FIITJEE

ALL INDIA TEST SERIES

FULL TEST – XI

JEE (Main)-2025

TEST DATE: 30-03-2025

ANSWERS, HINTS & SOLUTIONS

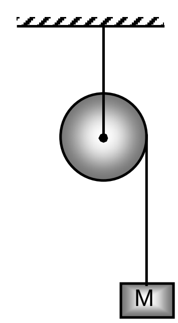
Physics

PART – A

SECTION – A

1. B

Sol. Applying conservation of angular momentum of system about centre of mass of disc



$$mvR = mv'R + \frac{2mR^2}{2}\omega$$

$$v' = R\omega$$

$$mvR = mv'R + mv'R$$

$$v' = \frac{v}{2} = \frac{\sqrt{2g\ell}}{2} = \sqrt{\frac{g\ell}{2}}$$

2. D

Sol. $I = neA\,(\mu_e + \mu_h)\,E$

$$= 1.0\times10^{6}\times1.6\times10^{-19}\times4\times10^{-4}(1.0)\times\frac{2}{2\times10^{-3}} = 6.4\times10^{-14}\text{ A}$$

3. C

Sol. Basic concepts

4. C

Sol. $C = C_V + \dfrac{dW}{ndT}$

$$\int dW = \int_{T_0}^{3T_0}\alpha T dT - \int_{T_0}^{3T_0}\frac{5R}{2}dT \text{ for one mole}$$

$$W = (4\alpha T_0 - 5R)T_0$$

5. C

Sol. $\frac{dN}{dt} = R - \lambda N$

So $\int_0^N \frac{dN}{R - \lambda N} = \int_0^t dt \Rightarrow \ln(R - \lambda N)\Big|_0^N = -\lambda t$

So $\ln \frac{R - \lambda N}{R} = -\lambda t$

So $1 - \frac{\lambda N}{R} = e^{-\lambda t} \Rightarrow N = \frac{R}{\lambda}\left(1 - e^{-\lambda t}\right)$

6. C

Sol. Zener current will be maximum, when V = 15V

15 – (i × 2.5k) = 5

i = 4 mA

i_z = 3 mA

7. B

Sol. $\frac{R_{Ge}}{R_{Be}} = \left(\frac{X}{9}\right)^{1/3}$

X = 72

Number of neutron = 72 – 32 = 40

8. B

Sol. frequency received by submarine

$n_1 = \left(\frac{1400 + 100}{1400}\right) \times 40 \times 10^3 = \left(\frac{15}{14}\right) \times 40 \times 10^3$

Frequency reflected by submarine

$n_2 = \left(\frac{1400}{1400 - 100}\right) n_1 = \left(\frac{15}{13}\right) \times 40 \times 10^3 \text{ Hz} = \frac{600}{13} \text{kHz}$

9. C

Sol. $f = \frac{2\pi(1 - \cos\theta_C)}{4\pi}$

$f = \frac{2\pi}{4\pi}\left[1 - \sqrt{1 - \frac{1}{\mu^2}}\right] = \frac{1}{2}\left[1 - \sqrt{1 - \frac{1}{\mu^2}}\right]$

10. D

Sol. For ($r \le R$)

$E \times 4\pi r^2 = \int_0^r cx 4\pi x^2 dx / \varepsilon_0$

So $E \propto r^2$

and For ($r \ge R$)

$E \propto \frac{1}{r^2}$

11. D

Sol. ${}_1^2H + {}_1^2H = {}_2^4He$

$BE_H = 1.1$ MeV

$BE_{He} = 7$ MeV

Q_{value} = Binding energy of product – Binding energy of reactants
= (4 × 7 – 4 × 1.1) MeV = 23.6 MeV
= $23.6 \times 1.6 \times 10^{-19} \times 10^{6} = 37.76 \times 10^{-23}$

12. C

Sol. $B = \frac{\mu_0 dI}{2\pi R} = \frac{\mu_0 I d_0}{(2\pi R)(2\pi R)} = \frac{\mu_0 I d_0}{4\pi^2 R^2}$

13. D

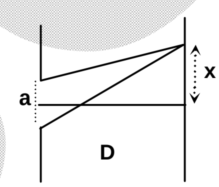
Sol. After long time,

$I_A = \frac{2V}{7R} = 20$ mA …(i)

Immediately after the key is closed,

$I = \frac{V}{3R} = \frac{70}{3}$ mA

14. C



Sol. For 1st secondary minima $\frac{ax}{D} = \lambda_1$

For 1st secondary maxima $\frac{ax}{D} = \frac{3\lambda_2}{2}$

$\lambda_1 = \frac{3}{2}\lambda_2$

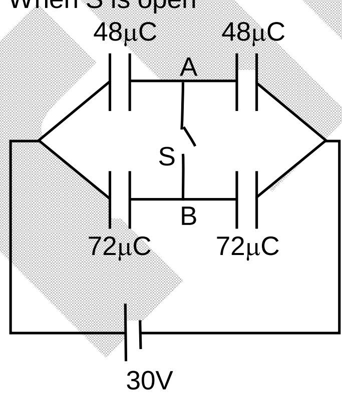
λ = 440 Å

15. D

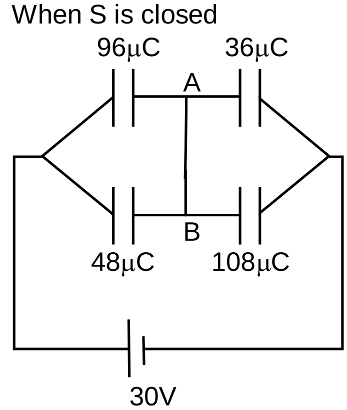
Sol. Basic Concepts

16. A

Sol. When S is open



When S is closed



So charge flown = 60 μC
From A to B

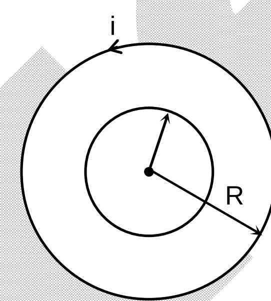
17. B
Sol. Basic concept

18. C
Sol. $E2\pi r = \frac{d}{dt}(B\pi r^2)$

$E = \frac{r}{2}\frac{dB}{dt}$

$\tau = QEr = \frac{Qr^2}{2}\frac{dB}{dt}$

19. B
Sol. $B = \frac{\mu_0 i}{2R}$



$\phi = B\pi r^2 = \frac{\mu_0 i\pi r^2}{2R}$

Mutual inductance, $M = \frac{\phi}{i} = \frac{\mu_0 \pi r^2}{2R}$

20. D
Sol. Rate of cooling

$-\frac{dT}{dt} = \frac{\varepsilon\sigma A(T^4 - T_s^4)}{mC} = r$

$\frac{r_{sphere}}{r_{cube}} = \frac{m_{cube}}{m_{sphere}} = \frac{\rho a^3}{\rho\frac{4}{3}\pi r^3}$

given, $4\pi r^2 = 6a^2$

$\frac{r_{sphere}}{r_{cube}} = \frac{3\left(\frac{4\pi}{6}\right)^{3/2} r^3}{4\pi r^3} = \sqrt{\frac{\pi}{6}}$

SECTION – B

21. 6
Sol. Separation between two maxima $\beta = \frac{\lambda D}{d}$

22. 40
Sol. $v_0^2 = 4v_0^2 - (2)(\mu g)(d) \Rightarrow 2\mu gd = 3v_0^2$

$v_0^2 = v^2 - (2)(5\mu g)(d) \Rightarrow v^2 = v_0^2 + 15V_0^2$

So $v = 4v_0$

23. 1
Sol. $\frac{2v}{2(\ell_0 + 1.2d)} = \frac{3v}{4(\ell_c + e)}$

So $4(23+e)=3(30+2e)$
So e = 1 cm

24. 9
Sol. $E_0 = CB_0$
$= 3\times10^{8}\times3\times10^{-8}$ = 9 V/m

25. 30
Sol. $\frac{1}{f_e}=-2\frac{1}{f_\ell}+\frac{1}{f_m}$,
Where $\frac{1}{f_\ell}=\left(\frac{4}{3}-1\right)\left(\frac{1}{40}\right)=\frac{1}{120}$
So $\frac{1}{f_e}=-2\frac{1}{120}-\frac{1}{20}=-\frac{1}{15}$cm
So R = 30 cm

Chemistry

PART – B

SECTION – A

26. B

Sol. $P_1V_1 = P_2V_2$

$10m \times (4) \times A = (10 + h)m \times h \times A$

$h = 3.06$ m

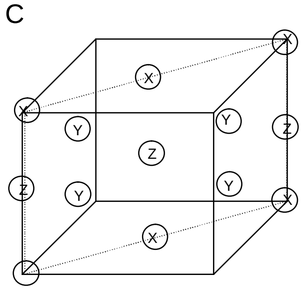
27. C

Sol. Dithionous acid $\rightarrow H_2S_2O_4$ $S = +3$

Dithionic acid $\rightarrow H_2S_2O_6$ $S = +5$

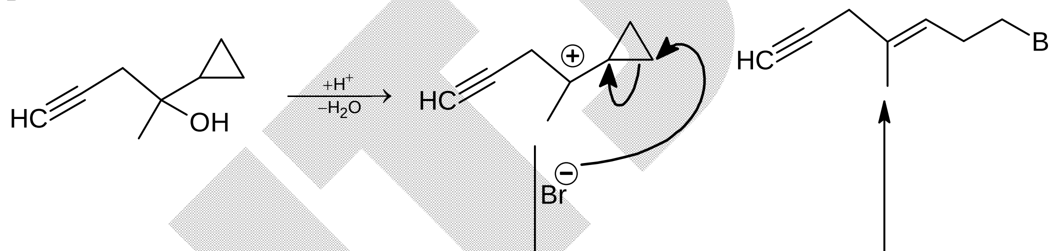
28. C

Sol.



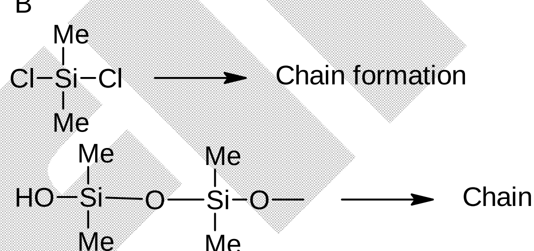
29. D

Sol.



30. B

Sol.



31. C

Sol. $LiClO_4$ is more soluble than LiF.

32. D

Sol. Factual

33. B

Sol. BF_3 is electron deficient and is used to generate electrophile in F.C. reactions. Therefore, acts as catalyst in industrial processes.

34. B

Sol. Uridine is glycosylated pyrimidine-containing uracil attached to ribose ring.

$$\text{Ribose}(\text{sugar}) + \text{Uracil}(\text{base}) \longrightarrow \text{Nucleoside}$$

35. A

Sol. Degenerate orbitals $= n^2$

$= (5)^2 = 25$

36. D

Sol. $\Delta S \rightarrow$ State function $\quad \Delta S = \Delta S_1 + \Delta S_2$

$\Delta S = \dfrac{q}{T}$ since q = same; smaller temperature, higher entropy.

37. D

Sol. $Ti^{+3} \longrightarrow 3d^1 \longrightarrow t_{2g}^1$

$Cr^{+3} \longrightarrow 3d^3 \longrightarrow t_{2g}^3$

$Mn^{+3} \longrightarrow 3d^4 \longrightarrow t_{2g}^3 eg^1$

$Co^{+3} \longrightarrow 3d^6 \longrightarrow t_{2g}^4 eg^2$

38. A

Sol. Factual

39. B

Sol. MnO_2 oxidises unhindered primary allylic and benzylic alcohols to aldehyde.

40. C

Sol. $\dfrac{1}{x_o - a} - \dfrac{1}{x_o} = k_2 t$

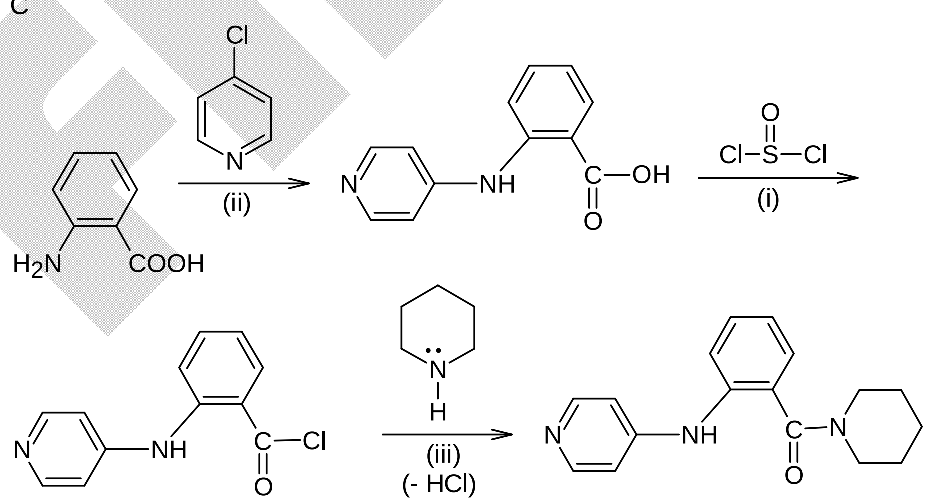
Rearranging

$\dfrac{a}{x_o - a} = x_o k_2 t$

$\therefore \dfrac{a}{x_o - a}$ vs. t gives $x_o k_2$ as slope.

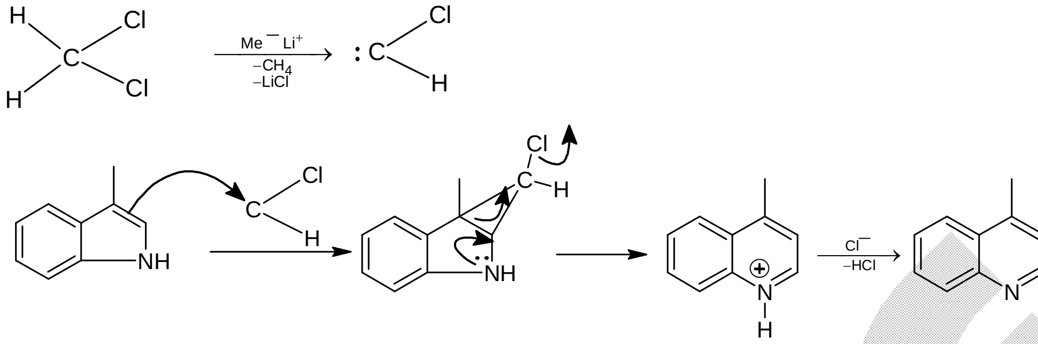
41. C

Sol.



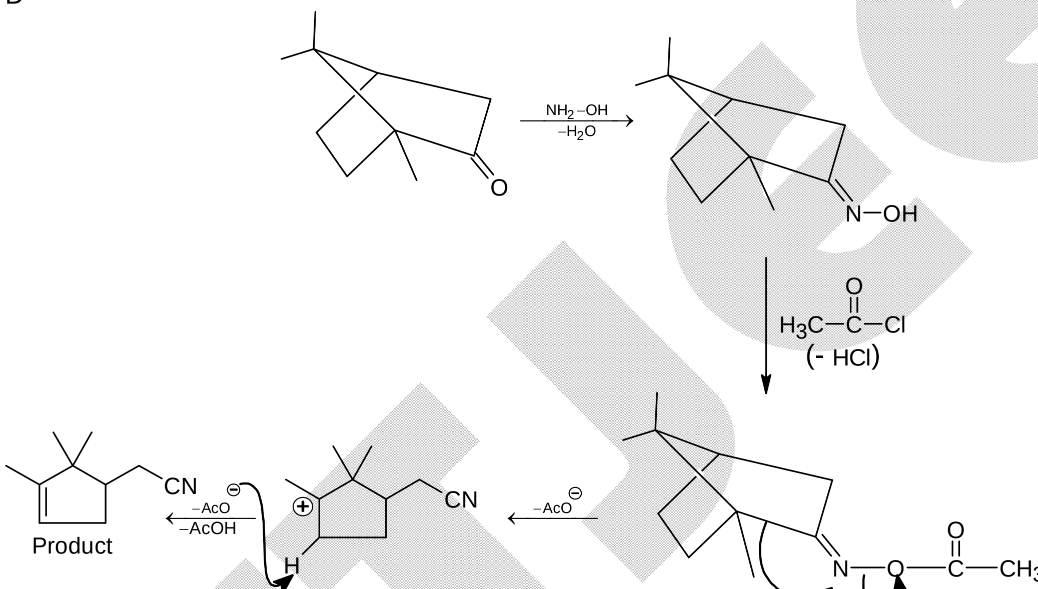
42. A

Sol.



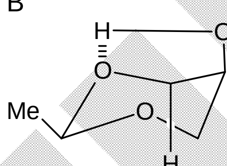
43. D

Sol.



44. B

Sol.



Hydrogen bonding and as 1-3 dihedral interaction between methyl and hydrogen.

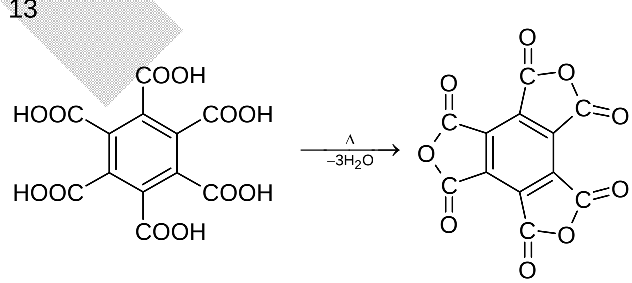
45. B

Sol. $x_A = \dfrac{0.744 + 0.359Z_{eff}}{r_A^2} \leftarrow$ Alfred – Rochow scale

SECTION – B

46. 13

Sol.



DOU = 13

47. 2

Sol. $\left[H^+\right] = 10^{-4}$

$\therefore \left[Ca^{+2}\right] = \dfrac{10^{-4}}{2} M$

Weight of $Ca^{+2} = 20 \times 10^{-4}$ g in 1 L

$\therefore$ Weight of Ca^{+2} ion in 10^6 mL $H_2O = \dfrac{20 \times 10^{-4} \times 10^6}{10^3} = 2$

$\therefore$ Hardness = 2 ppm.

48. 1

Sol. Theoretical efficiency $= \dfrac{-\Delta G^o}{-\Delta H^o}$

$0.84 = \dfrac{-\Delta G^o}{285}$

$\Delta G^o = -0.84 \times 285 \text{ kJ} = -nFE^o_{cell}$

$E^o_{cell} = 1.24 \text{ V}$

49. 2

Sol.

$$Cd^{+2} + H_2S \rightleftharpoons Cd(s) + 2H^+$$

Initial 0.1×10^{-3} moles $\quad 0.08 \times 10 \times 10^{-3}$ moles

final $\quad - \quad 0.8 \times 10^{-3} + 0.2 \times 10^{-3}$

$= 10^{-3}$ moles

$\therefore \left[H^+\right]_{final} = \dfrac{10^{-3}}{100} \times 1000 = 0.01 \text{ M} = 10^{-2} \text{ M}$

pH = 2.0

50. 8

Sol. For KCN: $\Delta T_f = i.K_f.m \Rightarrow 0.8 = K_f.0.2 \times 2$

$K_f = 2$ … (i)

$$Hg(CN)_2 + mCN^- \longrightarrow Hg(CN)_{m+2}^{-m}$$

	$Hg(CN)_2$	mCN^-	$Hg(CN)_{m+2}^{-m}$
Initial	0.1	0.2	–
Final	$(0.2 - 0.1\,m)$		0.1

Final effective molality = (0.2 – 0.1 m) + 0.1 + 0.2

= 0.5 – 0.1 m

New: $\Delta T_f = K_f.m$

$0.6 = 2 \times (0.5 - 0.1\,m)$

m = 2

4m = 8

Mathematics PART – C

SECTION – A

51. B

Sol. A = {1, 2, 3, …… , 141}

$A \cap (B - C) = \{5, 11, 14, 17, 23, 26, 29, \ldots\ldots 134, 137\}$

Sum of elements = (5 + 11 + 17 + ……. 137) + (14 + 26 + 38 + ….. 134)

52. C

Sol. $x^2 - ax + 4 = 0$ must have atleast one positive root

$\because$ $\alpha\beta > 0$

$\therefore$ both roots must be positive

$\Rightarrow$ $a \geq 4$

53. B

Sol. $30(1 + x + x^2)^{30}(1 + 2x) = \sum_{r=0}^{60} r a_r x^{r-1}(1 + x + x^2)$

Equating coefficient of x^{20} on both sides we have,

$30(a_{20} + 2a_{19}) = 21a_{21} + 20a_{20} + 19a_{19}$

$\Rightarrow 21a_{21} = 10a_{20} + 41a_{19}$

54. C

Sol. Use $\int (xg'(x) + g(x))dx = xg(x) + C_1$

55. C

Sol. $k = 2500 = 2^2.5^4$

$\therefore$ number of factor = 5

56. B

Sol. b = –4, c = 9

$2\sin^2\theta = 3\cos\theta$

$\Rightarrow 2\cos^2\theta + 3\cos\theta - 2 = 0$

$\cos\theta = \frac{1}{2}$ $\therefore \sin^2\theta = \frac{3}{4}$

$\therefore 4x^2 - 4y^2 + xy + 12x + \frac{3}{2}y + 9 = 0$

57. A

Sol. $r = \frac{r_1 r_2}{r_1 + r_2 + 2\sqrt{r_1 r_2}}$

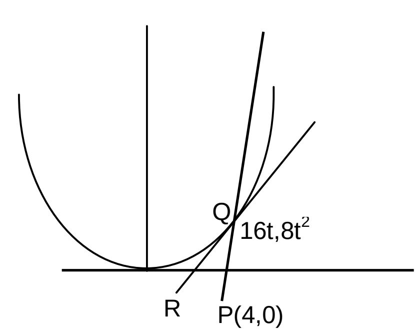
58. B

Sol. $A = \frac{1}{2}(4 - 8t)8t^2 = 16(t^2 - 2t^3)$

$\frac{dA}{dt} = 16(2t - 6t^2) = 0 \Rightarrow t = 0, \frac{1}{3}$

$\frac{d^2A}{dt^2} = 16(2 - 12t) < 0$ at $t = \frac{1}{3}$ $\Rightarrow$ A is maximum

$\therefore Q\left(\frac{16}{3}, \frac{8}{9}\right)$ lies on the line $\therefore m = \frac{2}{3}$



59. A

Sol. M is (1, 10)

$\therefore$ N is (4, 16)

L is (–2, 4)

Equation of tangent to $(x + a)y = \lambda$ is

$$y = 2x + \frac{\lambda}{t} + 2(a - t);\ \lambda = -2t^2$$

$\therefore$ $2a - 4t = +8 \Rightarrow a - 2t = 4$

and $(a - 2)4 = \lambda = -2t^2$

$\therefore$ $(t + 2)^2 = 0$

$\Rightarrow$ $t = -2$

$\therefore$ $\lambda = -8$ & $a = 0$

60. B

Sol. $4a^2 - b^2 = 25$

Equation of auxiliary circle is $x^2 + y^2 = 8$

$\Rightarrow$ $a^2 = 8,\ b^2 = 7$

Also $a^2 + b^2 = A^2 - \lambda^2$

$\Rightarrow$ $\lambda^2 = 25 - 15 = 10$

$\therefore$ eccentricity of ellipse $e = \sqrt{1 - \frac{10}{25}} = \sqrt{\frac{3}{5}}$.

61. D

Sol. IF = $e^{x/2}\sqrt{\sin x + \cos x}$

$\therefore$ solution is $ye^{x/2}\sqrt{\sin x + \cos x} = \int e^{x/2}\left(\tan x + 2\sec^2 x\right)dx$

$$ye^{x/2}\sqrt{\sin x + \cos x} = 2e^{x/2}\tan x + c$$

$\because y\left(\frac{\pi}{4}\right) = 2^{3/4}$ $\therefore$ $c = 0$

$$y = \frac{2\tan x}{\sqrt{\sin x + \cos x}}$$

62. D

Sol. $\text{Arg}\left(\frac{z^4 - z}{z^2 - z}\right) = 0$

$\Rightarrow \text{Arg}\left(\frac{z(z-1)(z^2 + z + 1)}{z(z-1)}\right) = 0$; $z \neq 0, 1$

$\Rightarrow z^2 + z + 1$ is positive real number $(x + iy)^2 + x + iy + 1 > 0$

$\Rightarrow x^2 - y^2 + x + 1 > 0$ and $y(1 + 2x) = 0$

(i) $y = 0,\ x^2 + x + 1 > 0 \Rightarrow x \in R$

(ii) $x = -\frac{1}{2},\ y^2 < \frac{3}{4} \Rightarrow y \in \left(-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}\right)$.

63. C

Sol. $\frac{a}{a - \sqrt{3}} + \frac{b}{b - \sqrt{5}} + \frac{c}{c - \sqrt{7}} = 2$

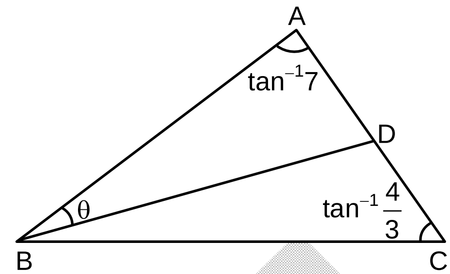
If $a = 2\sqrt{3}$, then $\frac{b}{b - \sqrt{5}} + \frac{c}{c - \sqrt{7}} = 0$

Possible value of $b = \frac{2\sqrt{5}}{3}$, $c = 2\sqrt{7}$.

64. D

Sol. $$\frac{\frac{1}{2}\sin\left(\tan^{-1}\frac{4}{3}\right)BD\sin\theta}{\frac{1}{2}\sin\left(\tan^{-1}7\right)BD\sin\left(\frac{\pi}{4}-\theta\right)}=2$$

$$\Rightarrow \frac{\frac{4}{5}\sin\theta}{\frac{7}{5\sqrt{2}}\left(\frac{\cos\theta-\sin\theta}{\sqrt{2}}\right)}=2 \Rightarrow \cot\theta=\frac{11}{7}$$



65. C

Sol. $P(A)=\frac{2}{5}$, $P(B)=\frac{3}{5}$

$P(D)=\frac{3}{20}$

$$6\times\frac{2}{5}x+\frac{3}{5}\times x=\frac{3}{20}\Rightarrow x=\frac{1}{20}$$

$$P\left(\frac{B}{D^C}\right)=\frac{P\left(B\cap D^C\right)}{P(D^C)}=\frac{\frac{3}{5}\times\frac{19}{20}}{\frac{85}{100}}=\frac{57}{85}$$

66. A

Sol. $$\frac{\sum_{i=1}^{n}x_if_i}{\sum_{i=1}^{n}f_i}=\frac{15a+25b+980}{26+a+b}=\frac{277}{9} \quad \ldots(1)$$

Also $$30+\frac{\frac{26+a+b}{2}-(a+b+3)}{11}\times10=\frac{335}{11}$$

$\Rightarrow$ a + b = 19 …(2)

From (1) and (2) a = 7, b = 12.

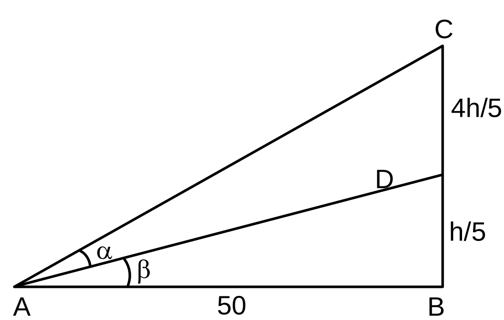
67. B

68. A

Sol. $\tan(\alpha+\beta)=\frac{h}{50}$

$$\Rightarrow \frac{h}{50}=\frac{\frac{8}{21}+\frac{h}{250}}{1-\frac{8}{21}\times\frac{h}{250}}=\frac{2000+21h}{5250-8h}$$

h = 25



69. B

Sol. $\boxed{3}\,\boxed{5}$ …… = 9 × 5 = 45

__ $\boxed{3}\,\boxed{5}$ ____ = 8 × 5 = 40

……………. = 8 × 9 × 9 × 5 = 3240

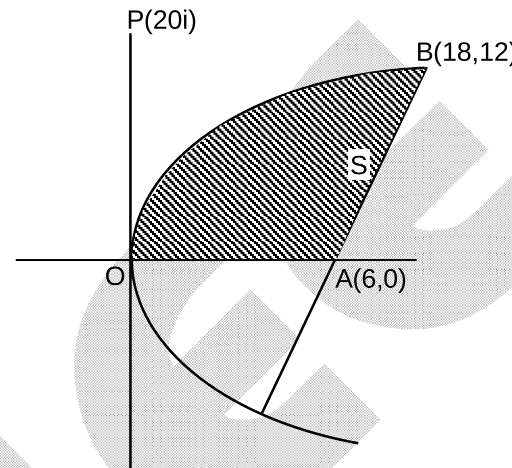
N = 3325

70. A

Sol. PB = $\sqrt{324+64} = \sqrt{388}$

PA = $\sqrt{36+400} = \sqrt{436}$

OP = 20



SECTION – B

71. 5

Sol. $$\sum_{m=1}^{15}\frac{\sin\left(\theta+m\frac{\pi}{18}-\left(\theta+(m-1)\frac{\pi}{18}\right)\right)}{\cos\left(\theta+m\frac{\pi}{18}\right)\cos\left(\theta+(m-1)\frac{\pi}{18}\right)}$$

$$=\sum_{m=1}^{15}\tan\left(\theta+m\frac{\pi}{18}\right)-\tan\left(\theta+(m-1)\frac{\pi}{18}\right)$$

$$\Rightarrow \quad \tan\left(\theta+\frac{5\pi}{6}\right)-\tan\theta=4+2\sqrt{3}$$

$$\Rightarrow \quad \cos\left(2\theta+\frac{5\pi}{6}\right)=1$$

$$\Rightarrow \quad \theta=n\pi-\frac{5\pi}{12};\ n\in I.$$

72. 59

Sol. Squaring and adding

$1+\sin^6 A+\cos^6 A+2(\cos^4 A-\sin^4 A)=1/4$

$\Rightarrow$ $2+1-3\sin^2 A\cos^2 A+2\cos 2A=1/4$

$2-3/4\sin^2 2A+2\cos 2A=1/4$

$\Rightarrow$ $3\cos^2 2A+8\cos 2A+4=0$

$\cos 2A=-2/3$

$$\sin A=\sqrt{\frac{5}{6}}$$

$$\therefore \quad \cos B=2\left(\sqrt{\frac{5}{6}}-\frac{5}{6}\sqrt{\frac{5}{6}}\right)=\sqrt{\frac{5}{54}}.$$

73. 13

Sol. $a = \frac{5\pi}{12}, b = \frac{\pi}{3}$

$$\int_{\pi/3}^{5\pi/12} \left[\frac{\tan x}{\sqrt{3}}\right] dx$$

$$= \int_{\pi/3}^{\tan^{-1} 2\sqrt{3}} 1 + \int_{\tan^{-1} 2\sqrt{3}}^{5\pi/12} 2dx = \cot^{-1} 2\sqrt{3} = \operatorname{cosec}^{-1} 13.$$

74. 546

Sol. Let A = I + B where $B = \begin{bmatrix} 0 & 0 & 0 \\ \sqrt{a} & 0 & 0 \\ a\sqrt{a} & \sqrt{b} & 0 \end{bmatrix}$, $B^2 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ \sqrt{ab} & 0 & 0 \end{bmatrix}$, $B^3 = 0$ (Null)

$\therefore A^n = I + {}^nC_1 B + {}^nC_2 B^2$

$$\Rightarrow A^n = \begin{bmatrix} 1 & 0 & 0 \\ n\sqrt{a} & 1 & 0 \\ na\sqrt{a} + \frac{n(n-1)}{2}\sqrt{ab} & n\sqrt{b} & 1 \end{bmatrix}$$

$\Rightarrow n\sqrt{a} = n\sqrt{b} = 72 \;\; \Rightarrow$ a = b and $72a + 36\left(72 - \sqrt{a}\right) = 3600$

$\Rightarrow \sqrt{a} = 4 \Rightarrow a = 16$ and n = 18.

75. 20

Sol. Let $P(t, t^2)$, $Q(t^4, t^2)$

$$\int_0^t \left(x^2 - f(x)\right) dx = 2\int_0^{t^2} \left(\sqrt{y} - y^2\right) dy$$

$\Rightarrow t^2 - f(t) = 2(t - t^4)2t$

$\Rightarrow f(t) = 4t^5 - 3t^2$

$$f\left(\frac{1}{2}\right) = \frac{4}{32} - \frac{3}{4} = -\frac{20}{32}.$$