JEE Model Exam - Answer KEYUnique Learı

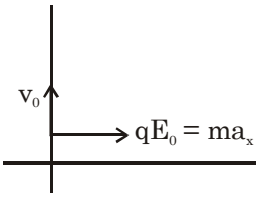
ANSWER KEY

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

HINT – SHEET

1. Ans. (3)

Sol.



$$\lambda_0 = \frac{R}{mv_0}$$

$$\frac{\lambda_0}{2} \Rightarrow v = 2v_0$$

$$v_x^2 + v_0^2 = 4v_0^2$$

$$v_x = \sqrt{3}v_0 = \frac{qE_0}{m_0}t$$

2. Ans. (1)

Sol. $i = \frac{dQ}{dt} = 3 - 12t$

$$t = \frac{1}{4}\sec$$

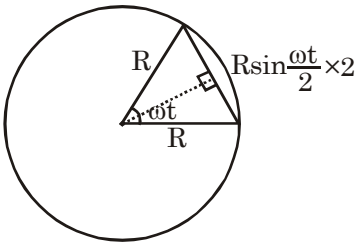
$$\mathbf{H} - \int_0^{1/4} (3-12t)^2 \times R dt$$

$$= \frac{(3-12t)^3}{3\times -12}\Bigg|_0^{1/4} R$$

$$= \frac{+1}{36}[27] = \frac{3R}{4}$$

3. Ans. (3)

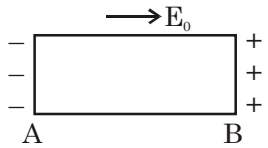
Sol.



$$S = 2R\sin\left(\frac{\omega t}{2}\right)$$

4. Ans. (1)

Sol.



5. Ans. (1)

Sol. $U_i = -\dfrac{3GMm}{2R}$

$$U_f = \frac{-GMm}{R}$$

$$\Delta U = \frac{GMm}{2R} = \frac{mgh}{2}$$

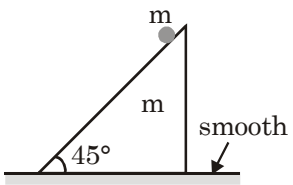
$$= \frac{4\times 10\times 6.4\times 10^6}{2} = 1.28\times 10^8 \text{ J}$$

6. Ans. (1)

Sol. $v_x = v \qquad v_{rel_x} = 2v$

$$\frac{v_y}{2v} = \tan 45°$$

$$v_y = 2v$$



$$R_{max} = \frac{v_y^2}{2g} = \frac{2v^2}{g}$$

7. Ans. (4)

Sol. $\Delta p_x = 3NS$

$\Delta p_y = 4NS$

$\Delta p_z = -5NS$

$$\Delta p = \sqrt{3^2+4^2+5^2} = 5\sqrt{2}NS$$

8. Ans. (3)

Sol. $345 \times 10^6 \times 2 \times 10^{-2} \times 2 \times 10^{-2} = F = mg$

$13800 \text{ kg} = m$

9. Ans. (4)

Sol. $p = \int_r^R \rho g dy + p_0$

$$= 10 \times \int_0^{10} \left(100 + 6R^2\right) dh + 10^5$$

$= 10^4 + 2 \times 10^4 + 10^5 = 1.3 \times 10^5$ Pa

10. Ans. (2)

Sol. $J_c = \sigma E_0 \sin(\omega t - kx)$

$$i_d = \in\in_0 \frac{d\phi_E}{dt} = \in\in_0 A\frac{dE}{dt}$$

$= \in\in_0 \times A\, E_0\omega \cos(\omega t - kx)$

$Jd = \in\in_0 E_0\omega$

$$\frac{J_c}{J_d} = \frac{\sigma}{\in\in_0 \omega}$$

11. Ans. (3)

Sol. $\ell + x = 2.12$

$2\ell + x = 4.10$

$x = 0.14$

12. Ans. (3)

13. Ans. (2)

Sol. $\dfrac{dH}{dt} = A\sigma T^4$

$$\frac{dH}{dt/A} = 5.67\times 10^{-8} \times (400)^4$$

$= 5.67 \times 64 \times 64 > 2000 \text{ W/m}^2$

14. Ans. (2)

Sol. When magnet is divided into two equal parts, the magnetic dipole moment

$$M' = \text{pole strength} \times \frac{1}{2} = \frac{M}{2}$$

(pole strength remains same)

Also, the mass magnet becomes half, ie,

$$m' = \frac{m}{2}$$

Moment of inertia of magnet

$$I = \frac{m\ell^2}{12}$$

New moment of inertia

$$I' = \frac{1}{12}\left(\frac{m}{2}\right)\left(\frac{\ell}{2}\right)^2 = \frac{m\ell^2}{12\times 8}$$

$$\therefore \qquad I' = \frac{1}{8}$$

Now, $$T = 2\pi\sqrt{\left(\frac{I}{MB_H}\right)}$$

$$T' = 2\pi\sqrt{\left(\frac{I'}{M'B_H}\right)} = 2\pi\sqrt{\left(\frac{I/8}{MB_H/2}\right)}$$

$$\therefore \quad T' = \frac{T}{2} \Rightarrow \frac{T'}{T} = \frac{1}{2}$$

15. Ans. (2)

16. Ans. (1)

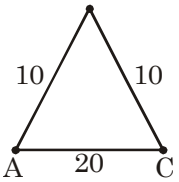
17. Ans. (3)

Sol. $$\frac{\Delta A}{A} = \frac{1}{2}\frac{\Delta P}{P} + \frac{1}{2}\frac{\Delta q}{q} + \frac{2\Delta r}{r} + 3\frac{\Delta s}{s}$$

$= 0.5 + 1.5 + 1 + 1 = 4\%$

18. Ans. (1)

Sol.



$$\Rightarrow R_{eq} = 20$$

$$\frac{dH}{dt} = \frac{100}{20} = 5\text{units}$$

19. Ans. (1)

Sol. $y = 2x - x^2 = 0$

$x = 0$

$x = 2$

$F = Bi\ell$

$= B_0 i \times 2$

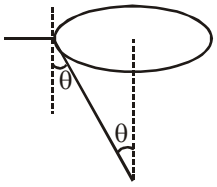
20. Ans. (2)

21. Ans. (4)

22. Ans. (3)

23. Ans. (2)

Sol.



$$\frac{5}{4}\sin\theta = 1$$

$$\theta = 53°$$

$$\frac{P}{P_T} = \frac{2\pi(1-\cos 53°)}{4\pi} = \frac{1}{2}\times\frac{2}{5} = \frac{1}{5} = 20\%$$

24. Ans. (3)

Sol. $$N_1 = N_{01}e^{-\lambda_1 t}$$

$$N_2 = N_{02}e^{-\lambda_2 t}$$

$$\frac{N_1}{N_2} = \frac{2}{1}\times e^{-(\lambda_1-\lambda_2)t}$$

$$\lambda_1 t = 3\ell n2$$

$$\lambda_2 t = 3\ell n2 \times \frac{3}{4.5} = 2\ell n2$$

$$\Rightarrow \frac{N_1}{N_2} = 2\times e^{-\ell n2} = 1$$

25. Ans. (4)

26. Ans. (1)

Sol. $$\Delta h = \frac{\omega^2 R^2}{2g} = \frac{(4\pi)^2 \times \left(\frac{1}{20}\right)^2}{20} = 0.02\text{m}$$

27. Ans. (4)

Sol. $$\frac{n}{2\times 1.95}\times v = 275$$

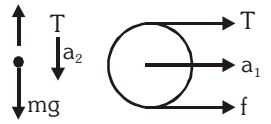
$$\frac{(n+1)}{2\times 1.95}\times v = 330$$

$$\frac{v}{2\times 1.95} = 55$$

$v = 55 \times 3.9 = 214.5$ m/s

28. Ans. (1)

Sol. Equation of motion



$mg - T = ma_2$ $\qquad T + f = ma_1$

Angular acceleration $\alpha = \frac{(T-f)R}{mR^2}$

$v_m = v_c + R\omega$; $a_2 = a_1 + R\alpha$

also $a_2 = 2R\alpha$ $\qquad (\because a_1 = R\alpha)$

29. Ans. (1)

30. Ans. (4)

31. Ans.(1)

$$d = \frac{Z.A}{N_A.V}$$

or, $5 = \frac{6\times A}{6\times10^{23}\times24\sqrt{2}\times(100\sqrt{2}\times10^{-10})} \Rightarrow A = 48.$

32. Ans.(2)

$$[HA]_{final} = \frac{20\times0.4}{100} = 0.08M$$

$$\therefore [H^+] = \sqrt{K_a.C}$$

$$= \sqrt{4\times10^{-7}\times0.08} = \sqrt{32\times10^{-9}}$$

and pH = – log $(32 \times 10^{-9})^{1/2}$ = 3.75

33. Ans.(3)

34. Ans.(3)

As $\Delta T = T_f - T_i = 0$, $\Delta U = 0$, $\Delta H = 0$, but $\Delta S \neq 0$ because volume of gas is increased.

35. Ans.(1)

$$\ln\frac{K_2}{K_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

or, $\ln\frac{0.08}{0.04} = \frac{E_a}{2}\left(\frac{1}{300} - \frac{1}{310}\right)$

$\therefore E_a$ = 13020 cal / mol = 13.02 kcal/mol

36. Ans.(2)

$$2FeS_2 + \frac{11}{2}O_2 \rightarrow Fe_2O_3 + 4SO_2$$

$\frac{20}{120} = \frac{1}{6}$mole $\qquad\qquad$ $\frac{1}{3}$mole

$$SO_2 + 2NaOH \rightarrow Na_2SO_3 + H_2O$$

$\frac{1}{3}$mole $\qquad$ $\frac{2}{3}$mole

$$\frac{2}{3} = \frac{1}{2}\times\frac{400\times M}{1000} \Rightarrow M = \frac{10}{3}$$

37. Ans.(4)

Sol particles are positively charged and hence, coagulation occur at cathode.

38. Ans.(3)

Formula based.

39. Ans.(2)

L.E. : $\frac{1}{2}H_2 + HCOO^- \rightleftharpoons HCOOH + e^-$

R.E. : $CH_3COOH + e^- \rightleftharpoons CH_3COO^- + \frac{1}{2}H_2$

Net reaction : $CH_3COOH + HCOO^- \rightleftharpoons CH_3COO^- + HCOOH$

$$Keq = \frac{K_a(CH_3COOH)}{K_a(HCOOH)} = \frac{1.8\times10^{-5}}{2.4\times10^{-4}} = \frac{3}{40}$$

$$\therefore E^o_{cell} = \frac{0.06}{1}.\log\frac{3}{40} = -0.0672V$$

40. Ans.(1)

$$C_4H_6(g) + \frac{11}{2}O_2(g) \rightarrow 4CO_2(g) + 3H_2O(l)$$

ΔH = [4 × (–94) + 3 × (–68)] – [–30] + 10 – 4 × 20 – 3 × 10

= –650 kcal/mol

41. Ans. (4)

42. Ans. (2)

43. Ans. (2)

44. Ans. (2)

45. Ans. (4)

46. Ans. (3)

47. Ans. (3)

48. Ans. (2)

49. Ans. (2)

50. Ans. (3)

51. Ans. (4)

52. Ans. (4)

53. Ans. (4)

54. Ans. (3)

55. Ans. (3)

56. Ans. (3)

57. Ans. (4)

58. Ans. (3)

59. Ans. (2)

60. Ans. (3)

61. Ans. (2)

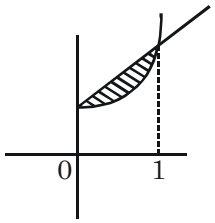
ends of L.R $\left(\pm ae, \pm \frac{b^2}{a}\right)$

$\Rightarrow$ tangents are $\pm\frac{e}{a}x \pm \frac{1}{a}y = 1$

$\Rightarrow$ Area $= \frac{2a^2}{e} - a^2e^2$

$\Rightarrow e^3 = 2$

62. Ans. (3)



$x = \sqrt{y-1}$

$y = x + 1$

$\int_0^1 \left(x + 1 - x^2 - 1\right)dx$

$= \frac{1}{6}$

63. Ans. (2)

$\frac{dy}{dx} + x\sin^2 y = \sin y \cos y$

$\text{cosec}^2 y \frac{dy}{dx} + x = \cot y$

Let $-\text{coty} = v$

$\frac{dv}{dx} + v = x$

$\therefore \quad -\cot y.e^x = \int xe^x dx$

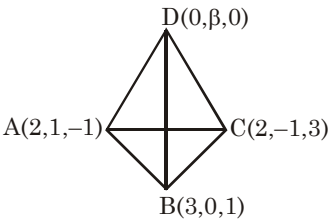
$\Rightarrow \quad \text{coty} = (x-1) + Ce^{-x}$

64. Ans. (3)

$\begin{vmatrix} -x & x & 2 \\ 2 & x & -x \\ x & -2 & -x \end{vmatrix} = 0 \Rightarrow x = 2, -2$

$\Rightarrow \quad n = 2 \quad \Rightarrow \quad \Delta(n) = 0$

65. Ans. (3)



$\left|\frac{1}{6}\begin{vmatrix} 2 & 1-\beta & -1 \\ 3 & -\beta & 1 \\ 2 & -1-\beta & 3 \end{vmatrix}\right| = 5$

$\Rightarrow \quad \beta = 8, -7$

Sum = 1

66. Ans. (1)

$S = (1-\omega)(1-\omega^2) + \ldots\ldots + (2017-\omega)(2017-\omega^2)$

$S = \sum_{n=1}^{2017}(n-\omega)(n-\omega^2) = \sum_{n=1}^{2017}(n^2+n+1)$

$= \frac{2017.2018.4035}{6} + \frac{2017.2018}{2} + 2017$

$\frac{S.\pi}{2017} = \left(\frac{2018.4035}{6} + \underbrace{\frac{1009+1}{\text{even}}}\right)$

= (odd + even)π = odd × π

$= \cos\left(\frac{S\pi}{2017}\right) = \cos(\text{odd} x\pi) = -1$

67. Ans. (4)

Reflexive, symmetric but not transitive.

68. Ans. (4)

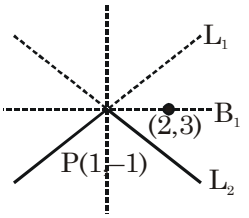
$^{2017}C_0 + {}^{2017}C_1 + \ldots\ldots {}^{2017}C_{1008} = 2^{2016} = \lambda^2$

$\lambda = 2^{1008} \Rightarrow 8.32^{201} = 8(33-1)^{201} = -8 = 25$

69. Ans. (1)

Fixed point of family is (1,–1)

$\Rightarrow$ other bisector is



$y + 1 = -\frac{1}{4}(x-1)$

$x + 4y + 3 = 0$

70. Ans. (2)

$\lim_{x^2 \to a} \frac{b - \cos\left(x^2 - a\right)}{\left(x^2 - a\right)\sin\left(x^2 - a\right)}$

Let $x^2 - a = t$

$\lim_{t \to 0} \frac{b - \cos t}{t\sin(c(t+a) - a)}$

$\Rightarrow \quad \frac{b-1}{0} \quad \Rightarrow \quad b = 1$

$\lim_{t \to 0} \frac{1 - \cos t}{t\sin(ct + a(c-1)} = \lim_{t \to 0} \frac{2\sin^2 \frac{t}{2}}{t\sin(ct + a(c-1))}$

$\lim_{t \to 0} \frac{\sin \frac{t}{2}}{\sin\left(ct + a(c-1)\right)} = \frac{0}{\sin a(c-1)} \Rightarrow \quad c = 1$

$\lim_{t \to 0} \frac{\sin \frac{t}{2}}{\sin t} = \frac{1}{2} \quad \Rightarrow \quad L = \frac{1}{2}$

71. Ans. (1)

$$\frac{1}{2}+\frac{1}{2\sin\frac{x}{2}}2\sin\frac{x}{2}\left(\cos x+\cos 2x+\cos 3x+\cos 4x\right)=0$$

$$=\frac{1}{2}+\frac{1}{2\sin\frac{x}{2}}\left(\sin\frac{9x}{2}-\sin\frac{x}{2}\right)=0$$

$$=\frac{\sin\left(\frac{9x}{2}\right)}{\sin\left(\frac{x}{2}\right)}=0\Rightarrow x=\frac{2n\pi}{9},n\neq 9m\ m\in I$$

72. Ans. (1)

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

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

x = 1, –5(reject)

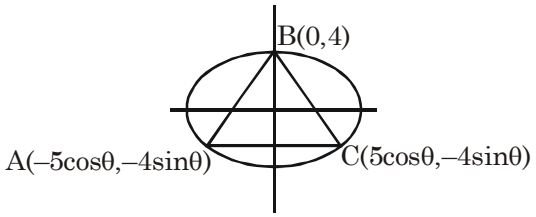
73. Ans. (3)

34 terms so mean of 17^{th} and 18^{th} term is median

$x_{10+n} = 148 + (n–1)(–2) = x_{17} = 136, x_{18} = 134$

hence median = 135

74. Ans. (3)



$$\text{Area}=\frac{1}{2}10\cos\theta\left(4+4\sin\theta\right)$$

$$\frac{dA}{d\theta}=0\Rightarrow\theta=\frac{\pi}{6}$$

$$A_{max}=15\sqrt{3}$$

75. Ans. (4)

Let point be $\left(8\lambda+\frac{1}{3},3\lambda,-6\lambda\right)$ which also satisfies both the plane $P_1 = 0 = P_2$

put in P_2 : $16\lambda+\frac{2}{3}+3\lambda-24\lambda+1=0$

$$\Rightarrow\quad -5\lambda+\frac{5}{3}=0\quad\Rightarrow\quad\lambda=\frac{1}{3}$$

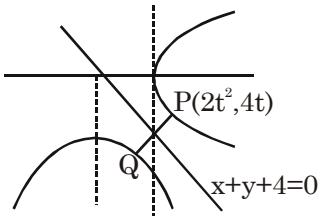
$(\alpha,\beta,\gamma) = (3, 1, –2)$ it also satisfy P_1

$\alpha+\beta+\gamma = 2$

76. Ans. (2)

p	~p	q	p→q	q ∨ ~p	(p→q) ↔(q ∨ ~p)
T	F	T	T	T	T
T	F	F	F	F	T
F	T	T	T	T	T
F	T	F	T	T	T

77. Ans. (1)



for minimum distance $\left.\frac{dy}{dx}\right|_P=-1$

$\Rightarrow t = –1$

$\Rightarrow$ min distance = PQ = $2\sqrt{2}$

78. Ans. (4)

Total cases $\Rightarrow$ $^{15}C_2.2! = 15.14$

$2x = 3y \quad\Rightarrow\quad (3, 2),(6, 4),(9, 6),(12, 8),(15,10)$

Fovourable cases = 5

$$\text{Probability}=\frac{5}{15.14}=\frac{1}{42}$$

79. Ans. (3)

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

$$\cot x=\frac{1}{2}\left\{\frac{1}{2}\left(\cot\frac{x}{4}-\tan\frac{x}{4}\right)-\tan\frac{x}{2}\right\}$$

$$=\frac{1}{4}\cot\frac{x}{4}-\frac{1}{4}\tan\frac{x}{4}-\frac{1}{2}\tan\frac{x}{2}$$

$$=\frac{1}{8}\left(\cot\frac{x}{8}-\tan\frac{x}{8}\right)-\frac{1}{4}\tan\frac{x}{4}-\frac{1}{2}\tan\frac{x}{2}$$

$$\Rightarrow \cot x = \frac{1}{2^n}\cot\left(\frac{x}{2^n}\right) - \frac{1}{2^{n-1}}\tan\left(\frac{x}{2^{n-1}}\right)....$$

$$-\frac{1}{8}\tan\left(\frac{x}{8}\right) - \frac{1}{4}\tan\left(\frac{x}{4}\right) - \frac{1}{2}\tan\left(\frac{x}{2}\right)$$

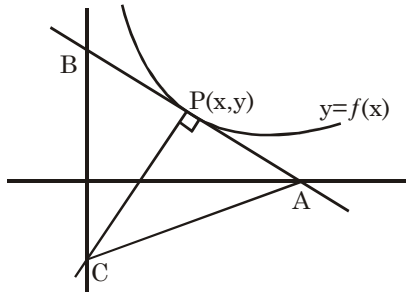
$$\Rightarrow \frac{1}{2}\tan\frac{x}{2} + \frac{1}{4}\tan\frac{x}{2} + \frac{1}{8}\tan\frac{x}{8}..... = \frac{1}{2^n}\cot\left(\frac{x}{2^n}\right) - \cot x$$

$$\Rightarrow \frac{1}{2}\tan\frac{x}{2} + \frac{1}{4}\tan\frac{x}{4} + ...\infty \text{ terms}$$

$$= \lim_{n\to\infty} \frac{1}{2^n}\cot\left(\frac{x}{2^n}\right) - \cot x = \frac{1}{x} - \cot x$$

put $x = \frac{\pi}{2}$

80. Ans. (1)



$\because$ AC = BC

$\therefore$ P is mid point of AB

$\Rightarrow$ A(2x.0) & B(0, 2y)

$$\Rightarrow \frac{dy}{dx} = -\frac{y}{x}$$

$\Rightarrow$ xy = c $\Rightarrow$ xy = 6

81. Ans. (2)

$$\left(\frac{n(n+1)}{2}\right)^2 - \sum_{p=1}^{n}\frac{m(m+1)}{2} = 80$$

$$\frac{n^2(n+1)^2}{4} - \frac{n(n+1)(2n+1)}{12} - \frac{n(n+1)}{4} = 80$$

$\Rightarrow$ n = 4

82. Ans. (2)

$$\Delta = \frac{1}{2}ah_1 = \frac{1}{2}bh_2 = \frac{1}{2}ch_3$$

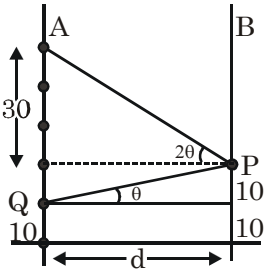
$$h_1 = \frac{2\Delta}{a} \text{ and } h_2 = \frac{2\Delta}{b} \text{ and } h_3 = \frac{2\Delta}{c}$$

$$\frac{1}{h_1} + \frac{1}{h_2} - \frac{1}{h_3} = \frac{1}{2\Delta}(a+b-c) = \frac{2\sqrt{7}}{15}$$

83. Ans. (4)

$$\begin{vmatrix} 4+x^2 & -6 & -2 \\ -6 & 9+x^2 & 3 \\ -2 & 3 & 1+x^2 \end{vmatrix} = x\left(x^3\right)\left(14+x^2\right)$$

84. Ans. (1)



d = 10cotθ; d = 30cot2θ

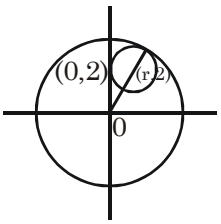
10cotθ = 3cot2θ

$\Rightarrow \theta = 30^o$

85. Ans. (2)

$$4 = \sqrt{r^2+4} + r$$

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



86. Ans. (1)

Let lengths of sides are 2a, 2b, 2c

= B(a, b, –c), A(–a, b, c), C(–a, –b, –c)

$$\frac{\overrightarrow{OB}.\overrightarrow{OC}}{|OB||OC|} = \cos\alpha = \frac{c^2-a^2-b^2}{a^2+b^2+c^2}$$

Similarly

$$\sum \cos\alpha = -1$$

87. Ans.(2)

$$\left|\ell nt\left(\frac{t^3}{3}-t\right)\right|_0^{|x|} - \int_0^{|x|}\frac{1}{t}\left(\frac{t^3}{3}-t\right)dt = \frac{5|x|}{6}$$

$$\ell n|x|\left(\frac{|x|^3}{3}-|x|\right) - \frac{|x|^2}{3} + |x| = \frac{5|x|}{6}$$

$$\ell n|x|\left(\frac{|x|^2}{3}-1\right) - \frac{|x|}{3} + 1 = \frac{5}{6}$$

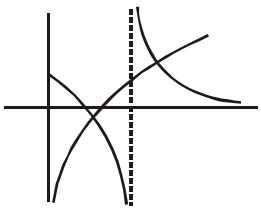
$$\ell n|x|\left(\frac{|x|^2}{3}-1\right) = \frac{|x|}{3} - \frac{1}{6}$$

$$\ell n|x|(|x|^2-3) = \frac{2|x|-1}{2}$$

$\Rightarrow \quad \ell n\,|x| = \dfrac{2|x|-1}{2(|x|^2-1)}$

$|x| = t = t > 0$

$\ell nt = \dfrac{2t-1}{2(t^2-1)}$



$\Rightarrow$ 2 solutions for $|x|$

$\Rightarrow$ 4 solutions.

88. Ans. (3)

$C - (B \cap C)$

89. Ans. (2)

$\overline{I} \quad \overline{II} \quad \overline{III} \quad - \quad - \quad - \quad - \quad - \quad \overline{IX} \quad \overline{X}$

Total number of numbers = 10^{10}

(without any restriction)

Total number of numbers = 9^{10}

(when we do not use 1)

Total number of numbers = 1

(when we use only 0)

Ans. = $10^{10} - 9^{10} - 1$

90. Ans. (1)

$3\hat{i} + 2\hat{j} - 5\hat{k}$

$= (2\lambda + \mu - 2\gamma)\hat{i} + (-\lambda + 3\mu + \gamma)\hat{j} + (\lambda - 2\mu - 3\gamma)\hat{k}$

$\therefore \quad 2\lambda + \mu - 2\gamma = 3$

$-\lambda + 3\mu + \gamma = 2$

$\lambda - 2\mu - 3\gamma = -5$

$\therefore \quad \mu = 1, \gamma = 4, \lambda = 5$