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DIVISION: JEE (MAIN+ADVANCED)

ACADEMIC SESSION: 2023-24

PERIODIC ASSESSMENT TEST (PAT)

STUDENT SUPPORT BOOKLET (SSB)

Answer Key (AK) | Standard Hints (SH) | Text Solutions (TS) | Weightage Sheet (WS)

CLASS	XII	COURSE NAME	VIJETA	COURSE CODE	JP
PHASE CODE(S)	05JP	TOTAL PAGES	1	BATCH CODE(S)	05JP

Target Examination & Year:

JEE (MAIN+ADVANCED) 2024

TEST PATTERN	TEST TYPE	TEST CODE & SEQUENCE
JEE (MAIN)	CUMULATIVE TEST (CT)	MCT 02

DATE & DAY:
10th September 2023 | Sunday

Duration & Time:
3 Hrs |11:30 AM to 02:30 PM

Contents:

- Weightage Sheet (WS) ✓
- Answer Key (AK) ✓
- Standard Hints (SH) ☐
- Text Solutions (TS) ✓
- Resonance Student's Critical Analysis of Learning for Excellence (ResoSCALE) ☐
- Student Self Assessment Sheet (SAS) ☐
- Video Solutions (VS) ☐

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ANSWER KEY (AK)

PAPER											
PART-A: PHYSICS	Q.No.	1	2	3	4	5	6	7	8	9	10
	Ans.	4	4	2	2	3	3	4	1	2	3
	Q.No.	11	12	13	14	15	16	17	18	19	20
	Ans.	2	1	3	2	3	4	4	1	3	3
	Q.No.	21	22	23	24	25	26	27	28	29	30
	Ans.	0001	0002	0005	0008	0004	0005	0002	0500	0054	0025
PART-B: CHEMISTRY	Q.No.	31	32	33	34	35	36	37	38	39	40
	Ans.	3	1	4	2	4	4	4	1	1	2
	Q.No.	41	42	43	44	45	46	47	48	49	50
	Ans.	3	3	2	3	3	3	1	1	4	4
	Q.No.	51	52	53	54	55	56	57	58	59	60
	Ans.	0005	0009	0005	0044	0008	0006	0002	0010	0031	0002
PART-C: MATHS	Q.No.	61	62	63	64	65	66	67	68	69	70
	Ans.	3	1	2	3	3	3	2	3	4	2
	Q.No.	71	72	73	74	75	76	77	78	79	80
	Ans.	4	3	2	1	3	4	1	4	3	2
	Q.No.	81	82	83	84	85	86	87	88	89	90
	Ans.	0031	0500	0002	3240	0432	0010	0002	0025	0800	0001

PAPER

PART-A: PHYSICS

1. $(NBA)i = C\theta$

Current sensitivity (वर्तमानसंवेंदनशीलता)

$$= \frac{\theta}{i_g} = \frac{NBA}{C}$$

$\Rightarrow$ If N is doubled then the current sensitivity will also be doubled

But voltage sensity of the galvanometer:

$\Rightarrow$ यदिNकोदोगुनाकरदियाजाए

तोवर्तमानसंवेदनशीलताभीदोगुनीहोजाएगीलेकिनगैल्वेन ोमीटरकीवोल्टेजसंवेदनशीलता

$$i_g = \left(\frac{C}{NBA}\right)\theta$$

$$\Delta V = i_g R_g = \left(\frac{C R_g}{NBA}\right)\theta$$

$$\frac{\theta}{\Delta V} = \text{voltage sensitivity} = \frac{NBA}{CR_g}$$

If N is doubled then R_g will also be doubled so voltage sensitivity will not change.

यदिNकोदोगुनाकरदियाजाए

तोRgभीदोगुनाहोजाएगाइसलिए

वोल्टेजसंवेदनशीलतानहींबदलेगी

4. $R_i = \frac{240}{3.2} = 75\Omega$

$R_f = \frac{240}{3} = 80\Omega$

$R_f = R_i(1 + \alpha\Delta T)$

$\Rightarrow \quad 80 = 75\,(1 + (2 \times 10^{-4})\Delta T)$

$\Delta T = \frac{1000}{3} = 333^oC$

$T_f = T_i + \Delta T = 27^oC + 333^oC = 360^oC$

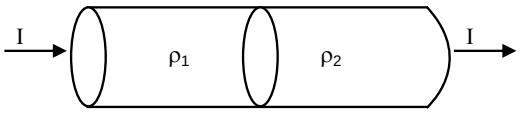
5. current through the resistance R = exactly 4A

प्रतिरोधRके माध्यम से धारा=बिल्कुल4 A

butp.d. across the resistor R = 20^-

$R = \frac{V}{I} = \frac{20^-}{4} = 5^-$

6.



Using the Gauss's theorem

$$\text{net flux } \phi_{net} = \frac{q_{in}}{\varepsilon_0}$$

7. $|a_c| = |a_t|$

$$\frac{v^2}{R} = \frac{dv}{dt}$$

$$\int_{v_0}^{v} \frac{dv}{v^2} = \frac{1}{R}\int_0^t dt$$

$$\frac{1}{v_0} - \frac{1}{v} = \frac{t}{R}$$

$$\frac{1}{v} = \frac{1}{v_0} - \frac{t}{R} \Rightarrow v = \frac{v_0 R}{R - v_0 t}$$

$$\frac{ds}{dt} = \frac{v_0 R}{R - v_0 t}$$

$$\int_0^{\pi R/2} dS = v_0 R \int_0^t \frac{dt}{R - v_0 t}$$

$$\frac{\pi R}{2} = \frac{v_0 R}{-v_0} \ln\left(\frac{R - v_0 t}{R - 0}\right)$$

$$\frac{\pi}{2} = \ln\left(\frac{R}{R - v_0 t}\right)$$

$$\frac{R}{R - v_0 t} = e^{\pi/2} \Rightarrow Re^{-\pi/2} = R - v_0 t$$

$$t = \frac{R}{v_0}\left(1 - e^{-\frac{\pi}{2}}\right)$$

$$= \frac{600}{15} \times \left(1 - e^{-\pi/2}\right)$$

$$= 40 \times \left(1 - e^{-\pi/2}\right)$$

8. $I_g R_g = (i - ig)s$

$$(i)_{max} = \left(\frac{Rg + s}{s}\right)(ig)_{max}$$

$$6 = \left(\frac{Rg + s}{s}\right)(3 \times 10^{-3})$$

$\Rightarrow \quad s \approx 5\ m\Omega$

10. $\frac{Q_1}{Q_2} = -\frac{13}{9}$

11. $i_1 = \frac{2\varepsilon}{2r + R}, \; i_2 = \frac{\varepsilon}{r/2 + R}$

$\frac{i_1}{i_2} = \frac{3}{2} \Rightarrow i_1 = \frac{3}{2} i_2$

$$\frac{2\varepsilon}{2r+R}=\frac{3}{2}\frac{\varepsilon}{\frac{r}{2}+R}$$

Solving R = 4 r

12. $\frac{1}{f}=\frac{2(\mu-1)}{R}$

$$\frac{1}{12}=\frac{2(1.5-1)}{R}=\frac{1}{R}$$

R = 12 cm

$$\frac{1}{f_w}=\frac{2[\mu_r-1]}{R}$$

$$\frac{1}{f_w}=\frac{2\left[\frac{1.5}{1.35}-1\right]}{12}=\frac{2\times0.15}{12\times1.35}$$

$f_w = 54$

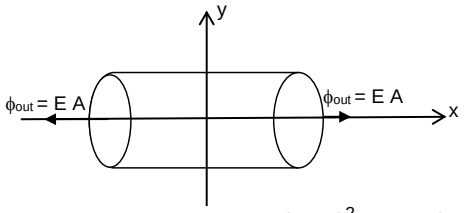
$\frac{1}{f_{eq}}=\frac{2}{54}\Rightarrow$ f_{eq} = 27 cm

13. By angular momentum conservation
कोणीय संवेगसंरक्षणसे

$$\frac{MR^2}{2}\omega=\left(\frac{MR^2}{2}+\frac{MR^2}{8}\right)\omega'$$

$$\omega'=\frac{4}{5}\omega$$

14.



$\phi_{net} = 2EA = 2 \times 200 \times \pi \times (0.05)^2 = \pi$ Volt. m

$\phi_{net} = \frac{q_{in}}{\varepsilon_0}$

so

$$q_{in}=\phi_{net}\times\varepsilon_0=\pi\times\frac{1}{4\pi\times9\times10^9}=\frac{25}{9}\times10^{-11}\,C$$

16. Current
धारा के

19. $P_1+\frac{1}{2}\rho v^2=P_2+\frac{1}{2}\rho(v+\Delta v)^2$

$$P_1-P_2+\frac{1}{2}\rho v^2\left[\left(1+\frac{\Delta v}{v}\right)^2-1\right]$$

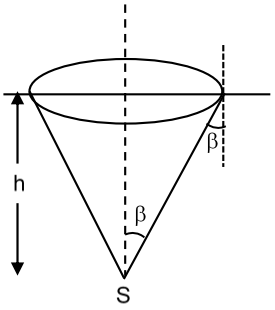
Lift force $(P_1 - P_2)$ A = mg

$$\frac{1}{2}\rho v^2\left[2\frac{\Delta v}{v}\right]A=mg\ ;\frac{\Delta v}{v}=\frac{mg}{\rho v^2A}$$

$$\frac{\Delta v}{v}\times100=\frac{mg}{\rho v^2A}\times100=\frac{5.4\times10^5\times10}{1.2\times(300)^2\times500}\%$$

= 10%

20.



$\sin\beta=\frac{3}{4}$, $\cos\beta=\frac{\sqrt{7}}{4}$

Solid angle ठोस कोण $d\Omega = 2\pi R^2 (1 - \cos\beta)$

Percentage of light प्रकाश का प्रतिशत

$$=\frac{2\pi R^2(1-\cos\beta)}{4\pi R^2}\times100$$

$$=\frac{1-\cos\beta}{2}\times100=\left(\frac{4-\sqrt{7}}{8}\right)\times100\approx17\%$$

21. The internal resistance of the cell
कोशिकाकाआंतरिकप्रतिरोध

$$r=\left(\frac{x_1}{x_2}-1\right)R=\left(\frac{3}{2.85}-1\right)19=1\ \Omega$$

22. In configuration 1 equivalent thermal resistance is $\frac{3R}{2}$

In configuration 2 equivalent thermal resistance is $\frac{R}{3}$

Thermal Resistance $\propto$ time taken by heat flow from high temperature to low temperature

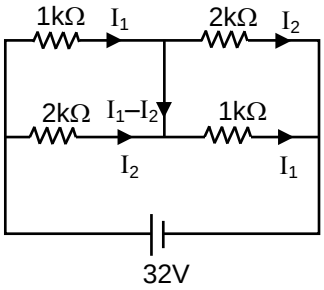
कॉन्फिगरेशन1मेंसमतुल्य तापीय प्रतिरोध है $\frac{3R}{2}$

कॉन्फिगरेशन2 मेंसमतुल्य थर्मलप्रतिरोध है $\frac{R}{3}$

थर्मलप्रतिरोध उच्चतापमानसेनिम्नतापमानतकगर्मी के प्रवाहमेंलगनेवाला$\propto$ समय

23. $\varepsilon = \dfrac{\dfrac{E_1}{r_1}+\dfrac{E_2}{r_2}}{\dfrac{1}{r_1}+\dfrac{1}{r_2}} = \dfrac{\dfrac{6}{1}+\dfrac{3}{2}}{\dfrac{1}{1}+\dfrac{1}{2}} = \dfrac{15}{3}$ = 5 volt

24. A and B are short circuited
AऔरB शॉर्टसर्किटहै



So $R_{eff} = \dfrac{4}{3}k\Omega$

$I_1 = \dfrac{32}{4/3k\Omega} = 24mA$

$\dfrac{I_1}{I_2} = \dfrac{R_2}{R_1} = \dfrac{2}{1}$

$\Rightarrow I_1 = \dfrac{2}{3}\times 24 = 16mA$

$\Rightarrow I_2 = \dfrac{1}{3}\times 24 = 8mA$

The required current is
$= I_1 - I_2$
$= 16 - 8 = 8$ mA

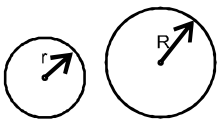
25. The equivalent resistance between A and D (of right circuit) is 4Ω.
Aतथा D के मध्य तुल्य प्रतिरोध 4Ω
Net resistance कुलप्रतिरोध = 3 + 4 + 2 = 9Ω.

Current धाराI = $\dfrac{9}{9}$ = 1 A.

This current will be divided in 8Ω between A and D and remainder 8Ω equally; so current in AB = 0.5 A. Similarly the current 0.5 A in AB is equally divided between BC and to the right mesh.
यहा धाराA तथा D के मध्य जुडेहुए 8Ωतथादुसरे8Ω के मध्य बराबरविभाजितहोजातीहै ।इसलिए AB मे धारा 0.5 A है ।इसीप्रकारAB मेंप्रवाहित धारा0.5 AभीBC बराबरविभाजितहोजातीहै ।अर्थात

$\therefore$ Current in 4 Ωमें धारा= 0.25 A.

26.



R = 4 cm.
r = 3 cm.

$P_r = \dfrac{4T}{r}$; $P_R = \dfrac{4T}{R}$

{$\because$ outside is vaccumबाहरनिर्वातहै}

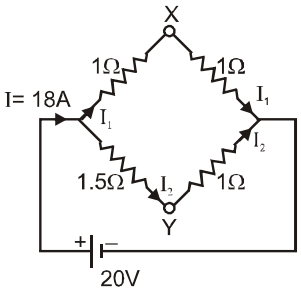
The two bubbles are coalescing; so conserving the no. of molecules inside, T_0 = Temperature.
जबदोनोबुलबुलोमिलायाजाताहैतबमोलसरंक्षणसे

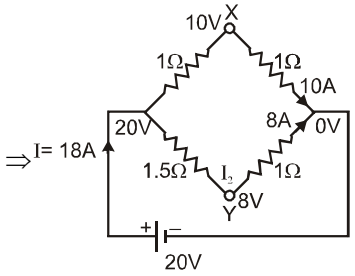
$$\frac{P_r\cdot\frac{4}{3}\pi r^3}{T_0} + \frac{P_R\cdot\frac{4}{3}\pi R^3}{T_0} = \frac{P_{final}\times\frac{4}{3}\pi(r')^3}{T_0}$$

Putting मानरखनेपर$P_{final} = \dfrac{4T}{r'}$ we get हमप्राप्तकरेगे

r' = $\sqrt{r^2+R^2}$
= $\sqrt{3^2+4^2}$ = 5 cm.

27.





$R_{eq} = \dfrac{2\times 2.5}{2+2.5} = \dfrac{10}{9}$

Net current I = $\dfrac{20}{10/9}$ = 18 Amp.

$I_1 = \dfrac{2.5}{4.5}\times 18$ = 10 Amp.

I_2 = 18 – 10 = 8 Amp.

$\Rightarrow$ $V_x - V_y = 10 - 8 = 2V$

28. $\frac{-dv}{v} = \frac{0.5}{100} = 0.005 = 0.005$

$$B = \frac{\frac{-dP}{dv}}{\frac{-dv}{v}} = \frac{pgh}{\frac{-dv}{v}}$$

$$9.8 \times 10^8 = \frac{10^3 \times 9.8 \times d}{5 \times 10^{-3}}$$

$\Rightarrow$ d = 500 m

29. $-\mu N = ma$

$0.3 \times 0.5 \times 10 = 0.5a$

$a = 3\ m/s^2$

Velocity after वेग के बाद2 sec V' = 18 – 3 × 2 = 12 m/s

Kinetic energy after गतिजऊर्जा के बाद2 sec

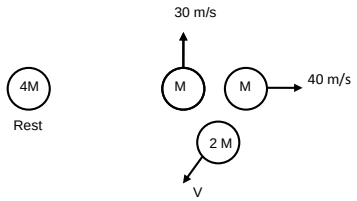
K.E. = $1/2\ mV^2 + 1/2\ I\omega^2$

$$K.E. = \frac{1}{2}mV'^2 + \frac{1}{2}\frac{mR^2}{2}\left(\frac{V'}{R}\right)^2$$

$$K.E. = \frac{1}{2}mV'^2 + \frac{1}{4}mV'^2$$

$$K.E. = \frac{1}{2} \times 0.5 \times (12)^2 + \frac{1}{4} \times 0.5 \times (12)^2 = 54J$$

30.



Applying C.O.L.M

$M(30\,\hat{j}) + M(40\,\hat{i}) = 2M\,\vec{v}$

$$\vec{v} = \frac{30\hat{j} + 40\hat{i}}{2}$$

$$= \frac{\sqrt{(32)^2 + (40)^2}}{2} = \frac{50}{2} = 25\ m/s$$

PART-B: CHEMISTRY

32. Vapour pressure in container (A) is more than that in container (B).
पात्र (A) मेवाष्पदाबपात्र (B) सेअधिकहै।

33. P–F bond length is smaller in $PF_2(CH_3)_3$ than $PF_2(CF_3)_3$
P–F बंध लम्बाई$PF_2(CF_3)_3$ की अपेक्षा$PF_2(CH_3)_3$में कम होतीहै।

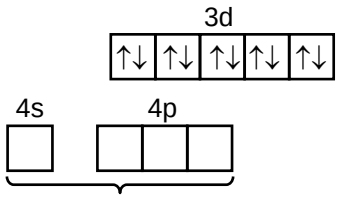
34. $[Ni(CN)_4]^{2-} \Rightarrow Ni^{2+} \Rightarrow 3d^8\ 4s^0 \Rightarrow dsp^2$
= Square planar $\Rightarrow$ diamagnetic

$[Ni(CO)_4] \Rightarrow Ni \Rightarrow 3d^8\ 4s^2 \Rightarrow 3d^{10}$ = $sp^3 \Rightarrow$ Tetrahedral $\Rightarrow$ diamagnetic

$[NiCl_4]^{2-} \Rightarrow Ni^{2+} \Rightarrow 3d^8\ 4s^0 \Rightarrow$ $sp^3 \Rightarrow$ Tetrahedral $\Rightarrow$ paramagnetic

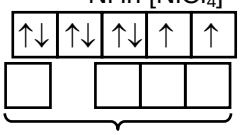
35. We have

Ni in $Ni(CO)_4$



sp^3 hybridization

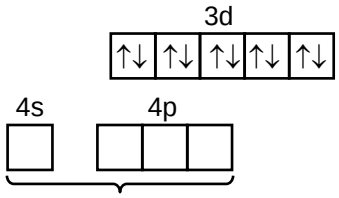
Ni in $[NiCl_4]^{2-}$



sp^3 hybridization

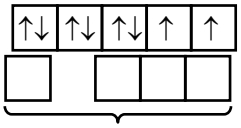
हल. हम रखते है

$Ni(CO)_4$में Ni



sp^3 संकरण

$[NiCl_4]^{2-}$में Ni



sp^3 संकरण

36. Theory based.

37. Non volatile solute is added in the solution therefore.
विलयनमेंअवाष्पशीलविलेय मिलातेहैइसलिए
V.P.↓, RLVP↑, T_f↓, ΔT_f↑, T_b↑, ΔT_b↑, π↑

38. Calculate no. of atoms of A & B per unit cell.

No. of atoms of A/ unit cell = $8 \times \frac{1}{8} = 1.$

No. of atoms of B/ unit cell = $6 \times \frac{1}{2} = 3.$

$\therefore$ Formula is AB_3 .

हल. प्रति एककोष्ठिकाA तथा B परमाणुओं की गणना।

A परमाणुओं की संख्या/एककोष्ठिका = $8 \times \frac{1}{8} = 1$.

B परमाणुओंकी संख्या/एककोष्ठिका = $6 \times \frac{1}{2} = 3$.

$\therefore$ सूत्र AB_3 हैं।

39.

P	Q	R	S
1,3,4	1,2,3,4	2,3,4	1,2,4

40.

P	Q	R	S
4	3	1	2

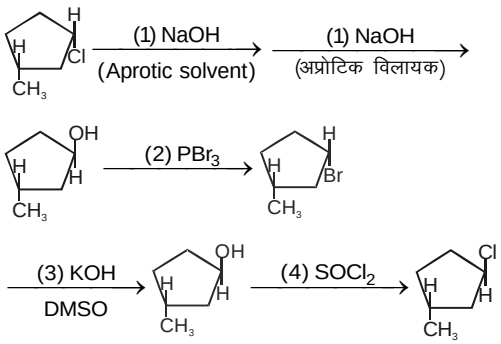
42.

a	b	c	d
Q	P	R	S

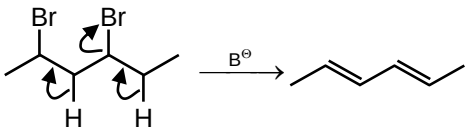
43. $H^{\oplus}$ SO_3 : CCl_2 $\overset{+}{N}O_2$ All are Electrophile.

$H^{\oplus}$ SO_3 : CCl_2 $\overset{+}{N}O_2$ सभीइलेक्ट्रॉनस्नेहीहैं।

44.

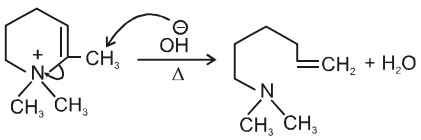


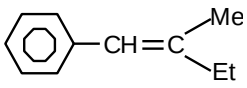
45.



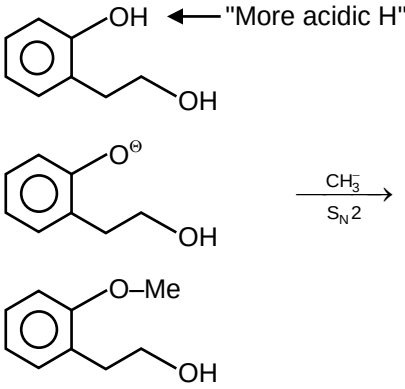
Conjugated alkene with more hyper conjugation is more stable and major product.

47.



49.  is most stable alkene due to conjugation, formed by E2 reaction.

50.



51. $[Ni(en)_3]^{2+} \Rightarrow$ 3 chelate ring

→ 2 optical isomer

→ 0 G.I.

हल. $[Ni(en)_3]^{2+} \Rightarrow$ 3 कीलेट वलय

→ 2 प्रकाशिक समावयवी

→ 0 ज्यामितिय समावयवी

52. a = Cl_2, Li_2, H_2, B_2 = 4

b = O_2, C_2 = 2

c = N_2 = 1

d = O_2, B_2 = 2

53. a = 200 pm = 200×10^{-10} cm = 2×10^{-8} cm

volume (आयतन) = $(2 \times 10^{-8})^3$

No. of atoms (परमाणुओं की संख्या)

$= \frac{Z \times A}{d \times a^3} = \frac{4 \times 100}{10 \times (2 \times 10^{-8})^3} = 5 \times 10^{24}$

54. T = 87 + 273 = 360 K

$\Pi_{Theoretical} = \frac{0.1}{2} \times \frac{1}{12} \times 360 = 1.5$ atm.

$\Pi_{observed} = 3$ atm

$\Rightarrow \quad i = \frac{3}{1.5} = 2 \Rightarrow i = \frac{M_T}{M_{ob}}$

$\Rightarrow \quad M_{observed} = \frac{M_T}{i} = \frac{24 + 2 \times 32}{2}$

= 12 + 32 = 44

हल. T = 87 + 273 = 360 K

$\Pi_{\text{सैद्धान्तिक}} = \frac{0.1}{2} \times \frac{1}{12} \times 360 = 1.5$ atm.

$\Pi_{\text{प्रेक्षित}} = 3$ atm

$\Rightarrow \quad i = \frac{3}{1.5} = 2 \Rightarrow i = \frac{M_T}{M_{ob}}$

$\Rightarrow \quad M_{\text{प्रेक्षित}} = \frac{M_T}{i} = \frac{24 + 2 \times 32}{2}$

= 12 + 32 = 44

55. $\Delta T_f = i.K_f \times m$

$0.68 = i \times 6.8 \times \frac{25.6 \times 1000}{32 \times 1000}$.

$\therefore i = \frac{1}{8}$

$\therefore$ 'i' is less than 1, therefore, 's' is associated, i.e. 8 moles of s are associated as shown below-

$\therefore$ 'i' 1से कम हैइसलिए 's' सम्बन्धितहैअर्थात् s के 8 मोलनीचेदर्शायेअनुसारसम्बन्धितहै।

$8S \rightleftharpoons S_8 \qquad \therefore S_x = S_8$

56. Alternate corners एकान्तरितकोने = 4.

Alternate edge centresएकान्तरितकिनारों के केन्द्र= 4.

$A = \frac{1}{8} \times 4 = \frac{1}{2}$

$B = \times 4 = 1$

$C = \frac{1}{8} \times 4 + \frac{1}{2} \times 2 = \frac{3}{2}$

$\Rightarrow \quad A_{\frac{1}{2}}, B, C_{\frac{3}{2}} \Rightarrow AB_2C_3$

x = 1

y = 2

z = 3 $\Rightarrow \quad x^2 + y + z = 1 + 2 + 3$

= 6.

PART-C: MATHEMATICS

61. Slope of AD = $\frac{4}{3} = \tan\theta$

$\cos\theta = \frac{3}{5}$

AD की प्रवणता= $\frac{4}{3} = \tan\theta$

$x = 4 + 5\cos\theta = 4 + 5 \times \frac{3}{5} = 7$

$\sin\theta = \frac{4}{5}$

$y = 0 + 5\sin\theta = 4$

$a = \frac{7+0}{2} = \frac{7}{2} \qquad b = \frac{4+3}{2} = \frac{7}{2}$

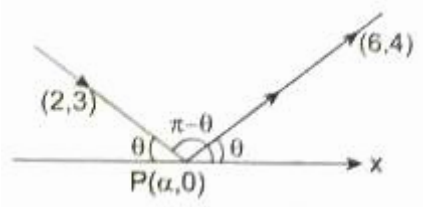
$a + b = \frac{7}{2} + \frac{7}{2} = 7$

62. Let the reflected ray make an angle θ with +ve direction of x-axis, then the incident ray makes angle $(\pi - \theta)$ with positive direction of x-axis.

मानापरावर्तितकिरणx अक्ष की धनात्मकदिशा के साथ θ कोणबनातीहैतोआपतितकिरणx अक्ष की धनात्मकदिशा के साथ $(\pi - \theta)$ कोणबनायेगी।

Now the slope of the incident ray

अबआपतितकिरण की प्रवणता



$= \frac{0-3}{\alpha - 2} = \tan(\pi - \theta)$

$\Rightarrow \tan(\pi - \theta) = \frac{0-3}{\alpha - 2}$ ...(1)

Slope of reflected ray is

परिवर्तितकिरण की प्रवणता

$\frac{4-0}{6-\alpha} = \tan\theta$ ...(2)

From (1) and (2) we get

(1) और(2) से

$\Rightarrow \alpha = \frac{26}{7}$

$\Rightarrow$ The co-ordinates of point P are $\left(\frac{26}{7},0\right)$.

$\Rightarrow$ अतः P के निर्देशांक $\left(\frac{26}{7},0\right)$ है।

63. Equation of line AB is $y + 5 = \frac{3}{2}(x-8)$

$2y + 10 = 3x - 24$

$\Rightarrow 3x - 2y - 34 = 0$ ..... (1)

let C be (h, k) then equation of AB

$hx + ky - \frac{3}{2}(x+h) + 5(y+k) - 15 = 0$

$x\left(h - \frac{3}{2}\right) + y(k+5) - \frac{3}{2}h + 5k - 15 = 0$ ..... (2)

comparing (1) and (2)

$$\frac{h-\frac{3}{2}}{3} = \frac{k+5}{-2} = \frac{\frac{-3}{2}h + 5k - 15}{-34}$$

(h, k) $\equiv \left(8, \frac{-28}{3}\right)$

$\therefore$ required radius = length of perpendicular drawn for (h, k) to line AB = $\frac{2\sqrt{13}}{3}$

64. Given circle $x^2 + y^2 - 4x - 6y + 11 = 0$

tangent at the point (3,2) is

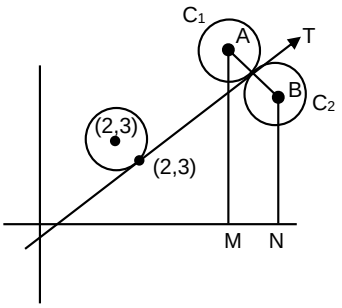
$3x + 2y - 2(x+3) - 3(y+2) + 11 = 0$

$\Rightarrow \quad x - y = 1$

On rolling the given circle $x^2 + y^2 - 4x - 6y + 11 = 0$ upwards 4 unit an the tangent T : $x - y - 1 = 0$ centre of the circle also moving upward 4 unit on T) Hence centre of new circle C_1 is $\left(2+2\sqrt{2},3+2\sqrt{2}\right)$ and radius remains same $\sqrt{2}$

$\Rightarrow C_1 : (x - 2 - 2\sqrt{2})^2 + (y - 3 - 2\sqrt{2})^2 = 2$

C_2 is imaged C_1 in T $\Rightarrow$ centre of C_2 is $\left(4+2\sqrt{2},1+2\sqrt{2}\right)$



$\Rightarrow \quad A\left(2+2\sqrt{2},3+2\sqrt{2}\right)$

$B\left(4+2\sqrt{2},1+2\sqrt{2}\right)$

Feet of perpendicular from A and B on x-axis are

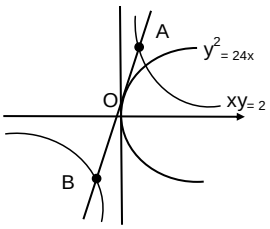
$M\left(2+2\sqrt{2},0\right)$

$N\left(4+2\sqrt{2},0\right)$

$\Rightarrow$ Area of trapezium AMNB

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

65.



$y^2 = 24x$ ..... (1)

$xy = 2$ ..... (2)

let mid-point of chord AB of $xy = 2$ be m (x_1, y_1)

$\therefore$ equation of AB be $T = S_1$

$$\frac{x(y_1) + y(x_1)}{2} - 2 = x_1y_1 - 2$$

$\Rightarrow x(y_1) + y(x_1) = 2x_1y_1$

$\Rightarrow y(x_1) = -x(y_1) + 2x_1y_1$

$\Rightarrow y = x\left(\frac{-y_1}{x_1}\right) + 2y_1$ ...(3)

$\because$ (3) is tanget to (1)

$\therefore c = \frac{a}{m} \Rightarrow 2y_1 = -\frac{6x_1}{y_1}$

$\therefore y_1^2 = -3x$

$\therefore$ locus of mid-point m (x_1, y_1) is

$y^2 = -3x$

length of latus rectum = 3

Directrix$\Rightarrow$ x = a

$x = \frac{3}{4} \Rightarrow 4x = 3$

66. Any tangent for $y^2 = 16x$ is $y = mx + \frac{4}{m}$

it is also a tangent to $x^2 + y^2 = 8$

if $\left(\frac{4}{m}\right)^2 = 8(1+m^2)$

$\frac{16}{m^2} = 8(1+m^2)$

$\Rightarrow m^4 + m^2 - 2 = 0 \Rightarrow (m^2 + 2)(m^2 - 1) = 0$

$\Rightarrow$ m = ± 1

$\therefore$ common tangent is y = x + 4

$\Rightarrow x - y + 4 = 0$

tangent to $x^2 + y^2 = 8$ is $xx_1 + yy_1 - 8 = 0$

$\therefore \frac{x_1}{1} = \frac{y_1}{-1} = \frac{-8}{4} \therefore Q(-2, 2)$

tangent to $y^2 = 16x$ is $yy_1 = 8(x + x_1)$

$8x - yy_1 + 8x_1 = 0$

$\frac{8}{1} = \frac{-y_1}{-1} = \frac{8x_1}{4}$

$y_1 = 8, x_1 = 4,$

$\therefore$ P(4, 8)

$\therefore$ distance = PQ = $\sqrt{(4+2)^2 + (8-2)^2}$

= $\sqrt{36+36} = 6\sqrt{2}$

$\therefore PQ^2 = 72$

67. If $\Delta = \nabla = \vee$

$\Rightarrow (p \to q) \vee (p \vee q)$

$\Rightarrow ((\sim p \vee q) \vee p) \vee q$

$\Rightarrow ((\sim p \vee p) \vee q) \vee q$

$\Rightarrow (t \vee q) \vee q = t \vee q = t$

68.

x_i	f_i	$d_i = x_i - 5$	$f_i d_i^2$	$f_i d_i$
2	**3**	**–3**	**27**	**-9**
3	**6**	**–2**	**24**	**-12**
4	**16**	**–1**	**16**	**–16**
5	**α**	**0**	**0**	**0**
6	**9**	**1**	**9**	**9**
7	**5**	**2**	**20**	**10**
8	**6**	**3**	**54**	**18**

$\sigma_\alpha^2 = \sigma_d^2 = \frac{\sum f_i d_i^2}{\sum f_i} - \left(\frac{\sum f_i d_i}{\sum f_i}\right)^2$

$= \frac{150}{45+\alpha} - 0 = 3$

$\Rightarrow 150 = 135 + 3\alpha$

$\Rightarrow 3\alpha = 15 \Rightarrow \alpha = 5$

69. $x^2 - x[x] - x - 3x + [x] + 3 = 0$

$x^2 - x[x] - (x - [x]) - 3(x - 1) = 0$

$x(x - [x]) - 1(x - [x]) - 3(x - 1) = 0$

$(x - 1)(x - [x]) - 3(x - 1) = 0$

$(x - 1)(x - [x] - 3) = 0$

$\Rightarrow x = 1$ as $\{x\} \neq 3$

70.

x_i	0	1	2	3
p_i	$\frac{35}{210} = \frac{1}{6}$	$\frac{105}{210} = \frac{1}{2}$	$\frac{3\times 21}{210} = \frac{3}{10}$	$\frac{7}{210} = \frac{1}{30}$

$\mu = \Sigma p_i x_i = \frac{1}{2}\times 1 + \frac{3}{10}\times 2 + \frac{1}{30}\times 3 =$

$\frac{1}{2} + \frac{3}{5} + \frac{1}{10} = \frac{5+6+1}{10} = \frac{6}{5}$

$\sigma^2 = \Sigma p_i x_i^2 - \mu^2 = \frac{1}{2} + \frac{3}{10}\times 4 + \frac{1}{30}\times 9 - \frac{36}{25} = \frac{14}{25}$

$10(\mu^2 + \sigma^2) = 10\left(\frac{36}{25} + \frac{14}{25}\right) = 20$

71. All positive or 3 positive and 2 negative or 1 positive and 4 negative

$\Rightarrow P = \left(\frac{3}{6}\right)^5 + {}^5C_2 \cdot \left(\frac{2}{6}\right)^2 \cdot \left(\frac{3}{6}\right)^3 + {}^5C_1 \cdot \left(\frac{3}{6}\right) \cdot \left(\frac{2}{6}\right)^4$

$= \frac{3^5}{6^5} + \frac{10.2^2.3^3}{6^5} + \frac{5.3.2^4}{6^5}$

$= \frac{243+1080+240}{6^5} = \frac{1563}{6^5} = \frac{521}{2592}$

72. $y = f(x) = \sin^3\left(\frac{\pi}{3}\left(\cos\left(\frac{\pi}{3\sqrt{2}}(-4x^3+5x^2+1)^{3/2}\right)\right)\right)$

$\frac{dy}{dx} = 3\sin^2\left(\frac{\pi}{3}\left(\cos\left(\frac{\pi}{3\sqrt{2}}(-4x^3+5x^2+1)^{3/2}\right)\right)\right) \times \frac{\pi}{3}$

$\left(-\sin\left(\frac{\pi}{3\sqrt{2}}\left(-4x^3+5x^2+1\right)^{\frac{3}{2}}\right)\right)$

$\left(\cos\left(\frac{\pi}{3}\cos\left(\frac{\pi}{3\sqrt{2}}\left(-4x^3+5x^2+1\right)^{\frac{3}{2}}\right)\right)\right) \times$

$\frac{\pi}{3\sqrt{2}}\left(\frac{3}{2}\left(-4x^3+5x^2+1\right)^{\frac{1}{2}}\right)(-12x^2+10x)$

at x = 1

$y = f(1) = \sin^3\left(\frac{\pi}{3}\left(\cos\left(\frac{\pi}{3\sqrt{2}}.2\sqrt{2}\right)\right)\right)$

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

$= \sin^3\left(-\frac{\pi}{6}\right) = \left(-\frac{1}{2}\right)^3 = -\frac{1}{8}$

$\left(\frac{dy}{dx}\right)_{x=1} = 3\left(-\frac{1}{2}\right)^2 \cdot \left(-\frac{\pi}{3}\right)\left(\frac{\sqrt{3}}{2}\right).\left(\frac{\sqrt{3}}{2}\right).$

$\frac{\pi}{3\sqrt{2}}\left(\frac{3}{2}\sqrt{2}\right)(-2)$

$= \frac{3}{4}.\frac{\pi}{3}.\frac{3\pi}{4} = \frac{3\pi^2}{16}$

Now (3) $2y' + 3\pi^2 y = 2\left(\frac{3\pi^2}{16}\right) + 3\pi^2\left(-\frac{1}{8}\right)$

$= \frac{3\pi^2}{8} - \frac{3\pi^2}{8} = 0$

73. for x > 0 के लिए

$\frac{\sin x}{x} < 1 \qquad \left[\frac{99\sin x}{x}\right] = 98$

similarly इसीप्रकार $\left[\frac{100x}{\sin x}\right] = 100$

$\lim_{x\to 0^+}\left[\frac{100x}{\sin x}\right] + \left[\frac{99\sin x}{x}\right] = 100+98 = 198$

for x < 0 $\left[\frac{99\sin x}{\sin x}\right] = 98$

$\left[\frac{100x}{\sin x}\right] = 100$

so इसलिए $\lim_{x\to 0^-} f(x) = 198$

74. $\cos^{-1}x > \sin^{-1}x > \tan^{-1}x$ is defined for $x \in [-1,1]$

$\cos^{-1}x > \sin^{-1}x > \tan^{-1}x$

परिभाषितहोगेंजबकि $x \in [-1,1]$;

Now अब $\cos^{-1}x > \sin^{-1}x$

$\Rightarrow \cos^{-1}x > \frac{\pi}{2} - \cos^{-1}x$

$\Rightarrow 2\cos^{-1}x > \frac{\pi}{2}$

$\Rightarrow \cos^{-1}x > \frac{\pi}{4}$

$\Rightarrow \cos^{-1}x \in \left(\frac{\pi}{4}, \pi\right]$

$\Rightarrow x \in \left[\cos\pi, \cos\frac{\pi}{4}\right)$ as $\cos^{-1}x$ is a decreasing and continuous function

$\Rightarrow x \in \left[\cos\pi, \cos\frac{\pi}{4}\right)$ जैसाकि $\cos^{-1}x$ एक सतत् एवंह्यसमानफलनहै।

$\Rightarrow x \in \left[-1, \frac{1}{\sqrt{2}}\right)$

Also from the graph given below, it is clear that $\sin^{-1}x > \tan^{-1}x$ for $x \in (0,1]$ in the domain [-1,1]

पुनः नीचेदियेगयेग्राफसे यह स्पष्टहैकिप्रान्त[–1, 1] में $x \in (0,1]$ के लिए $\sin^{-1}x > \tan^{-1}x$

75. $x \in N$ total ways = $^{100}C_1 = 100$

$x \in N$कुलक्रमचय = $^{100}C_1 = 100$

n(S) = 100

$$\frac{(x-20)(x-40)}{(x-30)} < 0$$

$\Rightarrow \quad x \in (-\infty, 20) \cup (30, 40)$

$\in$ = { 1, 2, 3,…….19, 31, 32……..39}

Required probability अभीष्टप्रायिकता

$$= \frac{28}{100} = \frac{7}{25}$$

76. f(0) = f(1) = 0 f(x) has to be continuous in [0, 1]

f(0) = f(1) = 0, [0, 1]मेंf(x) सततहै।

$$\lim_{x\to 0^+} f(x) = f(0) \Rightarrow \lim_{h\to 0} f(h) = f(0)$$

$$\Rightarrow \lim_{h\to 0} h^{\alpha} \ln h = 0$$

$$\Rightarrow \lim_{h\to 0} \frac{\ln h}{h^{-\alpha}} = 0$$

$$\Rightarrow \lim_{h\to 0} \frac{\frac{1}{h}}{-\alpha h^{-\alpha-1}} = 0$$

(By L- hospital) (L-हॉस्पीटलसे)

$$\Rightarrow \lim_{h\to 0} \frac{-h^{\alpha}}{\alpha} = 0$$

So $\alpha > 0$

77. $\left(2^{\frac{1}{2}} - 2^{\frac{1}{3}}\right)^n < \left(2^{\frac{1}{2}} - 2^{\frac{1}{3}}\right) \ldots\ldots \left(2^{\frac{1}{2}} - 2^{\frac{1}{2n-1}}\right) < \left(2^{\frac{1}{2}} - 2^{\frac{1}{2n+1}}\right)^n$

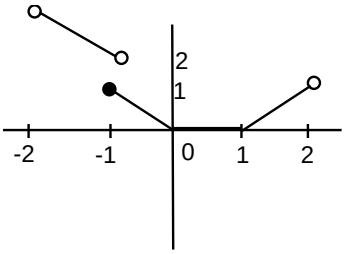
$$\Rightarrow \lim_{n\to\infty} \left(2^{\frac{1}{2}} - 2^{\frac{1}{3}}\right)^n < L < \lim_{n\to\infty} \left(2^{\frac{1}{2}} - 2^{\frac{1}{2n+1}}\right)^n$$

$\Rightarrow L = 0$

78.
$$\begin{cases} -2x & : -2 < x < -1 \\ -x & : -1 \le x < 0 \\ 0 & : 0 \le x \le 1 \\ x-1 & : 1 \le x < 2 \end{cases}$$

point of discontinuity → -1

point of non-differentiability → -1, 0, 1



79. g'(x) = f'(x) – f'(1–x)

If x > 1 – x

$\Rightarrow$ f' (x) > f' (1 – x) ∵ f'(x) is strictly increasing

$\Rightarrow$ g'(x) > 0 $\Rightarrow$ so g(x) is increasing when x > 1 – x $\Rightarrow x > \frac{1}{2}$

$\Rightarrow \alpha = \frac{1}{2}$

similarly when x < 1 – x $\Rightarrow$ g(x) is decreeing

Now

$$\tan^{-1}(2\alpha) + \tan^{-1}\left(\frac{1}{\alpha}\right) + \tan^{-1}\left(\frac{\alpha+1}{\alpha}\right)$$

$= \tan^{-1}(1) + \tan^{-1}(2) + \tan^{-1}(3) = \pi$

(∵ 1 + 2 + 3 = 1.2.3)

80. $f(x) = \left(\frac{\sqrt{3e}}{2\sin x}\right)^{\sin^2 x} : x \in \left(0, \frac{\pi}{2}\right)$

$$\Rightarrow \ell n f(x) = \sin^2 x \, \ell n\left(\frac{\sqrt{3e}}{2\sin x}\right)$$

$$\Rightarrow \ell n f(x) = \sin^2 x \left[\ell n\sqrt{3e} - \ell n(2\sin x)\right]$$

$$\Rightarrow \frac{f'(x)}{f(x)} = \sin 2x\left[\ell n\sqrt{3e} - \ell n(2\sin x)\right] + \sin^2 x(0 - \cot x)$$

$$\Rightarrow f'(x) = f(x)[\sin 2x[\ell n\sqrt{3e} - \ell n(2\sin x)) - \sin x\cos x]$$

$$= \sin 2x.f(x)\left(\ell n\sqrt{3e} - \ell n(2\sin x) - \frac{1}{2}\right)$$

$f'(x) = 0 \Rightarrow \ell n\left(\frac{\sqrt{3e}}{2\sin x}\right) = \frac{1}{2}$

$\Rightarrow \frac{\sqrt{3e}}{2\sin x} = \sqrt{e} \Rightarrow \sin x = \frac{\sqrt{3}}{2} \Rightarrow x = 60°$

Local maximum at $x = \frac{\pi}{3}$

$f\left(\frac{\pi}{3}\right) = \left(\frac{\sqrt{3e}}{\sqrt{3}}\right)^{\frac{3}{4}} = (e)^{3/8} = \frac{k}{e} \Rightarrow k = e^{11/8}$

Hence

$\left(\frac{k}{e}\right)^8 + \frac{k^8}{e^5} + k^8 = k^8\left(\frac{1+e^3+e^8}{e^8}\right) = e^{11}\left(\frac{1+e^3+e^8}{e^8}\right)$

$= e^3 + e^6 + e^{11}$

81. $y = \frac{60-3x}{4}$

(1 , 1), (1 , 2) , ……(1 , 14) $\rightarrow 14$

(2 , 2), (2 , 4) , ……(2 , 12) $\rightarrow 6$

(3 , 3), (3 , 6) , ……(3 , 12) $\rightarrow 4$

(4 , 4), (4 , 8) , …… $\rightarrow 2$

(5 , 5), (5 , 10) , …… $\rightarrow 2$

(6 , 6), (7 , 7) , (8 , 8) ……$\rightarrow 3$

Total number of points lying inside the triangle = 31

82.

A	B	A + B
$\bar{x}_1 = 40$	$\bar{x}_2 = 55$	$\bar{x} = 50$
$\sigma_1 = \alpha$	$\sigma_2 = 30 - \alpha$	$\sigma_2 = 350$
$n_1 = 100$	$n_2 = n$	$100 + n$

$\bar{x} = \frac{100\times 40 + 55n}{100+n} = 50$

$\Rightarrow n = 200$

$\sigma_1^2 = \frac{\sum x_i^2}{100} - 40^2 = \alpha^2$

$\sigma_2^2 = \frac{\sum y_i^2}{200} - 55^2 = (30-\alpha)^2$

$\sigma^2 = \frac{\sum x_i^2 + \sum y_i^2}{300} - 50^2 = 350^2$

$= \frac{\left(1600+\alpha^2\right)\times 100 + \left[3025+(30-\alpha)^2\right]\times 200}{300} - 50^2$

on solving $\alpha^2 - 40\alpha + 300 = 0$

$\Rightarrow \alpha = 10$ or 30

$\alpha = 30$ is not possible

$\sigma_1^2 + \sigma_2^2 = 10^2 + 20^2 = 500$

83. $\tan^{-1}\left(\frac{2x}{1-x^2}\right) + \cot^{-1}\left(\frac{1-x^2}{2x}\right) = \frac{\pi}{3}$

($x = \tan\theta \Rightarrow \tan^{-1}x = \theta$)

$\left(\frac{-\pi}{4} \le \theta \le \frac{\pi}{4}\right)$

$\tan^{-1}(\tan 2\theta) + \cot^{-1}(\cot 2\theta) = \frac{\pi}{3}$

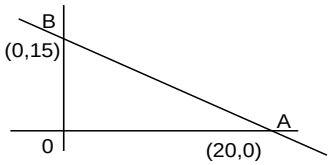
…..(i) $(-\pi/2 < 2\theta < \pi/2)$

Case-I: $0 < 2\theta < \frac{\pi}{2}$

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

$\theta = \frac{\pi}{12}$

$\tan^{-1}x = \frac{\pi}{12}$



$x = \tan\frac{\pi}{12}$

Case-II : $-\frac{\pi}{2} < 2\theta < 0$

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

$4\theta = -\frac{2\pi}{3}$

$\theta = -\frac{\pi}{6}$

$x = \tan\left(-\frac{\pi}{6}\right)$

Sum $= \tan\left(\frac{\pi}{12}\right) - \tan\left(\frac{\pi}{6}\right)$

$= \left(2-\sqrt{3}\right) - \frac{1}{\sqrt{3}} = \frac{2\sqrt{3}-3-1}{\sqrt{3}}$

$= \left(2-\frac{4}{\sqrt{3}}\right)$

$\therefore \alpha = 2$

84. **Case I**

f(1) has only 1 element in {1}, {2} ,{3}, {4}, {5}, {6}

f(2) has 2 elements in which 1 is same as f(1)

and so on

${}^6C_1 \, {}^5C_1 \, . \, {}^4C_1 \, {}^3C_1 \, . \, {}^2C_1 . 1 = 720$

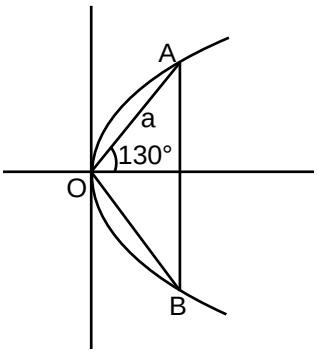
Case II

$f(1) = \phi$

f(2)	f(3)	f(4)	f(5)	f(6)	
1	2	3	4	5	
		${}^6C_1 \, {}^5C_1 \, . \, {}^4C_1 \, {}^3C_1 \, . \, {}^2C_1 = 720$			
1	2	3	4	6	
		${}^6C_1 \, {}^5C_1 \, . \, {}^4C_1 \, {}^3C_1 \, . \, {}^1C_1 = 360$			
1	2	3	5	6	4×360
1	2	4	5	6	
1	3	4	5	6	
2	3	4	5	6	

Total $720 + 720 + 360 + 4 \times 360 = 3240$

85.



Probability $= \frac{\frac{1}{3}\cdot\frac{\lambda}{10}}{\frac{1}{3}\cdot\frac{4}{10}+\frac{1}{3}\cdot\frac{5}{10}+\frac{1}{3}\cdot\frac{\lambda}{10}} = 0.4$

$\Rightarrow \frac{\lambda}{9+\lambda} = \frac{2}{5} \Rightarrow 5\lambda = 18 + 2\lambda$

$\Rightarrow \lambda = 6$

Parabola $y^2 = 6x$

Let side length of triangle be a

$\Rightarrow$ A (acos 30°, a Sin 30°) lies on $y^2 = 6x$

$\Rightarrow \left(\frac{a}{2}\right)^2 = 6\left(\frac{\sqrt{3}a}{2}\right) \Rightarrow \frac{a}{4} = 3\sqrt{3}$

$\Rightarrow a = 12\sqrt{3}$

$\Rightarrow a^2 = 432$

86. $|x - y| < a \Rightarrow -a < x - y < a$

$\Rightarrow \quad x - y < a$ and $x - y > -a$

$P(A) = \frac{ar(OACDEG)}{(OBDF)}$

$= \frac{ar(OBDF) - ar(ABC) - ar(EFG)}{ar(OBDF)}$

$\Rightarrow \frac{11}{36} = \frac{(60)^2 - \frac{1}{2}(60-a)^2 - \frac{1}{2}(60-a)^2}{3600}$

$\Rightarrow \quad 1100 = 3600 - (60 - a)^2$

$\Rightarrow \quad (60 - a)^2 = 2500 \Rightarrow 60 - a = 50$

$\Rightarrow \quad a = 10$

87. Note that g is discontinuous at x = 1, also

$f'(x) = e^{(x-1)} - 2ax$

$f'(1) = 1 - 2a = 2 \Rightarrow \boxed{a = -\frac{1}{2}}$

now, $h(x) = f(x) \cdot g(x)$

for h(x) to be continuous, f(1) = 0

hence $1 - a + b = 0 \quad \Rightarrow \quad a - b = 1$

$\Rightarrow \quad |a + b| = |-2| = 2$

हल. g, x = 1 परअसततहैतथा$f'(x) = e^{(x-1)} - 2ax$

$f'(1) = 1 - 2a = 2 \Rightarrow \boxed{a = -\frac{1}{2}}$

अब, $h(x) = f(x) \cdot g(x)$

h(x) के लिए सतत् हैf(1) = 0

अतः $1 - a + b = 0 \quad \Rightarrow \quad a - b = 1$

$\Rightarrow \quad |a + b| = |-2| = 2$

88. $f(x) = a + [13 \sin x]$

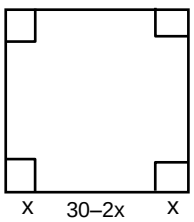
$\because$ $a \in I$ and $x \in (0, \pi)$

$\because$ total number of points of non-differentiability of $[p \sin x] = 2p - 1$ here

p = 13

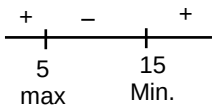
$\therefore$ total number of points of non-differentiability of [13 sinx] = 25

89.



$V = (30-2x)^2 x$

$\frac{dV}{dx} = (2x-30)(6x-30)$



Now

$T.S.A = (30-2x)^2 + 4x(30-2x)$

$= 400 + 400 = 800 cm^2$

90. Radius of circum circle of ΔPAB

$= \frac{1}{2}\sqrt{49+81} = \frac{1}{2}\sqrt{130} = \sqrt{\frac{65}{2}}$

$\Rightarrow$ Radius of director circle = $\sqrt{65}$

हल. ΔPAB के परिगत वृत्त की त्रिज्या

$= \frac{1}{2}\sqrt{49+81} = \frac{1}{2}\sqrt{130} = \sqrt{\frac{65}{2}}$

$\Rightarrow$नियामक वृत्त की त्रिज्या = $\sqrt{65}$

---- TEXT SOLUTIONS (TS) END ----

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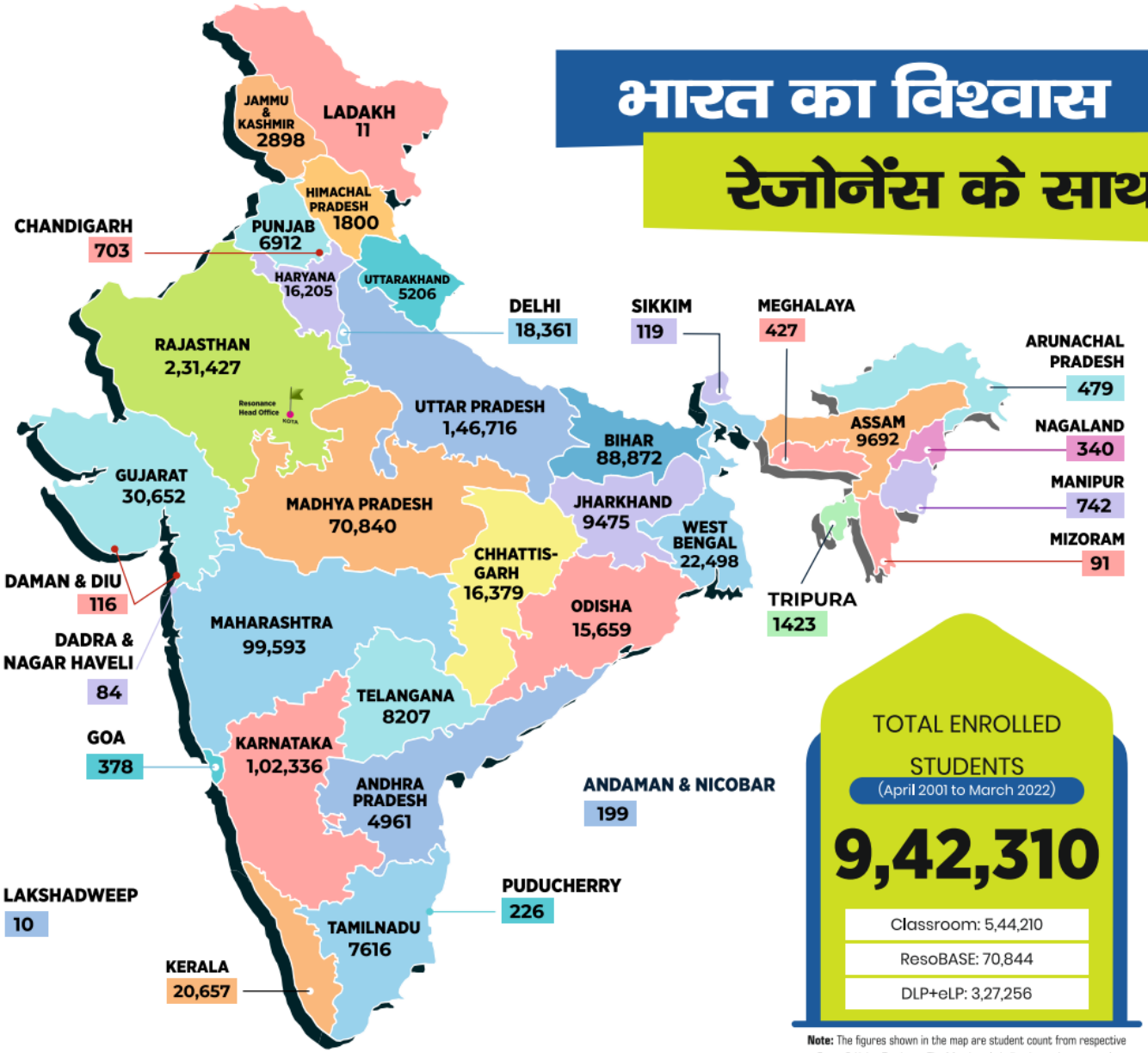

TOTAL ENROLLED STUDENTS
(April 2001 to March 2022)

9,42,310

Classroom: 5,44,210
ResoBASE: 70,844
DLP+eLP: 3,27,256

Note: The figures shown in the map are student count from respective State & Union Territory. The Map is only indicative and not to scale

Resonance : The Legacy of 21 Years (2001-2022) of Academic Excellence

- **JEE (Adv.) / IIT-JEE** ▸ **50 हजार +** SELECTIONS SINCE 2002
  229 AIRs in TOP-100 (Classroom + DLP)
- **JEE (Main) / AIEEE** ▸ **2.40 लाख+** SELECTIONS SINCE 2009
  136 AIRs in TOP-100 (Classroom + DLP)
- **NEET (UG) / AIPMT** ▸ **19 हजार+** SELECTIONS SINCE 2012
  19 AIRs in TOP-100 (Classroom + DLP)

- **NTSE** SINCE 2006 ▸ **2440** Scholars
- **KVPY** SINCE 2006 ▸ **2859** Fellowship Winners
- **OLYMPIADS** SINCE 2006 ▸ **52** Medalists (Gold/Silver/ Bronze) in International Olympiads
- **CA & CS** SINCE 2013 ▸ **4179** Selections — 5 Times AIR-1 in CA & CS Exams
- **CLAT, SET & GPTU** SINCE 2014 ▸ **77** Selections — AIR-1 in GPTU