BANSAL CLASSES PRIVATE LIMITED
Ideal for Scholars

ANSWER KEY

DATE: 31-12-2018

COURSE
NUCLEUS

JEE-MAIN MOCK TEST-17
XII

TEST CODE				
1	1	3	1	6

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	2	3	2	3	1	2	3	2	4	3	1	1	3	2	1
Q.No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	2	3	1	2	2	4	4	4	3	4	1	2	1	4	3
	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC
Q.No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans	1	1	4	4	4	1	4	3	3	3	2	4	2	3	2
	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC
Q.No.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	2	4	4	4	1	3	1	1	3	1	3	3	1	1	4
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans	1	2	3	2	2	3	4	2	1	4	2	1	1	4	2
Q.No.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans	4	3	3	1	4	1	2	3	1	2	3	1	3	2	3

HINTS & SOLUTIONS

PHYSICS

Q.1 $f \propto \frac{1}{l}$

$\therefore\ l = \frac{k}{f}$

Now $l = l_1 + l_2 + l_3$

$\therefore\ \frac{k}{f_0} = \frac{k}{f_1} + \frac{k}{f_2} + \frac{k}{f_3}$

$\therefore\ \frac{1}{f_0} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$

Q.2 Relative velocity of P with respect to S should be along PS or absolute velocity cimponents perpendicular to PS should be same.

$\therefore\quad \frac{2u}{3}\sin\theta = u\sin 30°$

$\therefore\quad \theta = \sin^{-1}\left(\frac{3}{4}\right)$

Q.3 Applying, $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$ we get,

$\frac{1.5}{v} - \frac{1}{\infty} = \frac{1.5 - 1.0}{+R}$

$\therefore\quad v = +3R$

Q.4 As I_L & I_C are 180° out of phase
So, $I_{net} = |I_L - I_C|$
$= 0.2$ A

Q.5 Spheres have minimum surface area as surface tension tends to minimize area of decrease surface energy to gain greater stability.

Q.6 $R = \frac{1}{\omega C} = X_C$

$\therefore\quad Z = \sqrt{R^2 + X_C^2} = \sqrt{2}\,R$

(as $X_C = R$)

$I_0 = \frac{V_0}{Z} = \frac{V_0}{\sqrt{2}R}$ ...(i)

When ω becomes $\frac{1}{\sqrt{3}}$ time, X_C will become $\sqrt{3}$ times or $\sqrt{3}$ R.

$$Z' = \sqrt{(R^2)+(\sqrt{3}R)^2} = 2R$$

$$I'_0 = \frac{V_0}{Z'} = \frac{V_0}{2R} = \frac{I_0}{\sqrt{2}}$$

Q.7 Initial phase $\phi = 0$
Thus the point from where time is considered, is origin.
$T = (t_{OA} + t_{AO}) + (t_{OB} + t_{BO})$

$$= t + t = 2t = \frac{2\pi}{\omega}$$

B O A

$\omega = \pi/t$
$x = a \sin \omega t = a \sin \pi = 0$
$v = a\omega \cos \omega t = -a\omega = -a\pi/t$

$$\text{Amplitude} = |a| = \frac{vt}{\pi}$$

Q.8 $H = \frac{T.D}{R}$

$$R = \frac{T.D}{H} = \frac{100-0}{1} = 100 \text{ kW}^{-1}$$

$$\text{Now, } R = \int_0^x dR = \int_0^x \frac{dx}{k_0(1+ax)A}$$

$$\text{or } 100 = \int_0^x \frac{dx}{10^2(1+x)(10^{-4})}$$

Solving this equation we get,
$x = 1.7$ m

Q.9 $u = -(x+f)$ and $v = +(4x+f)$

From $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

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

On solving, $f = 2x$

Q.10 $\ln\left(\frac{60-30}{50-30}\right) = b\,(10\text{ min}) = \ln\left(\frac{50-30}{\theta-30}\right)$

$$\Rightarrow \theta - 30 = \frac{2}{3} \times 20 \Rightarrow q = \frac{130}{3}°\text{C} > 40°\text{C}$$

Q.11 $\Delta U = nC_v\Delta T = \frac{nR\Delta T}{\gamma-1} = \frac{P_fV_f - P_iV_i}{\gamma-1}$

$$= \frac{1}{\gamma-1}\left[P_0\sqrt{\frac{P_0}{k}} - kV_0^2V_0\right]$$

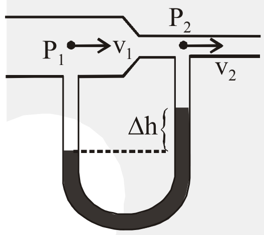
$$= \frac{k}{\gamma-1}\left[\left(\frac{P_0}{k}\right)^{3/2} - V_0^3\right]$$

Q.12 $W = \int_{V_1}^{V_2} PdV = nRT\int_{V_1}^{V_2}\frac{dV}{V-\beta n} - \alpha n^2\int_{V_1}^{V_2}\frac{dV}{V^2}$

$$= nRT\ln\left(\frac{V_2-\beta n}{V_1-\beta n}\right) + \alpha n^2\left(\frac{V_1-V_2}{V_1V_2}\right)$$

Q.13 $m_{ice}\,S_{ice}\,(10) + m_{ice}\,L_{ice} = ML_v + MS_{water}\,(100)$
$\Rightarrow 3200\,(0.5)\,(10) + 3200\,(80)$
$= m[540 + 100]$
$\Rightarrow m = 425$ gm

Q.14



$$P_1 - P_2 = \rho_{Hg}\,g\Delta h = \frac{1}{2}\rho_{water}\,(V_2^2 - V_1^2).....(1)$$

Also, $A_1U_1 = A_2U_2 = 500$ cm^3/s
$\Rightarrow U_1 = 1$ m/s and $U_2 = 2.5$ m/s
Putting in (1) and solving,
$\Delta h \approx 1.93$ cm

Q.15 $v_{rms} = \left[\frac{\int V^2 dN}{\int dN}\right]^{1/2} = \left[\frac{\int_0^{v_0} V^4 dV}{\int_0^{v_0} V^2 dV}\right]^{1/2}$

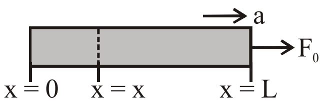
$$= \sqrt{\frac{3}{5}}\,V_0$$

Q.16 $\frac{\rho_\theta}{\rho_0} \approx 1 - \gamma\Delta\theta$
$\Rightarrow$ % change in density $= (\gamma\Delta\theta) \times 100$

$\frac{V_\theta}{V_0} = 1 + \gamma\Delta\theta \Rightarrow$ %change in volume $= (\gamma\Delta\theta) \times 100$

$\therefore V \propto r^3 \Rightarrow \frac{r_\theta}{r_0} = (1+\gamma\Delta\theta)^{1/3} \approx 1 + \frac{\gamma\Delta\theta}{3}$

$\therefore$ % change in radius $= \left(\frac{\gamma\Delta\theta}{3}\right) \times 100$

Q.17 

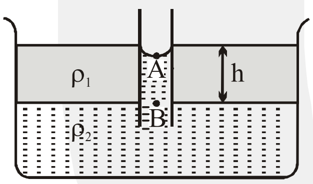
$a = \frac{F_0}{M} = \frac{T_x L}{Mx} \Rightarrow T_x = \frac{F_0 x}{L}$

$\Rightarrow \sigma_x = \frac{T_x}{S} = \frac{F_0 x}{LS}$

$\therefore \delta l = \frac{1}{Y}\int_0^L \sigma_x dx = \frac{F_0}{LSY}\frac{L^2}{2}$

$\therefore \in = \frac{\delta l}{L} = \frac{F_0}{2SY}$

Q.18 $C = -\frac{\delta V / V}{\delta P} \Rightarrow |\delta V| = VC\delta P = 0.4 \text{ cm}^3$

Q.19 

$P_{atm} - P_A = \frac{2S}{r}$ ....(1)

$P_A = P_B - \rho_2 gh$

$= P_{atm} + \rho_1 gh - \rho_2 gh$ ....(2)

from (1) and (2)

$S = \frac{rgh}{2}(\rho_2 - \rho_1)$

Q.20 Viscosity in liquids decreases with rise in temperature.

Q.21 $I_{R_2} = \frac{V_z}{1500} = \frac{1}{150} A \downarrow$

$I_{R_1} = \frac{15 - V_z}{R_1} = \frac{1}{100} A \downarrow$

$\Rightarrow I_z = I_{R_1} - I_{R_2}$

$= \frac{1}{300} A = 3.33 \text{ mA}$

Q.22 In NOR gate, output is high (1) only when both inputs are low (0).

Q.23 Option (4) represents standard circuit for a bridge type full wave rectifier.

Q.24 Linear width $= 2f\theta = \frac{2f\lambda}{a}$

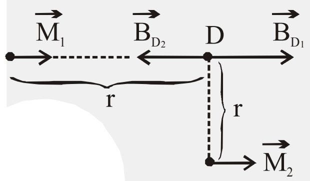
Q.25 for secondary maximas,

$a \sin\theta = \frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}, ...$

$\therefore$ For second maxima

$\sin\theta = \frac{3\lambda}{2a}$

Q.26 Standard results

Q.27 

$|\vec{B}_D| = B_{D_1} - B_{D_2}$

$= \frac{2\mu_0}{4\pi}\frac{M_1}{r^3} - \frac{\mu_0 M_2}{4\pi r^3} = 0.3 \text{ T}$

Q.28 Length = M.S.R. + V.S.R. × L.C.

M.S.R. = 4 mm V.S.R. = 5

L.C. = 1 M.S.D. – 1 V.S.D. = $\frac{1}{8}$ mm

$\therefore$ length $= \frac{37}{8}$ mm $= 4.625$ mm

Q.29 $\frac{3.06}{1.2} = 2.55 = 2.6$ ($\therefore$ it should have two significant digits)

Now 1.15 + 2.6 = 3.75 should be rounded off to 1 decimal place.

$\therefore$ Final answer = 3.8

Q.30 $f = \frac{\omega}{2\pi} = \frac{1}{2\pi\sqrt{LC}} = \frac{10^7}{2\pi}$ Hz

$\therefore \lambda = \frac{c}{f} = \frac{3\times10^8\times2\pi}{10^7} \approx 190$ m

CHEMISTRY

Q.31 $H_2SO_4 + 2OH^- \rightarrow SO_4^{2-} + 2H_2O$

$\therefore$ In 25 ml treated water,

$n_{OH^-} = 20 \times 10^{-3} \times 2$ mmol

$\therefore \quad n_{MgSO_4} = \frac{n_{OH^-}}{2} = 20 \times 10^{-3}$ mmol

$\therefore \quad$ In 1L $n_{MgSO_4} = \frac{20\times10^{-3}}{25} \times 1000$ mmol

$= \frac{4}{5}$ mmol

$\therefore \quad$ In 1L hard water, equivalent n_{CaCO_3}

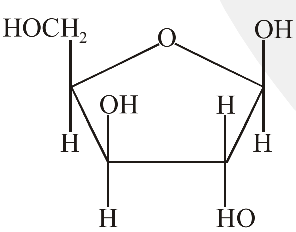
$= \frac{4}{5}$ mmol

$\therefore m_{CaCO_3} = \frac{4}{5}\times100\text{mg} = 80$ mg

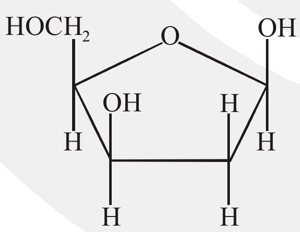
i.e. Hardness of water = 80 mg/L

= 80 ppm Ans.

Q.32 DNA : 2-Deoxyribosenucleic acid
RNA : Ribonucleic acid



β-D-Ribose in(RNA)



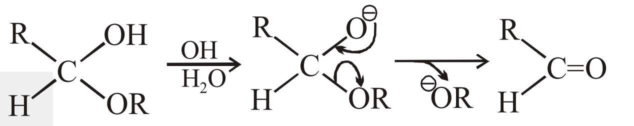
β-D-2-Deoxyribose in(RNA)

Q.34 Here, eq. of Ag = eq. of Cu = eq. of Au

$\Rightarrow 1 \times n_{Ag} = 2 \times 0.1 \text{ mol} = 3 \times n_{Au}$

$\therefore n_{Ag} = 0.2$ mol and $n_{Au} = 0.067$ mol

Q.35 Since sucrose doesn't have Hemiacetal linkage present. So it is not reduced fructose. Maltose and Lactose, all have hemiacetal link. So, they are reduced.



(Hemiacetal) (Aldehyde)

Q.36(a) Oxidation

$Cu^+ \xrightarrow[\text{medium}]{\text{Aqueous}} Cu^{2+}(aq.) + Cu$

Reduction

(b) Oxidation

$3\overset{+6}{Mn}O_4^{2-} + 4H^+ \longrightarrow 2\overset{+7}{Mn}O_4^- + \overset{+4}{Mn}O_2 + 2H_2O$

Reduction

(c) Reduction

$2K\overset{+7}{Mn}O_4 \xrightarrow{\Delta} K_2\overset{+6}{Mn}O_4 + \overset{+4}{Mn}O_2 + O_2$

Reduction

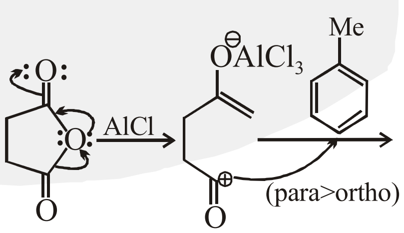
(d) Reduction

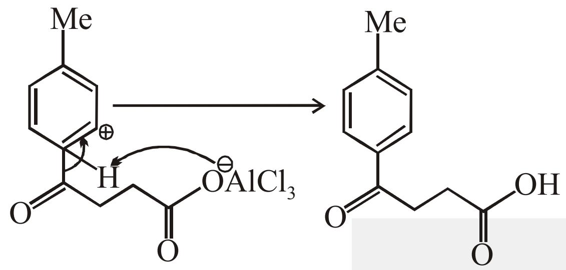
$2\overset{+7}{Mn}O_4^- + 3Mn^{2+} + 2H_2O \xrightarrow{\text{comproportionation}} 5\overset{+4}{Mn}O_2 + 4H^+$

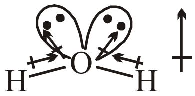
Oxidation

Q.37 $T_{completion} = \frac{2\sqrt{Co}}{K}$

Q.38



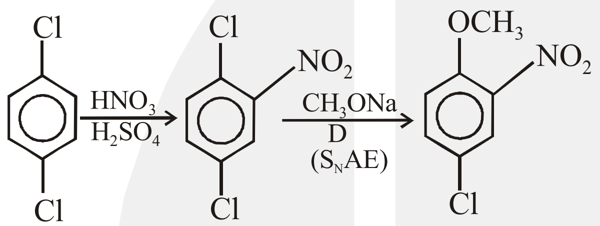


Q.39 H_2O 

Dipole moment of lone pair and bond pair are in same direction. So dipole moment is maximum.

Q.40 Theory based

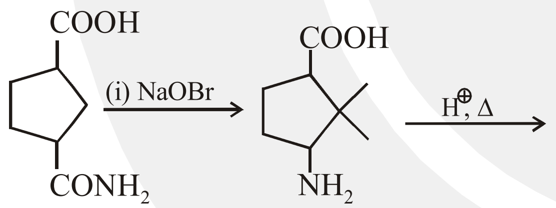
Q.41



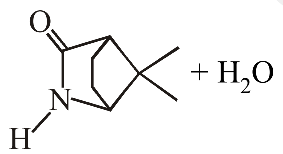
(A) **(B)**

Q.43 Theory based

Q.44



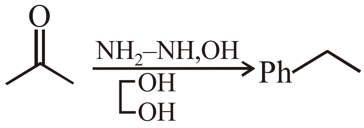
(Hoffmann Bromamide reaction)



Q.45 Bismuth forms only one well characterised compound in +5 oxidation state is BiF_5 because the electronegativity of F is high and it is of small size.

Stability : $Bi^{3+} > Bi^{5+}$ (Inert pair effect)

Q.46 Theory based

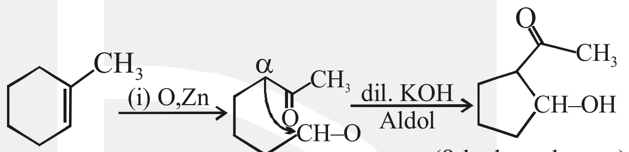
Q.47 

(Wolff kishner reduction)

Wolff kishner reduction is used to carbonyl compounds to alkanes.

Q.49 Theory based

Q.50



(β-hydroxy ketone)

Reactivity(Aldehyde > Ketone)

Q.51 $\Delta = \dfrac{hC}{\lambda_{absorbed}}$

i.e. means $\Delta \uparrow \lambda_{absorbed} \downarrow$

$\Delta \alpha$ strength of ligand

$\Delta : C > N > O$

So $\quad \Delta : [Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+}$

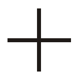
$\lambda_{absorbed} : [Co(CN)_6]^{3-} < [Co(NH_3)_6]^{3+} < [Co(H_2O)_6]^{3+}$

Q.52 $\because E^o_{cell} = -\dfrac{0.059}{n} \log K_{sp}$

$\Rightarrow (0.8 - 0.21)\ V = -\dfrac{0.059}{2} \log K_{sp}$

$\Rightarrow \log K_{sp} = -20$

$\therefore\ K_{sp} = 10^{-20}$ Ans.

Q.53 Polar protic solvent (EtOH) along with tertiary halide  Br will favour S_N1, reaction.

Q.54 $\underset{\text{(Coal)}}{C} + \underset{\text{(steam)}}{H_2O} \xrightarrow[\text{Catalyst}]{\approx 1200\,K} \underset{\text{Water gas / Syn gas}}{CO(g) + H_2(g)\uparrow}$

$CO(g) + H_2O\,(g) \xrightarrow[\text{Catalyst}]{673\,K} CO_2(g) + H_2\uparrow$

Q.55 Formula of unit cell = Na_3Cl_3 = NaCl Ans.

Q.56 Anti-addition of $\overset{\ominus}{O}H$ (nucleophile) and $\overset{\oplus}{Br}$ (electrophilic) takes place as per Markovnikov's rule in Halohydrin formation reaction.

Q.57 $M^{2+} \quad + \quad H_2S \xrightarrow[H^+/H_2O]{} MS\downarrow$

$[M = Hg^{2+}, Cu^{2+}]$

$M^{2+} \quad + \quad H_2S \xrightarrow{OH^-} MS\downarrow$

$[M = Ni^{2+} / Mn^{2+}]$

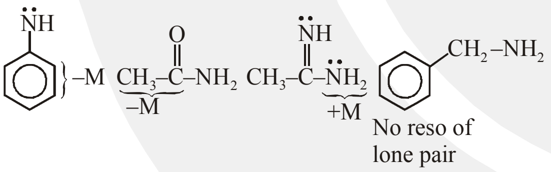
Q.58 After addition of 60 mL, 1 M HCl the base is neutralised.

$\therefore n_{base} = n_{HCl} = MV$

$= 1 \times \frac{60}{1000}\,\text{mol} = \frac{1g}{M_{base}}$

$\therefore M_{base} = \frac{50}{3}\,g/mol \approx 17$

$\therefore$ Base is NH_3

Q.59 

(–M) of $CH_3-\overset{\overset{O}{\|}}{C}-$ is greater than (–M) of –Ph that's why amide is weaker base than aniline.

Q.60 $\underset{\text{Black}}{CuS\downarrow} \xrightarrow{\text{dil.}HNO_3} Cu^{2+}\,(aq.)$

$\xrightarrow{K_4[Fe(CN)_6]} Cu_2\,[Fe(CN)_6]\downarrow$

Chocolate brown ppt.

MATHEMATICS

Q.61 $\frac{1}{2^{20}}\int_0^{\frac{\pi}{2}} \sin^{20}(2x)\,dx = \frac{1}{2^{20}}\left(\frac{1}{2}\right)\int_0^{\pi} \sin^{20} x\,dx$

$= \frac{1}{2^{20}}\int_0^{\frac{\pi}{2}} \sin^{20} x\,dx$.

Q.62 $A^T = 5A + 2I$

$A = 5A^T + 2I$

$A = 5\,(5A + 2I) + 2I$

$2A + I = 0;\ 2AX + X = 0$

$\Rightarrow AX = \frac{-X}{2}$.

Q.63 $\int_0^2 \frac{x}{\sqrt{1+x^2}}\,dx \Rightarrow \left[\frac{1}{2}\times 2\sqrt{1+x^2}\right]_{10}^{2} = \sqrt{5} - 1$

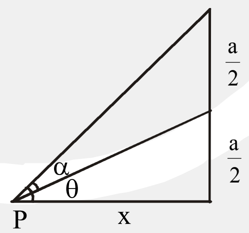
Q.64 $f(x) = -3 + x^3 \Rightarrow f(2) + f(-2) = -6$

Q.65 $\tan(\theta - \alpha) = \frac{a}{2x} = \frac{1}{6}$

$\tan\theta = \frac{a}{x} = \frac{1}{3}$

$\tan\alpha = \frac{\tan(\theta) - \tan(\theta-\alpha)}{1 + \tan\theta \cdot \tan(\theta - \alpha)}$

$= \frac{\frac{1}{3} - \frac{1}{6}}{1 + \frac{1}{18}} \Rightarrow \frac{6-3}{19} = \frac{3}{19}$



Q.66 $T = S_1$; $49hx + 16ky = 49h^2 + 16k^2$

equation of this line

$49x \cdot 10\cos\theta + 16y \cdot 10\sin\theta = 784$

Compare and eliminate $\sin\theta$ and $\cos\theta$

Result is $(49h^2 + 16k^2)^2 = \left(\frac{784}{10}\right)^2 (h^2 + k^2)$

Q.67 $S = {}^{30}C_0 \cdot \sin(0x) \cdot \cos 30x + {}^{30}C_1 \cdot \sin 1x \cdot \cos 29x + \ldots\ldots.. + {}^{30}C_{30} \cdot \sin 30x \cdot \cos 0x$

$S = {}^{30}C_{30} \cdot \sin(30x) \cdot \cos(0x) + {}^{30}C_{29} \cdot \sin 29x \cdot \cos 1x + \ldots\ldots.. +..$

$$2S = \sum_{r=0}^{30} {}^{30}C_r \left(\sin(rx)\cdot\cos(30-r)x + \cos(rx)\cdot\sin(30-r)x\right)$$

$$2S = \sum_{r=0}^{30} {}^{30}C_r \cdot \sin(30x)$$

$$S = 2^{29}\cdot \sin(30x)$$

Q.68 $4(1-2\sin^2 x) + 3\sin x + 5$

$\Rightarrow -8t^2 + 3t + 9$

maximum $\Rightarrow -8\times\frac{9}{256} + 3\times\frac{3}{16} + 9$

$= \frac{9}{32} + 9 = \frac{9\times 33}{32} = \frac{297}{32}$

Q.69 $2b = a + c$, $\beta^2 = bc$ and $\alpha^2 = ab$

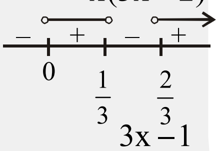
$2b = \frac{\alpha^2}{b} + \frac{\beta^2}{b} \Rightarrow \alpha^2 + \beta^2 = 2b^2$

Q.70 $\begin{vmatrix} a-1 & -1 & 0 \\ 1 & 1 & 3 \\ 1 & 1 & 2 \end{vmatrix} = 0 \Rightarrow \begin{vmatrix} a & -1 & 0 \\ 0 & 1 & 3 \\ 0 & 1 & 2 \end{vmatrix} = 0$

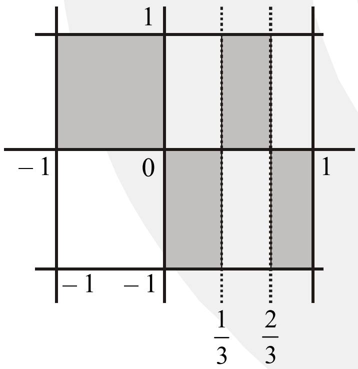
$\Rightarrow a(3-2) = 0 \Rightarrow a = 0$

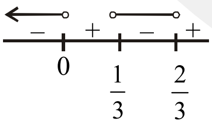
Q.71

Case (I) : $y < 0,\ \frac{3x-1}{x(3x-2)} > 0$



Case (II) : $y > 0,\ \frac{3x-1}{x(3x-2)} < 0$





Area = $1 + 1 = 2$

Q.72 Equation of C.O.C : $\frac{6\cos\theta\cdot x}{4} + \frac{6\sin\theta\cdot y}{9} = 1$

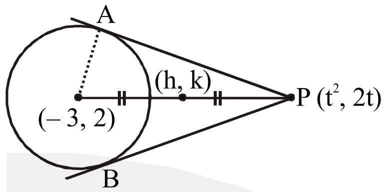
$x\cdot\frac{\cos\theta}{\left(\frac{4}{6}\right)} + \frac{y\cdot\sin\theta}{\left(\frac{9}{6}\right)} = 1$

$e^2 = 1 - \left(\frac{4/6}{9/6}\right)^2 \Rightarrow e^2 = 1 - \frac{16}{81} = \frac{65}{81}$

Q.73 $t^2 - 3 = 2h$ and $2t + 2 = 2k$

$(k-1)^2 = (2h+3)$, $t = k - 1$

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



$x + \frac{3}{2} = -\frac{2}{4} \Rightarrow x + 2 = 0$

Q.74 $Z = i\left(\frac{-1-i\sqrt{3}}{2}\right) = iw^2$

$z^{29} = (iw^2)^{29} = iw$ and $i^{29} = i$

$(iw + i)^{94} = z^n \Rightarrow (-iw^2)^{94} = (iw^2)^n$

$-w^2 = i^n w^{2n} \Rightarrow n = 10$

Q.75 L.H.S. ≤ 13 and R.H.S $= 2(y-2)^2 + 13$

$\Rightarrow$ R.H.S. ≥ 13

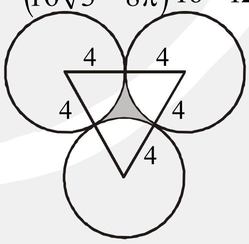
$\beta = 2$ and $\sin(\alpha + \theta) = 1$

$\Rightarrow \alpha = \frac{\pi}{2} - \theta = \frac{\pi}{2} - \tan^{-1}\left(\frac{5}{12}\right)$

$\alpha = \tan^{-1}\frac{12}{5} \Rightarrow \tan\alpha = \frac{12}{5}$

Q.76 Area of base $= \frac{\sqrt{3}}{4}\times 8^2 - \frac{\pi}{2}(4)^2$

Volume $= \left(16\sqrt{3} - 8\pi\right)16 = 128\left(2\sqrt{3} - \pi\right)\text{cm}^3$



Q.77 $\frac{1}{a-1} + \frac{y'}{a+1} = 1 \Rightarrow a = \frac{y'-1}{y'+1}$

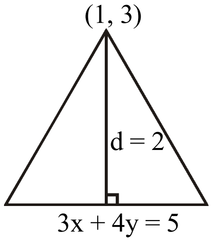
$\Rightarrow a + 1 = \frac{2y'}{y'+1}$ and $a - 1 = -\frac{2}{y'+1}$

$\Rightarrow \frac{y(y'+1)}{2y'} + \frac{x(y'+1)}{-2} = 1$

$\Rightarrow (y'+1)(y - xy') = 2y'$

Q.78 $\sec^2\theta + 2\operatorname{cosec}^2\theta \geq 3 + 2\sqrt{2}$

$d = \dfrac{3+12-5}{5} = 2$, then 2 points



Q.79 $x \to 0^+$, b sgn (– ve) = – b
x = 0, a
$\Rightarrow a = -b \Rightarrow a + b = 0$

Q.80 $\dfrac{{}^{25}C_2 + {}^{25}C_2}{{}^{50}C_2 + {}^{50}C_2} = \dfrac{12}{49}$

Q.81 $w = 2t$
$x + y + z + t = 15 \Rightarrow {}^{14}C_3$
$0 \leq x \leq 5$
$X + Y + Z + T = 9$
$x = 6 - X$
$\Rightarrow {}^{12}C_3 - {}^{4}C_1 \times {}^{6}C_3$
$y = 6 - Y$
$\Rightarrow \dfrac{12\times11\times10}{6} = 220 - 80 = 140$
$z = 6 - Z$

$t = 6 - T$

Q.82 $f'(x) = 3x^2 - 6x + a - 2\sin x \geq 0$
$= 3x^2 - 6x + a - 2 \geq 0$
$= 36 - 3 \times 4(a-2) \geq 0$
$= 3 - a + 2 \geq 0$
$= a \leq 5$

Q.83 $N^r . A(D^r) + B\left(\dfrac{d}{dx}D^r\right)$, $A = \dfrac{6}{29}$, $B = \dfrac{15}{29}$

Q.84 Volume $= \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$
$\Rightarrow |3abc - a^3 - b^3 - c^3|$
$= (a+b+c)(a^2+b^2+c^2-\Sigma ab)$
$\Rightarrow (\Sigma a)\left((\Sigma a)^2 - 3\Sigma ab\right)$
$\Rightarrow 9(81 - 3\times15) = 9 \times 36 = 324$

Q.85 $S_n = \displaystyle\sum_{n=3}^{n} \tan^{-1}\left(\dfrac{\frac{x}{2}}{1 + \frac{n}{2}\frac{(n+1)}{2}\cdot x^2}\right)$

$= \displaystyle\sum_{n=3}^{n} \tan^{-1}\left(\dfrac{(n+1)\frac{x}{2} - \frac{nx}{2}}{1 + (n+1)\frac{x}{2}\cdot n\frac{x}{2}}\right)$

$S_\infty = \dfrac{\pi}{2} - \tan^{-1}\left(\dfrac{3x}{2}\right) = 1 \Rightarrow \dfrac{3x}{2} = \cot 1,\ x = \dfrac{2}{3}\cot 1$

Q.86 Put $|x| = t$, $t\cdot e^{2-t} = 1$, $t \geq 0$, $e^{2-t} = \dfrac{1}{t}$, $t \neq 0$

number of solution are = '4'

Q.87 $n = 3,\ p = \dfrac{2}{6} = \dfrac{1}{3},\ q = \dfrac{2}{3}$

variance $= npq = 3 \times \dfrac{1}{3} \times \dfrac{2}{3} = \dfrac{2}{3}$

mean $= np = 3 \times \dfrac{1}{3} = 1$

Q.88 $\bar{x} = \dfrac{1+2+3+4+5}{5} = 3$

$\sum (x - \bar{x})^2 = 4 + 1 + 0 + 1 + 4 = 10$

S.D. $= \sigma = \sqrt{\dfrac{\sum(x-\bar{x})^2}{N}} = \sqrt{\dfrac{10}{5}} = \sqrt{2}$

Q.89 $A \equiv \{1, 2, 3, 4, 5\}$, $B \equiv \{0, 1, 2, 3\}$
Common in A & B are 3 elements
Then common in $A \times B$ and $B \times A$ are $3 \times 3 = 9$

Q.90 $\alpha \in [-2, 2]$