Physics
Section-A

1. (d)

A : Since polar dielectrics are randomly oriental $\vec{P}_{net} = \vec{0}$.

R : If $\vec{E}$ is absent, polar dielectric remain polar & are randomly oriented.

2. (a)

Voltage sensitivity $= \frac{\theta}{V} = \frac{NAB}{cR}$

Ratio $== \left(\frac{N_1A_1B_1}{N_2A_2B_2}\right)\frac{R_2}{R_1} = \frac{15 \times 3.6 \times 0.25}{21 \times 1.8 \times 0.5} \times \frac{7}{5} = \frac{1}{1}$

3. (b)

Diameter is given as R.

$\therefore$ Radius $= R/2$

$I_{\text{tangent}} = \frac{3}{2}m\left(\frac{R}{2}\right)^2 = \frac{3}{8}mR^2$

4. (a)

$2 \times \frac{4}{3}\pi R^3 = \frac{4}{3}\pi r^3 \Rightarrow r = 2^{1/3}R$

$U_i = 2 \times 4\pi R^2 T$

$U_f = 4\pi r^2 T = 4\pi R^2 T 2^{2/3}$

$\therefore$ Heat lost $= u_i - u_f = 4\pi R^2 T\left[2 - 2^{2/3}\right]$

5. (d)

Magnetic field does not work

$\therefore$ Speed will not charge, so De-Broglie wavelength remains same.

6. (a)

$v = \frac{\text{distance}}{\text{time}}$

$\mathrm{v} = \frac{12}{0.3} = 4 \text{ cm/s}$

$\mathrm{k} = \frac{2\pi}{\lambda} = \frac{2\pi}{7.5} = \frac{4\pi}{15} = 0.83\mathrm{v}$

$= \frac{\omega}{\mathrm{k}} \Rightarrow \omega = \mathrm{vk} = 4 \times \frac{4\pi}{15} = 3.35$

So $\mathrm{y} = \mathrm{A}\cos(\mathrm{kx} - \omega \mathrm{t})$

7. (b)

$\mathrm{Q} = \mathrm{AT}$

$\mathrm{I} = \mathrm{A}$

$\mu_0 = \mathrm{MLT}^{-2}\ \mathrm{A}^{-2}$

$\mathrm{P} = \mathrm{Q}^{\mathrm{x}}\mu_0{}^{\mathrm{y}}\mathrm{I}^{\mathrm{z}} = [\mathrm{AT}]^{\mathrm{x}}[\mathrm{MLT}^{-2}\ \mathrm{A}^{-2}]^{\mathrm{y}}[\mathrm{A}]^{\mathrm{z}}$

$\mathrm{MLT}^{-1} = \mathrm{M}^{\mathrm{y}}\mathrm{L}^{\mathrm{y}}\mathrm{T}^{\mathrm{x}-2\mathrm{y}}\mathrm{A}^{-2\mathrm{y}+\mathrm{z}+\mathrm{x}}$

Now; $\mathrm{y} = 1$

$x - 2y = -1$

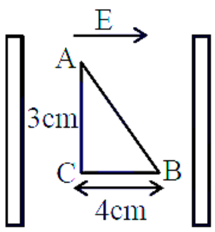
$-2y + z = 0$

$\therefore x = y = z = 1$

8. (d)

$\frac{U}{V} = \frac{B^2}{2\mu_r u_0} \Rightarrow U = \frac{B^2}{4\mu_0}V = \frac{B^2}{4\mu_0}A\ell$

9. (b)



Using $\Delta V = E(\Delta d)$
$V = E\,(10)$

$V_{AB} = E.4 = \frac{V}{10} \times 4 = \frac{2\text{ V}}{5}$

10. (c)

$Q = \Delta U + W = 0 \Rightarrow -\Delta U = W$
$WD = -nC_v\Delta T \Rightarrow |WD| = nC_v\Delta T \propto T_2 - T_1$
$\therefore$ B & E [Only possibility]

11. (c)

$r = r_0\frac{n^2}{z}$ & $z = 3$ for ${L_i}^{+2}$ and $n = 1$

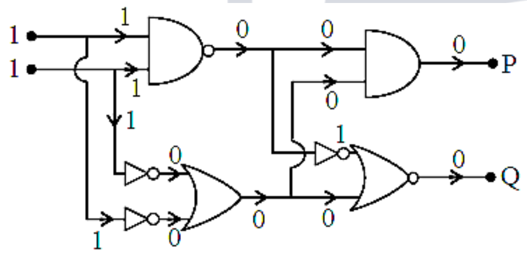
$\therefore r = r_0\frac{1^2}{3} = \frac{r_0}{3}$ $\therefore x = 3$

12. (c)

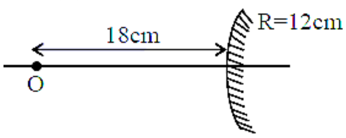
$\underset{\underset{1.1}{1.1\text{MeV}}}{H^2} + {}_1H^2 \rightarrow \underset{7.0\text{MeV}}{{}_1He^4}$

$E_B = BE_{\text{reactant}} - BE_{\text{product}}$
$= 1.1 \times 2 + 1.1 \times 2 - 7 \times 4 = -23.6\text{MeV}$
$= Q = 23.6\text{MeV}$

13. (b)

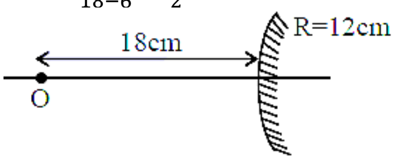


14. (a)



Using $m = \frac{f}{u-f}$

$m_1 = \frac{6}{18-6} = \frac{1}{2}$

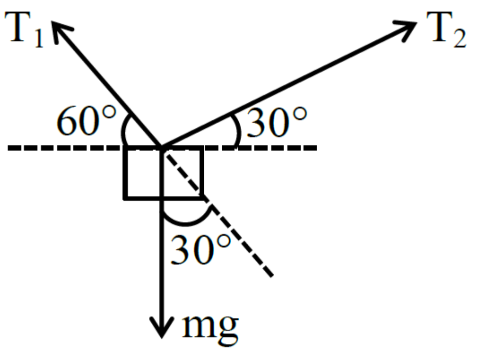


$m_2 = \frac{6}{18+6} = \frac{1}{4}$ $\therefore \frac{m_2}{m_1} = \frac{1}{2}$

15. (d)

Displacement $= 2r$
Distance $= 2\pi r + \pi r = 3\pi r$

16. (b)



$T_1 = mg\cos 30°$

$T_2 = mg\sin 30°$

17. (b)

This will happen when

$$\frac{1}{f_1} = \frac{1}{f_2}$$

$$(\mu - 1)\left(\frac{1}{R_1} - \frac{1}{-R_2}\right) = (\mu - 1)\left(\frac{2}{R}\right)$$

$$\frac{1}{R_1} + \frac{1}{R_2} = \frac{2}{R}$$

18. (b)

$$C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} \Rightarrow \frac{1}{\mu_0 \varepsilon_0} = C^2 = L^2\,T^{-2}$$

19. (d)

$$C' = \frac{\Delta Q}{\Delta\,T} = JK^{-1}$$

$$S = \frac{\Delta Q}{m\Delta\,T} = Jkg^{-1}\,K^{-1}$$

$$L = \frac{\Delta Q}{m} = Jkg^{-1}$$

$$\Delta Q = \frac{KA\Delta\,T}{L} \Rightarrow\; K = \frac{\Delta Q(\,L)}{A\Delta\,T} = Jm^{-1}\,K^{-1}\,s^{-1}$$

20. (c)

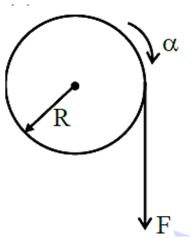
$$E = \frac{KQr}{(x^2 + R^2)^{3/2}}$$

$$\frac{dE}{dx} = 0$$

$$\therefore x = \frac{R}{\sqrt{2}} = \frac{\sqrt{2}a}{\sqrt{2}} = a$$

SECTION-B

21. (1)



$$FR = I\alpha$$

$$\Rightarrow I = \frac{FR}{\alpha} = \frac{10 \times 0.2}{2} = 1\text{ kg} - m^2$$

22.(12)

To find the internal energy of gas in the room.

$$U = nC_v\,T = n\frac{5RT}{2}$$

$= \frac{5}{2}PV = \frac{5}{2} \times 10^5 \times 48 = 12 \times 10^6$ J

23. (45)

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}, \text{ since } A = 60^\circ \therefore \delta m = 30^\circ$$

$\delta_m = 2i - A[\text{ as } i = e]$

$\Rightarrow i = 45^\circ$

24. (1)

$T = K(\ell - \ell_0)$

$\Rightarrow 5 = K(1.4 - \ell_0)$

$\Rightarrow 7 = K(1.56 - \ell_0)$

$\Rightarrow \frac{5}{1.4 - \ell_0} = \frac{7}{1.56 - \ell_0}$

$\therefore \ell_0 = 1$ m

25. (3)

$KE = \frac{1}{2}mv^2 = \frac{1}{2}m\frac{GM_e}{r} = \frac{GM_e m}{2r} = \frac{GM_e m}{2(R_E+h)}$

$$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 6.4 \times 10^6}{2(6.4 \times 10^6 + 2.7 \times 10^5)} = 3 \times 10^{10} \text{ J}$$

Chemistry

Section-A

26.(c)
27.(a)
28.(b)
29.(c)
30. (c)
31.(a)
32.(d)
33.(b)
34.(d)
35.(d)
36.(d)
37.(b)
38.(b)
39. (a)
40. (a)
41.(b)
42.(b)
43.(a)
44.(d)
45. (d)

Section-B

46.(43)
47.(23)
48. (184)
49.(25)
50.(0)

Mathematics

Section-A

51. (b)

P(1,0,3)

A(4,7,1), B(3,5,3)

Line AB $\Rightarrow \frac{x-3}{1}=\frac{y-5}{2}=\frac{z-3}{-2}=\lambda$

Let foot of perpendicular of P on AB be

$R \equiv (\lambda+3, 2\lambda+5, -2\lambda+3)$

$\Rightarrow (\lambda+3-1)(1)+(2\lambda+5-0)(2)+(-2\lambda+3-3)$

$(-2)=0$

$\Rightarrow \lambda+2+4\lambda+10+4\lambda=0$

$\Rightarrow \lambda=-\frac{4}{3}$

$\Rightarrow R \equiv \left(\frac{5}{3}, \frac{7}{3}, \frac{17}{3}\right)$

$Q \equiv \left(\frac{10}{3}-1, \frac{14}{3}-0, \frac{34}{3}-3\right) \equiv \left(\frac{7}{3}, \frac{14}{3}, \frac{25}{3}\right)$

$\Rightarrow \alpha+\beta+\gamma=\frac{7+14+25}{3}=\frac{46}{3}$

52. (b)

$10\frac{d}{dx}\int_1^x f(t)dt=\frac{d}{dx}(5xf(x)-x^5-9)$

$\Rightarrow 10f(x)=5f(x)+5xf'(x)-5x^4$

$\Rightarrow f(x)+x^4=xf'(x)$

$\Rightarrow y+x^4=x\frac{dy}{dx}$

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

$\Rightarrow ye^{\int -\frac{1}{x}dx}=\int x^3e^{\int -\frac{1}{x}dx}+c$

$\Rightarrow ye^{-|n|x|}=\int x^3e^{-|n|x|}+c$

$\Rightarrow \frac{y}{|x|}=\int \frac{x^3}{|x|}+c$

$\Rightarrow \frac{y}{x}=\int x^2+c$

$\Rightarrow \frac{y}{x}=\frac{x^3}{3}+c$

Put $x=1$ in given equation

$\Rightarrow 0=5f(1)-1-9 \Rightarrow f(1)=2$

$\Rightarrow \frac{2}{1}=\frac{1}{3}+c \Rightarrow c=\frac{5}{3}$

$\Rightarrow \frac{f(3)}{3}=\frac{27}{3}+\frac{5}{3}$

$\Rightarrow f(3) = 32$

53. (a)

$a_2 + a_4 + \cdots + a_n = 30$

$a_1 + a_3 + \cdots + a_{n-1} = 24$

(1) - (2)

$(a_2 - a_1) + (a_4 - a_3) \ldots (a_n - a_{n-1}) = 6$

$\Rightarrow \frac{n}{2} d = 6 \Rightarrow nd = 12$

$a_n - a_1 = (n-1)d = \frac{21}{2}$

$\Rightarrow nd - d = \frac{21}{2} \Rightarrow 12 - \frac{21}{2} = d$

$\Rightarrow d = \frac{3}{2}, n = 8$

Sum of odd terms $= \frac{4}{2}[2a + (4-1)3] = 24$

$\Rightarrow \mathrm{a} = \frac{3}{2}$

A.P. $\Rightarrow \frac{3}{2}, 3, \frac{9}{2}, 6, \frac{15}{2}, 9, \frac{21}{2}, 12$

no. of integer terms = 4

54. (c)

$\mathrm{a} = 2\,\mathrm{b} + 1$

$2\,\mathrm{b} = \mathrm{a} - 1$

$\mathrm{R} = \{(3,1), (5,2), \ldots, (99,49)\}$

Let $(2m+1, m), (2\lambda - 1, \lambda)$ are such ordered pairs.

According to the condition

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According to the condition

$\mathrm{m} = 2\lambda - 1 \Rightarrow \mathrm{m} =$ odd number

$\Rightarrow 1^{\text{st}}$ element of ordered pair (a, b)

$\mathrm{a} = 2(2\lambda - 1) + 1 = 4\lambda - 1$

Hence $\mathrm{a} \in \{3, 7, \ldots, 99\}$

$\Rightarrow \lambda \in \{1, 2, \ldots, 25\}$

$\Rightarrow$ set of sequence

$$\left\{\begin{matrix} (4\lambda - 1, 2\lambda - 1), (2\lambda - 1, \lambda - 1) \\ , \left(\lambda - 1, \dfrac{\lambda - 2}{2}\right), \ldots \ldots \end{matrix}\right\}$$

2^{nd} element of each ordered pair $= \frac{\lambda - 2^{\mathrm{r}-2}}{2^{\mathrm{r}-2}}$

For maximum number of ordered pairs in such sequence

$\frac{\lambda - 2^{\mathrm{r}-2}}{2^{\mathrm{r}-2}} = 1$ or $2; 1 \leq \lambda \leq 25$

$\lambda = 2^{\mathrm{r}-1}$ or $\lambda = 3.2^{\mathrm{r}-2}$

Case-I: $\lambda = 2\mathrm{r} - 1$

$\lambda = 2, 2^2, 2^3, 2^4$

$r = 2, 3, 4, 5$

Hence maximum value of r is 5 when $\lambda = 16$

Case-II : $\lambda = 3.2^{\mathrm{r}-2}$

$\lambda = 3, \quad 6, \quad 12,$

$\mathrm{r} = 2, \quad 3, \quad 4, 5$

Hence maximum value of r is 5 when $\lambda = 24$

55. (a)

$2\,\mathrm{b} = \frac{1}{4}(2\mathrm{ae})$

$\frac{b}{a} = \frac{e}{4}$

$e = \sqrt{1 - \frac{b^2}{a^2}}$

$e = \sqrt{1 - \frac{e^2}{16}}$

$e^2\left(1 + \frac{1}{16}\right) = 1$

$e = \frac{4}{\sqrt{17}}$

56. (a)

$L_1: (7\hat{i} + 6\hat{j} + 2k) + \lambda(-3\hat{i} + 2\hat{j} + 4k)$
$L_2: (5\hat{i} + 3\hat{j} + 4k) + \lambda(2\hat{i} + \hat{j} + 3k)$
Distance between skew lines

$= \frac{(2\hat{i} + 3\hat{j} - 2\hat{k}) \cdot (2\hat{i} + 17\hat{j} - 7\hat{k})}{\sqrt{342}}$

$= \frac{69}{\sqrt{342}} = \frac{69}{3\sqrt{38}} = \frac{23}{\sqrt{38}}$

57. (a)

$x^2 = 2y \& y = 2x + 6$
$x^2 = 4x + 12$

$x^2 - 4x - 12 = 0 \Rightarrow \left.\begin{matrix} x = 6 \\ y = 18 \end{matrix}\right| \text{ if } x = -2$

$y = 2$
$\therefore (6,18) \& (-2,2)$
Here (6,18) Rejected because (a, b) lies in 2^{nd} quadrant
$\therefore a = -2 \& b = 2$

$\therefore I = \int_{-2}^{2} \frac{9x^2}{1 + 5^x} dx = \int_{-2}^{2} \frac{9.5^x \cdot x^2}{1 + 5^x} dx$

$\therefore 2I = \int_{-2}^{2} 9x^2 dx = 18 \int_{0}^{2} x^2 dx = 18 \left(\frac{x^3}{3}\right)_0^2$

$2I = 48$
$T = 24$

58. (c)

$\Delta = 0 \Rightarrow \begin{vmatrix} 2 & \lambda & 3 \\ 3 & 2 & -1 \\ 4 & 5 & \mu \end{vmatrix} = 0$

$\Rightarrow 2(2\mu + 5) + \lambda(-4 - 3\mu) + 3(7) = 0$

$\Rightarrow 4\mu - 3\lambda\mu - 4\lambda + 31 = 0 \ldots\ldots (1)$

$\Delta_3 = 0 \Rightarrow \begin{vmatrix} 2 & \lambda & 5 \\ 3 & 2 & 7 \\ 4 & 5 & 9 \end{vmatrix} = 0$

$\Rightarrow 2(-17) + \lambda(1) + 5(7) = 0$

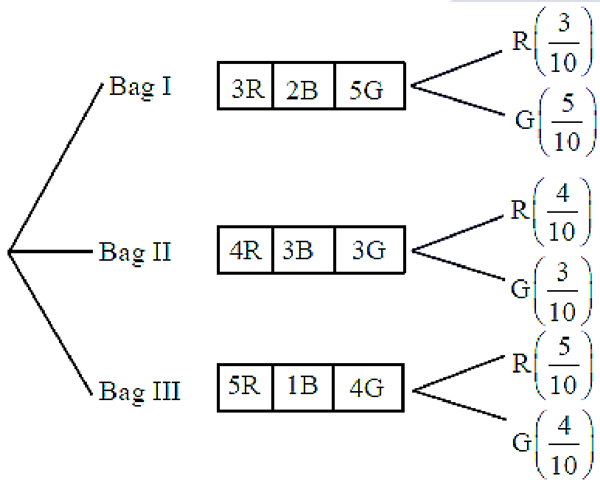
$\Rightarrow \lambda = -1$

from equation (1)
$4\mu + 3\mu + 4 + 31 = 0 \Rightarrow \mu = -5$
$\therefore \lambda^2 + \mu^2 = 26$

59. (a)

$$\operatorname{cosec}\theta=\frac{2(\sqrt{3}-1)\pm\sqrt{4(3+1-2\sqrt{3})+16\sqrt{3}}}{2\sqrt{3}}$$
$$=\frac{2(\sqrt{3}-1)\pm\sqrt{16+8\sqrt{3}}}{2\sqrt{3}}$$
$$=\frac{2(\sqrt{3}-1)\pm(2+2\sqrt{3})}{2\sqrt{3}}$$
$$\operatorname{cosec}\theta=2\text{ or }\frac{-2}{\sqrt{3}}$$
$$\therefore\sin\theta=\frac{1}{2}\text{ or }\frac{-\sqrt{3}}{2}$$
$$\therefore\sin\theta=\frac{1}{2}\text{ has 3 solutions \& also }\sin\theta=\frac{-\sqrt{3}}{2}$$
has 3 solutions in $\left[\frac{-7\pi}{6},\frac{4\pi}{3}\right]$

60. (c)



$$p=P\left(\frac{B_I}{R}\right)=\frac{\frac{1}{3}\left(\frac{3}{10}\right)}{\frac{1}{3}\left(\frac{3}{10}+\frac{4}{10}+\frac{5}{10}\right)}=\frac{1}{4}$$
$$q=\left(\frac{B_{III}}{G}\right)=\frac{\frac{1}{3}\left(\frac{4}{10}\right)}{\frac{1}{3}\left(\frac{5}{10}+\frac{3}{10}+\frac{4}{10}\right)}=\frac{1}{3}$$
$$\therefore\frac{1}{p}+\frac{1}{q}=7$$

61. (b)

$\because$ mean $=9$

$\therefore 53+a+b=72$

$\Rightarrow a+b=19$

$\because \sigma^2=\frac{37}{4}$ and $(\bar{X})^2+\sigma^2=\frac{\sum x_1^2}{N}$

$\Rightarrow 81+\frac{37}{4}=\frac{529+a^2+b^2}{8}$

$\Rightarrow 648+74=529+a^2+b^2$

$\Rightarrow a^2+b^2=193$

$\because a+b=19\Rightarrow a^2+b^2+2ab=361$

$\Rightarrow 2ab=168$

$\Rightarrow ab = 84$
$\therefore a + b + ab = 103$

62.(a)

$x + |x| > 0 \Rightarrow x \in (0, p0)$
$\&10 + 3x - x^2 > 0$
$\Rightarrow x^2 - 3x - 10 < 0$
$\Rightarrow x \in (-2,5)$
from (1) & (2) $x \in (0,5)$
$\therefore \mathrm{a} = 0 \& \mathrm{~b} = 5$
$\therefore (1 + \mathrm{a}^2) + \mathrm{b}^2 = 1 + 25 = 26$

63.(b)

$$4\int_0^1 \frac{1}{\sqrt{3+x^2}+\sqrt{1+x^2}}dx - 3\ln\sqrt{3}$$
$$= 4\int_0^1 \frac{\sqrt{3+x^2}-\sqrt{1+x^2}}{(3+x^2)-(1-x^2)}dx - \frac{3}{2}\ln 3$$
$$= 2\left[\left\{\frac{x}{2}\sqrt{3+x^2}+\frac{3}{2}\ln\left(x+\sqrt{3+x^2}\right)\right\}_0^1\right.$$
$$\left.-\left\{\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\ln\left(x+\sqrt{1+x^2}\right)\right\}_0^1\right] - \frac{3}{2}\ln 3$$
$$-\left\{\frac{x}{2}\sqrt{1+x^2}+\frac{1}{2}\ln\left(x+\sqrt{1+x^2}\right)\right\}_0^1\Bigg] - \frac{3}{2}\ln 3 =$$
$$2\left[\left\{\frac{1}{2}\sqrt{4}+\frac{3}{2}\ln(1+\sqrt{4})\right\}-\left\{0+\frac{3}{2}\ln\sqrt{3}\right\}\right.$$
$$\left.= -\left\{\frac{1}{2}\sqrt{2}+\frac{1}{2}\ln(1+\sqrt{2})\right\}+\left\{0+\frac{1}{2}(0)\right\}\right] - \frac{3}{2}\ln 3$$
$$=2\left[1+\tfrac{3}{2}\ln 3-\tfrac{3}{4}\ln 3-\tfrac{1}{\sqrt{2}}-\tfrac{1}{2}\ln(1+\sqrt{2})\right]-\tfrac{3}{2}\ln 3$$
$$= 2 + 3\ln 3 - \frac{3}{2}\ln 3 - \sqrt{2} - \ln(1+\sqrt{2}) - \frac{3}{2}\ln 3$$
$$= 2 - \sqrt{2} - \ln(1+\sqrt{2})$$

64. (a)

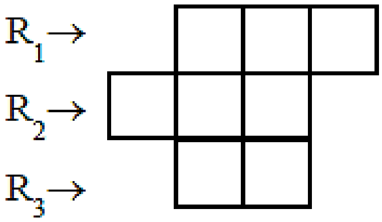
$$\lim_{x\to 0}\frac{\cos 2x + a\cos 4x - b}{x^4} = \text{ finite}$$
$$L = \frac{\left\{1-\frac{(2x)^2}{2}+\frac{(2x)^4}{4}\cdots\right\}+a\left\{1-\frac{(4x)^2}{2}+\frac{(4x)^4}{4}\cdots\right\}-b}{x^4}$$
$$L = \frac{(1+a-b)-x^2(2+8a)+x^4\left(\frac{2}{3}+\frac{32}{3}a\right)+x^6()\cdots}{x^4}$$
$$\therefore 1+a-b=0 \text{ and } 2+8a=0 \Rightarrow a=-\frac{1}{4}$$
$$b = a+1$$
$$= -\frac{1}{4}+1=\frac{3}{4}$$
$$\therefore a+b=-\frac{1}{4}+\frac{3}{4}=\frac{1}{2}$$

65.(d)

$$\sum_{r=0}^{10}\left(\frac{10^{r-1}-1}{10^r}\right)\ {}^{11}C_{r+1}$$
$$= \sum_{r=0}^{10}\left(10-\frac{1}{10^r}\right)\ {}^{11}C_{r+1}$$

$$= 10\sum_{r=0}^{10} {}^{11}C_{r+1} - 10\sum\left({}^{11}C_{r+1}\left(\frac{1}{10}\right)^{r+1}\right)$$
$$= 10[{}^{11}C_1 + {}^{11}C_2 + \cdots .. + {}^{11}C_{11}]$$
$$-10\left[{}^{11}C_1\left(\frac{1}{10}\right)^1 + {}^{11}C_2\left(\frac{1}{10}\right)^2 + \cdots .. + {}^{11}C_{11}\left(\frac{1}{10}\right)^{11}\right]$$
$$= 10[2^{11} - 1] - 10\left[\left(1 + \frac{1}{10}\right)^{11} - 1\right]$$
$$= 10(2)^{11} - 10 - \frac{11^{11}}{10^{10}} + 10$$
$$= \frac{(20)^{11} - 11^{11}}{10^{10}}$$
$\therefore \alpha = 20$

66.(d)



$=$ Total $-$ [(All in R_1 and R_3) + (All in R_2 and R_3) + (All in R_1 and R_2)

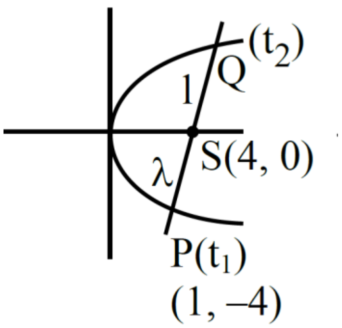
$= {}^8C_5 \cdot \lfloor 5 - \{\lfloor 5 + \lfloor 5 + {}^6C_5 \cdot \lfloor 5\}$

$= 5(56 - 1 - 1 - 6) = 120(48)$

$= 5760$

67.(a)

$y^2 = 16x; a = 4$ focus $S \equiv (4,0)$



$2at_1 = -4$

$\Rightarrow 2(4)t_1 = -4$

$\Rightarrow t_1 = -\frac{1}{2}$

$\because t_1t_2 = -1$

$\Rightarrow t_2 = 2$

$\therefore Q(at_2^2, 2at_2) = (16,16)$

Let, S divides PQ internally in $\lambda: 1$ ratio

$\therefore \frac{16\lambda - 4}{\lambda + 1} = 0\lambda$

$= \frac{1}{4} = \frac{m}{n}$

$\therefore m^2 + n^2 = 1 + 16 = 17$

68. (d)

$\vec{a} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}, \vec{b} = 3\hat{\imath} + 2\hat{\jmath} + 5\hat{k}$

$$\vec{a}\times\vec{b}=\begin{vmatrix} i & j & k \\ 2 & -3 & 1 \\ 3 & 2 & 5 \end{vmatrix}$$

$= -17\hat{\imath} - 7\hat{\jmath} + 13\hat{k}$

$(\vec{a}-\vec{c})\times\vec{b} = -18\hat{\imath} - 3j + 12\hat{k}$

$\Rightarrow (\vec{a}\times\vec{b}) - (\vec{c}\times\vec{b}) = -18\hat{\imath} - 3\hat{\jmath} + 12\hat{k}$

$\Rightarrow \vec{b}\times\vec{c} = (-18\hat{\imath} - 3\hat{\jmath} + 12\hat{k}) - (\vec{a}\times\vec{b})$

$= (-18\hat{\imath} - 3\hat{\jmath} + 12\hat{k}) - (-17i - 7\hat{\jmath} + 13\hat{k})$

$\vec{b}\times\vec{c} = -\hat{\imath} + 4\hat{\jmath} - \hat{k}$

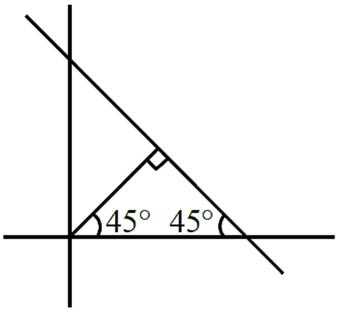
$\therefore \vec{a}\cdot\vec{d} = \vec{a}\cdot(\vec{b}\times\vec{c}) = (2i - 3j + k)\cdot(-\hat{\imath} + 4\hat{\jmath} - \hat{k})$

$= -2 - 12 - 1 = -15$

$\therefore |\vec{a}\cdot\vec{d}| = 15$

69. (c)

$$\frac{x}{-c} + \frac{y}{-c/b} = 1$$



$\therefore$ area of triangle $= \frac{1}{2}\left|\frac{c^2}{b}\right| = 48$

$\left|\frac{c^2}{b}\right| = 96$

$\because -c = -\frac{c}{b}$

$\Rightarrow b = 1 \ \therefore c^2 = 96$

$\therefore b^2 + c^2 = 97$

70.(a)

$A^3 - 2A^2 - 4A + 4I = 0$

$A^3 = 2A^2 + 4A - 4I$

$A^4 = 2A^3 + 4A^2 - 4A$

$= 2(2A^2 + 4A - 4I) + 4A^2 - 4A$

$A^4 = 8A^2 + 4A - 8I$

$A^5 = 8A^3 + 4A^2 - 8A$

$= 8(2A^2 + 4A - 4I) + 4A^2 - 8A$

$A^5 = 20A^2 + 24A - 32I$

$\therefore \alpha = 20, \beta = 24, \gamma = -32$

$\therefore \alpha + \beta + \gamma = 12$

Section-B

71. (21)

I.F. $= e^{\int 2\sec^2 x dx}$

$= e^{2\tan x}$

Solution of diff. eq.

$$y\cdot e^{2\tan x} = \int e^{2\tan x}(2\sec^2 x + 3\tan x\cdot\sec^2 x)dx$$

$y \cdot e^{2\tan x} = \int e^{2\tan x} \cdot (2\sec^2 x)dx + \int e^{2\tan x} \cdot (3\tan x \cdot \sec^2 x)dx$

$y \cdot e^{2\tan x} = e^{2\tan x} \cdot 2\tan x - \int e^{2\tan x} \cdot 2\sec^2 x \times 2\tan x dx + \int e^{2\tan x} \cdot 3\tan x \cdot \sec^2 x dx$

$y \cdot e^{2\tan x} = 2\tan x \cdot e^{2\tan x} - \int e^{2\tan x} \cdot \tan x \sec^2 x dx$

$y \cdot e^{2\tan x} = 2\tan x \cdot e^{2\tan x} - \frac{\tan x \cdot e^{2\tan x}}{2} + \frac{e^{2\tan x}}{4} + C$

$y = 2\tan x - \frac{\tan x}{2} + \frac{1}{4} + Ce^{-2\tan x}$

$= 0, y = \frac{5}{4}$x

$c = 1$

$y\left(\frac{\pi}{4}\right) = \frac{7}{4} + e^{-2}$

Then $12\left(y\left(\frac{\pi}{4}\right) - e^{-2}\right) = 12\left(\frac{7}{4}\right) = 21$

72. (441)

$T_r = \frac{4 \cdot r}{1 + 4 \cdot r^4}$

$T_r = \frac{4 \cdot r}{(2r^2 + 2r + 1)(2r^2 - 2r + 1)}$

$T_r = \frac{(2r^2 + 2r + 1) - (2r^2 - 2r + 1)}{(2r^2 + 2r + 1)(2r^2 - 2r + 1)}$

$T_r = \frac{1}{2r^2 - 2r + 1} - \frac{1}{2r^2 + 2r + 1}$

$T_1 = \frac{1}{1} - \frac{1}{5}$

$T_2 = \frac{1}{5} - \frac{1}{13}$

$T_{10} = \frac{1}{181} - \frac{1}{221}$

$S_{10} = 1 - \frac{1}{221} = \frac{220}{221} = \frac{m}{n}$

$m + n = 441$

73. (c)

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

$y = \frac{1}{2} \times \frac{x}{2} - \sqrt{1 - \frac{1}{4}}\sqrt{1 - \frac{x^2}{4}}$

$4y = x - \sqrt{3}\sqrt{4 - x^2}$

$3(4 - x^2) = x^2 + 16y^2 - 8xy$

$12 - 3x^2 = x^2 + 16y^2 - 8xy$

$4x^2 + 16y^2 - 8xy = 12$

$x^2 + 4y^2 - 2xy = 3$

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

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

74. (c)

Area of $\triangle$ ABC $= \frac{1}{2}\begin{vmatrix} 4 & -2 & 1 \\ 1 & 1 & 1 \\ 9 & -3 & 1 \end{vmatrix} = 6$ square units

Maximum area of AFDE $= \frac{1}{2} \times 6 = 3$sq. units

75. (7)

Both the roots are positive
$D \geq 0$
$4(a-3)^2 - 4 \times 9(1-a) \geq 0$
$a^2 - 6a + 9 - 9 + 9a \geq 0$
$a^2 + 3a \geq 0$
$a(a+3) \geq 0$
$a \in (-\infty, -3] \cup [0, \infty)$
$-\frac{b}{2a} > 0$
$\frac{2(a-3)}{2(a-1)} > 0a$
$\in (-\infty, 1) \cup (3, \infty)f$
$(0) = 9 > 0$
Equation (i) $\cap$ (ii)
$a \in (-\infty, -3] \cup [0,1)$
$2\alpha + \beta + \gamma - 6 + 0 + 1 = 7$