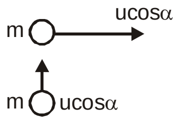
Physics

1. d $P = \rho \frac{RT}{M}$

$\frac{\rho_1}{\rho_2} = \frac{P_1 M_1}{P_2 M_2} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$

2. a At the highest point



the composite mass will have both components of its velocity equal.

Hence $\theta = 45°$

3. a $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ ...(i)

as $\mu = \frac{3}{2}$ $f = 2R$

$v = 8m$

$u = -24m$

solving equation (i)

$f = 6m \Rightarrow R = 3m$

4. b Lease count = 1 M.S.D. – 1 V.S.D.
= (0.05 – 0.049) cm
= 0.001 cm
Diameter = 5.10 + (0.001) × 24
= 5.10 + 0.024
= 5.124 cm

5. d The force is radial in nature.
Therefore work done along circular path = 0

6. c $\frac{\Delta l_2}{\Delta l_1} = \frac{L_2}{L_1} \times \frac{A_1}{A_2}$

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

7. a Let θ be the angle between the two vectors

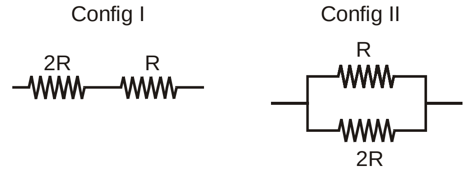
$\cos\theta = \hat{a}.\hat{b}$

$\cos\theta = -\frac{1}{2}$

$\theta = 120$

angle of incidence $= \frac{180 - \theta}{2} = 30°$

8. a



$\frac{\Delta Q}{\Delta t_1} = \frac{\Delta\theta}{3R}$ $\frac{\Delta Q}{\Delta t_2} = \frac{3\Delta\theta}{2R}$

$\frac{\Delta t_2}{\Delta t_1} = \frac{2}{9}$

$\Delta t_2 = \frac{2}{9} \times 9 = 2s$

9. b $P = \frac{E}{c} = \frac{30 \times 10^{-3} \times 10 \times 10^{-9}}{3 \times 10^{8}}$

$= 1.0 \times 10^{-17}$ kg ms^{-1}

10. b $I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$

here $I = \frac{I_{max}}{2}$

$\cos\left(\frac{\phi}{2}\right) = \frac{1}{\sqrt{2}}$

$\phi = (2n+1)\frac{\pi}{2}$

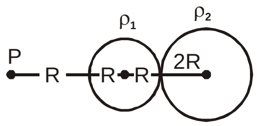
or $\Delta x = (2n+1)\frac{\lambda}{4}$

11. a,d Let the mass of lighter sphere be m then the mass of heavier sphere = 3m
Buoyancy required for equilibrium = 4 mg
This is only possible when both the spheres are completely submerged.
for the lower sphere
kx + 2mg = 3mg
kx = mg

$x = \frac{4}{3}\frac{\pi R^3}{k}\rho g$

12. b,d In first step,
charge on C_1 = $2CV_0$
In second step the charge is shared equally between both the capacitors
∴ charge on C_1 is CV_0 with upper plate positive.
In third step, C_2 gets charged with negative polarity.
∴ Charge on the upper plate of C_2 is $-CV_0$

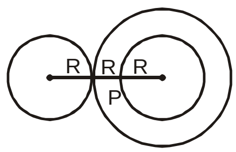
13. b,d **Case I**



$$\frac{\rho_1 R^3}{3\in_0 (2R)^2} = \frac{\rho_2 (2R)^3}{3\in_0 (5R)^2}$$

$$\frac{\rho_1}{\rho_2} = -\frac{32}{25}$$ [$\because$ both must be oppositely charged]

Case II



$$\frac{\rho_1 R^3}{3\in_0 (2R)^2} = \frac{\rho_2 R}{3\in_0}$$

$$\frac{\rho_1}{\rho_2} = 4$$

14. b,c No. of nodes = (m + 1) = 6

Length $= \frac{5\lambda}{2} = \frac{5\pi}{k} = \frac{5\times 3.14}{62.8} = 0.25\text{ m}$

Maximum displacement = 0.01 m

Fundamental frequency $= \frac{V}{2L} = \frac{\omega}{2Lk}$

$$= \frac{628}{2\times 0.25\times 62.8} = 20\text{ Hz}$$

15. a,c The direction of field is – z from right hand rule

time $t = \frac{\theta}{\omega}$

$\sin\theta = \frac{1}{2}$

$\theta = 30°$ or $\frac{\pi}{6}$

$$t = \frac{\pi m}{6\,QB}$$

$$B = \frac{\pi m}{6Q\times 10\times 10^{-3}} = \frac{50\pi m}{3Q}$$

16. **4**

Percentage fraction of sample decayed

$= \left(1 - e^{-\lambda t}\right)\times 100$

On solving

= 4

17. **5**

At the highest point of mass 1

speed $= \sqrt{gl_1}$

If this speed is sufficient for mass 2 to complete a circle,

$\sqrt{gl_1} = \sqrt{5gl_2}$

$\frac{l_1}{l_2} = 5$

18. **8**

Here $I_1\omega_1 = I_2\omega_2$ ...(i)

$I_1 = \frac{1}{2}MR^2 = \frac{1}{2}\times 50\times 0.4^2 = 4$ units

$I_2 = \frac{1}{2}MR^2 + 2\times 2mr^2 = 5$ units

from equation (i)

$\omega_2 = \frac{4}{5}\omega_1 = 8$

19. **1**

The slope of V vs. ν graph is $\frac{h}{e}$ and thus remains same for all

Hence ratio = 1

20. **5**

$W = \frac{1}{2}mv^2$

$0.5\times 5 = \frac{1}{2}\times 0.2\,v^2$

$v = 5\text{ m/s}$

Chemistry

21. a

22. c $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

$\Delta H = [6\times(-400)+6(-300)] - [-1300]$

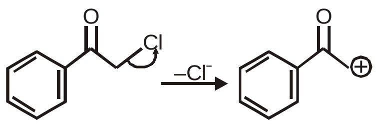
$= -2400 - 1800 + 1300$

$= -4200 + 1300$

$\Delta H = -2900\ kJ/mol$

$= \frac{-2900}{180} kJ/gm$

$= -16.11 kJ/gm$

23. b 

unstable

due to – I effect of $-\overset{O}{\overset{\|}{C}}-$ **,** so the formation of carbocation is not possible. Hence fastest S_N2 is given by S.

24. d Phenol don't liberate CO_2 on reacting with aq. $NaHCO_3$

25. b Spin only magnetic moment $= \sqrt{n(n+2)}$ B.M.

where $n \rightarrow$ no. of unpaired electrons.

$P = [FeF_6]^{3-} = Fe^{3+} = \sqrt{5(5+2)} = \sqrt{35}$

$Q = [V(H_2O)_6]^{2+} = V^{2+} = \sqrt{2(2+2)} = \sqrt{8}$

$R = [Fe(H_2O)_6]^{2+} = Fe^{2+} = \sqrt{4(4+2)} = \sqrt{24}$

26. d w.r.t. 'P' reaction is 1st order
w.r.t. 'Q' reaction is 0 order
overall order = 1 + 0 = 1

27. b HNO_3 on long standing produces NO_2 (Yellow brown)

28. a $\frac{r}{R} = 0.414; \quad \frac{r}{250} = 0.414$

r = 250 × 0.414 = 103.5 pm

$\simeq$ 104 pm

29. d $Zn + H_2S \rightarrow ZnS + 2H^+$
Curdy white
ppt.

30. b Adsorption (chemical) takes place and releases energy.

31. a,b,c,d
All forms aromatic compounds

32. a $[H^+]$ from weak acid = 10^{-2} M

so $C\alpha = 10^{-2}$

$K_a = C\alpha^2$

$K_a = \frac{(C\alpha)^2}{C} = \frac{(10^{-2})^2}{1} = 10^{-4}$

33. b,c,d
Being ideal, ΔH and $\Delta S_{surrounding} = 0$ and entropy of solution on mixing increases.

34. b,d

35. a In tert. carbocation, C has vacant P-orbital and hence $\sigma \rightarrow P$ (empty) overlap takes place.

36. **4**

37. **5**

$\frac{\lambda_{He}}{\lambda_{Ne}} = \frac{\sqrt{2mK.E_{Ne}}}{\sqrt{2mK.E_{He}}} = \frac{\sqrt{\frac{2\times 20}{N_A}\times\frac{3}{2}KT_{Ne}}}{\sqrt{\frac{2\times 4}{N_A}\times\frac{3}{2}KT_{He}}}$

Now $T_{Ne} = 1000\ K$

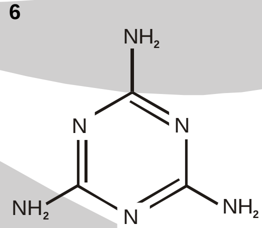
$T_{He} = 200K$

So $\frac{\lambda_{He}}{\lambda_{Ne}} = \sqrt{25} = 5$

$\frac{M\times\lambda_{He}}{\lambda_{Ne}} = 5$

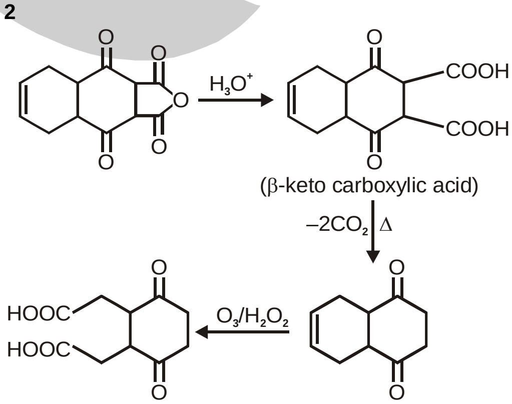
M = 5

38. **6**



Melamine

39. **2**



40. **8**

Mathematics

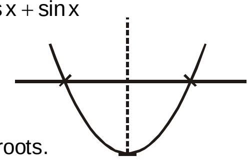
41. c $f(x) = x^2 - x\sin x - \cos x$

$f'(x) = 2x - \sin x - x\cos x + \sin x$

$= x(2 - \cos x)$

$f(0) = -2$

$\therefore$ $f(x) = 0$ have two roots.



42. b $1 + \sum_{k=1}^{n} 2k = 1 + 2n\frac{(n+1)}{2} = n^2 + n + 1$

$\sum_{n=1}^{23} \cot^{-1}(n^2 + n + 1)$

$\sum \tan^{-1}\frac{n+1-n}{n^2+n+1} = \sum_{n=1}^{23} \tan^{-1}(n+1) - \tan^{-1} n$

$= \tan^{-1} 24 - \tan^{-1} 1$

$= \tan^{-1}\frac{23}{25}$

Now $\cot\tan^{-1}\left(\frac{23}{25}\right)$

$= \cot\cot^{-1}\left(\frac{25}{23}\right) = \frac{25}{23}$

43. c $\vec{b} + \overrightarrow{SQ} = \vec{a}$

$\vec{b} - \vec{a} = \overrightarrow{SQ}$

$\vec{b} + \vec{a} = \overrightarrow{PR}$

$\overrightarrow{PS} = \vec{b} = \frac{\overrightarrow{SQ} + \overrightarrow{PR}}{2} = 2\hat{i} - \hat{j} - 3\hat{k}$

$\overrightarrow{PQ} = \vec{a} = \frac{\overrightarrow{PR} - \overrightarrow{SQ}}{2} = \hat{i} + 2\hat{j} + \hat{k}$

$\therefore$ Volume $= \left\|\begin{matrix} 1 & 2 & 3 \\ 1 & 2 & 1 \\ 2 & -1 & -3 \end{matrix}\right\| = \left|1(-6+1) - 2(-3-2) + 3(-1-4)\right|$

$= |-5 + 10 - 15| = 10$

44. c $|z - z_0| = r$

$\Rightarrow |z_0|^2 - (\alpha\bar{z}_0 + \bar{\alpha}z_0) + |\alpha|^2 - r^2 = 0$ …(i)

$\left|\frac{1}{\bar{\alpha}} - z_0\right|^2 = 4r^2$

$\Rightarrow 1 - (z_0\bar{\alpha} + \alpha\bar{z}_0) + |\alpha|^2|z_0|^2 - 4r^2|\alpha|^2 = 0$ …(ii)

Equation (i) –(ii) is

$1 - \left(|z_0|^2 + |\alpha|^2 - r^2\right) + |\alpha|^2|z_0|^2 - 4r^2|\alpha|^2 = 0$

Since $|z_0|^2 = \frac{r^2+2}{2}$

$\therefore$ $2 - \left(r^2 + 2 + 2|\alpha|^2 - 2r^2\right) + |\alpha|^2(r^2 + 2) - 8r^2|\alpha|^2 = 0$

$\Rightarrow |\alpha|^2 = \frac{r^2}{7r^2} = \frac{1}{7}$

Hence $|\alpha| = \frac{1}{\sqrt{7}}$

45. a Point of intersection of ax + by + c = 0 and bx + ay + c = 0 is

$\left(-\frac{c}{a+b}, -\frac{c}{a+b}\right)$

Now $\sqrt{\left(\frac{c}{a+b}+1\right)^2 + \left(\frac{c}{a+b}+1\right)^2} < 2\sqrt{2}$

$\sqrt{2}\left|\frac{a+b+c}{a+b}\right| < 2\sqrt{2}$

$\Rightarrow \frac{a+b+c}{a+b} < 2$

$\Rightarrow 2a + 2b > a + b + c$

i.e. $a + b - c > 0$

46. d Any point B on the line is $(2\lambda - 2, -\lambda - 1, 3\lambda)$

Point B lies on plane for some λ

$\Rightarrow (2\lambda - 2) + (-\lambda - 1) + (3\lambda) = 3$

$\therefore$ $\lambda = \frac{3}{2}$ $\Rightarrow B = \left(1, -\frac{5}{2}, \frac{9}{2}\right)$

The foot of perpendicular from point (–2, –1, 0) on the plane is the point A (0, 1, 2)

$\therefore$ D.R. of AB $\equiv (2, -7, 5)$

Hence equation of line is $\frac{x}{2} = \frac{y-1}{-7} = \frac{z-2}{5}$

47. a Required prob. $1 - P(\bar{A} \cap \bar{B} \cap \bar{C} \cap \bar{D})$

$= 1 - P(\bar{A})P(\bar{B})P(\bar{C})P(\bar{D})$

$= 1 - \frac{1}{2} \times \frac{1}{4} \times \frac{3}{4} \times \frac{7}{8}$

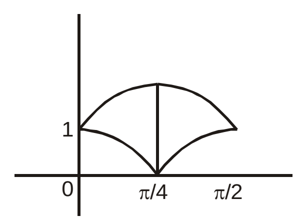
$= 1 - \frac{21}{256} = \frac{235}{256}$

48. b $y = \sin x + \cos x$

$= \sqrt{2}\sin\left(x + \frac{\pi}{4}\right)$

and $y = |\cos x - \sin x|$

$= \sqrt{2}\left|\cos\left(x + \frac{\pi}{4}\right)\right|$



Area enclosed $= \int_0^{\pi/4} \{(\sin x + \cos x) - (\cos x - \sin x)\} dx$

$+ \int_{\pi/4}^{\pi/2} \sin x + \cos x + (\cos x - \sin x) dx$

$= 2(-\cos x)_0^{\pi/4} + 2(\sin x)_{\pi/4}^{\pi/2}$

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

$= 4 - 2\sqrt{2} = 2\sqrt{2}(\sqrt{2} - 1)$

49. a $\frac{dy}{dx}=\frac{y}{x}+\sec\left(\frac{y}{x}\right)$

Let y = vx

$v+x\frac{dv}{dx}=v+\sec v$

$\Rightarrow \int \cos v\, dx=\int \frac{dx}{x}$

sin v = lnx + lnc

or $\sin\frac{y}{x}=\ln x+\ln c$

$\sin\frac{\pi}{6}=0+\ln c=\frac{1}{2}$

$\Rightarrow \sin\frac{y}{x}=\ln x+\frac{1}{2}$

50. d $f'(x)<2f(x)$

$\int_{1/2}^{x}\frac{f'(x)}{f(x)}dx<\int_{\frac{1}{2}}^{x}dx$

$\Rightarrow (\log f(x))_{1/2}^{x}<2(x)_{1/2}^{x}$

$\Rightarrow \log f(x)<2x-1$

$\Rightarrow f(x)<e^{2x-1}$

$\Rightarrow 0<\int_{1/2}^{1}f(x)<\int_{1/2}^{1}e^{2x-1}$

$0<\int_{1/2}^{1}f(x)dx<\left(\frac{e^{2x-1}}{2}\right)_{1/2}$

$0<\int_{1/2}^{1}f(x)dx<\frac{e-1}{2}$

51. c,d (a) If M is symmetric $\Rightarrow M^T=M$

$\therefore\ (N^TMN)^T=N^TM^TN=N^TMN=$ symmetric

If M is skew symmetric $\Rightarrow M^T=-M$

$(N^TMN)^T=N^TM^TN=N^T(-M)N=-N^TMN$

$\Rightarrow$ skew symmetric

$\therefore$ option (a) is correct statement.

(b) $(MN-NM)^T=(MN)^T-(NM)^T$

$=N^TM^T-M^TN^T$

$=NM-MN$ = skew symmetric

$\therefore$ statement (b) is correct

(c) $(MN)^T=N^TM^T$

= NM, which is not correct

(d) adj (MN) = (adj N) (adj M)

$\Rightarrow$ which is not correct.

52. b,d $L_1=3\hat{i}-\hat{j}++4\hat{k}+t(\hat{i}+2j66+2\hat{k})$

$L_2=3\hat{i}+3\hat{j}+2\hat{k}+s(2\hat{i}+2\hat{j}+\hat{k})$

Vector $\perp$ to L_1 and L_2 is given by $\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\1&2&2\\2&2&1\end{vmatrix}$ $-2\hat{i}+3\hat{j}-2\hat{k}$

Equation of line L is $\frac{x}{-2}=\frac{y}{3}=\frac{z}{-2}=r$

x = –2r, y = 3r, z = –2r

Putting in L_1 i.e. $\frac{x-3}{1}=\frac{y+1}{2}=\frac{z-4}{2}$

$-2r-3=\frac{3r+1}{2}=\frac{-2r-4}{2}\Rightarrow r=-1$

Intersection of L and L_1 is x = 2, y = –3, z = 2

point on L_2 i.e. $\frac{x-3}{2}=\frac{y-3}{2}=\frac{z-2}{1}=\lambda$

$2\lambda+3,\ 2\lambda+3,\ \lambda+2$

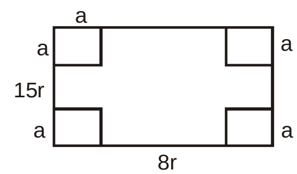
$\sqrt{(2\lambda+3+2)^2+(2\lambda+3+3)^2+(\lambda+2-2)^2}=\sqrt{17}$

$\Rightarrow\ 9\lambda^2+28\lambda+20=0$

$\Rightarrow \lambda=\frac{-28\pm 8}{18}=-2,-\frac{10}{9}$

$\therefore$ point on L_2 are $(-1,-1,0)$ and $\left(\frac{7}{9},\frac{7}{9},\frac{8}{9}\right)$.

53. c,a



$\Rightarrow 46r=k$; k is constant

Also $4a^2=100\Rightarrow a^2=25\Rightarrow a=5$

$v=(8r-2a)(15r-2a)\times a$

$v=(120r^2-46ar+4a^2)$

$v=120ar^2-46a^2r+4a^3$

$\frac{dv}{da}=120r^2-46r\times 2a+12a^2=0$

$\because$ a = 5 $\therefore$ $120r^2-460r+300=r=3,\frac{5}{6}$

$\therefore\ \frac{d^2v}{da^2}=-92r+24a<0 \text{ for } r=3$

$\therefore$ length of sides = 15 × 3, 8 × 3

45, 24.

54. a,d $S_n=\sum_{k=1}^{4n}(-1)^{\frac{k(k+1)}{2}}$

$=3^2-1^2+7^2-5^2+11^2-9^2+15^2-13^2+\cdots(4n-1)^2-(4n-3)^2$

$+4^2-2^2+8^2-6^2+12^2-10^2+\cdots(4n)^2-(4n-2)^2$

$=8[1+3+5+\cdots(2n-3)+(2n-1)]$

$+4[3+7+11+\cdots(4n-5)+(4n-1)]$

$=8\times\frac{n}{2}(2+(n-1)2)+4\times\frac{n}{2}[6+(n-1)4]$

$=16n^2+4n$

For n = 8 $\quad S_n$ = 16 × 64 + 32 = 1056

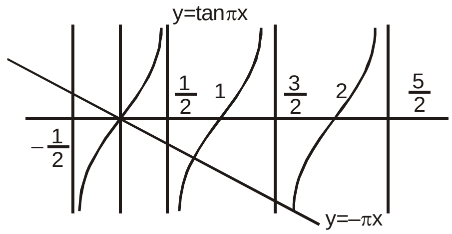
n = 9, $\quad S_n$ = 16 × 81 + 36 = 1332

55. b,c $f(x) = x\sin\pi x$

$f'(x) = \pi x\cos\pi x + \sin\pi x$

$f'(x) = 0$

$\tan\pi x = -\pi x$



$B\left(\frac{3}{2}, 2\right)$ unique solution

$C(1, 2)$ unique solution

56. **5**

Let number on remained cards is k, k + 1

$\therefore\ (1 + 2 + \cdots n) - [k + (k+1)] = 1224$

$\frac{n(n+1)}{2} - (2k+1) = 1224$

$n(n+1) - 4k - 2 = 2448$

$n(n+1) - 4k = 2450$

$n(n+1) - 2450 = 4k$

n = 50, k = 25

$\therefore$ k – 20 = 5.

57. **5**

Eight vectors are

$\vec{p} = \hat{i} + \hat{j} + \hat{k}$ $\quad$ $\vec{p}' = -\hat{i} - \hat{j} - \hat{k}$

$\vec{q} = \hat{i} + \hat{j} - \hat{k}$ $\quad$ $\vec{q}' = -\hat{i} - \hat{j} + \hat{k}$

$\vec{r} = \hat{i} - \hat{j} + \hat{k}$ $\quad$ $\vec{r}' = -\hat{i} + \hat{j} - \hat{k}$

$\vec{s} = -\hat{i} + \hat{j} + \hat{k}$ $\quad$ $\vec{s}' = \hat{i} - \hat{j} - \hat{k}$

If we take $\vec{p}$ and $\vec{p}'$ and any one of remaining.

six vectors will always be co-planar.

$\therefore$ No. of co-planar vectors = 6

Similarly taking q and q', r and r' and s and s'

No. of co-planar vectors in each case is 6.

$\therefore$ Total number of co-planar vectors = 24

$\therefore$ Required number of non-co-planar vector

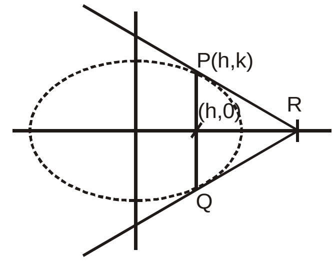
$= {}^8C_3 - 24 = 32 = 2^5$

58. **9**

Equation of tangent at P

$\frac{xh}{4} + \frac{yk}{3} = 1$

$R\left(\frac{4}{h}, 0\right)$



$\Delta = k\left(\frac{4}{h} - h\right)$

$= \sqrt{3\left(1 - \frac{h^2}{4}\right)}\left(\frac{4}{h} - h\right)$

$\Delta(h) = \frac{\sqrt{3}}{2h}\sqrt{4 - h^2}\,(4 - h^2)$

$\Delta_1 = \Delta\left(\frac{1}{2}\right) = \frac{\sqrt{3}}{2 \times \frac{1}{2}}\sqrt{4 - \left(\frac{1}{2}\right)^2}\left[4 - \left(\frac{1}{2}\right)^2\right]$

$= \sqrt{3}\frac{\sqrt{15}}{2} \times \frac{15}{4} = \frac{3\sqrt{5} \times 15}{8}$

$\Delta_2 = \Delta(1) = \frac{\sqrt{3}}{2}\sqrt{3} \times 3 = \frac{9}{2}$

$\therefore\ \frac{8}{\sqrt{5}}\Delta_1 - 8\Delta_2 = \frac{8}{\sqrt{5}} \times \frac{3\sqrt{5} \times 15}{8} - 8 \times \frac{9}{2}$

= 45 – 36 = 9

59. **6**

Let three consecutive terms are (r + 1), (r + 2), (r + 3)

$\therefore\ \frac{{}^{n+5}C_r}{{}^{n+5}C_{r+1}} = \frac{5}{10}$ and $\frac{{}^{n+5}C_{r+1}}{{}^{n+5}C_{r+2}} = \frac{10}{14}$

$\because\ \frac{{}^{n+5}C_r}{{}^{n+5}C_{r+1}} = \frac{1}{2}$

$\Rightarrow\ \frac{r+1}{n+5-r} = \frac{1}{2} \Rightarrow n - 3r = -3$ $\quad$ …(i)

Also $\frac{{}^{n+5}C_{r+1}}{{}^{n+5}C_{r+2}} = \frac{5}{7}$

$\Rightarrow\ \frac{r+2}{(n+5)-(r+1)} = \frac{5}{7} \Rightarrow 5n - 12r = -6$ $\quad$ …(ii)

Solving (i) and (ii)

n = 6.

60. **6**

$P(E_1 \cap E_2^1 \cap E_3^1) = \alpha \Rightarrow P(E_1).P(E_2^1).P(E_3^1) = \alpha$ …(i)

$P(E_1^1 \cap E_2 \cap E_3^1) = \beta \Rightarrow P(E_1^1).P(E_2).P(E_3^1) = \beta$ …(ii)

$P(E_1^1 \cap E_2^1 \cap E_3) = \gamma \Rightarrow P(E_1^1).P(E_2^1)P(E_3) = \gamma$ …(iii)

$P(E_1^1 \cap E_2^1 \cap E_3^1) = p \Rightarrow P(E_1^1).P(E_2^1).P(E_3^1) = p$ …(iv)

from (i) and (iv)

$$\frac{P(E_1)}{P(E_1^1)} = \frac{\alpha}{p} \Rightarrow P(E_1) = \frac{\alpha}{p+\alpha}$$

from (iii) and (iv)

$$\frac{P(E_3)}{P(E_3^1)} = \frac{\gamma}{p} \Rightarrow P(E_3) = \frac{\gamma}{p+\gamma}$$

$$\therefore \frac{P(E_1)}{P(E_3)} = \frac{\alpha(p+\gamma)}{\gamma(p+\alpha)} = \frac{\alpha p + \gamma\alpha}{p\gamma + \alpha\gamma} \quad \text{…(v)}$$

$$\because (\alpha - 2\beta)p = \alpha\beta \Rightarrow \beta = \frac{\alpha p}{\alpha + 2p}$$

Also, $(\beta - 3\gamma)p = 2\beta\gamma \Rightarrow \beta = \frac{3\gamma p}{p - 2\gamma}$

$$\therefore \frac{\alpha p}{\alpha + 2p} = \frac{3\gamma p}{p - 2\gamma}$$

$\Rightarrow \alpha p = 5\alpha\gamma + 6p\gamma$

$\Rightarrow \alpha p + \gamma\alpha = 6(\alpha\gamma + p\gamma)$

$$\Rightarrow \frac{\alpha p + \gamma\alpha}{\alpha\gamma + p\gamma} = 6$$

$\therefore$ from (v)

$$\frac{P(E_1)}{P(E_3)} = 6$$