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# CLASSROOM CONTACT PROGRAMME

(Academic Session : 2018 - 2019)

# JEE (Main + Advanced)

## LEADER COURSE (SCORE-I) & ENTHUSIAST COURSE (SCORE-II)

**ANSWER KEY** **TEST DATE : 19-03-2019**

Test Type : FULL SYLLABUS Test Pattern : JEE-Main

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

# JEE (Main + Advanced)

## LEADER COURSE (SCORE-I) & ENTHUSIAST COURSE (SCORE-II)

Test Type : FULL SYLLABUS Test Pattern : JEE-Main

## TEST DATE : 19 - 03 - 2019

## SOLUTION

**1. Ans. (3)**

**Sol.** time of flight, $t = \frac{2v_0 \cos\theta}{g}$

If projectile returns to point of projection, displacement along x direction = 0

$$s_x = u_x t + \frac{1}{2}a_x t^2$$

$$0 = (v_0 \sin\theta)\left(\frac{2v_0\cos\theta}{g}\right) + \frac{1}{2}(-a)\left(\frac{2v_0\cos\theta}{g}\right)^2$$

$$0 = v_0 \sin\theta - \frac{1}{2}.a\left(\frac{2v_0\cos\theta}{g}\right)$$

$\tan\theta = \frac{a}{g}$ option (3)

**2. Ans. (2)**

**Sol.** Tension of rope is maximum at lowest point

$$T_{max} - mg = \frac{mv^2}{\ell} \ ... (1)$$

By energy conservation,

$$mg\frac{\ell}{2} = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{g\ell}$$

from (1),

$$T_{max} - mg = \frac{m(g\ell)}{\ell} \Rightarrow T_{max} = 2mg$$

for 8 kg block, $T_{max} = f_L$

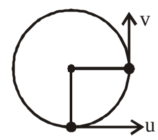
$$2mg = \mu(8g)$$

$\mu = 0.5$ option(2)

**3. Ans. (4)**

**Sol.** By conservation of energy,

$$mg\ell = \frac{1}{2}mu^2 - \frac{1}{2}mv^2$$




$$V = \sqrt{u^2 - 2g\ell}$$

$$|\Delta\vec{v}| = \sqrt{u^2 + v^2}$$

$= \sqrt{u^2 + u^2 - 2g\ell} = \sqrt{2(u^2 - g\ell)}$ option(4)

**4. Ans. (2)**

**Sol.** $a_t = \frac{dv}{dt} = \frac{t}{5} m/s^2$

$$a_r = \frac{v^2}{R} = \frac{t^4}{5000}$$

$$a_t = a_r \Rightarrow \frac{t}{5} = \frac{t^4}{5000} \Rightarrow t^3 = 1000$$

t = 10 sec.

**5. Ans. (4)**

**6. Ans. (2)**

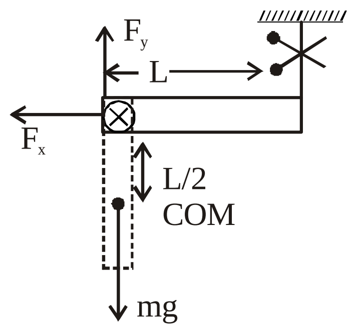
**Sol.** $M_1a_1 = T$, $M_2g - 2T = M_2a_2$ , $a_1 = 2a_2$

Hence $M_1(2a_2) = T$ and $M_2g - 2M_1(2a_2) = M_2a_2$

$M_2g = a_2\,(4M_1 + M_2)$ so $a_2 = \frac{M_2g}{4M_1 + M_2}$

**7. Ans. (4)**

**Sol.**



$F_y - Mg = m\omega^2 R$

$F_y - Mg = m\frac{L}{2}\frac{3g}{L} \quad \because \omega = \sqrt{\frac{3g}{L}}$

By energy conservation

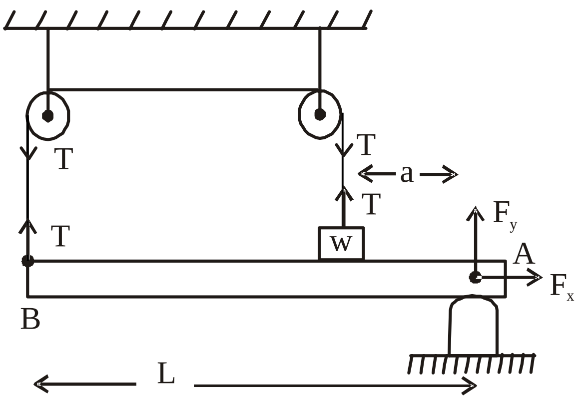
$F_y - mg = \frac{3mg}{2}$

$F_y = \frac{5mg}{2}$

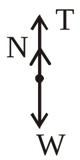
$F_x = 0;\ F_y = \frac{5mg}{2}$

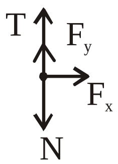
**8. Ans. (1)**

**Sol.**




**F.B.D of W** **F.B.D for rod**




$F_y + T = N$ ........ (i) (for rod)

$F_x = 0$

For equilibrium $\tau = 0$

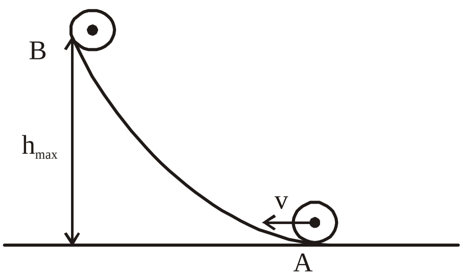
$\therefore$ $\tau$ about B, $N(L - a) = F_y L$ ...... (ii)

solving (i) & (ii) we get

$F_y = \frac{W(L-a)}{(L+a)}$

**9. Ans. (1)**

**Sol.**




Applying energy conservation at A & B

$\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2 = mgh \quad \left\{\begin{array}{l}\because I = \frac{mR^2}{2} \\ R\omega = v\end{array}\right\}$

$\therefore h = \frac{3v^2}{4g}$

**10. Ans. (2)**

**Sol.** The wave propogate in x-direction while electric field oscillates in y-direction. Thus the electric field resides in the x-y plane. Since the magnetic field is perpendicular to both E & propogation direction, it must be in x-z plane $\therefore$ $B_x = 0,\ B_y = 0,\ B_z \neq 0$

and $B_Z = \frac{E_y}{C} \Rightarrow B_z = \frac{0.5\cos\left[2\pi\times10^8\left(t-\frac{x}{c}\right)\right]}{3\times10^8}$

**11. Ans. (1)**

**Sol.** The given equation can be represented as

$y = 2\times10\cos\left(\frac{2\pi x}{50}\right)\sin\left(\frac{2\pi}{50}5000t\right)$

comparing it with standard equation of stationary wave

$\frac{2\pi}{\lambda} = \frac{2\pi}{50}$

$\lambda = 50$ units

so loop length $\lambda/2 = 25$ units.

**12. Ans. (2)**

**Sol.** When the two positions of the resonance are obtained at distances $\ell_1$ & $\ell_2$ respectively then the velocity V of sound is given by $V = 2f(\ell_2 - \ell_1)$

$V = 2 \times 1600 \times 10 \times 10^{-2} = 320$ m/s

**13. Ans. (4)**

**Sol.** Frequency observed for A

$(f_A) = \left(\frac{340-20}{340-20+20}\right)68$

$= \frac{32}{34}\times 68 = 64$

Frequency observed for B

$(f_B) = \left(\frac{340+20}{340+20-20}\right)68$

$= \left(\frac{36\not{0}}{34\not{0}}\right)68 = 72$

So beat frequency $f_B - f_A = 72 - 64 = 8$

**14. Ans. (1)**

**Sol.** w.r.t stationary block

$T = 2\pi\sqrt{\frac{\mu}{k}}$ (for oscillation)

so time of contact T/2

$t = T/2$

$= \pi\sqrt{\frac{\frac{4\times 4}{4+4}}{\pi^2}} = \sqrt{2}$ sec.

**15. Ans. (1)**

**Sol.** The given lens is a convex lens. Let the magnification be m, then for real image

$\frac{1}{mx}+\frac{1}{x}=\frac{1}{f}$ .....(i)

and for virtual image $\frac{1}{-my}+\frac{1}{y}=\frac{1}{f}$ .. (ii)

From Eq. (i) and Eq.(ii), we get

$f = \frac{x+y}{2}$

**16. Ans. (2)**

**17. Ans. (1)**

**18. Ans. (2)**

**Sol.** $v_e = \sqrt{2}v_0 = 1.414\, v_0$% increase in orbital velocity $= \frac{v_0 - v_0}{v_0}\times 100 = 41.4\%$

**19. Ans. (2)**

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

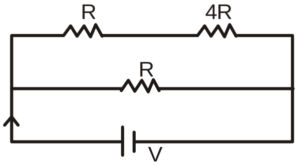
$= 9\times 10^{-6}\left(\hat{i}-\hat{j}+\hat{k}\right)\times 0.20\times 100\ \hat{i}$

$\vec{\tau} = 18\times 10^{-7}\,(\hat{k}-\hat{j})$

$|\vec{\tau}| = 25.45\times 10^{-7}\,N-m$

**20. Ans. (1)**

**Sol.**




$W_1 = \frac{V^2}{R} = \frac{V^2}{\frac{V^2}{P}} = P$

$W_2 = \left(\frac{V}{5R}\right)^2 .4R = \frac{4V^2.P}{25V^2} = \frac{4P}{25}$

**21. Ans. (1)**

**Sol.** $\tau = R_{Th}.C, R_{Th}$ is the thevenin resistance at the capacitor terminals.

$R_{Th} = 8 + (20\,|\,(9 + (70\,|\,30)) = 20\ K\Omega$

$\tau = 0.12$ s

**22. Ans. (2)**

**Sol.** $\phi = \frac{\mu_0 i}{2R}.\pi r$

compare with $\phi = Mi$

$\Rightarrow \left[M = \frac{\mu_0 \pi r^2}{2R}\right]$

**23. Ans. (1)**

**Sol.** $P = L\, i\, \frac{di}{dt} = 8i \;\therefore\; di = dt$

$\Rightarrow \int_{i_2}^{i_4} di = \int_2^4 dt \quad i_4 - i_2 = 2A$

**24. Ans. (1)**

**Sol.** $V_s = \tan\theta \,.\, \upsilon + C$

$4V = \tan\theta \,.\, 2\upsilon_0 + C$

$10V = \tan\theta.\ 4\upsilon_0 + C$

$6V = 2\upsilon_0 \tan\theta \Rightarrow \tan\theta = \frac{3V}{\upsilon_0}$

$4V = 6V - \frac{W_e}{e}$

$W_e = (2V)e \quad h = \frac{(3V)e}{\upsilon_0}$

**25. Ans. (4)**

**Sol.** $\lambda_\alpha = \frac{1}{3240}$ per year and $\lambda_\beta = \frac{1}{810}$ per year and it is given that the fraction of the remained activity $\frac{A}{A_0} = \frac{1}{4}$

Total decay constant

$\lambda = \lambda_\alpha + \lambda_\beta = \frac{1}{3240} + \frac{1}{810} = \frac{1+4}{3240}$ per year

$= \frac{1}{648}$ per year

We know that $A = A_0 e^{-\lambda t} \Rightarrow t = \frac{1}{\lambda}\log_e \frac{A_0}{A}$

$\Rightarrow t = \frac{1}{\lambda}\log_e 4 = \frac{2}{\lambda}\log_e 2$

$t = 648 \times 2 \times 0.693 = 898$ years

**26. Ans. (4)**

**Sol.** White spot on screen would be central maxima where

$\Delta x = 0 \qquad y = \frac{d}{2} - \frac{d}{8} = \frac{3d}{8}$

**27. Ans. (1)**

**Sol.** After falling first fragment on the ground, horizontal velocity of c.m. remains unchanged but vertical acceleration decreases.

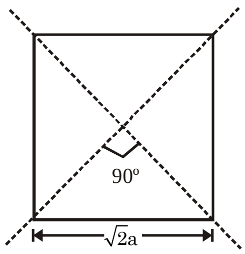
**28. Ans. (1)**

**Sol.** $e = \frac{\left|\frac{\vec{v}_2.\Delta\vec{p}}{|\Delta\vec{p}|}\right|}{\left|\frac{\vec{v}_1.\Delta\vec{p}}{\Delta\vec{p}}\right|} = \frac{|\vec{v}_2.(\vec{v}_2 - \vec{v}_1)|}{|\vec{v}_1.(\vec{v}_2 - \vec{v}_1)|}$

$= \frac{|(\hat{i}+2\hat{j}).(-\hat{i}-\hat{j})|}{|(2\hat{i}+3\hat{j}).(-\hat{i}-\hat{j})|} = \frac{3}{5}$

**29. Ans. (2)**

**Sol.** Consider prism of mass 4 m by joining 4 prism given in question. total MOI of this system will be




$I = (4I_{prism}) = \frac{(4m)(\sqrt{2}a)^2}{6}$

$\Rightarrow I_{prism} = \frac{ma^2}{3}$

**30. Ans. (2)**

**Sol.** More slit width more will be light intensity coming from it and width of central maxima decreases with slit width, so A will move towards O.

**31. Ans. (1)**

Let x mL of 0.2 M $H_2SO_4$ is required

| | $2NaCN$ | $+ H_2SO_4 \longrightarrow$ | $2HCN$ | $+ Na_2SO_4$ |
|---|---|---|---|---|
| Initial | 50 mL, 0.2 M | x mL, 0.2 m | —— | —— |
| final | (10–0.4x)mmol | —— | 0.4 x mmol | |

$pH = pK_a + \log\frac{[NaCN]}{[HCN]}$

$10 = 9.4 + \log\frac{(10-0.4x)}{0.4x}$

on solving x = 5 mL

**32. Ans. (2)**

Colloidal particles in $As_2S_3$ solution are negatively charged

**33. Ans. (2)**

On balancing equation

$3I_3^- + 11Cr_2O_7^- + 82H^+ \longrightarrow 9IO_4^- + 22Cr^{+3} + 41H_2O$

$(a+b+c)/(d+e+f) \Rightarrow \frac{(3+11+82)}{(9+22+41)}$

$= \frac{4}{3}$

**34. Ans. (3)**

$C_{v(mix)} = \frac{n_1C_{v_1} + n_2C_{v_2}}{n_1 + n_2}$

$= \frac{3\times\frac{5R}{2} + \frac{2\times 5R}{2}}{5} = \frac{5R}{2}$

$\Delta U = nC_v(T_2 - T_1)$

$\Delta U = 5\times\frac{5}{2}\times 2[T_2 - 300]$ ...(1)

$-P_{ext}\left[\frac{T_2}{P_2} - \frac{T_1}{P_1}\right]nR = nC_v(T_2 - T_1)$

$-10\left[\frac{T_2}{10} - \frac{300}{1}\right]nR = n\times\frac{5R}{2}[T_2 - 300]$

$T_2 = \frac{1500}{1.4}K$

$\Delta U = 5\times\frac{5}{2}\times 2[1071.4 - 300]$ calorie

= 19.285 kcal

**35. Ans. (3)**

| | $A \rightarrow$ | $B +$ | $C +$ | $D +$ | $E + ....... +$ | $x + y + z$ |
|---|---|---|---|---|---|---|
| $t = 0$ | $P_0$ | 0 | 0 | 0 | 0 | $0+0+0$ |
| $t = t$ | $P_0 - x$ | $x$ | $x$ | $x$ | $x$ | $x \quad x \quad x$ |
| $t = \infty$ | 0 | $P_0$ | $P_0$ | $P_0$ | $P_0$ | $P_0 \quad P_0 \quad P_0$ |

$\therefore At\ t = t; \qquad P_0 + 24x = p$

$$x = \frac{P - P_0}{24}$$

$$\& \ P_0 - x = P_0 - \frac{P}{24} + \frac{P_0}{24} = \frac{25P_0 - P}{24}$$

$$K = \frac{1}{t}\ell n\left(\frac{24P_0}{25P_0 - P}\right) = \frac{2.303}{t}\log\left(\frac{24P_0}{25P_0 - P}\right)$$

**36. Ans. (2)**

dG = vdp – SdT

T = const  dT = 0

$$\int dG = nRT\int \frac{1}{p}.dp$$

$$\Delta G = 2 \times 2 \times 353\ell n\frac{0.2}{1} = -2.27\,kcal$$

**37. Ans. (2)**

$$\Lambda_m = \Lambda_m^{\infty}$$

$$\frac{k \times 1000}{M} = 63 + 67$$

$$\frac{2.6 \times 10^{-6} \times 1000}{M} = 130$$

$M = 2 \times 10^{-5} =$ solubility in mol/L

$$Ksp(AgCl) = \left(2 \times 10^{-5}\right)^2 = 4 \times 10^{-10}$$

**38. Ans. (4)**

n = 4, m = – 3

i.e. only possible value of *l* is 3.

i.e. Orbital angular momentum

$$= \sqrt{l(l+1)}\frac{h}{2\pi} = \frac{2\sqrt{3}h}{2\pi} = \frac{\sqrt{3}h}{\pi}$$

**39. Ans. (2)**

Anode $\rightarrow 2Cl^- \rightarrow Cl_2(g) + 2e^-$

Cathode $\rightarrow C\ell_2(g) + 2e^- \rightarrow 2C\ell^-$

-----------------------------------------------------

Net reaction : $\rightarrow C\ell_2(g)_{cathode} \rightarrow C\ell_2(g)_{anode}$

Applying nerst equation

$$E_{cell} = 0 - \frac{0.059}{2}\log\frac{P_1}{P_2} = \frac{0.059}{2}\log\frac{P_2}{P_1}$$

If $P_2 > P_1$ then cell will be spontaneous

Since $E_{cell}$ will be positive.

**40. Ans. (4)**

When AgCl Starts precipitating

$$[Ag^+] = \frac{10^{-10}}{0.06}$$

at that time conc of $[I^-]$

$$= \frac{4 \times 10^{-16}}{\frac{10^{-10}}{0.06}} = 2.4 \times 10^{-7}$$

**41. Ans. (2)**

When chloroform is treated with concentrated nitric acid, its hydorgen is replaced by nitrogroup

$CHCl_3 + HONO_2 \rightarrow CNO_2Cl_3 + H_2O$

**42. Ans. (2)**

Hydrazine does not have carbon atoms so it does not form NaCN and hence does not give a positive lassaigne's test

**43. Ans. (4)**

$CH_2 = C(Cl) - CH = CH_2$ is the monomer of neoprene.

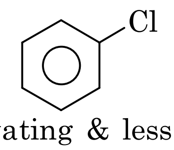
$$CH_2 = \underset{\displaystyle Cl}{\underset{|}{C}} - CH = CH_2 \xrightarrow{Polymerisation} \left[ CH_2 - \underset{\displaystyle Cl}{\underset{|}{C}} = CH - CH_2 \right]_n$$

Neoprene

**44. Ans. (4)**

Option (4) have α-H atom ∴ it show tautomerism.

**45. Ans. (3)**

A is  where Cl is ring deactivating & less reactive.

**46. Ans. (4)**

Sunlight / hv is responsible for formation of F. R.

**47. Ans. (2)**

Only terminal alkynes can react.

**48. Ans. (3)**

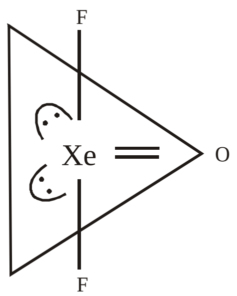
Only 1° amide can undergo Hoffmann Bromamide Reaction.

**49. Ans. (4)**

**50. Ans. (2)**

**51. Ans. (2)**

$XeOF_2$ is 'T' shaped




with Xe in $sp^3d$ hybridization

The geometry is trigonal bipyramidal

**52. Ans.(1)**

According to IUPAC ligands are named in alphabetical order

**53. Ans. (4)**

Being the first alkali metal Li shows some difference with remaining alkali metal.

**54. Ans. (1)**

NaCN acts as depresant for ZnS for the mixture of PbS and ZnS ores.

**55. Ans. (4)**

Electronegativity of elements :

$B = 2,\ Al = 1.5,\ Ga = 1.6,\ In = 1.7,\ T\ell = 1.8$

**56. Ans. (4)**

$x = 101°$, $y = 79°$ & $z = 118°$ According to NCERT.

**57. Ans. (3)**

$$2CuCl_2 + SO_2 + 2H_2O \longrightarrow Cu_2Cl_2 + H_2SO_4 + HCl$$

$x = SO_2$ gas.

**58. Ans. (2)**

**59. Ans. (1)**

**60. Ans. (2)**

**61. Ans. (4)**

$$\frac{1.5 + 2.4 + 3.0 + 4.f}{5 + 4 + 0 + f} = 3 \Rightarrow f = 14$$

**62. Ans. (2)**

Let $\vec{s} = x\hat{i} + y\hat{j} + z\hat{k}$

$\vec{p}.\vec{s} = 0$ gives $x - y = 0$ .... (1)

and $[\vec{q}\ \vec{r}\ \vec{s}] = 0 \Rightarrow$ gives $x + y + z = 0$ ...(2)

i.e. $x = y$ and $z = -2x$ and $x^2 + y^2 + z^2 = 1$.(3)

i.e. $x = \pm\frac{1}{\sqrt{6}},\ y = \pm\frac{1}{\sqrt{6}},\ z = \mp\frac{2}{\sqrt{6}}$

$$\vec{s} = \pm\left(\frac{\hat{i} + \hat{j} - 2\hat{k}}{\sqrt{6}}\right)$$

**63. Ans. (3)**

| p | q | $\sim p \vee q$ | $\sim p \wedge \sim q$ | $(\sim p \vee q) \wedge (\sim p \wedge \sim q)$ |
|---|---|---|---|---|
| T | T | T | F | F |
| T | F | F | F | F |
| F | T | T | F | F |
| F | F | T | T | T |

**64. Ans. (4)**

It's D.R is {3, 1, 0}

i.e. option (1) & (2) are correct

Any point onto line is $3 + 3\lambda,\ 2+\lambda,\ 1$

hence for $\lambda = 1$, option (3) is correct

Line & plane are parallel to each other hence option (4) is incorrect.

**65. Ans. (3)**

| P | ~P | $P \Rightarrow \sim P$ | $\sim P \Rightarrow P$ | $(P \Rightarrow \sim P) \wedge (\sim P \Rightarrow P)$ |
|---|---|---|---|---|
| T | F | F | T | F |
| F | T | T | F | F |

**66. Ans. (2)**

Set $S \times S$ will have $4 \times 4 = 16$ elements. Number of elements except (1, 2), (2, 3) and (3, 4) in $S \times S = 16 - 3 = 13$

Thus number of subsets of $S \times S$ containing (1, 2), (2, 3) and (3, 4) $= 2^{13} = 8192$.

**67. Ans. (3)**

$$\sim \{p \wedge (q \to r)\} \equiv \sim p \vee \sim (q \to r)$$

$$[\because \sim (a \wedge b) \equiv \sim a \vee \sim b]$$

$$\equiv \sim p \vee (q \wedge \sim r) \quad [\because \sim (a \to b) \equiv a \wedge \sim b]$$

**68. Ans. (2)**

Let $g(x) = f(x) - x^3$

$\Rightarrow$ g(x) has at least 4 real roots which are x = 1, 2, 3, 4

$\Rightarrow$ g'(x) = 0 has atleast 3 real roots in (1, 4)

$\Rightarrow$ g''(x) = 0 has atleast 2 real roots in (1, 4)

$\Rightarrow$ g'''(x) = f '''(x) – 6 = 0 has atleast 1 real root in (1, 4)

**69. Ans.(2)**

$$ydx - xdy + 3x^2y^2e^{x^3}dx = 0$$

$$\Rightarrow \frac{ydx - xdy}{y^2} + 3x^2e^{x^3}dx = 0$$

$$\Rightarrow d\left(\frac{x}{y}\right) + d\left(e^{x^3}\right) = 0 \Rightarrow \frac{x}{y} + e^{x^3} = C$$

**70. Ans. (3)**

We know that

$\tan\alpha = \cot\alpha - 2\cot(2\alpha)$.........(i)

Putting

$\alpha = \theta,\ 2\theta,\ 2^2\theta$ ..........., $2^{10}\theta$ in (i),

we get

$\tan\theta = (\cot\theta - 2\cot(2\theta))$

$2(\tan(2\theta)) = 2(\cot(2\theta) - 2\cot(2^2\theta))$

$2^2(\tan(2^2\theta)) = 2^2(\cot(2^2\theta) - 2\cot(2^3\theta))$

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$2^{10}(\tan(2^{10}\theta)) = 2^{10}(\cot(2^{10}\theta) - 2\cot(2^{11}\theta))$

adding

$\tan\theta + 2\tan(2\theta) + 2^2\tan(2^2\theta) + \ldots\ldots +$

$2^{10}\tan(2^{10}\theta) = \cot\theta - 2^{11}\cot(2^{11}\theta)$

**71. Ans. (2)**

Locus will be : $3|x| = 2|y|$

**72. Ans. (2)**

Let S : $x^2 + y^2 + 2gx + 2fy + c = 0$

$S_1 : x^2 + y^2 - 9 = 0$

$S_2 : x^2 + y^2 - 2x - 4y + 2 = 0$

Common chord of S and $S_1$ passing through (0, 0)

$S - S_1 = 0,\ 2gx + 2fy + c + 9 = 0$

$c = -9$

common chord of S and $S_2$ passing through (1, 2)

$S - S_2 = 0,\ 2gx + 2fy + 2x + 4y + C - 2 = 0$

$2g + 4f + 2 + 8 - 9 - 2 = 0$

$2g + 4f - 1 = 0$

So locus is $-2x - 4y - 1 = 0$

$\Rightarrow 2x + 4y + 1 = 0$

**73. Ans. (3)**

Point lie on directrix so angle will be 90º.

**74. Ans. (2)**

$$\frac{3\cos 2x + \cos^3 2x}{\cos^6 x - \sin^6 x} = \frac{\cos^2 2x + 3}{1 - \frac{\sin^2 2x}{4}} = 4$$

$x^2 + 3 = 4 \Rightarrow x = \pm 1$

**75. Ans. (2)**

Point should lie on director circle $x^2 + y^2 = 41$

**76. Ans. (2)**

Let $E_1$, $E_2$ & $E_3$ be the event that letter has come from RAJASTHAN, MAHARASTRA and MADRAS resp.

A be the event that consecutive letters RA are visible.

$\therefore\ P(E_1) = P(E_2) = P(E_3) = \frac{1}{3}$

$$P\left(\frac{A}{E_1}\right) = \frac{1}{8},\ P\left(\frac{A}{E_2}\right) = \frac{2}{9},\ P\left(\frac{A}{E_3}\right) = \frac{1}{5}$$

$$P\left(\frac{E_1}{A}\right) = \frac{P(E_1)\,P\left(\frac{A}{E_1}\right)}{P(E_1)P\left(\frac{A}{E_1}\right) + P(E_2)P\left(\frac{A}{E_2}\right) + P(E_3)P\left(\frac{A}{E_3}\right)}$$

$$= \frac{\frac{1}{3}\times\frac{1}{8}}{\frac{1}{3}\times\frac{1}{8} + \frac{1}{3}\times\frac{2}{9} + \frac{1}{3}\times\frac{1}{5}} = \frac{45}{197}$$

**77. Ans. (3)**

$x^3 - x + 3 = 0$

$\alpha + \beta + \gamma = 0,\ \alpha\beta\gamma = -3$

Now $(\alpha + \beta)^3 + (\beta + \gamma)^3 + (\gamma + \alpha)^3$

$= (-\gamma)^3 + (-\alpha)^3 + (-\beta)^3$

$= -[\alpha^3 + \beta^3 + \gamma^3]$

$= -3\alpha\beta\gamma,\ (\because \alpha + \beta + \gamma = 0)$

$= -3(-3) = 9$

**78. Ans. (1)**

$$e=\sqrt{1+\frac{\sin^2 2\theta}{\cos^2\theta}}=\sqrt{1+\frac{4\sin^2\theta\cos^2\theta}{\cos^2\theta}}$$

$$=\sqrt{1+4\sin^2\theta}$$

$$e_{max}=\sqrt{1+4\sin^2\left(\frac{\pi}{6}\right)}=\sqrt{2}$$

**79. Ans. (2)**

$$\det A=\begin{bmatrix}7&0&1\\-2&1&0\\-1&3&1\end{bmatrix}=7+1\times(-6+1)=2$$

$$\therefore\ |\text{adj(adj(adj(adj A)))}|=|A|^{2^4}=2^{16}$$

**80. Ans. (4)**

Alphabatical order of letters are A,E,H,J,R,S

| | | | | | | |
|---|---|---|---|---|---|---|
| A | | | | | | 5! |
| E | | | | | | 5! |
| H | | | | | | 5! |
| J | | | | | | 5! |
| R | A | E | | | | 3! |
| R | A | H | | | | 3! |
| R | A | J | E | H | S | 1 |
| R | A | J | E | S | H | |

Total number of words before the word RAJESH is 493

**81. Ans. (2)**

$$\left.\begin{matrix}ar^3=7!\\ar^6=8!\end{matrix}\right\}\Rightarrow r=2,\ a=\frac{7!}{8}=630$$

$$\text{Now}\quad a\left(\frac{r^n-1}{r-1}\right)=S$$

$$\Rightarrow 630\left(\frac{2^n-1}{2-1}\right)=19530$$

$\Rightarrow 2^n-1=31$

$\Rightarrow 2^n=32$

$\Rightarrow n=5$

**82. Ans. (3)**

$(1+x)^{89}={}^{89}C_0x^0+{}^{89}C_1x'+...+{}^{89}C_{89}x^{89}$

integrating from 0 to 1

$$\left[\frac{(1+x)^{90}}{90}\right]_0^1=\left[\frac{{}^{89}C_0x^1}{1}+\frac{{}^{89}C_1x^2}{2}+...\frac{{}^{89}C_{89}x^{90}}{90}\right]_0^1$$

$$\frac{2^{90}-1}{90}=\frac{{}^{89}C_0}{1}+\frac{{}^{89}C_1}{2}+...+\frac{{}^{89}C_{89}}{90}\quad ...(i)$$

similarly integrating from $(1+\omega)$ and $(1 \text{ to } \omega^2)$

we have (where $\omega$ is complex cube root of unity)

$$0=\frac{{}^{89}C_0\omega^1}{1}+\frac{{}^{89}C_0\omega^2}{2}+...+\frac{{}^{89}C_{89}\omega^{90}}{90}\quad ...(ii)$$

$$0=\frac{{}^{89}C_0\omega^2}{1}+\frac{{}^{89}C_1\omega^4}{2}+...+\frac{{}^{89}C_{89}\omega^{180}}{90}\quad ...(iii)$$

Now $(1)+\omega^2(2)+\omega(3)$

we get the required result

**83. Ans. (4)**

$$\lim_{n\to\infty}\frac{1}{\left(\frac{x-3}{5}\right)^n+5-\frac{1}{n}}=\frac{1}{5}$$

$$\Rightarrow\lim_{n\to\infty}\frac{1}{\left(\frac{x-3}{5}\right)^n+5}=\frac{1}{5}\left(\because\lim_{n\to\infty}\frac{1}{n}=0\right)$$

$$\Rightarrow\lim_{n\to\infty}\left(\frac{x-3}{5}\right)^n=0$$

$$\Rightarrow -1<\frac{x-3}{5}<1\ \Rightarrow -2<x<8$$

**84. Ans. (3)**

$$\lim_{x\to0}\left[\frac{\tan 3x}{x}\right]=3,\ \lim_{x\to0}\left[\frac{\sin x}{x}\right]=0$$

$\Rightarrow$ curve is $5+x^2\sqrt{y-2}=y^2-3x$

$$\left.\frac{dy}{dx}\right]_{(1,3)}=\frac{10}{11}$$

$\Rightarrow$ slope of normal is $\frac{-11}{10}$

$\Rightarrow$ equation of normal is $11x+10y=41$

**85. Ans. (3)**

f(x) is continuous at $x^3-5x=2x^2-6$

$\Rightarrow x^3-2x^2-5x+6=0$

$\Rightarrow x=-2, 1, 3$

$\Rightarrow x_1=-2, x_2=1, x_3=3$

**86. Ans. (3)**

$$I=\int\frac{\left(\frac{1}{x}-\frac{1}{x^3}\right)dx}{\sqrt{1+\frac{3}{x^2}+\frac{1}{x^4}}}=\int\frac{\left(1-1/x^2\right)dx}{\sqrt{x^2+3+1/x^2}}$$

$$=\int\frac{\left(1-1/x^2\right)dx}{\sqrt{\left(x+1/x\right)^2+1}}$$

Now put $x+\frac{1}{x}=t$

$\left(1-\frac{1}{x^2}\right)dx=dt \quad =\int \frac{dt}{\sqrt{t^2+1}}$

$=\ell n\left(x+\frac{1}{x}+\sqrt{x^2+\frac{1}{x^2}+3}\right)+c$

**87. Ans. (3)**

$f(x)=x^n \Rightarrow f(1)=1$

$f'(x)=nx^{n-1} \Rightarrow f'(1)=n$

$f''(x)=n(n-1)x^{n-2} \Rightarrow f''(1)=n(n-1)$

$\Rightarrow f(1)-\frac{f'(1)}{\lfloor 1}+\frac{f''(1)}{\lfloor 2}-\ldots+\frac{(-1)^n f^n(1)}{\lfloor n}$

$= {}^nC_0-{}^nC_1+{}^nC_2-{}^nC_3+\ldots(-1)^n\,{}^nC_n=0$

**88. Ans. (4)**

$I=\int_{-1/2}^{1/2}\left([x]+\ell n\left(\frac{1-x}{1+x}\right)\right)dx$

$=\int_{-1/2}^{1/2}[x]dx+\int_{-1/2}^{1/2}\ell n\left(\frac{1-x}{1+x}\right)dx=$

$=\int_{-1/2}^{0}[x]dx+\int_{0}^{1/2}[x]dx+0$

(because $\ell n\left(\frac{1-x}{1+x}\right)$ is odd function)

$=\int_{-1/2}^{0}(-1)\,dx+0+0$

$=(-x)_{-1/2}^{0} \quad =-(0+1/2) \quad =-1/2$

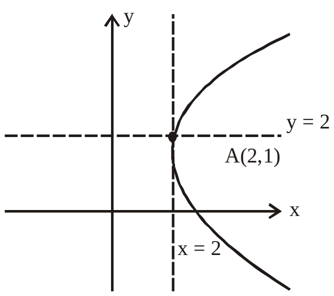
**89. Ans. (1)**

$x=y^2-2y+3$

$x=(y-1)^2+2$

$x-2=(y-1)^2$

$\Rightarrow (y-1)^2=1(x-2)$




Now let slope of tangent is an

so m $=-1/2$

$\therefore$ equation of tangent will be

$y-1=m(x-2)+\frac{1}{4m}$

$y-1=-\frac{1}{2}(x-2)+\frac{1}{4(-1/2)}$

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

$2y-2=-x+2-1$

$2y-2=-x+1$

$x+2y=3$

**90. Ans. (4)**

$p=1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+----\infty$

$p=\frac{1}{1-1/2}=2$

Let $n^{th}$ term of 1, 1, 2, 3, 4, ---- .

$=(n-1)^{th}$ term of 1, 2, 3, 4, --------

$=1+(n-2)\times 1 \quad =n-1$

now q = $20^{th}$ term of 1, 1, 2, 3, 4, -----

= 20 – 1

= 19

so desired 2 quadratic equation will be

$x^2-(p+q)x+pq=0$

$x^2-21x+38=0$