All India Aakash Test Series for JEE (Main)-2022

TEST - 5 - Code-A

Test Date : 10/04/2022

ANSWERS

PHYSICS

1. (3)
2. (2)
3. (1)
4. (4)
5. (4)
6. (4)
7. (1)
8. (3)
9. (2)
10. (1)
11. (1)
12. (1)
13. (2)
14. (1)
15. (4)
16. (4)
17. (3)
18. (3)
19 (2)
20. (1)
21. (02.50)
22 (06.00)
23. (00.30)
24 (02.50)
25. (01.20)
26 (05.00)
27 (31.25)
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30. (01.00)

CHEMISTRY

31. (2)
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MATHEMATICS

61. (4)
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PART - A (PHYSICS)

1. Answer (3)

Hint : $U = \frac{1}{2}Li^2$

Sol. : $u = \frac{V^2L}{2R^2}\left(1-e^{t/\tau}\right)^2$

For $t = 0, u = 0$

And $t = \infty,\ u = \frac{V^2L}{2R^2}$

2. Answer (2)

Hint : $N = N_0\ e^{-\lambda t}$

Sol. : $N = N_0\ e^{-\lambda t}$

$t_{\text{mean}} = \frac{1}{\lambda}$

So $\frac{N}{N_0} = \frac{1}{e}$

3. Answer (1)

Hint & Sol. : Net capacitance of the circuit is $2C$

So charge flown from cell is $2CE$

So charge on Q is $2CE$

This charge is divided in $3C$ and $6C$ in the ratio of 1 : 2 so charge on P is $\frac{2CE}{3}$

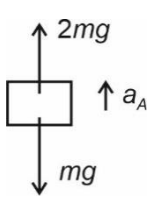
4. Answer (4)

Hint : Spring force will not charge

Sol. : Tension in upper spring is $2mg$ so

$2mg - mg = ma_A$

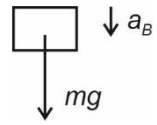
$a_A = g$



Tension in lower spring is 0, so

$mg = ma_B$

$a_B = g$



5. Answer (4)

Hint : Use $C = C_V + \frac{R}{1-n}$

Sol. : $\frac{P}{V^2} = \text{constant}$

$\frac{T}{V^3} = \text{constant}\quad \left(P = \frac{nRT}{V}\right)$

$\frac{T_1}{V_1^3} = \frac{T_2}{V_2^3}$

$\left(\frac{V_2}{V_1}\right)^3 = \frac{T_2}{T_0}$

$\Rightarrow \quad T_2 = 8T_0$

and $C = \frac{3}{2}R + \frac{R}{1-(2)} = \frac{11R}{6}$

So $Q = 1\times\frac{11R}{6}\times(8T_0 - T_0)$

$= \frac{77RT_0}{6}$

6. Answer (4)

Hint : $V = \frac{dy}{dt}$

Sol. : $\frac{2\pi}{T} = 2$

$T = \pi$

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

$\frac{dy}{dt} = 20\cos\left(2t + \frac{\pi}{3}\right)$

$= 20\cos\left(2\times\frac{\pi}{4} + \frac{\pi}{3}\right)$

$$= -20\frac{\sqrt{3}}{2} = -10\sqrt{3}$$

So $\left|\frac{dy}{dt}\right| = 10\sqrt{3}$

7. Answer (1)

Hint & Sol. : Let the mass of moon is m then the mass of earth is 1000 m. If the distance of moon from COM is d_m and that of from earth is d_e then

$$\frac{m d_m - M d_e}{m + M} = 0$$

So $\frac{d_m}{d_e} = \frac{M}{m} = 1000$

8. Answer (3)

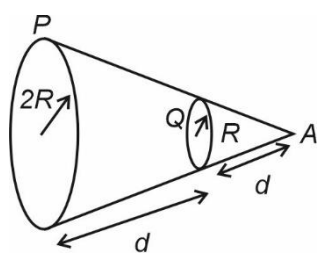
Hint : Using Kirchhoff's law

Sol. : Using Kirchhoff's law current in the circuit is i = 1 amp. Using Kirchhoff's law from A to B $V_A - V_B = 0$

9. Answer (2)

Hint : Use formula of potential due to ring on its axis

Sol. : Potential by rings



$$V_P = \frac{kq}{((2R)^2 + (2d)^2)^{1/2}}$$

$$= \frac{kq}{2(R^2 + d^2)^{1/2}}$$

$$V_Q = \frac{kq}{(R^2 + d^2)^{1/2}}$$

So $\frac{V_P}{V_Q} = \frac{1}{2}$

10. Answer (1)

Hint : Use escape speed = $\sqrt{\frac{2GM}{R}}$

Sol. : $\sqrt{\frac{2GM}{R}} = 20$ km/sec

$\frac{GM}{R} = 200\ \text{km}^2/\text{sec}^2$

$v_0 = \sqrt{\frac{GM}{8R}}$

$= \sqrt{\frac{200}{8}}$ = 5 km/sec

11. Answer (1)

Hint : $V_C^2 + V_R^2 = v_0^2$

Sol. : $V_C^2 + V_R^2 = v_0^2$

so $V_C = 120$ V

12. Answer (1)

Hint : $\frac{d\theta}{dt} = kA\frac{\Delta T}{l}$

Sol. : $\frac{d\theta}{dt} = kA\frac{\Delta T}{l}$

or $\frac{l_1}{l_2} = \frac{K_1 \Delta T_1}{K_2 \Delta T_2} = \frac{2k \times 100}{k60} = \frac{10}{3}$

13. Answer (2)

Hint : $P = P_0 + \rho g h$

Sol. : $0.75\rho g$ = 1 atm

$P_0 + 1 \times \cos 53 \rho g$ = 1 atm

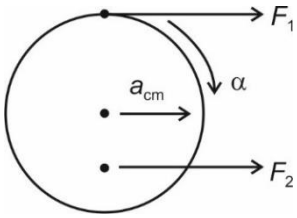
$P_0 + \frac{3 \times 4}{5 \times 3} \times 1\,\text{atm} = 1\,\text{atm}$

$P_0 = \frac{1}{5} \times 1\,\text{atm} = 2 \times 10^4$ Pa

14. Answer (1)

Hint : For pure rolling $a_{cm} = \alpha R$

Sol. : Let disc is moving with acceleration a_{cm} and angular acceleration α as shown.



So

$$F_1 + F_2 = ma_{cm} \quad \ldots(1)$$

$$RF_1 - \frac{R}{2}F_2 = \frac{mR^2}{2}\alpha$$

or $\quad 2F_1 - F_2 = ma_{cm} \quad \ldots(2)$

So $\quad F_1 + F_2 = 2F_1 - F_2$

$$\Rightarrow \quad \frac{F_1}{F_2} = 2$$

15. Answer (4)

Hint : $h = \dfrac{2S\cos\theta}{r\rho g}$

Sol. : $h = \dfrac{2S\cos\theta}{r\rho g}$

So $\quad \dfrac{h_1}{h_2} = \dfrac{\cos\theta_1 r_2}{\cos\theta_2 r_1} = \dfrac{\cos 0\ 2r}{\cos 60\ r}$

$$\frac{h}{h'} = 4$$

$$h' = \frac{h}{4}$$

16. Answer (4)

Hint : For 1st minima

$b\sin\theta_1 = \lambda_0$

Sol. : For 1st minima

$b\sin\theta_1 = \lambda_0$

or $\sin\theta_1 = \dfrac{\lambda_0}{b}$

For 1st maxima

$$b\sin\theta_1 = \frac{3\lambda}{2}$$

$$\sin\theta_2 = \frac{3\lambda}{2b}$$

Given $\sin\theta_1 = \sin\theta_2$

$$\frac{3\lambda}{2b} = \frac{\lambda_0}{b}$$

$$\lambda = \frac{2\lambda_0}{3} = 500\text{ nm}$$

17. Answer (3)

Hint : $\phi = EA$

Sol. : $\phi = EA$

$$= \frac{FA}{Q}$$

$$= \frac{FA}{it}$$

$$= \frac{[MLT^{-2}][L^2]}{[A][T]}$$

$$= [ML^3T^{-3}A^{-1}]$$

18. Answer (3)

Hint : $\omega = \dfrac{v}{r}$

Sol. : $\quad r \propto \dfrac{n^2}{Z}$

$$\nu \propto \frac{Z}{n}$$

So $\quad \omega = \dfrac{v}{r}$

$$\therefore \quad \omega \propto \frac{Z^2}{n^3}$$

19. Answer (2)

Hint : $\mu = \dfrac{C}{V}$

Sol. : $t = \dfrac{\mu\omega}{C}$

$$= \frac{1.5 \times 2}{3 \times 10^8} = 10\text{ nsec}$$

20. Answer (1)

Hint : $\phi = BA$

Sol. : $B = \mu_0 ni$

$\Rightarrow \quad n = \dfrac{B}{\mu_0 i}$

and $\quad NB_0\pi r^2 = \dfrac{N}{l} B_0 \pi r^2 l$

$= nB_0V$

$= \dfrac{B_0^2 V}{\mu_0 i}$

21. Answer (02.50)

Hint : $q = \dfrac{\text{Flux swept}}{\text{Resistance}}$

Sol. : $q = \dfrac{\text{Flux swept}}{\text{Resistance}} = \dfrac{BA}{R}$

$= \dfrac{1 \times 1 \times 5}{2}$ = 2.5 C

22. Answer (06.00)

Hint : Two principle axis for two lens

Sol. : Position of final image $= \dfrac{1}{v} - \dfrac{1}{-30} = \dfrac{1}{20}$

$v = 60$ cm

So magnification $m = \dfrac{v}{u} = -\dfrac{60}{30} = -2$

So distance between image = (2 + 2 + 2) mm

= 6 mm

23. Answer (00.30)

Hint : $R = \rho \dfrac{l}{a}$

Sol. : Resistance of inner rod $R_1 = \dfrac{3\rho l}{a^2}$

Resistance of outer rod $R_2 = \dfrac{\rho l}{3a^2}$

Both are in parallel so $R_{\text{net}} = \dfrac{R_1 R_2}{R_1 + R_2}$

$= 0.3 \dfrac{\rho l}{a^2}$

24. Answer (02.50)

Hint : $F = q(\vec{V} \cdot \vec{B}) + q\vec{E}$

Sol. : $B = \dfrac{E}{v}$

$= \dfrac{12.5 \times 10^3}{5000}$

= 2.5 Tesla

25. Answer (01.20)

Hint : $\dfrac{f}{f_0} = \dfrac{v + v_w + v_b}{v + v_w - v_s}$

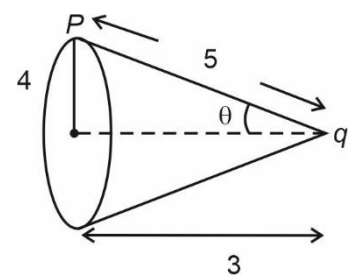
Sol. : $\dfrac{f}{f_0} = \dfrac{v + v_w + v_b}{v + v_w - v_s} = \dfrac{300 + 20 + 40}{300 + 20 - 20}$ = 1.2

26. Answer (05.00)

Hint : Use Gauss' law

Sol. : $\phi = \dfrac{q}{2\varepsilon_0}(1 - \cos\theta)$

$= \dfrac{q}{2\varepsilon_0}\left(1 - \dfrac{3}{5}\right) = \dfrac{q}{5\varepsilon_0}$



27. Answer (31.25)

Hint : $i = ne\,A\,v_d$

Sol. : $i = ne\,A\,vd$

or $\quad \dfrac{i}{A} = J = ne\,v_d$

so $\quad n = \dfrac{J}{ev_d}$

$= \dfrac{0.5}{1.6 \times 10^{-19} \times 2 \times 10^{-2}}$

$= 31.25 \times 10^{19}$

28. Answer (16.00)

Hint : $\vec{v}_{I/O} = 2\vec{v}_{m/o}$

Sol. : Speed of image w.r.t. person

= 2 × speed of mirror w.r.t. person

= 2 × 8 = 16 m/sec

29. Answer (07.55)

Hint : Reading = M.S.R. + V.S.R(L.C.)

Sol. : Least count $= 1 - \frac{\text{MSD}}{\text{VSD}} = 1 - \frac{19}{20} = \frac{1}{20}$ mm

So reading $= 7 + 11 \times \frac{1}{20}$ mm = 7.55 mm

30. Answer (01.00)

Hint : $C = C_V + \frac{R}{1-n}$

Sol. : $\frac{Q}{U} = \frac{C}{C_V} = \frac{4}{3}$

$C = \frac{4}{3}C_V = \frac{4}{3} \times \frac{3}{2}R = 2R$

and $C = C_V + \frac{R}{1-n}$ for gas following process PV^n = constant

$2R = \frac{3}{2}R + \frac{R}{1-n}$

$\frac{1}{1-n} = \frac{1}{2}$

$\Rightarrow n = -1$

So $m = 1$

PART – B (CHEMISTRY)

31. Answer (2)

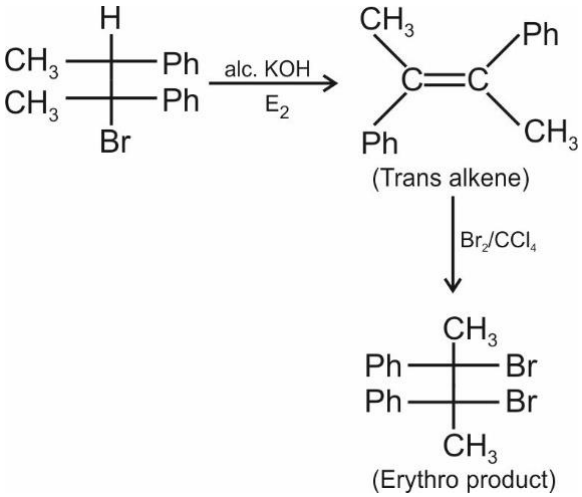
Hint : Tritium is radioactive in nature

Sol. : Tritium will emit low energy β^- particle and has a half life of 12.33 yrs.

32. Answer (3)

Hint : Reaction with alc. KOH is an example of E_2 mechanism

Sol. :



33. Answer (4)

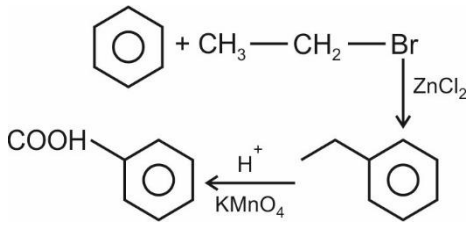
Hint & Sol. : Pyridoxine (Vit - B_2) $\rightarrow$ Convulsions

Option (4) is correct

34. Answer (1)

Hint : Hot acidic $KMnO_4$ will oxidise the Ph — CH_2 — CH_3 into Ph — COOH

Sol. :



35. Answer (4)

Hint : Tl has more I.P. than Al, Ga

Sol. : Correct order is – B > Tl > Ga > Al > In

36. Answer (3)

Hint : $[Cr(NH_3)_6]^{3+}$ cannot show optical isomerism

Sol. : Cis form of $[Co(en)_2Cl_2]^+$ can show optical isomerism.

37. Answer (2)

Hint : Aromatic aldehydes do not respond to Fehling's test.

Sol. : Benzaldehyde does not respond to both of the test.

38. Answer (2)

Hint :

$$P_4 + 20HNO_3 \rightarrow 4H_3PO_4 + 20NO_2\uparrow + 4H_2O$$

Sol. : m. moles of NaOH = 3 × m. moles of H_3PO_4

$\therefore$ mili moles of

$H_3PO_4 = \frac{200 \times 0.1}{3} = \frac{20}{3}$ mili mole

$\therefore$ mili moles of $HNO_3 = \frac{20}{4} \times \frac{20}{3}$ = 33.33 ml

39. Answer (3)

Hint : Benzene sulphonyl chloride is Hinsberg reagent

Sol. : Used to detect 1º/2º/3º Amines

40. Answer (1)

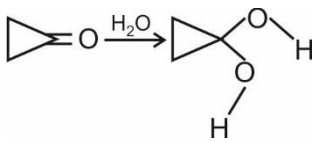
Hint : Al_2O_3 is amphoteric oxide

Sol. : Cl_2O_7 – Acidic

K_2O – Basic

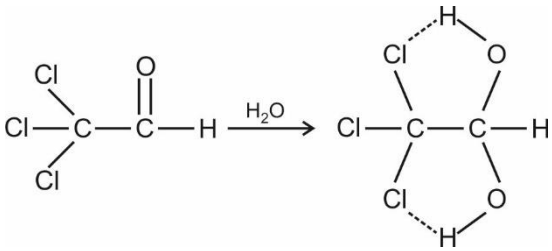
41. Answer (4)

Hint :



(Release in angle strain, so stable hydrate)

Sol. :

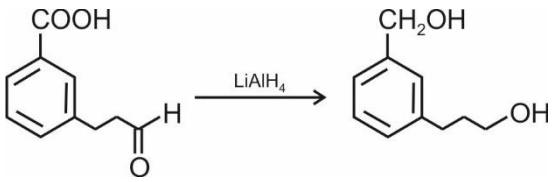


(Because of H-bonding with Cl atom hydrate is stable)

42. Answer (1)

Hint : $LiAlH_4$ reduces Aldehyde and Acid to alcohol.

Sol. :



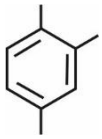
43. Answer (3)

Hint : Only three 'CO' molecules acting as the bridging ligand and there is only one metal-metal 'δ' bond.

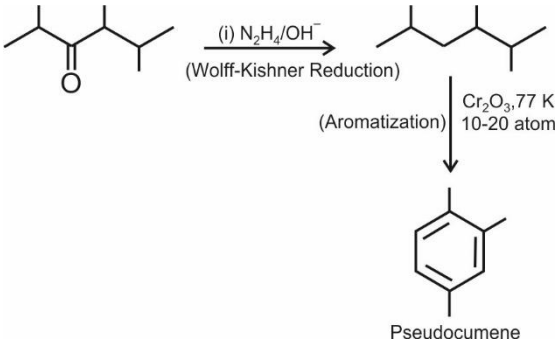
Sol. : EAN value = $\frac{26 \times 2 + 9 \times 2 + 2}{2} = 36$

$\therefore$ Complex follows the EAN rule

44. Answer (3)

Hint : Pseudocumene is 

Sol. :



45. Answer (1)

Hint : SF_4-See-Saw shape

Sol. : PCl_3 has trigonal pyramidal shape

46. Answer (1)

Hint : Initially $\frac{X_A}{X_B} = 1$

Sol. : $\frac{(X_A)_f}{(X_B)_f} = \left(\frac{P_A^o}{P_B^o}\right)^4 \times \frac{(X_A)_i}{(X_B)_i}$

$= 2^4 \times 1$

$= 16$

47. Answer (4)

Hint : Siderite is the mineral of iron

Sol. : Calamine is the carbonate of zinc metal.

48. Answer (3)

Hint : Gum, Sb_2S_3 and congo red sols are negatively charged

Sol. : Basic dye stuff is positively charged sol.

49. Answer (3)

Hint : KO_2 is paramagnetic

Sol. : $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$

$CaH_2 + H_2O \longrightarrow Ca(OH)_2 + H_2$

(Hydrolith)

50. Answer (2)

Hint : Barbiturates are tranquilizers

Sol. : Novestrol is antifertility drug

51. Answer (13.80)

Hint : $\log(k) = \log(A) - \frac{E_a}{2.3 \times R} \times \frac{1}{T}$

Sol. : On comparing with above equation:

$\frac{E_a}{2.3 \times R} = 3000$

$\therefore E_a = 3000 \times 2.3 \times 2$

$= 13.8$ kcal

52. Answer (53.00)

Hint : $E_{cell} = E_{cell}^o - \frac{0.0591}{n} \log \frac{[P]}{[R]}$

Sol. :

$E_{cell} = 0.0 - (-0.44) - \frac{0.0591}{2} \log \frac{[Fe^{2+}]}{[H^+]^2}$

$E_{cell} = 0.44 + 0.9 = 0.53$

$= 53 \times 10^{-2}$

$y = 53$

53. Answer (40.00)

Hint : $\Delta T_f = T_f^o - T_f = i \times K_f \times m$

ΔT_f = Depression in freezing point

Sol. :

(molality) $m = \frac{\frac{12.25}{122.5}}{\frac{500}{1000}} = 0.2$

$\alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{1.4 \times 10^{-3}}{0.2}} = 8 \times 10^{-2}$

$= 0.083$

$i = 1 + \alpha$

$i = 1 + 0.083 = 1.083$

$\Delta T_f = 1.083 \times 1.86 \times 0.2$

$= 0.402$

$= 40 \times 10^{-2}$

$\Rightarrow \quad x = 40$

54. Answer (17.00)

Hint : $C_2H_4 + H_2 \longrightarrow C_2H_6$

Sol. :

$\Delta H_r = -\left[\Delta H_{C-C}^{B.E} + 6 \times \Delta H_{C-H}^{B.E}\right] + \left[\Delta H_{H-H}^{B.E} + \Delta H_{C=C}^{B.E} + 4 \times \Delta H_{C-H}^{B.E}\right]$

$\Delta H_r = -350 - 6 \times 410 + 400 + 600 + 4 \times 410$

$\Delta H_r = -170$ kJ / mol

$\left|\Delta H_{hydrogenation}\right| = +170$ kJ / mol $= 10X$, $X = 17$

55. Answer (02.00)

Hint : $\Delta p_x . \Delta x = \frac{h}{4\pi}$

Sol. : $\Delta x = \frac{h}{4\pi \times m \times \Delta v}$

$$\Delta x = \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 10^{-6} \times 4 \times 10^{-20} \times 6 \times 10^{-3}}$$

$$= 2.2 \times 10^{-7} m$$

$$\therefore\ x = 2.2 \simeq 2$$

56. Answer (04.00)

Hint : Octahedral void formed by the combination of two triangular void

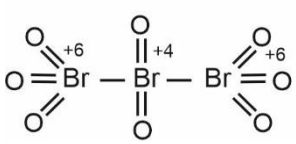
Sol. : In Antifluorite structure, the formula unit is 4. So, effective octahedral void = 4

57. Answer (02.00)

Hint : Br has +6 and +4 O.S. in Br_3O_8

Sol. :

Br_3O_8



| 6 – 4| = 2

58. Answer (02.00)

Hint : en is a bidentate ligand

Sol. : $[Cr(en)_3]^{3+}$ has 2 optically active isomers

59. Answer (73.00)

Hint : $\ln\left(\frac{K_2}{K_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

Sol. : $\ln(4) = \frac{E_a}{R}\left(\frac{1}{300} - \frac{1}{315}\right)$

$$E_a = \frac{\ln(4) \times 8.314 \times 300 \times 315}{15}$$

$$E_a = 72611\ J/mol$$

$$= 72.6\ kJ/mol$$

$$\simeq 73\ kJ/mol$$

60. Answer (09.00)

Hint & Sol. :

HA	+	NaOH	$\rightleftharpoons$	NaA	+	H_2O
0.2 M		0.2 M				
50 mL		50 mL				
10		10		–		–
–		–		10		

[NaA] $= \frac{10}{100} = 0.1$

S.B + W.A

$$pH = 7 + \frac{1}{2}(pK_a + \log c)$$

$$pH = 9$$

PART - C (MATHEMATICS)

61. Answer (4)

Hint : Number of subsets of $A = 2^{10} = 1024$

Sol. : Number of subsets of $A = 2^{10} = 1024$

Number of subsets of the set {4, 5, 6, 7, 8, 9, 10} $= 2^7$

Required number of subsets = 1024 – 128

= 896

62. Answer (2)

Hint : For $1^3 \le x < 2^3$, $[\sqrt[3]{x}] = 1$

Sol. : For $1^3 \le x < 2^3$, $[\sqrt[3]{x}] = 1$

For $2^3 \le x < 3^3$, $[\sqrt[3]{x}] = 2$

For $3^3 \le x < 4^3$, $[\sqrt[3]{x}] = 3$

For $4^3 \le x < 5^3$, $[\sqrt[3]{x}] = 4$

$\therefore \quad [\sqrt[3]{1}]+[\sqrt[3]{2}]+[\sqrt[3]{3}]+[\sqrt[3]{4}]+\ldots[\sqrt[3]{124}]$

$= (2^3 - 1^3)1 + (3^3 - 2^3)2 + (4^3 - 3^3)3 + (5^3 - 4^3)4$

$= 7 + 19(2) + 37(3) + 61(4)$

$= 400$

63. Answer (1)

Hint : $\tan\alpha + 2\tan2\alpha + 4\cot4\alpha = \cot\alpha$

Sol. : $\tan\alpha + 2\tan2\alpha + 4\cot4\alpha = \cot\alpha$

Putting $\alpha = \frac{\pi}{16}$, we get

$$\tan\frac{\pi}{16} + 2\tan\frac{\pi}{8} + 4\cot\frac{\pi}{4} = \cot\frac{\pi}{16}$$

$$\Rightarrow \cot\frac{\pi}{16} - \tan\frac{\pi}{16} - 2\tan\frac{\pi}{8} = 4\cot\frac{\pi}{4} = 4$$

64. Answer (4)

Hint : $\cot A = \frac{b^2+c^2-a^2}{4\Delta}$

Sol.:

As $\cot A = \frac{\cos A}{\sin A} = \frac{b^2+c^2-a^2}{2bc\cdot\sin A} = \frac{b^2+c^2-a^2}{4\Delta}$

But $b^2 + c^2 - a^2 = \Delta$

$\Rightarrow \cot A = \frac{1}{4} \Rightarrow \tan A = 4$

$$\tan 2A = \frac{2\tan A}{1-\tan^2 A} = \frac{2\times 4}{1-16} = -\frac{8}{15}$$

$$\Rightarrow \quad \tan 2A + \frac{8}{15} = 0$$

65. Answer (2)

Hint : $(x_1x_2x_3, \ldots, \infty)^2(z_1z_2z_3, \ldots, \infty)^4$

Sol. : $(x_1x_2x_3, \ldots, \infty)^2(z_1z_2z_3, \ldots, \infty)^4$

$$= \left(e^{i\left(\frac{\pi}{2}\right)}\cdot e^{i\left(\frac{\pi}{2^2}\right)}\cdot e^{i\left(\frac{\pi}{2^3}\right)}\cdot\ldots\cdot\infty\right)^2$$

$$\left(e^{i\left(\frac{\pi}{3}\right)}\cdot e^{i\left(\frac{\pi}{3^2}\right)}\cdot\ldots\cdot\infty\right)^4$$

$$= \left[e^{i\left(\frac{\frac{\pi}{2}}{1-\frac{1}{2}}\right)}\right]^2\left[e^{i\left(\frac{\frac{\pi}{3}}{1-\frac{1}{3}}\right)}\right]^4$$

$$= (\cos\pi + i\sin\pi)^2\left(\cos\frac{\pi}{2} + i\sin\frac{\pi}{2}\right)^4$$

$= (-1)^2(i)^4$

$= 1$

66. Answer (1)

Hint : India wins exactly in 5 matches $\Rightarrow$ loses in none $\Rightarrow {}^5C_0$ ways

Sol. : India wins exactly in 5 matches $\Rightarrow$ loses in none $\Rightarrow {}^5C_0$ ways

India wins exactly in 6 matches $\Rightarrow$ wins the 6th and loses anyone in the 1st five $\Rightarrow {}^5C_1$ ways and so on

$\Rightarrow \quad {}^5C_0 + {}^5C_1 + {}^6C_2 + {}^7C_3 + {}^8C_4 = 126$

67. Answer (4)

Hint : Let $t = x^2 + x + 1$

Sol. : Let $t = x^2 + x + 1$

$$\Rightarrow \quad t \in \left[\frac{3}{4}, \infty\right)$$

$\Rightarrow \quad (t + 1)^2 - (a - 3)t(t + 1) + (a - 4)t^2 = 0$

$\Rightarrow \quad t^2 + 2t + 1 - (a - 3)(t^2 + t) + (a - 4)t^2 = 0$

$\Rightarrow \quad t(2 - a + 3) + 1 = 0$

$$\Rightarrow \quad t = \frac{1}{(a-5)}$$

$$\Rightarrow \quad \frac{1}{(a-5)} \geq \frac{3}{4}$$

$\Rightarrow \quad 19 - 3a \geq 0,\ a - 5 > 0$

$$\Rightarrow \quad a \leq \frac{19}{3},\ a > 5$$

$$\Rightarrow \quad a \in \left(5, \frac{19}{3}\right]$$

68. Answer (1)

Hint : Rewrite expansion in $\left(x+\frac{2}{x}\right)$

Sol. : $1+{}^6C_1\left(x+\frac{2}{x}\right)+{}^6C_2\left(x+\frac{2}{x}\right)^2+...$

$+{}^6C_6\left(x+\frac{2}{x}\right)^6$

The constant term

$= 1 + {}^6C_2 \cdot {}^2C_1 \cdot 2^1 + {}^6C_4 \cdot {}^4C_2 \cdot 2^2 + {}^6C_6 \cdot {}^6C_3 \cdot 2^3$

$= 581$

69. Answer (2)

Hint : Use sum and product of roots

Sol. : Let α and β be the numbers.

$\frac{\alpha+\beta}{2}=20, \sqrt{\alpha\beta}=16 \Rightarrow \alpha+\beta=40, \alpha\beta=256$

70. Answer (3)

Hint : Unit's digit of the sum of first two terms = Zero

Sol. : Unit's digit of the sum of first two terms = Zero

Unit's digit of the sum of first three terms = 01 and so on.

71. Answer (1)

Hint : Circumcentre will be the point of intersections of lines $x + y + 4 = 0$ and $2x - y + 7 = 0$

Sol. : Circumcentre will be the point of intersections of lines $x + y + 4 = 0$ and $2x - y + 7 = 0$

i.e. $\left(\frac{-11}{3}, \frac{-1}{3}\right)$

72. Answer (3)

Hint : Let $(\sqrt{27}\cos\theta, \sqrt{48}\sin\theta)$ be any point on ellipse $\frac{x^2}{27}+\frac{y^2}{48}=1$

Sol. : Let $(\sqrt{27}\cos\theta, \sqrt{48}\sin\theta)$ be any point on ellipse $\frac{x^2}{27}+\frac{y^2}{48}=1$

Now, equation of tangent is

$\frac{x\sqrt{27}\cos\theta}{27}+\frac{y\sqrt{48}\sin\theta}{48}=1$

$\therefore$ m(slope) = $\frac{-4}{3}=\frac{-\cos\theta}{\sqrt{27}}\times\frac{\sqrt{48}}{\sin\theta}$

$\therefore$ $\cot\theta = 1$

$\therefore$ Equation $\frac{x}{3\sqrt{6}}+\frac{y}{4\sqrt{6}}=1$

$\therefore$ Area of ΔOAB = $\frac{1}{2}\times 3\sqrt{6}\times 4\sqrt{6}$ = 36 sq.units

73. Answer (3)

Hint : $r_1 - r_2 < d < r_1 + r_2$

Sol. : Centres of circles C_1 and C_2 are (0, 0), (2, 3) and radii are 5 and 3 respectively $d = \sqrt{13}$

$r_1 = 5$

$r_2 = 3$

$r_1 - r_2 < d < r_1 + r_2$

$\therefore$ Two common tangents.

74. Answer (1)

Hint : Make truth table

Sol. :

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

75. Answer (2)

Hint : Put $x + y = v \Rightarrow \frac{dy}{dx}=\frac{dx}{dn}-1$

Sol. : From given equation,

$\frac{dy}{dx}=\cos(x+y)$, Put, $x + y = v$

$\Rightarrow 1+\frac{dy}{dx}=\frac{dv}{dx}$

$\therefore$ From given equation, $\frac{dv}{dx} - 1 = \cos v$

$$\Rightarrow \frac{dv}{dx} = 1 + \cos v = 2\cos^2\frac{v}{2}$$

$$\Rightarrow \int \frac{1}{2}\sec^2\frac{v}{2}dv = \int dx$$

$$\Rightarrow \tan\frac{v}{2} = x + c$$

$$\Rightarrow \tan\left(\frac{x+y}{2}\right) = x + c$$

76. Answer (1)

Hint : n = 11, then the median term = $\left(\frac{11+1}{2}\right)^{th}$

Sol. : n = 11, then the median term = $\left(\frac{11+1}{2}\right)^{th}$

= 6th term.

Last five observations are increased by 2, then median term is 6th observation which is remaining unchanged.

$\therefore$ There will be no change in median.

77. Answer (4)

Hint : Check for the reflexive, symmetric and transitive properties in relation

Sol. : (i) $\frac{a}{b}R\frac{a}{b} \Rightarrow ab = ab$ (Reflexive)

(ii) $\frac{a}{b}R\frac{c}{d} \Rightarrow ad = bc \Rightarrow bc = ad \Rightarrow \frac{c}{d}R\frac{a}{b}$

(symmetric)

(iii) $\frac{a}{b}R\frac{c}{d}$ and $\frac{c}{d}R\frac{e}{f} \Rightarrow ad = bc$ and

$cf = ed$

$\Rightarrow adcf = bced \Rightarrow af = be$

$\Rightarrow \frac{a}{b}R\frac{e}{f}$ (transitive)

78. Answer (4)

Hint : Simplify $f(x)$

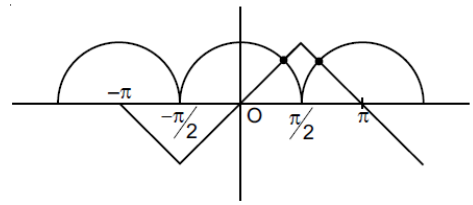
Sol. : On simplifying $f(x) = 4\sin 2x + 2$

$\Rightarrow -2 \le f(x) \le 6 \Rightarrow f(x)$ is many one into function

79. Answer (3)

Hint : Use the graph

Sol. : $|\cos x| = \sin^{-1}(\sin x)$, (two solutions)



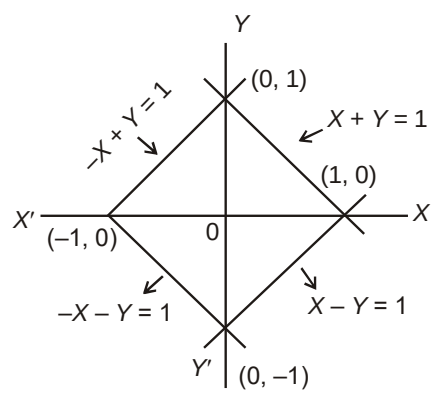
80. Answer (3)

Hint: Given lines can be transformed as $|X| + |Y| = 1$ and drawing graph, we can find area.

Sol.: Given line is

$$\left|\frac{3}{5}x + \frac{4}{5}y\right| + \left|\frac{4}{5}x - \frac{3}{5}y\right| = 1$$

$\Rightarrow$ $|X| + |Y| = 1$ (transformed form)



$\Rightarrow$ Area of region = $2 \times \left(\frac{1}{2} \times 2 \times 1\right) = 2$ sq. units

81. Answer (65.00)

Hint: Use Leibniz's rule of differentiation for definite integral.

Sol.:

$f'(x) = \frac{1}{\sqrt{1+x^3}} \times 1$ and $f(4) = \int_4^4 \frac{dt}{\sqrt{1+t^3}} = 0$

Given $g(x) = f^{-1}(x)$

$\Rightarrow$ $g(f(x)) = x$

$\Rightarrow$ $g'(f(x)) \cdot f'(x) = 1$

$\Rightarrow \quad g'(f(x)) = \dfrac{1}{f'(x)}$

$\Rightarrow \quad g'(f(x)) = \dfrac{1}{\dfrac{1}{\sqrt{1+x^3}}} = \sqrt{1+x^3}$

$\Rightarrow \quad g'(f(4)) = \sqrt{65}$

$\Rightarrow \quad g'(0) = \sqrt{65}$

82. Answer (10.00)

Hint: Use property

$\int_0^{nT} f(x)\ dx = n\int_0^{T} f(x)\ dx$

where T is period of $f(x)$

Sol.:

$\int_0^{2017} \sin(x-[x])dx = 2017\ \int_0^1 \sin\{x\}dx$

$= 2017\ \int_0^1 \sin(x-[x])dx$

$= 2017 \int_0^1 \sin(x-0)dx$

$= 2017(-\cos x)_0^1$

$= 2017(1 - \cos 1)$

83. Answer (08.00)

Hint: Use substitution method by taking as

$x^3 + 12x + 32 = t^3$

Sol.:

Let $f(x) = I = \int \dfrac{(x^2+4)dx}{(x^3+12x+32)^{\frac{1}{3}}}$

Substitute $x^3 + 12x + 32 = t^3$

$\Rightarrow \quad (3x^2 + 12)dx = 3t^2dt$

$\Rightarrow \quad (x^2 + 4)dx = t^2dt$

$\therefore \quad I = \int \dfrac{t^2dt}{t} = \dfrac{1}{2}t^2 + C$

$\therefore \quad f(x) = \dfrac{(x^3+12x+32)^{\frac{2}{3}}}{2} + C,$

Putting $x = 0$

$f(0) = \dfrac{1}{2} \times (2^5)^{\frac{2}{3}} + C$

$\Rightarrow \quad 2^{\frac{7}{3}} = 2^{\frac{7}{3}} + C \Rightarrow C = 0$

$\therefore \quad f(x) = \dfrac{(x^3+12x+32)^{\frac{2}{3}}}{2} \Rightarrow f(2) = 8$

84. Answer (10.00)

Hint: Distance between parabola and the line is the shortest if line is parallel to the tangent of the parabola.

Sol.: Here slope of tangent $= \dfrac{dy}{dx} = 2x + 7 = 3$

$\Rightarrow \quad x = -2$ and then $y = -8$

$\therefore$ Point of contact is $(-2, -8)$

$\therefore$ Shortest distance = perpendicular distance of the point $(-2, -8)$ from given line

$\therefore \quad$ S.D. $= \dfrac{|3(-2)-(-8)-3|}{\sqrt{9+1}} = \dfrac{|-6+8-3|}{\sqrt{10}}$

$= \dfrac{1}{\sqrt{10}}$

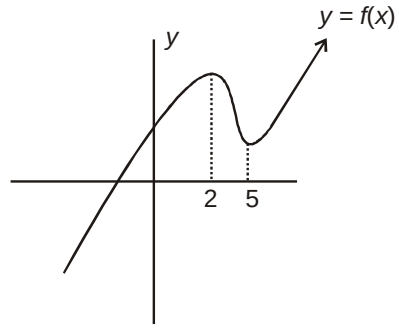
85. Answer (06.00)

Hint: Check local maxima or local minima using first order derivative test for given function

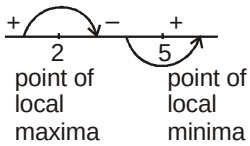
Sol.: From given function

$f'(x) = 6x^2 - 42x + 60 = 6(x-2)(x-5)$

when $f'(x) = 0 \Rightarrow x = 2, 5$



sign for $f'(x)$



$f(x)$ has local minima at $x = 5$

But $f(5) > 0$

$\Rightarrow a + 25 > 0$

$\Rightarrow a > -25$

$\Rightarrow a \in (-25, \infty)$

86. Answer (04.00)

Hint : Use condition for coplanarities.

Sol. : Since vectors are coplanar,

So, $\begin{vmatrix} a & a & c \\ 0 & 1 & 1 \\ c & c & 4b \end{vmatrix} = 0$

$\Rightarrow 4ab = c^2$

$\Rightarrow c^2 - 4ab = 0$ ...(i)

And

Discriminant of given equation is

$= c^2 - 4ab = 0$, [from (i)]

87. Answer (32.00)

Hint : Use $\left(\frac{0}{0}\right)$ form.

Sol. : $\lim_{x\to 0} \frac{\sqrt{ax+b}-2}{x} \left(\frac{\sqrt{b}-2}{0} \text{ form}\right)$

If $(\sqrt{b}-2)$ is non-zero, then limit does not exist.

For existence of limit numerator must be zero

$\sqrt{b}-2=0 \Rightarrow b = 4$

Now, $\lim_{x\to 0} \frac{\sqrt{ax+4}-2}{x} \times \frac{\sqrt{ax+4}+2}{\sqrt{ax+4}+2}$

$= \lim_{x\to 0}\left(\frac{ax+4-4}{x(\sqrt{ax+4}+2)}\right) = \frac{a}{4}$

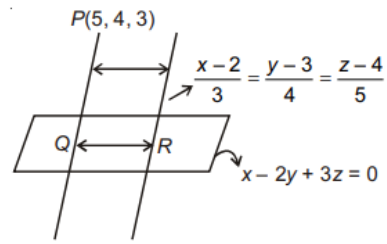
$\Rightarrow \frac{a}{4} = 1 \Rightarrow a = 4$

So, $a^2 + b^2 = 32$

88. Answer (09.00)

Hint : Use concept of the distance of any point from line parallel to any plane

Sol. :



Coordinates of R are $(3\lambda + 2, 4\lambda + 3, 5\lambda + 4)$ and are satisfying the equation $x - 2y + 3z = 0$

i.e., $(3\lambda + 2) - 8\lambda - 6 + 15\lambda + 12 = 0$

$\Rightarrow 10\lambda = -8$

$\Rightarrow \lambda = -\frac{4}{5}$

$\therefore$ Coordinates of R are $\left(-\frac{2}{5}, -\frac{1}{5}, 0\right)$

Here equation of line PQ is

$\frac{x-5}{3} = \frac{y-4}{4} = \frac{z-3}{5} = \mu(say)$

Coordinates of Q are $(3\mu + 5, 4\mu + 4, 5\mu + 3)$ and the point Q lies on the plane $x - 2y + 3z = 0$

$\therefore (3\mu + 5) - (8\mu + 8) + (15\mu + 9) = 0$

$\Rightarrow 10\mu = -6 \Rightarrow \mu = \frac{-3}{5}$

$\therefore$ Coordinates of Q are $\left(\frac{16}{5}, \frac{8}{5}, 0\right)$

$\therefore$ Required distance

$= QR = \frac{9}{\sqrt{5}}$

89. Answer (85.00)

Hint : $n(S) = \frac{9!}{2! \times 3!}$

$$n(E) = {}^7C_3 \times \frac{6!}{2!} - {}^6C_3 \times 5!$$

Sol. : $n(S) = \frac{9!}{3! \times 2!} = \frac{9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3!}{3! \times 2!}$

$= 9 \times 8 \times 7 \times 6 \times 5 \times 2 = 9 \times 8 \times 7 \times 6 \times 10$

To find n(E)

Case I.

No two T's come together but N may or may not
position for T is denoted by ×
× A × E × N × I × O × N ×

Total words formed

$$= 7C_3 \times \frac{6!}{2!} = \frac{7!}{3! \times 4!} \times \frac{6 \times 5 \times 4!}{2}$$

$$= \frac{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 5}{2} = 42 \times 300 = 12600$$

Case. II

No two T's come together but two N come together
× A × E × $\boxed{\text{NN}}$ × I × O ×

['×' is the position for T]

In this case total words formed

$= {}^6C_3 \times 5! = \frac{6 \times 5 \times 4 \times 3!}{3! \times 3!} \times 5 \times 4 \times 3 \times 2 \times 1$

= 20 × 120 = 2400

$\therefore$ n(E) = 12600 – 2400 = 10200

$\therefore$ Required probability $= \frac{n(E)}{n(S)}$

$$= \frac{10200}{9 \times 8 \times 7 \times 6 \times 10}$$

$$= \frac{85}{18 \times 14} = \frac{85}{252}$$

90. Answer (26.00)

Hint : $n(S) = 6^6$, $n(E) = 6$

$\Rightarrow$ $P(E) = 1 - \frac{6}{6^6} = 1 - \frac{1}{6^5}$

Sol. : $n(S) = 6^6$, $n(E) = {}^6C_1 \times 1 \times 1 \times 1 \times 1 \times 1$

$\therefore$ Required probability

$$= 1 - \frac{6}{6^6} = 1 - \frac{1}{6^5} = \frac{6^5 - 1}{6^5} = \frac{7775}{6^5}$$

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