\dfrac{E - Bvd}{E}\right) = -\dfrac{B^2d^2t}{mR}$

$v = \dfrac{E}{Bd}\left(1 - e^{-\frac{B^2d^2t}{mR}}\right)$

25. Ans. (1)

Sol.



Pythagores theorem

$a^2 + R^2 = (b - R)^2 = b^2 + R^2 - 2bR$

so, $\dfrac{mv_0}{qB} = R = \left(\dfrac{b^2 - a^2}{2b}\right)$

26. Ans. (1)

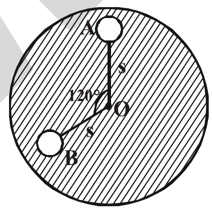
Sol. $K_i = K_f + E_{photon} + K_{atom}$

$K_i - K_f = E_{photon} + K_{atom}$

27. Ans. (3)

28. Ans. (3)

Sol.



Initially $B_1 = \dfrac{\mu_0 I}{2\pi s}$

Finally

$B_2 = \sqrt{B_1^2 + B_1^2 + 2B_1B_2\cos 120°}$

$= 2B_1\cos 60° = B_1$

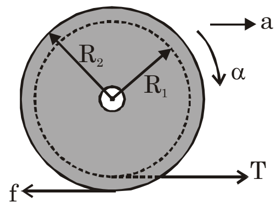
So, B remains unchanged.

29. Ans. (3)

Sol. For narrow single slit diffraction width of central maxima is $\left(\dfrac{\lambda}{b}\right)$. where, $\lambda = \dfrac{h}{mv}$ and b is slit width.

30. Ans. (2)

Sol.



Force equation

$T - f = ma$ ... (i)

Torque equation

$fR_2 - TR_1 = I\alpha$ ... (ii)

Condition for no sliping,

$a - \alpha R_2 = 0$ ... (iii)

Solving we have,

$f = \left(\dfrac{I + mR_1R_2}{I + mR_2^2}\right)T$

31. Ans. (4)
32. Ans. (1)
33. Ans. (1)
34. Ans. (3)
35. Ans. (3)
36. Ans. (4)
37. Ans. (2)
38. Ans. (3)
39. Ans. (1)
40. Ans. (2)
41. Ans. (4)
42. Ans. (2)
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44. Ans. (4)
45. Ans. (1)
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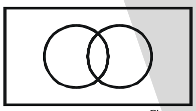
54. Ans. (1)
55. Ans. (3)
56. Ans. (4)
57. Ans. (4)
58. Ans. (3)
59. Ans. (2)
60. Ans. (4)
61. Ans. (3)

Sol. $\text{Mode} = \ell + \dfrac{(f_0 - f_1)}{(2f_0 - f_1 - f_2)} \times h$

$h = 5$; $f_0 = 11$, $f_1 = f_1 = 7$, $f_2 = 2$

62. Ans. (2)

Sol. $A - B = A \cap B^C$



$A - (A \cap B^C) = A \cap B$

63. Ans. (4)

Sol. Equation becomes

$4a^2 + 6ax - (x^4 + x^3 - 2x^2) = 0$

$$a = \frac{-6x \pm \sqrt{36x^2 + 16(x^4 + x^3 - 2x^2)}}{8}$$

$a = \dfrac{-x^2}{2} - x$ and $a = \dfrac{x^2}{2} - \dfrac{x}{2}$

$x^2 + 2x + 2a = 0$ or $x^2 - x - 2a = 0$

$D_1 \geq 0$ & $D_2 \geq 0$

$a \in \left[-\dfrac{1}{8}, \dfrac{1}{2}\right]$

64. Ans. (4)

Sol. $\Delta = \dfrac{1}{2}(2ae)(b\sin\theta)$

Maximum when $\sin\theta = 1$

$\Delta = abe$

65. Ans. (1)

Sol. Let $f(x) = a(x - x_1)(x - x_2) \ldots\ldots (x - x_{10})$

$\ell n f(x) = \ell n a + \ell n(x - x_1) + \ell n(x - x_2) + \ldots\ldots + \ell n(x - x_{10})$

$$\frac{f(x)}{f'(x)} = \frac{1}{(x - x_1)} + \frac{1}{(x - x_2)} + \ldots\ldots + \frac{1}{(x - x_{10})}$$

$$\frac{f(x)f''(x) - (f'(x))^2}{(f'(x))^2} = 0$$

$$= -\left(\frac{1}{(x - x_1)^2} + \frac{1}{(x - x_2)^2} + \ldots\ldots + \frac{1}{(x - x_{10})^2}\right).$$

66. Ans. (4)

Sol. $C_1 \to aC_1$, $C_2 \to bC_2$ & $C_3 \to cC_3$

$$\frac{1}{abc}\begin{vmatrix} a(b^2 + c^2) & ab^2 & ac^2 \\ a^2b & b(c^2 + a^2) & bc^2 \\ a^2c & b^2c & c(a^2 + b^2) \end{vmatrix}$$

$$= \begin{vmatrix} b^2 + c^2 & b^2 & c^2 \\ a^2 & c^2 + a^2 & c^2 \\ a^2 & b^2 & a^2 + b^2 \end{vmatrix}$$

Use $C_1 > (C_1 + C_2 + C_3)$ and solve

67. Ans. (1)

Sol. It is 0° form

Let $y = (\sin\theta)^{(\sin\theta - \sin^2\theta)}$

$\ell n y = (1 - \sin\theta)(\sin\theta\ \ell n \sin\theta)$

$\ell n y = \lim\limits_{\theta \to 0} \dfrac{\ell n \sin\theta}{\operatorname{cosec}\theta}$ (Use L'pital and solve)

68. Ans. (2)

Sol. Let $z = x + iy$

$\sqrt{x^2 + y^2} + x + iy - 3x + 3iy = 0$

$y = 0$ and $\sqrt{x^2 + y^2} = 2x$

$x = 0$

(0, 0) is only possiblity

69. Ans. (1)

Sol. $T_{(r+1)} = {}^{400}C_r 3^{\left(50 - \frac{r}{8}\right)} \qquad 5^{\frac{r}{3}}$

$r = 0, 24, \ldots\ldots, 24 \times 16$

Total terms = 17

70. Ans. (4)

Sol. $\sin^{-1}\left(1-\frac{1}{(2+x^2)}\right)$

$y = \sin^{-1}(1)$ when $x \to \infty = \frac{\pi}{2}$

When $x = 0 \Rightarrow y = \sin^{-1}\left(\frac{1}{2}\right) = \frac{\pi}{6}$

71. Ans. (2)

Sol. $\frac{dy}{dx} = \frac{\alpha_1}{\sqrt{1-x^2}} + \frac{\alpha_3(3\sin^{-1}x)^2}{\sqrt{1-x^2}} + ...$

$+\frac{(2x+1)(\sin^{-1}x)^{2n}}{\sqrt{1-x^2}} + \frac{1}{(1+x^2)}$

$\frac{dy}{dx} > 0$ and function is one one

but range $\neq$ codomain

$\Rightarrow$ into function

72. Ans. (2)

Sol. $\int_1^{e^2} \frac{\tan^{-1}t}{t}dt - \int_1^{1/e^2} \frac{\tan^{-1}t}{t}dt$

$\left(\text{Put } t = \frac{1}{z} \Rightarrow dt = -\frac{dz}{z^2}\right)$

$\int_1^{e^2} \frac{\tan^{-1}t}{t}dt + \int_1^{e^2} \frac{\tan^{-1}\left(\frac{1}{z}\right)}{z}dz$

$= \int_1^{e^2} \frac{\pi}{2}\frac{dz}{z} = \frac{\pi}{2}(2) = \pi$

73. Ans. (1)

Sol. Let $y^2 = t \Rightarrow 2y\frac{dy}{dx} = \frac{dt}{dx}$

$2\frac{dt}{dx} = \frac{1}{x(x^2\sin t + 1)}$

$\frac{dx}{dt} = \frac{x^3\sin t}{2} + \frac{x}{2}$

$x^{-3}\frac{dx}{dt} = \frac{\sin t}{2} + \frac{x^{-2}}{2}$

Let $x^{-2} = z \Rightarrow x^{-3}\frac{dx}{dt} = -\frac{dz}{2dt}$

$-\frac{1}{2}\frac{dz}{dt} = \frac{\sin t}{2} + \frac{z}{2}$

$\frac{dz}{dt} = -\sin t - z$

$\frac{dz}{dt} + z = -\sin t$

$ze^t = -\int e^t \sin t\,dt$

$ze^t = -\frac{(-e^t\cos t + e^t\sin t)}{2} + C$

$\frac{e^{y^2}}{x^2} = e^t\frac{(\cos t - \sin t)}{2} + C$

$e^{y^2}\left(\frac{1}{x^2} - \frac{\cos t}{2} + \frac{\sin t}{2}\right) \pm C$

$e^{y^2}\left(\frac{1}{x^2} - \frac{\cos y^2}{2} + \frac{\sin y^2}{2}\right) = C$

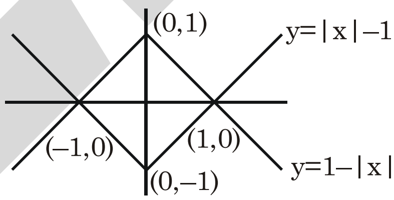
74. Ans. (3)

Sol. $3\cos\theta + 4\sin\theta = 5$ & $3\sin\theta - 4\cos\theta = x$

Square and add $x^2 = 0$

75. Ans. (1)

Sol.



Area bounded = $\left(\sqrt{2}\right)^2 = 2$

76. Ans. (4)

Sol. $f'(x)e^x + e^x f(x) \le e^x$

$d(f(x)e^x) \le e^x dx$

$\int_0^1 D(f(x)e^x) \le \int_0^1 e^x\,dx$

$ef(1) \le (e-1)$

$f(1) \le \frac{(e-1)}{e}$

77. Ans. (1)

Sol. $x = y^{x^x} \Rightarrow \ell nx = x^x\,\ell ny$ (when $x = 1, y = 1$)

$\frac{1}{x} = x^x(1+\ell nx)\,\ell ny + \frac{x^x}{y}y'$

$y' = 1$

78. Ans. (2)

Sol. ABC = I

BC = A^{-1}

BCA = I

BC = A^{-1}

C = $B^{-1}A^{-1}$

CA = B^{-1} ⇒ CAB = I

tr(3I) = 9

79. Ans. (1)

Sol. $\left(\cos^2 2x - \cos x\cos^2 5x + \cos^4 \frac{5x}{4}\right) + \frac{\cos^2 5x(1-\cos^2 5x)}{4} = 0$

$\cos 2x = \frac{\cos^2 5x}{2}$ & $\sin 10x = 0$

$x = \frac{n\pi}{10}$

$x = 0, \frac{\pi}{10}, \frac{2\pi}{10}, \frac{3\pi}{10}$

No solution

80. Ans. (1)

Sol. $V = \pi r^2 h$

$V = \pi r^2(6 - r^2)$

$V = \pi(6r^2 - r^4)$

$\frac{dV}{dr} = \pi(12r - 4r^3) = 0$

$r^2 = 3h = 3$

$\frac{r}{h} = \frac{1}{\sqrt{3}}$

81. Ans. (4)

Sol. $\frac{dy}{dx} = 2(Ae^{2x} - Be^{-2x})$

$\frac{d^2y}{dx^2} = 4(Ae^{2x} + Be^{-2x}) \Rightarrow \frac{d^2y}{dx^2} = 4y$

82. Ans. (4)

Sol. $\int_0^1 \tan^{-1}\left(\frac{\tan x}{2}\right)dx - \int_0^1 \tan^{-1}(\cot x)\,dx$

$\alpha - \int_0^1 \left(\frac{\pi}{2} - x\right)dx$

$\alpha - \frac{\pi}{2} + \frac{1}{2}$

83. Ans. (1)

Sol. Sample space = 36

A > B then

(6,1) (6,2) (6,3) (6,4) (6,5)

(5,1) (5,2) (5,3) (5,4)

(4,1) (4,2) (4,3) (3,1) (3,2) & (2,1)

Probability = $\frac{15}{36} = \frac{5}{12}$

84. Ans. (4)

Sol. $\frac{1}{2\sqrt{x}} + \frac{1}{2\sqrt{y}}y' = 0$

$\Rightarrow y' = -\frac{\sqrt{y}}{\sqrt{x}} \Rightarrow y' = -\frac{1}{2}$

Length of subtangent = $\left|\frac{y}{dy/dx}\right| = 2$

85. Ans. (4)

Sol. $R_2 \to R_2 - 2R_1$ & $R_3 \to R_3 - 3R_1$

$\begin{vmatrix} 1 & x & y \\ 0 & \sin x & \sin y \\ 0 & \cos x & \cos y \end{vmatrix} = \sin(x-y)$

86. Ans. (2)

Sol. $\left(A - \frac{I}{2}\right)\left(A^T - \frac{I}{2}\right) = I$

$AA^T - \frac{A^T}{2} - \frac{A}{2} = \frac{3I}{4}$ ...(1)

Similarly $AA^T + \frac{A^T}{2} + \frac{A}{2} = \frac{3I}{4}$ ...(2)

(2) – (1) ⇒ $A + A^T = 0$

Skew symmetric matrix

But (1) + (2)

$\Rightarrow AA^T = \frac{3I}{4}$

But $|A| \neq 0$

87. Ans. (3)

Sol. $xy = c^2$

$2xy = 2c^2$

$\frac{xc}{t} + (ct)y = 2c^2$ (tangent)

$\frac{x}{t} + ty = 2c$

$a_1 = 2ct$, $b_1 = \frac{2c}{t}$

for normal

$$y - \frac{c}{t} = t^2(x - ct)$$

$$a_2 = \left(ct - \frac{c}{t^3}\right) \ \& \ b_2 = \left(\frac{c}{t} - ct^3\right)$$

$a_1a_2 + b_1b_2 = 0$

88. Ans. (2)

Sol. $$\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]^2 = \begin{vmatrix} \hat{a}.\hat{a} & \hat{a}.\hat{b} & \hat{a}.\hat{c} \\ \hat{b}.\hat{a} & \hat{b}.\hat{b} & \hat{b}.\hat{c} \\ \hat{c}.\hat{a} & \hat{c}.\hat{b} & \hat{c}.\hat{c} \end{vmatrix}$$

$$\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]^2 = \begin{vmatrix} 1 & \cos\theta & \cos\theta \\ \cos\theta & 1 & \cos\theta \\ \cos\theta & \cos\theta & 1 \end{vmatrix}$$

$$\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right]^2 = (1 - \cos\theta)^2(1 + 2\cos\theta) \geq 0$$

$$\cos\theta \geq -\frac{1}{2}$$

$$\theta = \frac{2\pi}{3}$$

89. Ans. (3)

Sol. $$y' = \frac{1 - \ell nx}{x^2} \ \& \ y' = 2\lambda x$$

$1 - \ell nx = 2\lambda x^3$

$\ell nx = \lambda x^3$

$$\ell nx = \frac{1}{3} \ \& \ x = e^{\frac{1}{3}}$$

$$\frac{1}{3} = \lambda e$$

$$\lambda = \frac{1}{3e}$$

90. Ans. (4)

Sol. $$\left(x\vec{a} + y\vec{b} + z\vec{c}\right).\left(\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right)$$

$= 2(x + y + z)$

$$(x + y + z)\left[\vec{a}\ \ \vec{b}\ \ \vec{c}\right] = 2(x + y + z)$$