# RITS-31
# JEE MAINS-2019
# ANSWER KEY
# Code: 119717

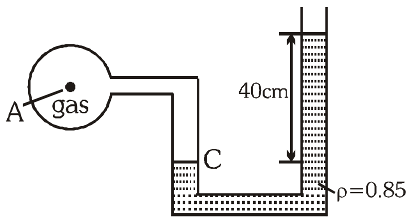
| PHYSICS | | CHEMISTRY | | MATHEMATICS | |
|---|---|---|---|---|---|
| 1 | 3 | 1 | 2 | 1 | 2 |
| 2 | 1 | 2 | 3 | 2 | 1 |
| 3 | 4 | 3 | 1 | 3 | 1 |
| 4 | 2 | 4 | 2 | 4 | 3 |
| 5 | 2 | 5 | 4 | 5 | 2 |
| 6 | 3 | 6 | 2 | 6 | 2 |
| 7 | 1 | 7 | 2 | 7 | 4 |
| 8 | 3 | 8 | 4 | 8 | 3 |
| 9 | 2 | 9 | 2 | 9 | 1 |
| 10 | 2 | 10 | 3 | 10 | 3 |
| 11 | 1 | 11 | 4 | 11 | 3 |
| 12 | 3 | 12 | 4 | 12 | 2 |
| 13 | 4 | 13 | 3 | 13 | 3 |
| 14 | 3 | 14 | 4 | 14 | 2 |
| 15 | 1 | 15 | 2 | 15 | 2 |
| 16 | 1 | 16 | 1 | 16 | 1 |
| 17 | 3 | 17 | 4 | 17 | 2 |
| 18 | 1 | 18 | 2 | 18 | 3 |
| 19 | 3 | 19 | 3 | 19 | 1 |
| 20 | 1 | 20 | 2 | 20 | 1 |
| 21 | 1 | 21 | 3 | 21 | 1 |
| 22 | 4 | 22 | 4 | 22 | 1 |
| 23 | 1 | 23 | 1 | 23 | 4 |
| 24 | 3 | 24 | 2 | 24 | 3 |
| 25 | 1 | 25 | 3 | 25 | 3 |
| 26 | 2 | 26 | 4 | 26 | 1 |
| 27 | 1 | 27 | 2 | 27 | 3 |
| 28 | 2 | 28 | 2 | 28 | 4 |
| 29 | 4 | 29 | 3 | 29 | 1 |
| 30 | 2 | 30 | 4 | 30 | 3 |

## SOLUTION

**1. Ans.(3)**

**Sol.** Starting from the point A, the manometetric equation may be written as

$P_A - (0.85)(10^3)(10)(0.4) = P_{atm} = 10^5$




or $P_A = (3.4 \times 10^3) + (100 \times 10^3) = 103.4$ kPa

***Note :*** The variation of pressure in the gas is ingnored because the density of gas is negligible compared to that of the liquid.

**2. Ans.(1)**

**3. Ans.(4)**

**4. Ans. (2)**

**Sol.** Let M = mass of boat, m = mass of stones

for floating condition

weight = up thrust

$(M + m) g = V_D \rho_w g$

$V_D = \frac{M}{\rho_w} + \frac{m}{\rho_w}$ ... (1)

When stones are unloaded into the water

$V_{D_1} = \frac{M}{\rho_w}$ ( $V_{D_1}$ = displaced volume by boat)

$V_{D_2} = \frac{m}{\rho_s}$ ( $V_{D_2}$ =displaced volume by stones)

∴ total displaced volume

$V_D' = V_{D_1} + V_{D_2} = \frac{M}{\rho_w} + \frac{m}{\rho_s}$ ...(2)

∴ $\frac{m}{\rho_w} > \frac{m}{\rho_s} \Rightarrow V_D > V_D'$

So level will fall.

**5. Ans.(2)**

**Sol.** Energy $= \frac{1}{2} \epsilon_0 E^2 (\text{volume})$

$8.85 \times 10^{-6} = \frac{1}{2} \times 8.85 \times 10^{-12} E^2 \left(10^{-6}\right)$

$E = \sqrt{2} \times 10^6 \, V/m$

flux $(\phi) = EA$

$= \sqrt{2} \times 10^{+6} \times 10^{-4} = 100\sqrt{2} (V - m)$

**6. Ans. (3)**

**Sol.** at t = 0 'L' behaves as open circuit and at t = ∞ as short circuit

**7. Ans. (1)**

**Sol.** $V_{eq} = \sqrt{V_0^2 + \left(\frac{V_0}{2}\right)^2}$

$R_{eq} = \sqrt{(\omega L)^2 + R^2}$

**8. Ans. (3)**

**Sol.** $I = \frac{BV\ell}{15}$

$I_1 = I_2 = \frac{I}{2}$

**9. Ans. (2)**

**Sol.** $q = \frac{1}{R} d\phi = -\frac{1}{R}(\phi_2 - \phi_1)$

$\phi_1 = NBA \cos\theta$

$(\theta = 0)$

$\phi_1 = NBA$

$\phi_2 = 0$ [∵ $\theta = 90°$]

$q = \frac{NBA}{R}$

**10. Ans. (2)**

**Sol.** $W_A > W_B$ as mass of water in A is more than in B

$P_A = P_B$

Area of A = Area of B

or $P_A \, Area_A = P_B \, Area_B$

or $F_A = F_B$

**11. Ans. (1)**

**Sol.** At steady state, current in capacitor is zero, during charging current passing through capacitor.

**12. Ans. (3)**

**Sol.** For particle starts S.H.M. from extreme position

$y = A\cos\omega t$

$\Rightarrow \frac{A}{2} = A\cos(\omega \times 1)$

$\Rightarrow \frac{1}{2} = \cos\omega$

$\Rightarrow \cos\frac{\pi}{3} = \cos\omega$

$\Rightarrow \cos\omega = \cos\frac{\pi}{3}$

$\Rightarrow \omega = \frac{\pi}{3}$

$\Rightarrow T = \frac{2\pi}{\omega} = \frac{2\pi \times 3}{\pi} = 6\,s$

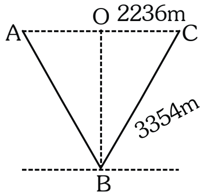
**13. Ans. (4)**

**Sol.** Time for the echo $= 10\sqrt{5}\,s$ (i.e., for sound to travel ABC). Velocity of the plane = 200 m/s.

OC = 200 × $5\sqrt{5}$ = 2236m

BC = velocity of sound × $5\sqrt{5}$

$\Rightarrow$ BC = 300 × $5\sqrt{5}$ =3354m




$\therefore OB = \sqrt{BC^2 - OC^2}$

OB = 2500 m

The plane is 2500 m above the ground.

**14. Ans. (3)**

**Sol.** Energy (E) ∞ (Amplitude)$^2$ (Frequency)$^2$ Amplitude is same in both the case, but frequency $2\omega$ in the second case is two times the frequency ($\omega$) in the first case. Hence $E_2 = 4E_1$.

**15. Ans. (1)**

**Sol.** Here, E = 6V/m, c = 3 × $10^8$ ms$^{-1}$

$B = \frac{E}{C} = \frac{6V/m}{3 \times 10^{8 ms^{-1}}} = 2 \times 10^{-8} T$

E is along the y-direction and the plane e.m. wave propagate along x-direction. Therefore, B should be in a direction perpendicular to both x and y-axis. Using vector algebra $\vec{E} \times \vec{B}$ should be along x-direction.

Since $(+\hat{j}) \times (+\hat{k}) = \hat{i}$, B is along the z-direction.

Thus, magnetic field component B would be 2 × $10^{-8}$ T along z-direction.

**16. Ans. (1)**

**17. Ans. (3)**

**Sol.** Output equation y = $\overline{\overline{\overline{A} + \overline{B}}} = \overline{A.B}$

**18. Ans. (1)**

**Sol.** Object is placed at centre of curvature.

Image after reflection from mirror will form on object itself.

Hence O & image will form at same point after refraction from plane surface. so distance is zero

**19. Ans. (3)**

**20. Ans. (1)**

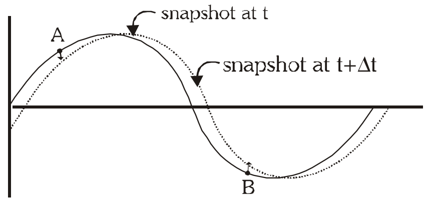
**Sol.** $T = 2\pi\sqrt{\frac{m}{k_{eq}}}$

$F_{net} = -(4k)(4x) = -16kx$

$\Rightarrow k_{eq} = 16K$

**21. Ans. (1)**

**Sol.** $v_{Particle} = -(\text{slope})(v_{wave})$




At A **:** slope → +ve so $v_P$ is –ve.

***OR***

At B **:** slope → –ve so $v_P$ is +ve.

**22. Ans. (4)**

**Sol.** $\frac{mv^2}{R} = \mu mg;\ v = \sqrt{\mu Rg}\ \therefore t = \sqrt{\frac{2h}{g}}$

Horizontal distance = vt = $\sqrt{2\mu Rh}$

**23. Ans. (1)**

**Sol.** The force exerted by ground on the block

$= \sqrt{N^2 + f^2}$

$= \sqrt{(Mg)^2 + \left[\left(\frac{4}{5}\right)(3Mg)\right]^2} = \frac{13}{5}Mg = 2.6Mg$

**24. Ans. (3)**

**Sol.** From the figure net resistance

$R_1$ = 1ohm, $R_2 = \frac{1}{2}$ ohm, $R_3$ = 1 ohm

It is clear that $R_3 = R_1 > R_2 \therefore P_2 > P_1 = P_3$ $\left[\text{As}P = \frac{V^2}{R}\right]$

**25. Ans. (1)**

**26. Ans. (2)**

**Sol.** T. E. in orbit – P E at surface

$= \frac{-GM_em}{2(3R)} - \left(\frac{-GM_em}{R}\right)$

$= GM_em\left(\frac{1}{R} - \frac{1}{6R}\right) = \frac{5}{6}\frac{GM_em}{R} = \frac{5}{6}mgR$

**27. Ans. (1)**

**Sol.** $R_1 = \frac{\ell}{kA} = 2R$ $\qquad$ $R_2 = \frac{\ell}{2kA} = R$

in configuration 1 ; equivalent R = 3R

in configuration 2 ; equivalent R = $\frac{2}{3}R$

$\Delta Q_1 = \frac{\Delta T}{3R} t_1$ ; $\Delta Q_2 = \frac{\Delta T}{\frac{2R}{3}} t_2$

$$\Rightarrow \frac{\Delta T}{3R} t_1 = \frac{3\Delta T}{2R} t_2 \Rightarrow t_2 = \frac{2}{9} t_1 = 2\,\text{sec}.$$

**28. Ans. (2)**

**Sol.** $kE = \frac{1}{2}mv^2$

$$\frac{\Delta kE}{kE} = \frac{\Delta m}{m} + 2\frac{\Delta v}{v}$$

$$\frac{\Delta kE}{kE} \times 100 = 2 + 2 \times 3$$

= 8%

**29. Ans. (4)**

**Sol.** $\Delta Q = \Delta U + \Delta W$

$$= \frac{f}{2} nR\Delta T + P\Delta V = \left(\frac{f}{2} + 1\right) nR\Delta T$$

$$= \left(\frac{3}{2} + 1\right)(2 \times 8.31)(5) = 208 \text{ J}$$

**30. Ans. (2)**

**Sol.** $P_1 + \frac{1}{2}\rho V_1^2 = P_2 + \frac{1}{2}\rho V_2^2$

$$P_1 - P_2 = \frac{1}{2}\rho\ (V_2^2 - v_1^2)$$

$$h \times 13600 \times g = \frac{1}{2} \times 1000\ (V_2^2 - V_1^2)$$

$$A_1V_1 = A_2V_2 = \frac{d(\text{volume})}{dt}$$

$$V_1 = \frac{500}{5} = 100\text{cm/s} = 1\text{m/s}$$

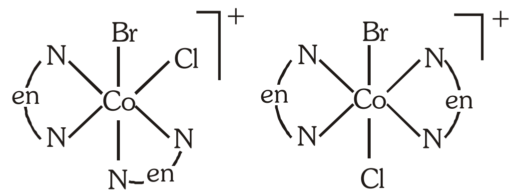
$$V_2 = \frac{500}{2} = 250\,\text{cm/s} = 2.5\text{ m/s}$$

$$h = \frac{\frac{1}{2} \times 1000(0.25 - 1)}{13600 \times 10} m$$

$$h = \frac{1}{2} \times \frac{5.25 \times 100}{136} cm$$

**31. Ans. (2)**

**Sol.** Only two geometrical isomers are possible of $[CoBrCl(en)_2]^+$.



**32. Ans. (3)**

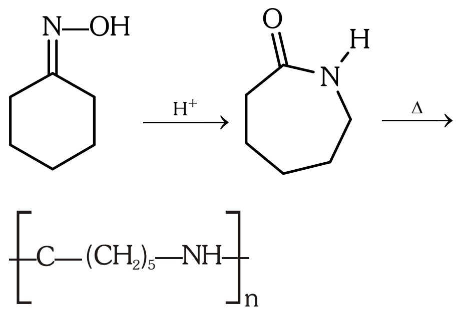
**Sol.** $Na_2B_4O_7 \xrightarrow{\Delta} 2NaBO_2 + B_2O_3$

$CuO + B_2O_3 \xrightarrow{\Delta} Cu(BO_2)_2$

$2Cu(BO_2)_2 + 4NaBO_2 + 2C \xrightarrow{\Delta} 2Cu$ (red and opaque) $+ 2Na_2B_4O_7 + 2CO\uparrow$

**33. Ans. (1)**

**Sol.**



nylon-6

**34. Ans. (2)**

**Sol.** 11.95 ppm means 11.95 g chloroform in $10^6$ g solution.

Hence $m = \frac{11.95 \times 1000}{119.5 \times 10^6} = 1 \times 10^{-4}$

**35. Ans. (4)**

**Sol.** 1140 torr × 10 litre = $P_{gas} \times 15$

760 torr = $P_{gas}$

final pressure of gas = $P_{gas} + P_{\text{aqueous tension}}$

760 + 20 = 780 torr.

**36. Ans. (2)**

**Sol.** $W = \frac{E.it}{F}$ $\qquad$ $\left\{Z = \frac{E}{F} = 0.0011180\right\}$

∴ W = 0.0011180 × 0.5 × 200

= 0.11191 gram

**37. Ans. (2)**

**Sol.** $d = \frac{Z \times M}{N_A \times a^3}$

so, $Z = \frac{2.72 \times 6 \times 10^{23} \times (404 \times 10^{-10})^3}{27} = 4$

so, fcc.

**38. Ans. (4)**

**Sol.** (A) $Mg = 1s^2 2s^2 2p^6 3s^2$ ; $Al = 1s^2 2s^2 2p^6 3s^2 3p^1$ As electron is to be removed from stable completely filled s-orbital of Mg as compared to partially filled p-orbital of Al.

(B) $Li^+$ due to small in size attracts more no. of water moleucules and thus have bigger hydrated ion.

(C) Addition of 2nd $e^-$ to an anion (same charge) is difficult due to the electrostatic repulsion.

All statements are true.

**39. Ans. (2)**

**Sol.** Due to poor shielding effect of 'd' electrons.

**40. Ans. (3)**

**Sol.** B.O. of $O_2^{2-} = \frac{10-8}{2} = 1$

B.O. of $B_2 = \frac{6-4}{2} = 1$

**41. Ans. (4)**

**Sol.** MgO cannot be reduced by carbon at moderate temperature because 'Mg' is highly electropositive metal and has very high lattice energy.

(A) $PbO + C \longrightarrow Pb + CO$

(B) $SnO_2 + 2C \longrightarrow Sn + 2CO$

(C) $ZnO + C \longrightarrow Zn + CO$

**42. Ans. (4)**

**Sol.** $NH_4Cl$ gives $NH_3$, $NH_4NO_3$ gives $N_2O$ and $AgNO_3$ gives $NO_2$.

(A) $NH_4Cl \xrightarrow{\Delta} NH_3 + HCl$

(B) $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$

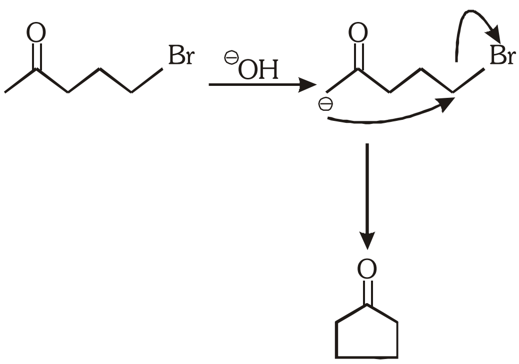
(C) $AgNO_3 \xrightarrow{\Delta} Ag + NO_2 + 1/2O_2$

**43. Ans. (3)**

**Sol.** Both compounds give above product on oxidative ozonolysis.

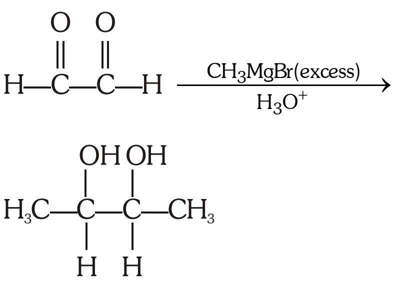
**44. Ans. (4)**

**Sol.**

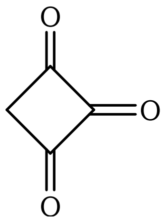


**45. Ans. (2)**

**Sol.**



**46. Ans. (1)**

**Sol.** enol of  is aromatic.

**47. Ans. (4)**

**Sol.** $t_{1/2} \propto C_{AO}^{1-n} \Rightarrow \frac{120}{30} = \left(\frac{0.1}{0.2}\right)^{1-n}$

or, $\frac{1}{4} = \left(\frac{1}{2}\right)^{n-1} \Rightarrow n-1 = 2 \Rightarrow n = 3$

**48. Ans. (2)**

**Sol.** $\Delta G_3 = \Delta G_1 + \Delta G_2$

$-n_3FE_3 = -n_1FE_1 - n_2FE_2$

$E_3 = \frac{E_1n_1 + E_2n_2}{n_3}$

**49. Ans. (3)**

**Sol.** $\Delta U = q + w$

heat absorb (q) = 45 joule

w = –70 joule since

Work done by the system.

$\Delta U = q + w = 45 - 70 = -25$ joule

**50. Ans. (2)**

**Sol.** The total molarity of all the ions is maximum in $Na_3PO_4$ (0.1 × 3 = 0.3 M). So it has the highest boiling point.

**51. Ans. (3)**

**Sol.** $Al_4C_3$ reacts with water to produce methane ($CH_4$).

$Al_4C_3 + 12H_2O \longrightarrow 4Al(OH)_3 + 3CH_4$

Therefore, it may be called as methanide.

**52. Ans. (4)**

**Sol.** The sulphide ion, $S^{2-}$, reacts with sodium nitroprusside to give a dark red complex.

$S^{2-} + Na_2[Fe(CN)_5NO] \longrightarrow \underset{\text{dark red complex}}{Na_2[Fe(CN)_5NOS]} + 2e$

**53. Ans. (1)**

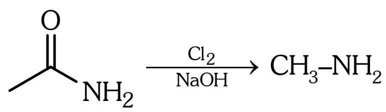
**Sol.** Due to steric crowding on S atom, hydrolysis of $SF_6$ doesn't occur.

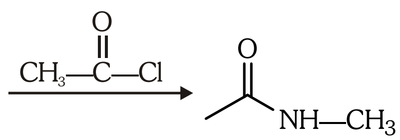
**54. Ans. (2)**

**Sol.** 1° amine can give positive isocyanide test.

**55. Ans. (3)**

**Sol.**





**56. Ans. (4)**

**Sol.** $K_P = K_C(RT)^{\Delta ng}$ ; $\Delta ng = 0$

**57. Ans. (2)**

**Sol.** As pH = 7.2 so $[H_3O^+]$ = antilog (–7.2)

$= 6.3 \times 10^{-8}$ M.

**58. Ans. (2)**

**Sol.** $k = \frac{2.303}{15}\log\frac{0.36}{0.30}$

**59. Ans. (3)**

**Sol.** $K_2SO_4$ is a salt of a strong acid and strong base. So the electrolysis of $K_2SO_4$(aq) is the electrolysis of water.

**60. Ans. (4)**

**Sol.** The coordination number of Na in NaCl and that of Cl in the same compound is six, which is same as that of the Ni ion in NiO.

**61. Ans. (2)**

**Sol.** Putting $cx = c^2 + z$

$c\int_{1+c}^{a+c} f(cx)dx = \int_{c}^{ac} f(c^2+z)dz$ .

so, the required value $= c\int_{1+c}^{a+c} dx = c(a-1)$ .

**62. Ans. (1)**

**Sol.** $a \le 4\sin A \Rightarrow \frac{a}{\sin A} \le 4 \Rightarrow R \le 2$

so for any point (x, y) inside the circumcircle,

$x^2 + y^2 < 4 \Rightarrow |xy| < 2$.

**63. Ans. (1)**

**Sol.** If exactly four girls sit together and one boy sits with them then number of ways are

${}^2C_1 \times 2 \times {}^5C_4 \times 4! \times {}^9C_1 \times {}^{11}P_9$.

If all the five girls sit together then

${}^5C_5 \times 5! \times 2 \times {}^{11}P_9$.

If exactly four girls sit together and no boy sits with them then number of ways are

${}^5C_4 \times 4! \times 4 \times {}^{11}P_{10}$.

Total ways $= {}^{11}P_9 . 5![2 + 36 + 8] = {}^{11}P_9 . 5! . 46$

**64. Ans. (3)**

**Sol.** $0 \le \arg z \le \frac{\pi}{4}$ , represent the region of complex plane lying in the first quadrant and bounded by x-axis and the line y = x.

$|2z - 4i| = 2|z - 2i|$

least value of $|z - 2i|$ is length of perpendicular from (0, 2) to y = x, which is $\sqrt{2}$ .

So the least value of $\sqrt{2}$ $|2z - 4i|$ is 4.

**65. Ans. (2)**

**Sol.** Since f(x) and g(x) are one-one and onto and are also the mirror images of each other with respect to the line y = 2. It clearly indicates that h(x) = f(x) + g(x) will be a constant function and will always be equal to 4.

**66. Ans. (2)**

**Sol.** Number of ways of selecting 3 consecutive numbers (1, 2, 3; 2, 3, 4;, 3, 4, 5; ...; 8, 9, 10) = 8.

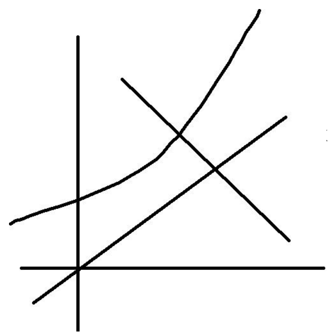
Number of ways of selecting 3 numbers so that no two of them are consecutive $= {}^{10-3+1}C_3$

$= {}^8C_3 = 56$

Desired probability $= \frac{8+56}{{}^{10}C_3} = \frac{8}{15}$ .

**67. Ans. (4)**

**Sol.** We know the shortest and greatest distance between two curves always lie along the common normal. Let the normal to the $y = e^x$ at $Q(\alpha, e^\alpha)$ meets the line y = x at P.



$\frac{dy}{dx} = e^x$

$\therefore$ $-1 = \left(-\frac{1}{\frac{dy}{dx}}\right)_{x=\alpha}$ $\Rightarrow -e^{-\alpha} = -1 \Rightarrow \alpha = 0$

$\therefore$ $Q \equiv (0, 1)$

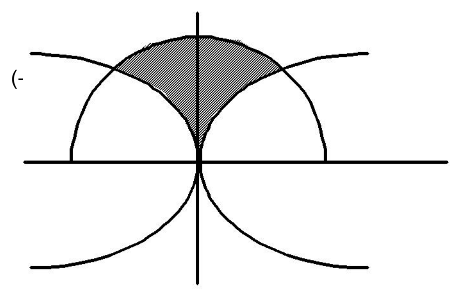
$\therefore$ normal $= y - 1 = -1(x - 0) \Rightarrow x + y - 1 = 0$

$\therefore$ $P = \left(\frac{1}{2}, \frac{1}{2}\right)$

$\therefore$ $PQ = \sqrt{\frac{1}{4}+\frac{1}{4}} \Rightarrow \frac{1}{\sqrt{2}}$ .

**68. Ans. (3)**

**Sol.** Required area $= 2\int_0^1\left(\sqrt{4-x^2} - \sqrt{3}x\right)dx$




$= 2\left(\frac{x}{2}\sqrt{4-x^2} + \frac{4}{2}\sin^{-1}\left(\frac{x}{2}\right) - \frac{\sqrt{3}\cdot 2x^{1/2}}{3}\right)_0^1$

$= \frac{2\pi - \sqrt{3}}{3}$

**69. Ans. (1)**

**Sol.** Slope of normal at any point is $\frac{-1}{\left(\frac{dy}{dx}\right)} = \frac{1}{2x}$

$\Rightarrow dy = -2x\,dx$

$\Rightarrow y = -x^2 + c$ and passes through (4, 3)

$\Rightarrow x^2 + y = 19.$

**70. Ans. (3)**

**Sol.** Let the coordinate of foot of perpendicular be $D \equiv (x_1, y_1, z_1)$

Direction ratio of *CD* are proportional to direction of *BC*.

$\Rightarrow \quad x_1 = 2 + 2k, \quad y_1 = -3 + 8k, \quad z_1 = 1 - 3k$

$DA \perp BC$

$k = 1$

coordinates is (4, 5, –2)

**71. Ans. (3)**

**Sol.** Let $\alpha$ be the common root of the given equation.

Then $a\alpha^2 + 2c\alpha + b = 0$ and $a\alpha^2 + 2b\alpha + c = 0$

$\Rightarrow \quad 2\alpha(c-b) + (b-c) = 0$

$\Rightarrow \quad \alpha = \frac{1}{2} \quad [\because b \neq c]$

Putting $\alpha = \frac{1}{2}$ in $a\alpha^2 + 2c\alpha + b = 0$, we get

$a + 4b + 4c = 0$

**72. Ans. (2)**

**Sol.** $\sin 10^\circ = \frac{a}{2b} \quad \Rightarrow \quad \sin 30^\circ = 3\sin 10^\circ - 4\sin^3 10^\circ$

$\frac{1}{2} = \frac{3a}{2b} - \frac{4a^3}{8b^3}$

$1 = \frac{3a}{b} - \frac{a^3}{b^3} \quad = a^3 + b^3 = 3ab^2$

**73. Ans. (3)**

**Sol.** $45^\circ = 22^\circ + 23^\circ$ .

Use $\cot(45^\circ) = \cot(22^\circ + 23^\circ) = \frac{\cot 22^\circ \cot 23^\circ - 1}{\cot 22^\circ + \cot 23^\circ}$

$\Rightarrow \cot 22^\circ + \cot 23^\circ = \cot 22^\circ \cot 23^\circ - 1$

$\Rightarrow 1 + \cot 22^\circ = (\cot 22^\circ - 1)\cot 23^\circ$

$\Rightarrow \frac{1 + \cot 22^\circ}{(\cot 22^\circ - 1)} = \cot 23^\circ$

$\Rightarrow 1 - \cot 23^\circ = 1 - \frac{1 + \cot 22^\circ}{(\cot 22^\circ - 1)}$

$= \frac{\cot 22^\circ - 1 - 1 - \cot 22^\circ}{(\cot 22^\circ - 1)}$

**74. Ans. (2)**

**Sol.** If f(x) is continuous at x = 0 then

$f(0^+) = f(0^-) = f(0) = e^{\lim_{x\to 0}\frac{(x+1-1)}{x}} = e$

**75. Ans. (2)**

**Sol.** Coefficient of $x^6$ in

$= 1 \times {}^6C_1 + 1 \times {}^5C_1 + 1 \times {}^2C_1 \times {}^3C_1 + {}^2C_1 \times {}^4C_1 + {}^3C_2$

$= 28$

**76. Ans. (1)**

**Sol.** $f'(x) = \frac{1}{2 + x^4}$

By LMVT $f'(c) = \frac{f(2) - f(1)}{2 - 1}$ for some $c \in (1, 2)$

$\Rightarrow f(2) = \frac{1}{2 + c^4}$

$\Rightarrow 1 < c < 2$

$\Rightarrow 3 < 2 + c^4 < 18 \quad \Rightarrow \quad f(2) < \frac{1}{3}$

**77. Ans. (2)**

**Sol.** $a\sin x + 2\cos\left(x + \frac{\pi}{3}\right)$

$= a\sin x + 2\left[\cos x \cos\frac{\pi}{3} - \sin x \sin\frac{\pi}{3}\right]$

$= a\sin x + 2\left[\cos\frac{1}{2} - \sin x\frac{\sqrt{3}}{2}\right]$

$= (a - \sqrt{3})\sin x + \cos x$

maximum value $\sqrt{(a-\sqrt{3})^2 + 1^2} = 1$

$(a - \sqrt{3})^2 + 1 = 1 \quad \Rightarrow \quad a = \sqrt{3}$

Answer B.

**78. Ans. (3)**

**Sol.** $2x + 3y - 13 = 0$

$x - y + 1 = 0$

$x = 2, y = 3$

$\therefore$ equation $y - 3 = -\frac{2}{3}(x - 2)$

$3y - 9 = -2x + 4$

$2x + 3y = 13$ (C)

**79. Ans. (1)**

**Sol.** $\bar{a}.\bar{d} + \bar{b}.\bar{d} + \bar{c}.\bar{d} = (x + y + z)\left[\bar{a}\,\bar{b}\,\bar{c}\right]$

$\therefore x + y + z = 0$

**80. Ans. (1)**

**Sol.** $\frac{xx_1}{24} - \frac{yy_1}{18} = 1$ … (i)

Equation of tangent

$y = mx + \sqrt{a^2m^2 - b^2}$

$y = \frac{-3}{2}x + \sqrt{36}$

$y = -\frac{3}{2}x + 6$

From (i) and (ii)

$x_1 = -6, \; y_1 = 3$

**81. Ans. (1)**

**Sol.** $2y\frac{dy}{dx} = 2\lambda$

$\Rightarrow \lambda = y\frac{dy}{dx}$

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

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

Square both sides : $\left(y^2 - 2xy\frac{dy}{dx}\right)^2 = 4\left(y\frac{dy}{dx}\right)^3$

**82. Ans. (1)**

**Sol.** $\Delta = \begin{vmatrix} 2 & -1 & 2 \\ 1 & -2 & 1 \\ 1 & 1 & \lambda \end{vmatrix} = 0$

$\Rightarrow \lambda = 1$

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

**83. Ans. (4)**

**Sol.** S.D. $= \sqrt{\frac{\sum_{j=1}^{18}(x_j - 8)^2}{n} - \left(\frac{\sum_{j=1}^{18}(x_j - 8)}{n}\right)^2}$

$= \sqrt{\frac{45}{18} - \frac{1}{4}} = \frac{3}{2}$

**84. Ans. (3)**

**Sol.** $|\hat{u}| = |\hat{V}| = 1$

and $\hat{u}.\hat{V} = 0$

$\Rightarrow$ $\hat{u}$ and $\hat{V}$ are at right angles.

$\Rightarrow \hat{u} \times \hat{V} = |\hat{u}|.|\hat{V}|\sin\theta = 1$

$\Rightarrow |\vec{r} \times (\hat{u} \times \hat{V})| =$

$||\vec{r}||\hat{u} \times \hat{V}|\sin\theta| = ||\vec{r}|.1.\sin 90°| = |\vec{r}|$

**85. Ans. (3)**

**Sol.** $f'(x) = \frac{1 - \ell n x}{x^2} = 0 \Rightarrow x = e$

$\therefore a \in (1, e) \Rightarrow a = 2$

by rolle's theorem f(a) = f(b)

$\Rightarrow \frac{\ell n 2}{2} = \frac{\ell n b}{b} \Rightarrow b = 4$

**86. Ans. (1)**

**Sol.** $\frac{1 + 2 + 6 + x_1 + x_2}{5} = 4 \Rightarrow x_1 + x_2 = 11$

$\frac{(1-4)^2 + (2-4)^2 + (6-4)^2 + (x_1 - 4)^2 + (x_2 - 4)^2}{5} = 5.2$

$\Rightarrow (x_1 - 4)^2 + (x_2 - 4)^2 = 9$

$\therefore x_1 = 4$ and $x_2 = 7$.

**87. Ans. (3)**

**Sol.** (2, 2); (3, 3) $\notin$ R

$\Rightarrow$ not reflexive.

(2, 1); (1, 2) $\in$ R and (2, 2) $\notin$ R

$\Rightarrow$ not transitive

$R = R^{-1}$

$\Rightarrow$ symmetric

**88. Ans. (4)**

**Sol.** p $\Rightarrow$ (~p v q) is false means p is true and ~ pvq is false

$\Rightarrow$ p is true and false ~ p and q are false

$\Rightarrow$ p is true and q is false.

**89. Ans. (1)**

**Sol.** $A^2 = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 2\left(\frac{1}{2}\right) & 1 \end{bmatrix}$

$A^3 = A^2 \cdot A = \begin{bmatrix} 1 & 0 \\ 2\left(\frac{1}{2}\right) & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 3\left(\frac{1}{2}\right) & 0 \end{bmatrix}$

$A^{100} = \begin{bmatrix} 1 & 0 \\ 50 & 1 \end{bmatrix}$

**90. Ans. (3)**

**Sol.** $s_n = 1 + 1/2 + 1/2^2 + \ldots\ldots\ldots\ldots + 1/2^{n-1}$

$s_n = \frac{1\left(1 - (1/2)^n\right)}{\left(1 - 1/2\right)} = 2\left[1 - \frac{1}{2^n}\right]$

$2 - s_n < \frac{1}{100}$

$\frac{2}{2^n} < \frac{1}{100}$

$n \geq 8$