FIITJEE

ALL INDIA TEST SERIES

JEE (Advanced)-2025

FULL TEST – X

PAPER –1

TEST DATE: 07-05-2025

ANSWERS, HINTS & SOLUTIONS

Physics

PART – I

SECTION – A

1. B

Sol. Mass defect $\Delta m = 2 \times 2.014 - 4.0026 = 0.0256$ a.m.u.

Energy released when two ${}_1H^2$ nuclei fuse = $0.0256 \times 931 = 23.8$ MeV

Total energy required to be produced by nuclear reaction in 1 year

$= 2500 \times 10^6 \times 3.15 \times 10^7 = 7.88 \times 10^{16}$ J

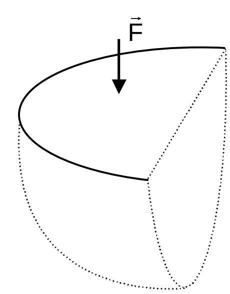
No. of nuclei of ${}_1H^2$ required = $\frac{7.88 \times 10^{16}\,J}{23.8 \times 1.6 \times 10^{-13}} \times 2 = 4.14 \times 10^{28}$

Mass of Deuterium required = $\frac{4.14 \times 10^{28}}{6.02 \times 10^{23}} \times 2 \times 10^{-3}\,kg = 138$ kg

2. A

Sol. $\vec{F} = (\rho g R)\left(\frac{\pi R^2}{2}\right)$

Force = $\vec{B} - \vec{F}$



3. A

Sol. $dC = \frac{k\varepsilon_0 A}{dx}$

$\frac{1}{C_{eV}} = \int \frac{1}{dC} = \int \frac{1}{k\varepsilon_0 A}dx$

$= \int_0^d \frac{1}{k_0 e^{\lambda x}\varepsilon_0 A}dx$

$C_{eq} = \frac{\lambda k_0 \varepsilon_0 A}{1 - e^{-\lambda d}}$

4. A

Sol. $I_{CBF} = (K)\left(A_1^2 + A_2^2 + 2A_1A_2\cos\theta\right) = I_0$

$A_1 = A,\ A_2 = 5A,\ \theta = 0°$

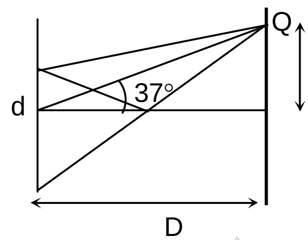
$kA^2 = \frac{I_0}{36}$

$I_Q = I = \frac{16}{25}K\left(A_1^2 + A_2^2 + 2A_1A_2\cos\phi\right)$

$\phi = \frac{2\pi}{\lambda}\Delta x$

$\phi = \frac{2\pi}{\lambda}\cdot\frac{3}{5}d = \frac{\pi}{3}$

$I_Q = \left(\frac{124}{225}\right)I_0$



$\Delta x = d\sin 37°$

$\Delta x = (3/5)d$

5. A, C

Sol. Number of carbon atoms in 4g carbon of living tree = $\frac{4}{12}\times 6\times 10^{23}\times 8\times 10^{-14} = 16\times 10^{9}$

Number of carbon atoms at present = $\frac{16\times 10^9}{2^{t/T}} = \frac{RT}{\ell n2} = \frac{1}{3}\times\frac{2.1\times 10^9}{0.7}$

$\frac{t}{T} = 4$

6. A, D

Sol. For u to be minimum, it just grazes the cylinder at two points as shown.

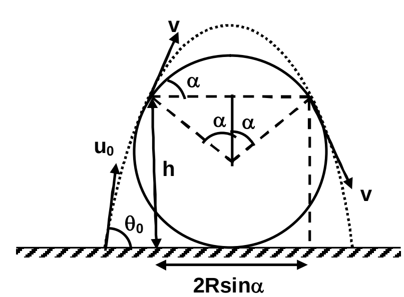
From COME

$\frac{mu^2}{2} = \frac{mv^2}{2} + mgh$

$u^2 = v^2 + 2gh$

$u^2 = v^2 + 2gR(1+\cos\alpha)$

Also $2R\sin\alpha = v^2\frac{\sin 2\alpha}{g} \Rightarrow v^2 = \frac{Rg}{\cos\alpha}$ ...(2)



From (1) and (2)

$u^2 = Rg\left[2 + 2\cos\alpha + \frac{1}{\cos\alpha}\right]$

For $u \to$ min. $\frac{d}{d\alpha}\left(u^2\right) = 0 \Rightarrow \cos\alpha = \frac{1}{\sqrt{2}} \Rightarrow \alpha = 45°$

$u_0^2 = Rg\left[2 + 2\sqrt{2}\right]$

Also $u\cos\theta = v\cos\alpha$

$\tan^2\theta_0 = [3 + 2\sqrt{2}]$

7. A, C

Sol. Let induced electric field be E.

Then, $eEa = ma^2\alpha$

$\Rightarrow E = \frac{ma\alpha}{e}$

Thus, induced current

$$I = \frac{E \times 2\pi a}{R} = \frac{2\pi m a^2 \alpha}{eR}$$

Magnetic field on axis

$$B = \mu_0 nI = \frac{2\pi\mu_o m n a^2 \alpha}{eR}$$

8. C

Sol. (P) $Q = \int T ds$ = Area between T-s diagram = 700 J

(Q) $\Delta Q = n\frac{3}{2}R(T_f - T_i) + n\frac{5}{2}R(T_f - T_i)$

$= \frac{3}{2}(nRT_f - nRT_i) + \frac{5}{2}(nRT_f - nRT_i)$

$= \frac{3}{2}(500 - 100) + \frac{5}{2}(1000 - 500) = 1850$ J

(R) Process is T = 100 V $\Rightarrow \frac{T}{V} =$ constant i.e. pressure = constant

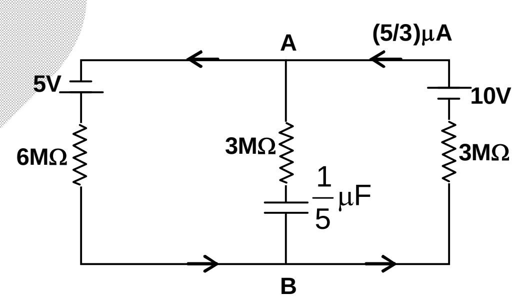
$\therefore$ Q = $nC_P\Delta T = 2\frac{5}{2}R(300 - 100) = 1000R$

(S) A $\to$ B is V = constant and B $\to$ C, P = constant

$\Delta Q = n\frac{3}{2}R(T_B - T_A) + n\frac{5}{2}R(T_C - T_B) = (1000 - 500) + \frac{5}{3}(500 - 1000)$

9. D

Sol. For τ:



$R_{eq} = \frac{6 \times 3}{6 + 3} + 3 = 5$ MΩ

$\tau = 5 \times \frac{1}{5} = 1$ sec

$\Rightarrow$ For q_{max} at steady state

Current passing through 10 V battery = $\frac{5}{3}\mu A$

$V_A + 5 - \frac{5}{3} \times 6 = V_B$

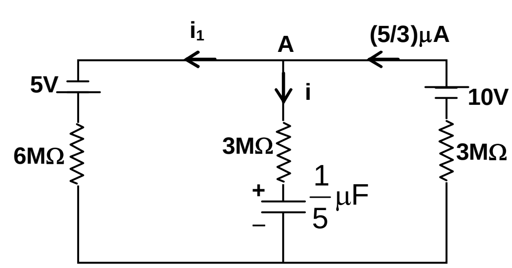
$V_A - V_B = 5V$

$q_{max} = 1\mu C$

$\Rightarrow$ At time t = 1sec

$q = 1(1 - e^{-t}) = 0.63\ \mu C$

$i = \frac{dq}{dt} = e^{-t} = 0.31\ \mu amp$



From KVL

$\frac{0.63}{1/5} + (0.37)3 + 5 - i_1(6) = 0$

$i_1 = 1.54\ \mu A$

10. C

Sol. **Case –I :** $\frac{mR^2}{2}\omega_0 = \left(\frac{mR^2}{2} + \frac{mR^2}{4} + \frac{mR^2}{4}\right)\omega$

$\omega = \frac{\omega_0}{2} = 3 \text{ rad/s}$

Case –II: $\omega = \omega_0 = 6 \text{ rad/s}$

Case –III: $\frac{mR^2}{2}\omega_0 + mv\frac{R}{2} = (mR^2)\omega$

So, $3 + \frac{8}{2} = \omega = 7 \text{ rad/s}$

Case –IV: $\frac{mR^2}{2}\omega_0 + mv\frac{R}{2}\left(\frac{1}{2}\right) = mR^2\omega$

$3 + \frac{8}{4} = \omega = 5 \text{ rad/s}$

11. B

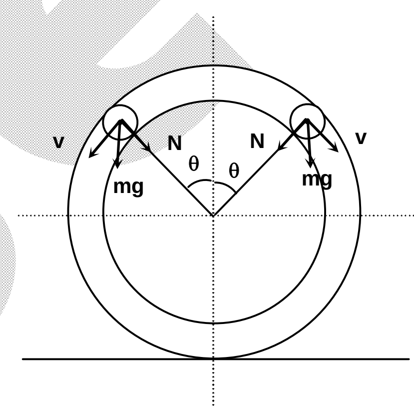
Sol. To loose contact by the tube with the horizontal surface

$2N\cos\theta = Mg$ …(i)

$mg\cos\theta + N = \frac{mv^2}{R}$ …(ii)

$\frac{1}{2}m\left(v^2 - u^2\right) = mgR\left(1-\cos\theta\right)$

$v^2 = u^2 + 2gR(1-\cos\theta)$ …(iii)



When $\theta = 37°$ and $u = \sqrt{gR}$

$N = \frac{5Mg}{8}$

$v^2 = gR + \frac{2gR}{5} = \frac{7gR}{5}$

From equation (ii)

$\frac{4}{5}mg + \frac{5Mg}{8} = \frac{7mg}{5} \Rightarrow \frac{M}{m} = \frac{24}{25}$

when $\theta = 37°$ and $u = \sqrt{2gR}$, $\frac{M}{m} = \frac{64}{25}$

when $\theta = 53°$ and $u = \sqrt{gR}$, $\frac{M}{m} = \frac{36}{25}$

when $\theta = 53°$ and $u = \sqrt{2gR}$, $\frac{M}{m} = \frac{66}{25}$

SECTION – B

12. 6

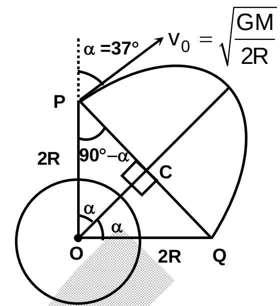
Sol. Since the loop is in equilibrium $\sum\tau = 0$

$\Rightarrow \left\{(2\lambda g\ell)\frac{\ell}{2}\sin\theta + \lambda\ell^2 g\sin\theta\right\}\hat{j} + I\ell^2(-\cos\theta\hat{i} - \sin\theta\hat{k})\times B_0(\hat{i}-\hat{k}) = 0$

$\Rightarrow B_0 = \frac{6\lambda g}{7I}$

13. 8

Sol. Total mechanical energy of the satellite



$$\varepsilon = -\frac{GMm}{2R} + \frac{1}{2}mv_0^2$$

$$\varepsilon = \frac{-GMm}{2R} + \frac{GMm}{4R}$$

$$\varepsilon = -\frac{GMm}{4R}$$

Semi-major axis, a = 2R

a cos α = ae

$$e = \cos 37° = \frac{4}{5}$$

e = 0.8

n = 8

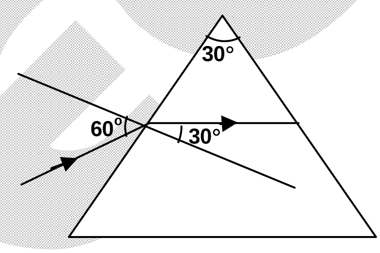
14. 3

Sol. $\delta = i + e - A$

30° = 60° + e – 30°

$\Rightarrow$ e = 0 $\Rightarrow$ ray is perpendicular on the second surface of prism, so that r=30°

$$\mu = \frac{\sin 60°}{\sin 30°} = \sqrt{3}$$



15. 4

Sol. $\frac{1}{4}mv_0^2 = \frac{3}{4}E_0 z^2$, where E_0 = 13.6 eV

$$\Rightarrow z = \sqrt{\frac{m}{3E_0}} \times v_0 = 4$$

16. 4

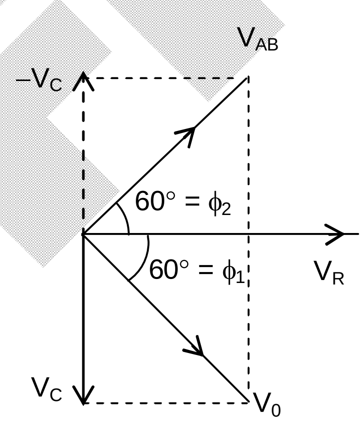
Sol. va = 4 $\Rightarrow a^2 + v\frac{da}{dt} = 0$

$$\Rightarrow \int_{2/3}^{a} 4\frac{da}{a^3} = -\int_{2}^{5} dt \qquad \text{(at t = 2 sec, a = 2/3)}$$

$$a = \sqrt{\frac{4}{15}}$$

17. 3

Sol.



$$\theta = \tan^{-1}(RC\omega) = \frac{\pi}{6}$$

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

$\Rightarrow$ n = 3

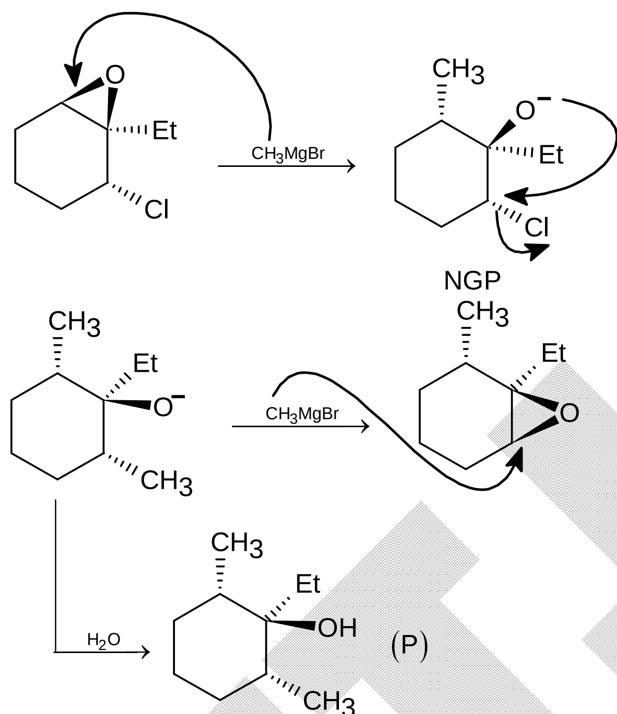
Chemistry

PART – II

SECTION – A

18. D
Sol. Due to absence of plane of symmetry. Option (D) is optically active.

19. A
Sol.



20. A
Sol. $KI + O_3 \longrightarrow KOH + I_2 + O_2$

$I_2 + Na_2S_2O_3 \longrightarrow NaI + Na_2S_4O_6$

Law of chemical equivalence,

$(ne)_{I_2} = (ne)_{Na_2S_2O_3} = (ne)_{O_3}$

$\therefore (ne)_{Na_2S_2O_3} = (ne)_{O_3}$

$\Rightarrow 2 \times 1 = 2 \times [\text{mole}]_{O_3}$

$[\text{mole}]O_3 = 1$

Mole of % $O_3 = \dfrac{1}{4} \times 100 = 25\%$

21. C
Sol. $XeF_2 \longrightarrow$ linear

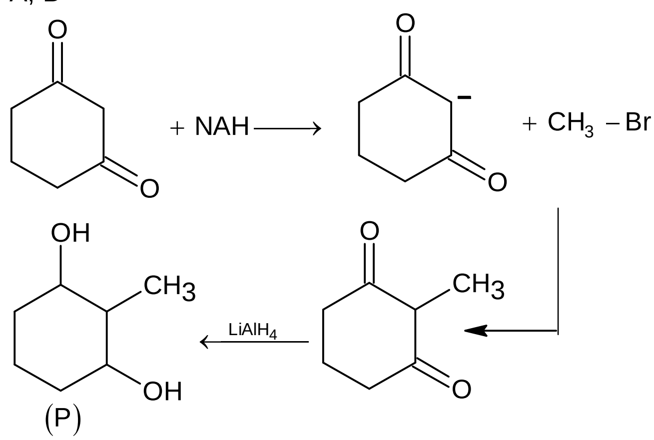
$ICl_4^- \longrightarrow$ square planar

$XeF_5^+ \longrightarrow$ square pyramidal

$XeF_5^- \longrightarrow$ pentagonal planar

22. A, B

Sol.



Number of stereo isomers in P is 4.

23. A, C, D

Sol. $\psi_{n,\ell,m} \propto \left(\frac{Z}{a}\right)^{3/2}\left(\frac{Zr}{a}\right)e^{-2r/2a}\cos(\theta)$ and xy plane is nodal plane

Number of nodal plane = 1

$2p_z$ is ungerade orbital.

24. A, B, D

Sol. $\left[Ag(NH_3)_2\right]\left[AgCl_2\right]$ will not show the co-ordination isomerism.

25. B

Sol. (P) $E_{cell} = E^o - \frac{0.059}{2}\log\frac{\left[Cu^{+2}\right]}{\left[Ag^+\right]^2}$

$= E^o - \frac{0.059}{2}\log\frac{10^{-4}}{\left(10^{-2}\right)^2}$

$E_{cell} = E^o - \frac{0.059}{2}\log 1 = E^o$

(Q) $E_{cell} = E^o - \frac{0.059}{2}\log\frac{\left[Ni^{+2}\right]}{\left[Cu^{+2}\right]}$

$E_{cell} = 0.59 - \frac{0.059}{2}\log\frac{1}{(0.1)} = 0.59 - \frac{0.059}{2}$

$E_{cell} = 0.5605$

(R) E^o of SHE $= 0$

(S) E^o of concentration cell $= 0$

$E = 0 - \frac{0.059}{2}\log\frac{C_2}{C_1} = \frac{0.059}{2}\log\frac{1}{0.1}$

$= \frac{0.059}{2} = 0.0295$ V

26. C
Sol. At equilibrium $\Delta G = 0,\ \Delta H = T\Delta S$
In reversible isothermal expansion $|\Delta S_{system}| = |\Delta S_{surrounding}|$
$|W_{rev}| < |W_{irrev}|$ in isothermal compression.

27. C

28. C
Sol.
$K_4[Fe(CN)_6] \xrightarrow{Fe^{3+}} Fe_4[Fe(CN)_6]_3 \downarrow$ Blue
$K_4[Fe(CN)_6] \xrightarrow{Cu^{2+}} Cu_2[Fe(CN)_6] \downarrow$ Chocolate brown

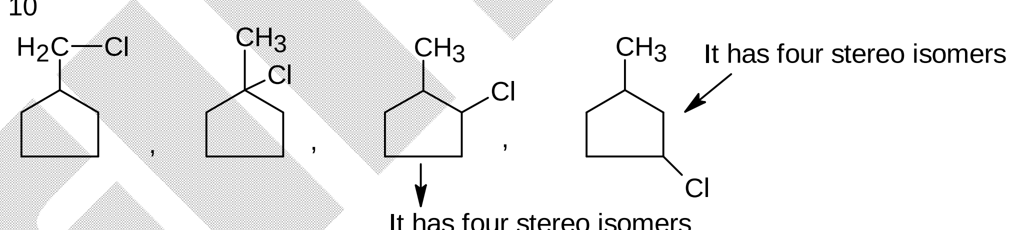
$Ni^{2+} + DMG \xrightarrow{OH^-}$ Red ppt.

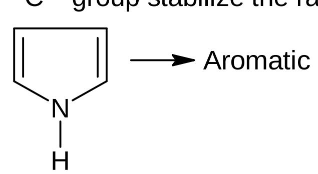
$Pb^{2+} + KI \longrightarrow PbI_2 \downarrow$ Yellow

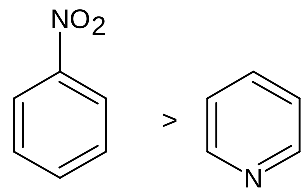
$PbI_2 + KI(excess) \longrightarrow K_2PbI_4$

$Cu^{2+} + KCN \longrightarrow Cu(CN)_2 \downarrow$ Yellow
$Cu(CN)_2 \longrightarrow \underset{(White)}{CuCN \downarrow} + (CN)_2 \uparrow$
$CuCN + KCN \longrightarrow \underset{(Colourless)}{K_3[Cu(CN)_4]}$

SECTION – B

29. 10
Sol.


30. 3
Sol. $F-\dot{C}(F)-F \rightarrow$ hybridization sp^3.
$-\overset{O}{\overset{\|}{C}}-$ group stabilize the radical.




$\longrightarrow$ For EAS reaction

$[\Delta S]_{system} > 0$ for adiabatic irreversible process.

31. 4

Sol. Number of diastereomeric pair 8_{C_2-4}

$= \dfrac{\lfloor 8}{\lfloor 2 \lfloor 6} - 4$

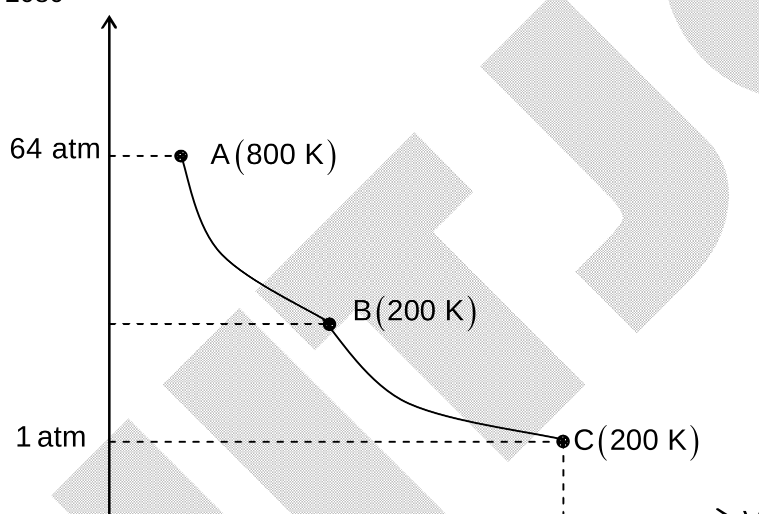
$= \dfrac{7 \times 8}{2} - 4$

$x = 24$

$\therefore \dfrac{x}{6} = 4$

32. 2080

Sol.



For AB path :

$P_2 = P_1\left(\dfrac{T_1}{T_2}\right)^{\frac{1}{\frac{1}{7}-1}} = 64\left(\dfrac{800}{200}\right)^{\left(\frac{1}{\frac{3}{5}-1}\right)} = 2 \text{ atm}$

Total $W_{done} = W_{AB} + W_{BC}$

$= nC_V\Delta T + \left(-nRT\ell n\dfrac{P_B}{P_C}\right)$

$= 1 \times \dfrac{3}{2}R \times (200 - 800) + \left[-1 \times R \times 200\ell n\dfrac{2}{1}\right]$

$= (-900R) + (-140R)$

$= 2080.00$ cal

33. 100

Sol. $\left(\frac{\ell n2}{15}\right)\times t=\ell n\frac{100}{1}$

$t=\frac{2\times 15}{0.30}=100$

34. 6

Sol. Cerrusite $\rightarrow PbCO_3$

Azurite $\rightarrow Cu(OH)_2.2CuCO_3$

Calamine $\rightarrow ZnCO_3$

Zincite $\rightarrow ZnO$

Siderite $\rightarrow FeCO_3$

Magnetite $\rightarrow Fe_3O_4$

Magnesite $\rightarrow MgCO_3$

Dolomite $\rightarrow MgCO_3, CaCO_3$

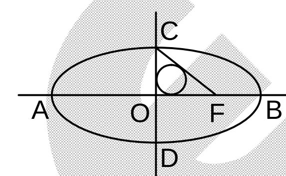
Bauxite $\rightarrow Al_2O_3.2H_2O$

Mathematics PART – III

SECTION – A

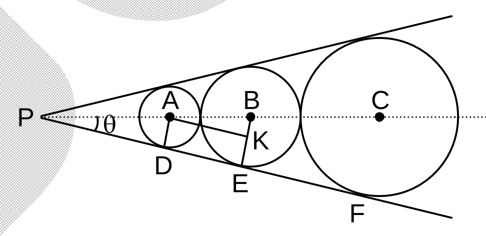
35. A
Sol. The two parabolas are congruent and the focus of moving parabola must be reflection of focus of static parabola along the tangent at any point.

36. A
Sol. $a^2e^2 = 36 \Rightarrow a^2 - b^2 = 36$

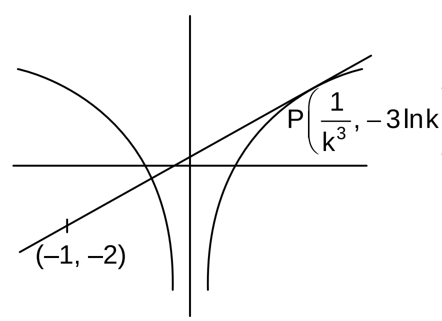


Using $r = (s-a)\tan\frac{A}{2}$ in ΔOCF
$1 = (s - a)$
$\Rightarrow 2 = 2s - 2a$
$\Rightarrow 2 = 2s - AB$
$\Rightarrow\ 2 = 6 + \frac{AB}{2} + \frac{CD}{2} - AB$
$\Rightarrow AB - CD = 8$
$\Rightarrow a - b = 4$ also $a^2 - b^2 = 36$
$\Rightarrow 2a = 13;\ 2b = 5$

37. A
Sol. The radii of all such circles will be in G.P.



38. A
Sol. $\frac{-3\ln k + 2}{\frac{1}{k^3} + 1} = k^3$



Let $h(k) = k^3 + 3\ln k - 1$
$f\left(\frac{1}{\sqrt{e}}\right) f(e) < 0$

39. A, B
Sol. $\vec{p}\times(\vec{x}\times\vec{q}) = (\vec{p}\cdot\vec{q})\vec{x} - (\vec{p}\cdot\vec{x})\vec{q} = \vec{p}\times\vec{r}$
$$\vec{x} = \frac{(\vec{p}\cdot\vec{x})\vec{q}}{\vec{p}\cdot\vec{q}} + \frac{(\vec{p}\times\vec{r})}{\vec{p}\cdot\vec{q}} = \frac{\alpha}{\vec{p}\cdot\vec{q}}\vec{q} + \frac{(\vec{p}\times\vec{r})}{\vec{p}\cdot\vec{q}}$$

40. A, B, C
Sol. $x^2 = \cos^2 A + \cos^2 B + 2\cos A\cdot\cos B$
$y = 2(\cos^2 A + \cos^2 B) - 2$
$\therefore\ \cos^2 A + \cos^2 B = 1 + \frac{y}{2}$

$\because$ $\cos A \cdot \cos B = \frac{1}{4}\left(2x^2 - y - 2\right)$ and $z = -2x^3 + 3xy + 3x$

$\therefore$ $2x^3 + z = 3x(y + 1)$

$xyz = 0$ $\forall$ A and B is not true

41. A, B, C, D

Sol. $|PR|^2 + |RQ|^2 \ge 2|PR|\,|RQ|$

$|PR|\cdot|RQ| \ge 2Ar(\Delta PQR)$

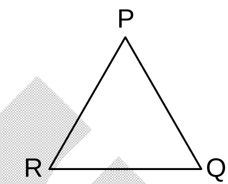
$\Rightarrow 8Ar(\Delta PQR) \le |PR|^2 + |RQ|^2 + 4Ar(\Delta PQR)$

$\le |PR|^2 + |RQ|^2 + 2\cdot|PR|\cdot|RQ| < 8Ar(\Delta PQR) + 1$

$\Rightarrow 8Ar(\Delta PQR) = |PQ|^2 + |QR|^2 + 4Ar(\Delta PQR)$ and

$|PR|^2 + |QR|^2 = 2|PR|\cdot|QR| = 4Ar(\Delta PQR)$

$\therefore \angle R = 90^o$ and $RP = RQ$



42. A

Sol. (P) As we know

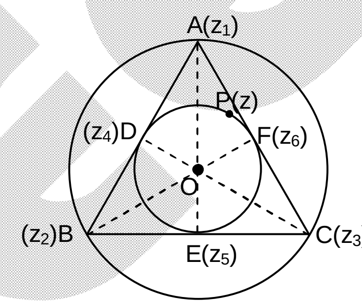
$|z_1 - z_2|^2 = |z_1|^2 + |z_2|^2 - 2\text{Re }z_1\bar{z}_2$

$\Rightarrow AB^2 = OA^2 + OB^2 - 2\text{Re }z_1\bar{z}_2$

$\Rightarrow \text{Re }(z_1\bar{z}_2) = -2$

Similarly, $\text{Re }\left(z_2\bar{z}_3\right) = \text{Re}\left(z_3\bar{z}_1\right) = -2$

$\Rightarrow \text{Re }\left(z_1\bar{z}_2 + z_2\bar{z}_3 + z_3\bar{z}_1\right) = -6$



(Q) Since $\angle AOC = \frac{2\pi}{3}$ $\therefore$ $\frac{z_1 - 0}{z_3 - 0} = \frac{2}{2}e^{\frac{2\pi}{3}i} \Rightarrow \frac{4z_1}{z_3} = \left(-\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)\times 4 = 2\left(-1 + i\sqrt{3}\right) \Rightarrow a = 2.$

(R) We have

$$|z_1 + z_2|^2 + |z_2 + z_3|^2 + |z_3 + z_1|^2 = 2(|z_1|^2 + |z_2|^2 + |z_3|^2)$$
$$+2\text{Re}\left(z_1\bar{z}_2 + z_2\bar{z}_3 + z_3\bar{z}_1\right) = 12$$

(S) $DP^2 + EP^2 + FP^2 = |z - z_4|^2 + |z - z_5|^2 + |z - z_6|^2$

$= 3|z|^2 + |z_4|^2 + |z_5|^2 + |z_6|^2 = 6.$

43. D

Sol. (P) $\int_0^1 \left(f^3(x) - 4x\right)^2 dx = 0$

(Q) $g(x) = \frac{x^5}{5}\int_1^x f(u)\,du$

(R) $\int_0^1 \frac{t^x - 1}{\ln t}dt = \ln|x + 1|$

(S) $I_2 = \int_0^1 \frac{t^2}{e^{t^3}\left(2 - t^3\right)}dt$; $t^3 = z$

$\Rightarrow \frac{1}{3}\int_0^1 \frac{dz}{e^z(2 - z)}$

44. B

Sol. (P) Angle between line and plane is 45°

$\therefore$ Minimum distance = $\frac{\left|\sqrt{2} + 7 - \sqrt{2} - 1\right|}{2} = 3$

(Q) $\left[\vec{a}\times\vec{b} \quad \vec{b}\times\vec{c} \quad \vec{c}\times\vec{a}\right]=\left[\vec{a} \quad \vec{b} \quad \vec{c}\right]^2$

For maximum value $\vec{c}$ is perpendicular to $\vec{a}$ and $\vec{b}$ thus $\vec{c}$ is parallel to $\vec{a}\times\vec{b}$

Hence, $\left|\left(\vec{a}\times\vec{b}\right)\times\vec{c}\right|=0$

(R) $\left[\vec{a} \ \vec{b} \ \vec{c}\right]=2$

(S) The point of intersection with planes

$\left(a\hat{i}-\hat{j}+7\hat{k}\right)\cdot\vec{r}=1,\ a\hat{i}+\hat{j}-2\hat{k}=-1$ and $\hat{k}\cdot\vec{r}=0$ is (0, –1, 0)

The point of intersection $\left(2\hat{i}-\hat{j}+2\hat{k}\right)\cdot\vec{r}=5$, $\hat{k}\cdot\vec{r}=0$ and $\left(a\hat{i}-\hat{j}+7\hat{k}\right)\cdot\vec{r}=1$

$\left(\frac{4}{2-a},\frac{5a-2}{2-a},0\right)$. This point lie on x-axis $\Rightarrow a=\frac{2}{5}$

45. C

Sol. (P) $n(E_2) = {}^9C_7=36$

$n(E_1 \text{ of } E_2)$

= {matrix formed by 7 one's and 2 0's and both 3 are at same row of same column}

$= 6\times {}^3C_2=18$

$P\left(\frac{E_1}{E_2}\right)=\frac{1}{2}\ \therefore\ p + q = 3$

(Q) $\begin{vmatrix}1 & a & a^2\\ 1 & b & b^2\\ 1 & c & c^2\end{vmatrix}-\frac{1}{abc}\begin{vmatrix}a & a^2 & abc\\ b & b^2 & abc\\ c & c^2 & abc\end{vmatrix}=0$

(R) $-1(1-\cos^2 P) + \cos R(\cos Q \cos P + \cos R) + \cos Q(\cos R \cos P + \cos Q)$

$=\left(\sum\cos^2 P\right)+2\cos P\cos Q\cos R-1=0$

(S) $(B - rI) = (n - r)A$

$|(n - r) A((n - r)A - n(n - r)I)| = |(n - r)^2A^2 - n(n - r)^2A|$

$= |n(n - r)^2A - n(n - r)^2A| = 0$

SECTION – B

46. 3

Sol. $\tan^2 t\ge\frac{\theta^2-\sin\theta^2}{\tan\theta^2-\sin\theta^2}\ \forall\,\theta\in\left(0,\frac{\pi}{2}\right)$

So; $\tan^2 t\ge\left(\frac{\theta^2-\sin\theta^2}{\tan\theta^2-\sin\theta^2}\right)_{max}\ \forall\,\theta\in\left(0,\frac{\pi}{2}\right)$

Since; in $\left(0,\frac{\pi}{2}\right)$: $\tan\theta^2>\theta^2$ and the same is subtracted from numerator and denominator both

So; maximum value occurs at $\theta\to0^+$

Therefore $\tan^2 t\ge\frac{1}{3}$; $t\in\left(\frac{\pi}{6},\frac{\pi}{2}\right)$

47. 7

Sol. Clearly: $m_1 < k < k_2$

For slope of ON

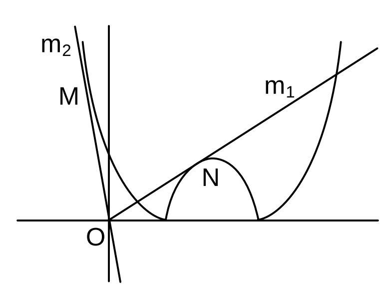
$-(x^2 - 7x + 6) = kx$

Must have equal roots

For slope of OM

$x^2 - 7x + 6 = kx$

Must have equal roots



48. 5

Sol. Let a + 2b + c = x, a + b + 2c = y, a + b + 3c = z

a = –x + 5y – 3z, b = z + x – 2y, c = z – y

Apply A.M. ≥ G.M.

$$\frac{a+3c}{a+2b+c}+\frac{4b}{a+b+2c}-\frac{8c}{a+b+3c} \geq -17+12\sqrt{2}$$

49. 1

Sol. Probability that B wins the match in the 4th game

$$= \frac{1}{2}\times\frac{1}{6}\times\frac{1}{3}\times\frac{1}{2}\times 6+{}^{3}C_{1}\times\frac{1}{2}\times\frac{1}{3}\times\frac{1}{3}\times\frac{1}{2}$$

$$= \frac{6}{72}+\frac{3}{36}=\frac{6+6}{72}=\frac{1}{6}$$

50. 1

Sol. Given a + b + c = 1 ..... (1)

9a + 3b + c = 7 ..... (2)

18 < 25a + 5b + c < 22 ..... (3)

⇒ From above (1), (2) and (3)

4 < 7a – b – c < 8

4 < 7a – b + a + b – 1 < 8

5 < 8a < 9

$\frac{5}{8}<a<\frac{9}{8}$ (a = 1)

a = 1, b = –1, c = 1

For question, let $h(x) = \ln(x^2 - x + 1) - x$

51. 2

Sol. $B^2 - tr(B)\cdot B + I = O$

$\Rightarrow AB - (tr(B))A + AB^{-1} = O$

$\therefore tr(AB) - tr(A)tr(B) + tr(AB^{-1}) = O$