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# CLASSROOM CONTACT PROGRAMME
(ACADEMIC SESSION 2014-2015)

**TARGET : JEE (Main) 2015**

**LEADER & ENTHUSIAST COURSE : SCORE**

**ALLEN JEE (Main) TEST**

**DATE : 01 - 04 - 2015**

## ANSWER KEY

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

# SOLUTION

**1. Ans. (1)**

**2. Ans. (1)**

**3. Ans. (4)**

**Sol.** Electric energy & magnetic energy is same.

**4. Ans. (2)**

**5. Ans. (3)**

**Sol.** $30\,(1+\alpha\theta) = 30.01$

$15.52\,(1+\alpha\theta) = x$

$x = 15.52 \times \dfrac{30.01}{30}$

**6. Ans. (3)**

**Sol.** Let rate of heat supplied be Q. J/sec

Total heat given in melting

$= Q \times (90-10) = 80Q$ J

Total heat given in vapourization = Q (120– 100)

= 20 Q J

$L_v < L_f$

Inverse of slope of line represent the specific heat, $S_s > S_\ell$

**7. Ans. (4)**

**Sol.** $\dfrac{1}{2}\rho v^2 = \rho gh + \dfrac{Mg}{A}$

$\Rightarrow v = \sqrt{2gh + \dfrac{2Mg}{\rho A}} = \sqrt{2\times10\times6 + \dfrac{2\times50\times10}{10^3\times1}}$

$= \sqrt{120+1} = \sqrt{121} = 11\,m/s$

**8. Ans. (3)**

**9. Ans. (3)**

**Sol.**


mu cos 60

net I = 2mu cos 60

= mu

**10. Ans. (1)**

**Sol.** Normal reaction between wedge and ball as well as between wedge and ground is impulsive. Also friction force between ground and wedge is impulsive.

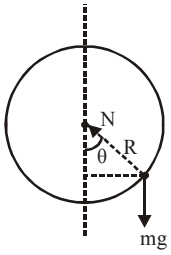
**11. Ans. (2)**

**Sol.** Applying work energy theorem from initial to final position, $mg \sin 30^\circ\, \ell = \dfrac{1}{2} mv^2$

Applying NLM, along radial direction at final position $-mg\sin 30^\circ + T = \dfrac{mv^2}{\ell} \Rightarrow T = \dfrac{3}{2}mg$

**12. Ans. (1)**

**Sol.**




$N\sin\theta = m\omega^2 R\sin\theta \Rightarrow N = 2N$

**13. Ans. (3)**

**Sol.** $K_1 = \dfrac{Y_1 A}{L_1}$, $K_2 = \dfrac{Y_2 A}{L_2}$

$K = \dfrac{K_1 K_2}{K_1 + K_2}$

**14. Ans. (3)**

**Sol.** Fundamental frequency of sonometer

$$n = \frac{1}{2\ell}\sqrt{\frac{T}{m}}$$

when tension is increased by 44% then n' = n+6

$\Rightarrow n+6 = \dfrac{1}{2\ell}\sqrt{\dfrac{1.44T}{m}} = 1.2n \Rightarrow n = 30Hz$

When length of the wire is increased by 20% then

$$n' = \frac{1}{2\ell'}\sqrt{\frac{T}{m}} = \frac{1}{2(1.2\ell)}\sqrt{\frac{T}{m}} = \left(\frac{1}{1.2}\right)(30) = 25Hz$$

Change in frequency = 30 – 25 = 5 Hz

**15. Ans. (1)**

**Sol.** Energy & momentum conservation.

**16. Ans. (3)**

**Sol.** $W = \frac{nR\Delta T}{1-2}$

$\Delta U = n\frac{5}{2}R\Delta T$

$\frac{W}{\Delta U} = -\frac{2}{5} = -0.4$

**17. Ans. (3)**

**18. Ans. (4)**

**19. Ans. (4)**

**Sol.** AB $\perp$ to line y = x + 3

**20. Ans. (1)**

**21. Ans. (1)**

**Sol.** $q_1 = CE$

$q_2 = CE \times \frac{3}{5}$

**22. Ans. (3)**

**Sol.** $\tau = \vec{P} \times \vec{B}$

$B_{\text{at center}} = \frac{\mu I}{2R}$

**23. Ans. (4)**

**Sol.** Here f = 0.5 HZ; N = 100, A = 0.1 $m^2$ and B = 0.01 T. Employing eq.

$e_0 = NBA\ (2\pi\ v)$

$= 100 \times 0.01 \times 0.1 \times 2 \times 3.14 \times 0.5$

= 0.314 V

The maximum voltage is 0.314 V

We urge you to explore such alternative possibiliities for power generation.

**24. Ans. (1)**

**Sol.** $V_{mean} = \frac{\int_0^{T/2} V_0 dt}{\int_0^{T/2} dt} = V_0,\ V_{rms} = \sqrt{\frac{\int_0^{T} V_0^2 dt}{\int_0^{T} dt}} = V_0$

**25. Ans. (1)**

**Sol.** $\frac{hc}{\lambda} = 5\ eV_0 + \phi$

$\frac{hc}{3\lambda} = eV_0 + \phi \Rightarrow \frac{2hc}{3\lambda} = 4eV_0 \Rightarrow \phi = \frac{hc}{6\lambda}$

**26. Ans. (3)**

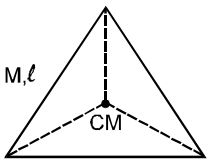
**27. Ans. (2)**

**Sol.** MI of the system w.r.t an axis $\perp$ to plane & passing through one corner

$$= \frac{ML^2}{3} + \frac{ML^2}{3} + \left[\frac{\mu L^2}{12} + \mu\left(\frac{\sqrt{3}\ L}{2}\right)^2\right]$$

$$= \frac{2ML^2}{3} + \left[\frac{ML^2}{12} + \frac{3ML^2}{4}\right]$$

$$= \frac{2ML^2}{3} + \frac{10\,ML^2}{12} = \frac{3ML^2}{3} = \frac{18ML^2}{12} = \frac{3}{2}ML^2$$




Now $\frac{3}{2}\ ML^2 = 3k^2$

$k = \frac{\ell}{\sqrt{2}}$

**28. Ans. (4)**

**Sol.** Point 'D' is ICR pure rotation about ICR.

**29. Ans. (3)**

**Sol.** Two point masses and bar taken together as a system the angular momentum about centre of bar is (2mv) (1) + (2mv) (2a)

$$= \left[\frac{8m \times (6a)^2}{12} + 2ma^2 + m4a^2\right]\omega$$

$\Rightarrow 30\ a\omega = 6v \Rightarrow \omega = \frac{v}{5a} \Rightarrow v_c = 0;\ E = \frac{1}{2}I\omega^2$

$$= \frac{1}{2} \times 30ma^2 \times \left(\frac{v}{5a}\right)^2 = \frac{3mv^2}{5}$$

**30. Ans. (3)**

**Sol.** Let the block is in translational equilibrium and ready to topple.

f = F

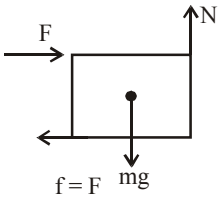
N = mg

Taking torque about C.O.M. = 0

$$F\left(\frac{a}{2}\right)+f\left(\frac{a}{2}\right)=N\left(\frac{a}{2}\right)$$

$$2F = N$$

$$F = \frac{N}{2}$$




$$f = \frac{N}{2}$$

but $f \le \mu N$

$$\frac{N}{2} \le \mu N$$

$$\mu \ge \frac{1}{2}$$

**31. Ans. (4)**

**32. Ans. (2)**

| | $Cl_2(g) \rightleftharpoons 2Cl_2(g)$ | |
|---|---|---|
| t = 0 | $P_0$ | — |
| t = t | $P_0 - P_0\,\alpha$ | $2P_0\,\alpha$ |

$\Rightarrow \quad P_0 - P_0\alpha + 2P_0\alpha = 15$

$\Rightarrow \quad P_0 (1 + \alpha) = 15$

$P_0 (1.5) = 15 \Rightarrow P_0 - 10$

$$K_{eq} = \frac{(2P_0\alpha)^2}{(P_0 - P_0\alpha)} = \frac{100}{5} = 20$$

$\Delta G^\circ = -RT \ln K^\circ_{eq}$

$$= -\frac{2}{1000}\times 1000 \ln 20P_0(20)$$

$= -2\ln 20 = -5.99$

**33. Ans. (4)**

| $AgCl(s) \rightleftharpoons$ | $Ag^+(aq.) +$ | $Cl^-(aq.)$ |
|---|---|---|
| y | x – y | $4 \times 10^{-5} - y$ |

$4 \times 10^{-5} - y = 10^{-5}$

$y = 3 \times 10^{-5}$

$(x - y)(4 \times 10^{-5} - y) = 10^{-10}$

$(x - y)(10^{-5}) = 10^{-10}$

$x - y = 10^{-5}$

$x - 3 \times 10^{-5} = 10^{-5}$

$x = 4 \times 10^{-5}$

**34. Ans. (1)**

**35. Ans. (1)**

$N_2H_5^{\oplus} + NH_3 \rightleftharpoons NH_4^{\oplus} + N_2H_4$

By this reaction we can deduce that acidic strength of $N_2H_5^{\oplus}$ > acidic strength of $NH_4^{\oplus}$

$N_2H_4 + HBr \rightleftharpoons N_2H_5^{\oplus} + Br^{\ominus}$

By this reaction

Acidic strength of HBr > Acidic strength of $N_2H_5^{\oplus}$

**36. Ans. (3)**

**37. Ans. (3)**

In 2 years (730 days) around three

Half life has been passed so after three half life remaining value of gadolinium will be 12.5%.

**38. Ans. (3)**

$$7H_2O + 2Cr^{3+}_{(aq.)} \longrightarrow Cr_2O_{7(aq.)}^{-2} + 14H^+_{(aq.)} + 6e^-$$

$$E = E^\circ - \frac{0.06}{6}\log\frac{[H^+]^{14}(Cr_2O_7^{-2})}{(Cr^{+3})^2}$$

$$E = E^\circ - 0.01\ \log\frac{(Cr_2O_7^{-2})}{(Cr^{+3})^2} - 0.14\log[H^+]$$

$$E = E^\circ - 0.01\ \log\frac{(Cr_2O_7^{-2})}{(Cr^{+3})^2} + 0.14\ pH$$

$$E_2 - E_1 = 0.14\ [P_2^H - P_1^H] = 0.14$$

**39. Ans. (2)**

Change in radius

$$r_2 - r_1 = \frac{0.529}{Z}\times[n_2^2 - n_1^2]$$

$r_2 - r_1 \propto (n_2 - n_1)(n_1 + n_2)$

**40. Ans. (3)**

$$V_m = \frac{\text{Mol.wt.}}{\text{density}} = \frac{27}{0.3} = 90 \text{ litre}$$

$$Z = \frac{PV_m}{RT} = \frac{1\times 90}{0.08\times 750} = 1.5$$

**41. Ans. (4)**

**42. Ans. (1)**

**43. Ans. (2)**

**44. Ans. (2)**

**45. Ans. (4)**

**46. Ans. (3)**

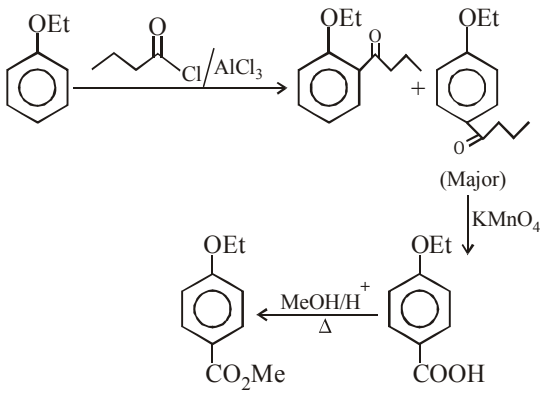
**47. Ans. (2)**

**48. Ans. (3)**

**49. Ans. (1)**

**50. Ans. (4)**

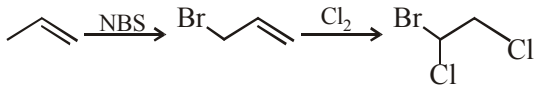
**51. Ans. (3)**




**52. Ans. (2)**

Anti and gauche are non-mirror image and non-superimposable, hence diastereomers

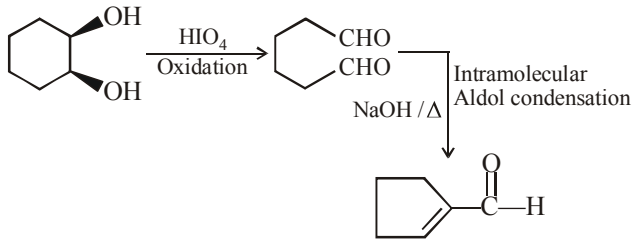
**53. Ans. (3)**




**54. Ans. (2)**

Aromatic $SN^{AE}$ reaction, $-NO_2$ is ortho & para directing group for Aromatic nucleophilic substitution

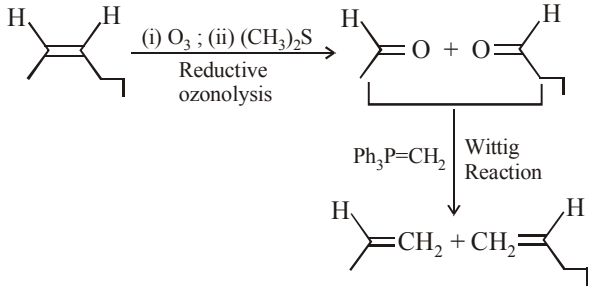
**55. Ans. (3)**




**56. Ans. (2)**

Hemi-acetal is present in 'Y', hence reducing sugar.

**57. Ans. (4)**




**58. Ans. (2)**

pH = 2.45 is isoelectric point

**59. Ans. (1)**

Alkyl halide is formed as product.

**60. Ans. (1)**

Both cis and trans can be formed

**61. Ans. (3)**

$a = r\cos\theta$ & $b = r\sin\theta$

$$r = \frac{9}{(12\cos\theta + 5\sin\theta)}$$

minimum value of $r = \frac{9}{13}$

$$r^2 = \frac{81}{169}$$

**62. Ans. (1)**

$$\int \frac{e^x(\sec x + \sec x \tan x)dx}{(1 + e^{-x}\sin x)} = f(x) + C$$

Let $1 + e^x \sec x = t$

$\Rightarrow$ $e^x(\sec x + \sec x \tan x)dx = dt$

$$\int \frac{dt}{t} = \ell nt = \ell n\left(1 + e^x \sec x\right) + C$$

**63. Ans. (4)**

Let roots are (a – d), a, (a + d)

(a – d) + a + (a + d) = 2

a = 3

27 – 81 + 3a – 15 = 0 $\Rightarrow$ 3a = 69, a = 23

**64. Ans. (3)**

$T_1 = (2 + 1)(1!) = 2! + 1!$

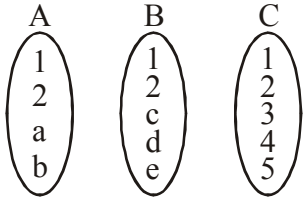
$T_2 = -(3 + 1)(2!) = (3! + 2!)$

$T_3 = (4 + 1)(3!) = 4! + 3!$

⋮

Sum = 1

**65. Ans. (4)**




common elements are {(1, 2)(1, 1)(2, 1)(2, 2)}

**66. Ans. (2)**

$f'(x) = 4x^3 5^{x^2} - 18x\,5^{3x}$ value of limit is $= 2f'(3)$

$2(54.5^9) = 108(5^9)$

**67. Ans. (2)**

$$\begin{vmatrix} 2\alpha & 1 & 5 \\ 1 & -6 & \alpha \\ 1 & 1 & 2 \end{vmatrix} = 0$$

$2\alpha(-12-\alpha)-(2-\alpha)+5(7)=0$

$2\alpha^2-24\alpha-2+\alpha+35=0$

$2\alpha^2-23\alpha+33=0$

$\alpha_1+\alpha_2=\frac{23}{2}$

**68. Ans. (1)**

$f'(x)=(e^x-e^{-x})-\sin x$

alwasys positive and three an increasing function.

**69. Ans. (1)**

$$\frac{(\alpha^5+\beta^5)}{(\alpha^3+\beta^3)}=\frac{11}{3}$$

$$\frac{1}{(\alpha^2+\beta^2-\alpha\beta)}(\alpha^4+\beta^4-\alpha\beta(\alpha^2+\beta^2-\alpha\beta))=\frac{11}{3}$$

$$\frac{(\alpha^4+\beta^4)}{(\alpha^2+\beta^2-\alpha\beta)}-\alpha\beta=\frac{11}{3}$$

$$\frac{25-2(\alpha\beta)^2}{5-\alpha\beta}-\alpha\beta=\frac{11}{3}$$

Let $\alpha\beta = t$; by cofficient $\alpha\beta = 2$.

**70. Ans. (2)**

put $x = 1$

$(31)! = a_0 + a_1 + a_2 + \ldots\ldots$ .....(1)

put $x = -1$

$0 = a_0 - a_1 + a_2 - \ldots\ldots$ .....(2)

(1) + (2) $\Rightarrow \frac{(31)!}{2} = a_0 + a_2 + a_4 + \ldots\ldots$

**71. Ans. (1)**

$y(\ell ny)dy - x\cos y dy = \sin y dx + e^x dx$

$\int \ell ny dy - \int e^x dx = d(x\sin y)$

$y((\ell ny)-1) = e^x - x\sin y + C$

**72. Ans. (1)**

Let $\frac{x}{\cos\theta}=t \Rightarrow dx=(\cos\theta)dt$

$\cos\theta\int_{\tan\theta}^{1} f(t)dt - \cos\theta\int_{1}^{\tan\theta} f(t)dt$

**73. Ans. (4)**

$\mu \le 100$

$\mu = 1, 2, 3, \ldots\ldots, 100$

Sum = 1 + 2 + 3 + ..... + 100

$=\frac{100(100+1)}{2}=5050$

**74. Ans. (4)**

(a) $\frac{80!}{40!\,40!} \Rightarrow N_r$ has exponent of 7 as 12 & $D_r$ has exponent of 7 as 10 divisible by 7.

(b) $N_r$ has exponent of 23 as 3 and denominator as 2.

divisible by 23.

(c) $N_r$ has exponent of 11 as 7 and denomination has exeponent of 6.

(d) $N_r$ & $D_r$ have same exponent of 29. Hence not divisible by 29.

**75. Ans. (4)**

$z = 1$ satisfies the equation

$(z-1)(z^2 - z(3+3i)+5i) = 0$

$(z-1)(z-(2+i))(z-(1+2i)) = 0$

**76. Ans. (3)**

$A \cap B' = A - (A \cap B)$

$A \cap B' = (A \cup B) - B$

**77. Ans. (3)**

Sample space = $^{1000}C_2 = 500 \times 999$

{1, 2, 3, 4, 6, .....}

& {5, 10, 15, 20, .....}

first first set select any two numbers or from second set select any two numbers $^{800}C_2 + {}^{200}C_2$

$= 400 \times 799 + 100 \times 199 = 100(3196 + 199)$

$= 3339500$

**78. Ans. (1)**

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

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

$f(x) = f(-x)$

$$f(x) = \frac{1}{3x}\sin\left(x - \frac{1}{x}\right)$$

$$I = \frac{1}{3}\int_{1/e}^{e} \frac{\sin\left(x - \frac{1}{x}\right)}{x}dx \qquad .....(i)$$

Let $x = \frac{1}{t} \Rightarrow dx = -\frac{dt}{t^2}$

$$I = \frac{1}{3}\int_{e}^{1/e} \frac{\sin\left(\frac{1}{t} - t\right)}{\left(\frac{1}{t}\right)}\left(-\frac{dt}{t^2}\right)$$

$$I = -\frac{1}{3}\int_{1/e}^{e} \frac{\sin\left(t - \frac{1}{t}\right)}{t^2}dt \qquad .....(ii)$$

(i) + (ii) $\Rightarrow$ $I = 0$

**79. Ans. (3)**

$x = 2 \times 5^{60}$

$n(x) = 6! \times 5!$

$n(y) = 10! \times 5!$, where $y - 2^{100} \times 5^{50}$

$z = 2^{40} \times 3^{40} \times 5^{40}$

$n(z) = 41^3$

$n(x \cap y) = 6! \times 5!$

$n(y \cap z) = 41^2 = n(z \cap x)$

$n(x \cap y \cap z) = 41^2$

$n(x \cup y \cup z) = n(x) + n(y) + n(z)$

$= n(x \cap y) - (y \cap z) - n(z \cap x) + n(x \cap y \cap z)$

$= 61^2 + 101 \times 51 + (41)^3 - 61 \times 51 - 41^2 - 41^2$

$= 61(61 - 51) + 41^2(41 - 1) + 101 \times 51 = 73001$

**80. Ans. (3)**


$CD = (2 - r)$

$\Delta ACD = -(6 + r)^2$

$= 6^2 + (12 - r)^2$

$r = 4$ c.m.

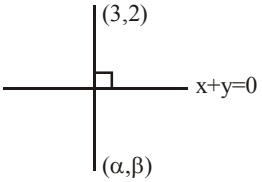
**81. Ans. (1)**

$x + iy = -i(x - iy)$

$x + iy = -ix - y$

$x = -y$ is a straight line and the reflection of point (3, 2)

$$\frac{(\alpha + 3)}{2} + \frac{(\beta + 2)}{2} = 0$$




$\alpha + \beta + 5 = 0$

$$\frac{\beta - 2}{\alpha - 3} = 1 \Rightarrow \beta = \alpha - 1$$

$\alpha = -2$ & $\beta = -3$

**82. Ans. (4)**

$$f(\theta) = \frac{1}{\sqrt{\sin\theta + \cos\theta}}$$

$$\theta \in \left[0, \frac{\pi}{2}\right]$$

$$\text{Maximum value} = \frac{1}{0 + 1} = 1$$

$$\text{minimum value} = \frac{1}{\sqrt{\sqrt{2}}} = \frac{1}{2^{1/4}}$$

**83. Ans. (2)**

$\frac{1}{r_1}, \frac{1}{r_2}, \frac{1}{r_3}$ are in A.P.

$\frac{(s-a)}{\Delta}, \frac{(s-b)}{\Delta}, \frac{(s-c)}{\Delta}$ are in A.P.

a,b,c are in AP

$$\frac{a + c}{b} = 2$$

**84. Ans. (2)**

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

focus (3,0) & directrix is $\sqrt{2}x + y + c = 0$

$$\frac{a}{e} - ae = \frac{\left(3\sqrt{2} + 1\right)}{\sqrt{3}}$$

$$e = \frac{1}{\sqrt{3}} \Rightarrow 2ae = \frac{\left(3\sqrt{2} + 1\right)}{4\sqrt{3}}$$

**85. Ans. (3)**

$\cos^2\theta + \cos^2\theta + \cos^2\beta = 1$

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

$1 - 3\sin^2\theta = 1 - 2\sin^2\theta$

$\sin^2\theta = 0$

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

$1 - 3\sin^2\theta = 1 - 2\cos^2\theta$

$1 - 3(1 - \cos^2\theta) = 1 - 2\cos^2\theta$

$5\cos^2\theta = 3$

$\cos^2\theta = 3/5$

**86. Ans. (1)**

$4r = R$

$$16\sin^2\frac{A}{2}\sin\left(\frac{180^\circ - 2A}{2}\right) = 1$$

$$\frac{16(1-\cos A)}{2}\cos A = 1$$

**87. Ans. (3)**

$$\frac{\sin A \sin B \sin C}{\left(3(\sin A + \sin B + \sin C) - 4\left(\sin^3 A + \sin^3 B + \sin^3 C\right)\right)}$$

$$= -\frac{1}{12}$$

**88. Ans. (3)**

$$T_r = \tan^{-1}\left(\frac{\frac{1}{3}}{1 + \frac{r}{3}\frac{(r-1)}{3}}\right)$$

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

$$T_1 = \tan^{-1}\left(\frac{1}{3}\right) - \tan^{-1}(0)$$

$$T_2 = \tan^{-1}\left(\frac{2}{3}\right) - \tan^{-1}\left(\frac{1}{3}\right)$$

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

$$S_n = \tan^{-1}\left(\frac{n}{3}\right) = \frac{\pi}{2}$$

**89. Ans. (3)**

$$h'(x) = \left(5\left(f(x)\right)^2 + f(x) + 2\right) f'(x)$$

$h'(x) = (f'(x))$ (+ve)

as $f(x)$ increases, $h(x)$ increases.

**90. Ans. (2)**

$AB = BC = CA = \sqrt{6}$

It is a regular tetrahedron

$$\left[\vec{a}\ \vec{b}\ \vec{c}\right]^2 = \begin{vmatrix} \vec{a}.\vec{a} & \vec{a}.\vec{b} & \vec{a}.\vec{c} \\ \vec{b}.\vec{a} & \vec{b}.\vec{b} & \vec{b}.\vec{c} \\ \vec{c}.\vec{a} & \vec{c}.\vec{b} & \vec{c}.\vec{c} \end{vmatrix} = \begin{vmatrix} 6 & 3 & 3 \\ 3 & 6 & 3 \\ 3 & 3 & 6 \end{vmatrix}$$

$[a\ b\ c]^2 = 108$

$$\text{volume} = \frac{1}{6}\sqrt{108} = \sqrt{3}$$