**1. (d)** $T = 2\pi\sqrt{\frac{\ell}{g}}$

$T \propto \frac{1}{\sqrt{g}}$

on Everest g decreases, so T increases, so moves slow.

**2. (c)** $f \alpha r^a \rho^b s^c$

$T^{-1} = [L]^a[ML^{-3}]^b[MT^{-2}]^c$

$T^{-1} = L^{a-3b}, M^{b+c}T^{-2c}$

$-2c = -1$

$c = 1/2$

$b + c = o$

$b = -1/2$

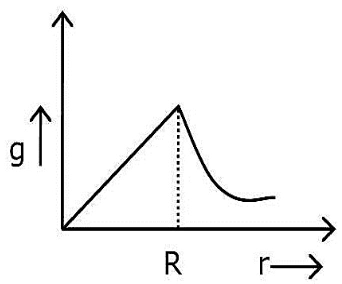
$a - 3b = 0$

$a = 3b = \frac{-3}{2}$

**3. (d)**

$g\left(1 - \frac{2h}{R}\right) = g\left(1 - \frac{d}{R}\right)$

$h = \frac{d}{2}$




**4. (c)**

$$\begin{aligned} B &= \mu_0 ni \\ &= 4 \times \frac{22}{7} \times 10^{-7} \times 70 \times 100 \times 2 \\ &= 176 \times 10^{-4} \end{aligned}$$

**5. (a)** $V_C = \frac{K}{R_1}q_1 + \frac{kq_2}{R_2}$

$$= \frac{1}{4\pi\varepsilon_0} \times \frac{\lambda\pi R_1}{R_1} + \frac{1}{4\pi\varepsilon_0} \times \frac{\lambda\pi R_2}{R_2}$$

$= \frac{\lambda}{2\varepsilon_0}$

**6.** **(b)** $T^2 \propto R^3$

$\left(\frac{T_E}{T_p}\right)^{\frac{2}{3}} = \left(\frac{R_E}{R_p}\right)$

$\left(\frac{1}{2.83}\right)^{\frac{2}{3}} = \frac{1.5 \times 10^6}{R}$

$R = 1.5 \times 10^6 \times (2.83)^{\frac{2}{3}}$

$1.5 \times 10^6 \times (1.41 \times 2)^{\frac{2}{3}}$

$1.5 \times 10^6 \times (2\sqrt{2})^{\frac{2}{3}}$

$1.5 \times 10^6 \times (\sqrt{8})^{\frac{2}{3}}$

$3 \times 10^6 KM$

**7.** **(d)** $\Delta E = E_4 - E_1$

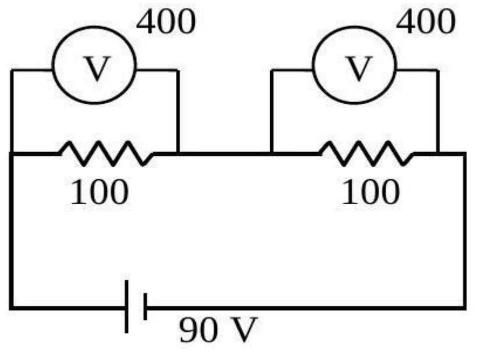
$\frac{hc}{\lambda} = -0.85 - (-13.6)$

$\frac{4 \times 10^{-15} \times 3 \times 10^{17}}{\lambda_{(nm)}} \frac{nm}{s} = 12.75$

$\lambda = \frac{1200}{12.75}$ nm

$= 94.1$ nm

**8.** **(b)**




as Resistance are same so equal division of potential.

$\therefore \frac{90}{2} = 45$ V

**9.** **(c)** $\vec{P} \cdot \vec{Q} = 0$

$4 \times 1 + 2mx - 2 + m^2 = 0$

$m^2 - 4\,m + 4 = 0$

$(m - 2)^2 = 0$

$m = 2$

**10. (c)**

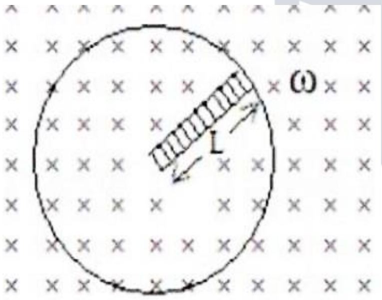
by theory of EM wave

$\frac{E_0}{B_0} = v = \frac{\omega}{K}$

**11. (a)**
**12. (a)**

$\frac{r_1}{r_2} = \frac{\frac{5}{3}}{\frac{7}{5}} = \frac{25}{21}$

**13. (c)**
**14. (d)**




$\epsilon = \int_0^L B\omega x dx$

$= \frac{1}{2}\ B\omega L^2$

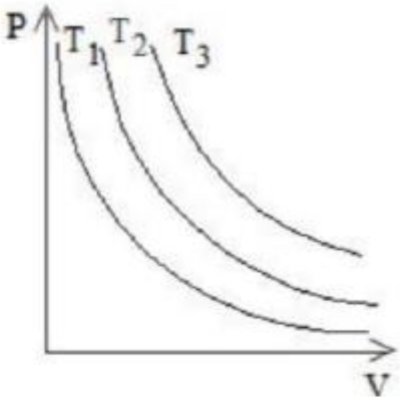
**15. (a)**

$\lambda = \frac{h}{\sqrt{2mkE}} \propto \frac{1}{\sqrt{m}}$

$m_a > m_p > m_e$

$\therefore \lambda_\alpha < \lambda_p < \lambda_e$

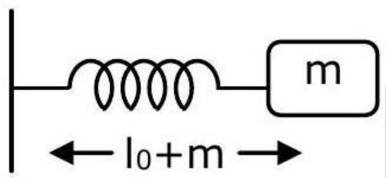
**16. (a)** Steel is more elastic.
**17. (c)** PV = nRT const.




$P \propto \frac{1}{V}$

**18.** **(a)** by concept of AM & FM freq. range

**19.** **(c)**




$kx = m\omega^2(\ell_0 + x)$

$\frac{k}{m\omega^2} = \frac{\ell_0}{x} + 1$

$\frac{12.5}{0.2 \times 25} = \frac{\ell_0}{x} + 1$

$\frac{125}{50} - 1 = \frac{\ell_0}{x}$

$\frac{3}{2} = \frac{\ell_0}{x}$

$\frac{x}{\ell_0} = \frac{2}{3}$

**20.** **(c)** disp. = area

$= 8 \times 2 + (4 \times 4) - 2 \times 4 - 2 \times 4$

$= 32 - 16$

$= 16$

distance $= 32 + 16$

$= 48$

**21.** **(100)**

$$\vec{V}=\int_0^2 t dt\hat{i}+3\int_0^2 t^2 dt\hat{j}$$
$$=2\hat{i}+8\hat{j}$$
$$\vec{F}=2\hat{i}+12\hat{j}$$
$$P=\vec{F}\cdot\vec{V}$$
$$=4+96$$
$$=100w$$

**22. (54)** $\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

$\frac{1}{18}=(1.5-1)\frac{2}{R}.$

$$\frac{1}{f}=\left(\frac{1.5}{\frac{4}{3}}-1\right)\frac{2}{R}$$

Div eq. by eq. 2

$$\frac{f}{18}=\frac{0.5\times 8}{1}$$

$f=72$ cm

change $=72-18$

$=54$

**23. (6)** no. of atoms $=\frac{120}{240}\times 6\times 10^{23}$

$=3\times 10^{23}$

Energy rebased $=200\times 3\times 10^{23}$

$=6\times 10^{25}$

**24. (32)**

$$I_1=\frac{MR^2}{2}$$

mass $=\rho\pi\frac{R^2}{4}\cdot\frac{L}{2}$

$$m_2=\frac{M}{8}$$

$$I_2=\frac{m_2R_2^2}{2}=\frac{MR^2}{8\times 4\times 2}$$

$$\frac{I_1}{I_2}=32$$

**25. (105)** $C=\frac{A\varepsilon_0}{d}$

$C = \frac{KA\varepsilon_0}{2\,d}$

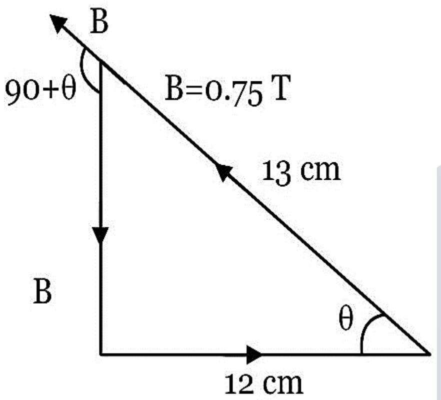
$= \frac{KC}{2}$

$= \frac{3.5 \times 15}{2}$

$= \frac{105}{4}$

$= 105$

**26. (9)**




Force on 5 cm length $= i\int d\vec{\ell} \times \vec{B}$

$= i \times \left(\frac{5}{100}\right) \times 0.75 \times \sin(90+\theta)$

$= 2 \times \frac{5}{100} \times 0.75 \times \cos\theta$

$= \frac{10}{100} \times 0.75 \times \frac{12}{13} = \frac{x}{130}$

$\Rightarrow x = 9$

**27. (1)**

$2\pi\sqrt{\frac{m}{k}} = 1 \ldots \ldots.$

$2\pi\sqrt{\frac{m+3}{k}} = 2$

(b) ÷ (a)

$\sqrt{\frac{m+3}{m}} = \frac{2}{1}$

$\frac{m+3}{m} = 4$

$4m = m + 3$

m = 1 kg.

**28. (44)** Length becomes = 1.2 times

$\ell' = 1.2\ell$

$R' = n^2R$

$= (1.2)^2R$

$= 1.44R$

$\Delta R = 0.44R$

$\frac{\Delta R}{R} \times 100\% = 44\%$

**29. (3)** Short all inductor

$\text{Req.} = \frac{R}{3} = \frac{12}{3} = 4\Omega$

$I = \frac{12}{4} = 3\text{ A}$

**30. (7)**

$$V_T = \frac{2r^2\, g(\sigma_s - \rho_\ell)}{a_n}$$

$$\frac{2 \times 10^{-6} \times 9.8 \times (10.5 - 1.5) \times 10^3}{9.8 \times 0.1 \times 9}$$

$$= 2 \times 10^{-2}\text{ m/s}$$

$$F = 6\pi xrVT$$

$$= 6 \times \frac{22}{7} \times 9.8 \times 0.1 \times 10^{-3} \times 18 \times 10^{-2}$$

$$= 3696 \times 10^{-7}$$

$$= 7$$

**31. (d)**

(i) These standard potentionals of

| Element | Li | Na | Rb |
|---|---|---|---|
| SRP | -3.237 | -2.898 | -3.079 |

(ii) All the alkali metal hydrides are ionic solids with high M.P.

**32. (c)** Be has least negative SRP value. Value in alkaline earth metal group as it has high hydration enthalpy and high enthalpy of atomization.

**33. (d)**

$t^{1/2} \propto (Co)^{1-n}$

$= \dfrac{(t^{1/2})_1}{(t^{1/2})_2} = \left(\dfrac{P_1}{P_2}\right)^{1-n}$

$= \dfrac{4}{2} = \left(\dfrac{50}{100}\right)^{1-n} \Rightarrow 2\left(\dfrac{1}{2}\right)^{1-n}$

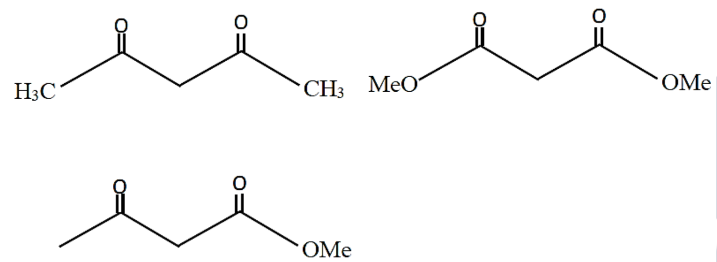
$2 = (2)^{n-1}$

$n = 2$

**34. (c)** $K_2Cr_2O_7 + 2H^+ + SO_2 \rightarrow \underset{\text{(green)}}{2Cr^{+3}} + 3SO_4^{-2} + H_2O$

**35. (b)**

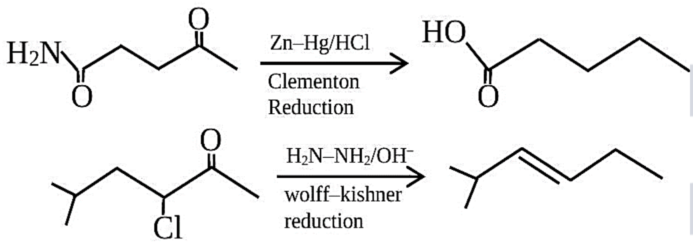
order of –m effect $= -\overset{\overset{\displaystyle O}{\|}}{C}-CH_3 > -\overset{\overset{\displaystyle O}{\|}}{C}-OCH_3$




strong −m effect of both ketone

**36. (c)**

**37. (b)**




**38. (a)** Crystal field theory introduce spectrochemical series based upon the experimental value of Δ but can't explain it's order. While other three points are explained by CFT. Specially when the CFSE increases thermodynamic stability of the comples increases.

**39. (b)**

$Cs^+_{(55)} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^6, 5s^2, 4d^{10}, 5p^6$

no. of s-electron = 10

**40. (c)** $Ce^{+4}$ & $Tb^{+4}$ are good oxidizing agent.

**41. (a)**

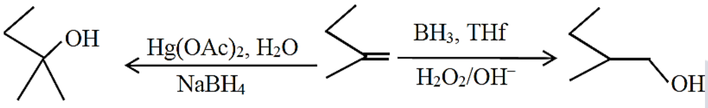
$C_6H_5COOH + NaOH \rightarrow C_6H_5COONa + H_2O$

when weak acid $C_6H_5COOH$ titrated against strong base NaOH in the beginning the conductance Inc. slowly and after equivalent point it increase rapidly.

**42. (c)**

| LIST I | | LIST II | |
|---|---|---|---|
| Type | | | Name |
| A. | Antifertility drug | I. | Norethindrone |
| B. | Tranquilizer | II. | Meprobomate |
| C. | Antihistamine | III | Seldane |
| D. | Antibiotic | IV. | Ampicillin |

**43. (b)**




(A)

**44. (a)** Both A and R are correct and R is the correct explanation of A
**45. (c)**
**46. (c)**
**47. (a)** An average human being requires. hearly $12-15$ times more air than the food.
**48. (b)**

$N_2=\sigma_{1s^2},\sigma_{1s^2}^*,\sigma_{2s^2},\sigma_{2s^2}^*,\pi_{2Px}{}^2=\pi_{2Py^2},\sigma_{2Pz^2}$

no. of $e^-$present in Homo $=0$

$N_2^+=\sigma_{1s^2},\sigma_{1s^2}^*,\sigma_{2s^2},\sigma_{2s^2}^*,\pi_{2Px}2=\pi_{2Py}{}^2,\sigma_{2Pz}$

no. of unpaired $e^-$present in HOMO $=1$

$O_2=\sigma_{1s}2,\sigma_{1s^2}^*,\sigma_{2s}{}^2,\sigma_{2s^2}^*,\sigma_{2Pz^2},\pi_{2Px}{}^2=\pi_{2Py}{}^2,\pi_{2Px}^*=\pi^*{}_{2Py}1$

no. of unpaired $e^-$present in HOMO $=2$

$O_2^+=\sigma_{1s^2},\sigma_{1s^2}^*,\sigma_{2s^2},\sigma_{2s^2}^*,\sigma_{2Pz^2},\pi_{2Px^2}=\pi_{2Py^2,\pi^*}{}_{2Px}1=\pi^*{}_{2Py}0$

no. of unpaired $e^-$present in HOMO $=1$

**49. (a)**

$4Ag(s)+8CN^-(aq)+2H_2O(aq)+O_2(g)\rightarrow 4[Ag(CN)_2]^-_{(aq)}+4OH^-(aq)$
$2[Ag(CN)_2]^-_{(aq)}+Zn(s)\rightarrow 2Ag(s)+[Zn(CN)_4]^{-2}_{(aq)}$

**50. (b)** Red
**51. (2)**

(A) $T_4>T_3>T_2>T_1$

(C) The peak of the spectrum shift to shorter wavelength of temp. Inc.

**52. (5)**

Conc. Express in → mass percentage
→ mole fraction
→ molarity
→ PPM
→ molality

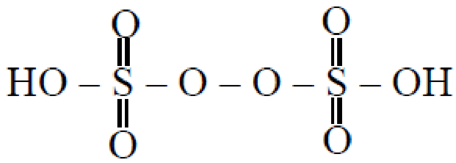
**53. (2)**

(C) It decreases with increase in temperature

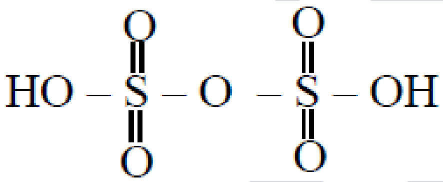
(E) No activation energy is needed

**54. (8)**

Peroxodisulphuric acid ($H_2\ S_2O_8$)



Pyrosulphuric acid ($H_2\ S_2O_7$)



$\pi$ bond = 4
total $\pi$ bond = 4 + 4 = 8

**55. (85)**

$Ca(Lac)_2 \longrightarrow Ca^{+2} + 2lac^{-}$

$5\times10^{-3}\ 5\times10^{-3}\ 10^{-2}M$

Salt of strong base weak acid salt

$$\begin{aligned} pH &= 7+\frac{1}{2}pka+\frac{1}{2}\log c \\ &= 7+\frac{1}{2}\times5+\frac{1}{2}\log10^{-2} \\ &= 7+2.5-1=8.5 \\ &= 85\times10^{-1} \end{aligned}$$

**56. (314)**

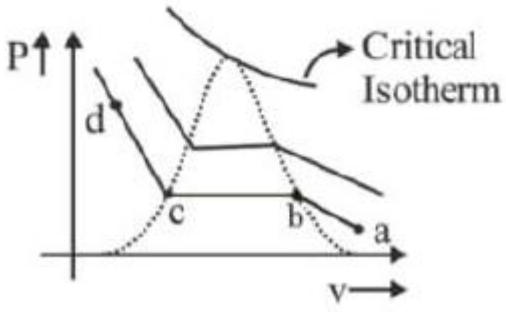
$XaP_A^o + X_BP_B^o = P_S$

$0.7P_A^O + 0.3P_B^o = 350$

$0.2P_A^o + 0.8P_B^o = 410$

$\therefore P_A^O = 314$ torr

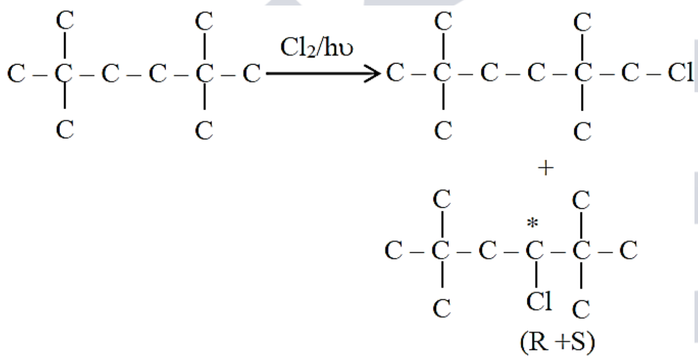
**57. (4)**




At
(a) → $CO_2$ exist as gas
(b) → liquefaction of $CO_2$ starts
(c) → liquefaction ends
(d) → $CO_2$ exist as liquid

Between (b) & (c) → liquid and gaseous $CO_2$ co-exist.
As volume changes from (b) to (c) gas decreases and liquid increases.
(A), (C) → Correct

**58. (3)**




**59. (8)**

(a) P-P-P (b) V – V – V
(c) P – V – V (d) V – P – V
(e) V – V – P (f) V-P-P
(g) P – V – P (h) P – P – V

**60. (6)**

$I \rightarrow II \rightarrow$ Isobaric
$II \rightarrow III \rightarrow$ Isochoric
$III \rightarrow I \rightarrow$ Isothermal
$W_{I-II} = -1[40 - 20] = -20$ Lit atm
$W_{II\text{-}III} = 0$

$$W_{IV\text{-}I} = 2.303nRt\log\frac{V_2}{V_1}$$
$$= 2.303PV\log\frac{V_2}{V_1}$$
$$= 2.303(1 \times 20)\log 2$$
$$= 2.303 \times 20 \times 0.3010 = 13.818$$

W total $= -20 + 13.818 = (-6.182$ lit alm $) = 6.182$ lit alm

**61. (b)**

$f(x) = x^3 - x^2f'(a) + xf''(b) - f'''(c)$
$f(x) = x^3 - ax^2 + bx - c$
$f'(x) = 3x^2 - 2ax + b$
$f''(x) = 6x - 2a$
$f'''(x) = 6$
$f'''(c) = 6$
$f'(a) = 3 - 2a + b = a \Rightarrow 3a = b + 3$
$f''(b) = 12 - 2a = b \Rightarrow 2a = 12 - b$
$a = 3, b = 6$
$f'''(c) = 6 = c$
$f(x) = x^3 - 3x^2 + 6x - 6$
$f(0) = -6$ $f(b) = 2$
$f(a) = -2$ $f(c) = 12$

**62. (c)** Planes are not parallel

$\therefore (x + 2y + 3z - 3) + a(4x + 3y - 4z - 4)$

$= 8x + 4y - \lambda z - 9 - \mu = 0$

$$\frac{1 + 4a}{8} = \frac{2 + 3a}{4} = \frac{3 - 4a}{-\lambda} = \frac{-3 - 4a}{-9 - \mu}$$

(i) $1 + 4a = 4 + 6a$

$$a = \frac{-3}{2}$$

(ii) $\frac{2-\frac{9}{2}}{4} = \frac{3+6}{-\lambda}$

$$-\lambda = \frac{36}{-5} \times 2$$

$$\lambda = \frac{72}{5}$$

(iii) $\frac{-5}{8} = \frac{-3-4a}{-9-\mu}$

$$\frac{5}{8}=\frac{3-6}{-9-\mu}$$

$$-9-\mu=\frac{-24}{5}$$

$$\mu=\frac{-45+24}{5}$$

$$\mu=\frac{-21}{5}$$

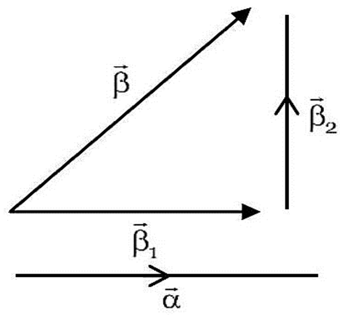
**63. (a)**

$$f(x)=\frac{4^x}{4^x+2}$$

$$f(1-x)=\frac{\frac{4}{4^x}}{\frac{4}{4^x}+2}=\frac{4}{4+2.4^x}=\frac{2}{2+4^x}$$

$$f(x)+f(1-x)=1$$

**64. (a)**




$$\overrightarrow{\beta_1}=\frac{(\vec{\alpha}\cdot\vec{\beta})}{|\vec{\alpha}|}\hat{\alpha}$$

$$=\left(\frac{4+6-20}{\sqrt{16+9+25}}\right)\frac{(4,3,5)}{\sqrt{50}}$$

$$=\frac{-10}{50}(4,3,5)$$

$$\vec{\beta}_1=\frac{(-4,-3,-5)}{5}$$

$$\vec{\beta}_1+\vec{\beta}_2-=(1,2,-4)$$

$$\beta_2=\left(1+\frac{4}{5},2+\frac{3}{5},-4+1\right)$$

$$\beta_2=\left(\frac{9}{5},\frac{13}{5},-3\right)$$

$$\therefore 5\beta_2=(9,13,-15)$$

$\therefore 5\beta_2 \cdot (1,1,1) = 9 + 13 - 15$

$= 7$

**65. (a)**

$(x^2 - 3y^2)dx + 3xydy = 0$

$\frac{dy}{dx} = \frac{3y^2 - x^2}{3xy}$

$y = vx$

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

$v + x\frac{dv}{dx} = \frac{3v^2x^2 - x^2}{3vx^2}$

$v + x\frac{dv}{dx} = \frac{3v^2 - 1}{3v}$

$\frac{xdy}{dx} = \frac{3v^2 - 1}{3v} - v \Rightarrow \frac{-1}{3v}$

$3vdv = -\frac{dx}{x}$

$\frac{3v^2}{2} = -\ln x + C[y(a) = 1]$

$\frac{3y^2}{2x^2} = -\ln x + C$

$C = \frac{3}{2}$

$\frac{3y^2}{2x^2} = \frac{3}{2}\ln e = \ln x$

$\therefore 3y^2 = 3x^2\ln e - 2x^2\ln x$

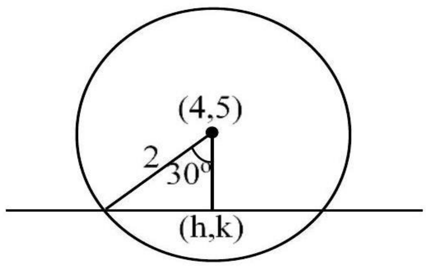
$x = e\ 3y^2 = 3e^2\ln e - 2e^2\ln e$

$= e^2\ln e$

$= e^2$

$6y^2 = 2e^2$

**66. (b)**




$r_1 = 2\cos 30°$

$r_3 = 2\cos 60°$

$3 = r_2^2 + 1 \Rightarrow r_2 = \sqrt{2}$

$2\cos\theta = \sqrt{2}, \theta = \frac{\pi}{4}$

$\therefore \theta_2 = \frac{\pi}{2}$

**67. (a)**

$$3\left[\left(x+\frac{1}{x}\right)^2 - 2\right] - 2\left[x+\frac{1}{x}\right] + 5 = 0$$

$3t^2 - 2t - 1 = 0$

$3t^2 - 3t + t - 1 = 0$

$(3t+1)(t-1) = 0$

$t = 1, t = \frac{-1}{3}$

**68. (b)**

$$\begin{aligned} |\operatorname{adj}(\operatorname{adj}\operatorname{adj} A)| = |A|^{(n-1)^3} &= 12^4 \\ |A|^8 &= (12)^4 \\ |A| &= (12)^{\frac{1}{2}} \end{aligned}$$

$$\begin{aligned} \therefore |A^{-1}\cdot \operatorname{adj}(A)| &= |A^{-1}| \times |\operatorname{adj} A| \\ &= \frac{1}{|A|} \times |A|^{n-1} \\ &= \frac{1}{|A|} \times |A|^2 = |A| = \sqrt{12} = 2\sqrt{3} \end{aligned}$$

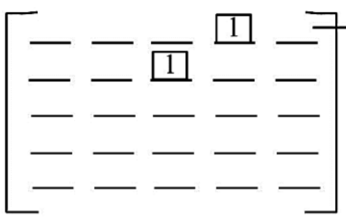
**69. (a)**

$$48\int_{\frac{3\sqrt{2}}{4}}^{\frac{3\sqrt{3}}{4}} \frac{dx}{\sqrt{9-4x^2}} = \frac{48}{2}\sin^{-1}\left\{\frac{2x}{3}\right\}_{\frac{3\sqrt{2}}{4}}^{\frac{3\sqrt{3}}{4}}$$

$$= 24\left[\sin^{-1}\frac{\sqrt{3}}{2} - \sin^{-1}\frac{1}{\sqrt{2}}\right]$$

$$= 24\left[\frac{\pi}{3} - \frac{\pi}{4}\right] = 2\pi$$

**70. (d)**



$\rightarrow {}^5C_1 \times {}^4C_1 \times {}^3C_1 \times {}^2C_1 \times {}^1C_1$

$$^{5}C_1 \times {}^{4}C_1 \times {}^{3}C_1 \times {}^{2}C_1 \times {}^{1}C_1 = 120$$

**71. (d)**

$C_1^2 + 2C_2^2 + 3C_3^2 \ldots + 30C_{30}^2$

$S = 0C_0^2 + 1C_1^2 + \cdots + 30C_{30}^2$

$S = 30C_{30}^2 + 29C_{29}^2 + \cdots + 0C_0^2$

$2\,S = 30[C_0^2 + C_1^2 + \cdots + C_{30}^2]$

$$S = 15 \times {}^{60}C_{30} = \frac{\alpha \cdot 60!}{(30!)^2} \Rightarrow \alpha = 15$$

**72. (b)** $[x + (\lambda + 4)y + z - 1] + \mu[2x + y + z - 2] = 0$

$(0,1,0)$

(i) $(\lambda + 4 - 1) + \mu[-1] = 0$

$\lambda - \mu = -3$

$(1,0,1)$ (ii) $1 + \mu[1] = 0 \Rightarrow \mu = -1, \lambda = -4$

$\therefore$ point $(-8, -4, 4)$; $2x + y + z - 2 = 0$

$$d = \left|\frac{-16 - 4 + 4 - 2}{\sqrt{6}}\right| = \frac{18}{\sqrt{6}} = 3\sqrt{6}$$

**73. (d)**

$$\begin{aligned} &f(x + y) = f(x) \cdot f(y), x, y \in N \\ &f(b) = 3^2 \\ f(c) = 3^3 \quad &\therefore 3\frac{[3^n - 1]}{2} = 3279 \\ &3^n - 1 = 1093 \times 2 \\ &3^n - 1 = 2186 \\ &3^n = 2187 \\ &n = 7 \end{aligned}$$

**74. (a)** $a + (a + 2\,d) = 10 \Rightarrow a + d = 5$

Mean $\Rightarrow \frac{\frac{6}{2}[2a+5\,d]}{6} = \frac{19}{2}$

$2a + 5\,d = 19$

from (a) and (b)

$3\,d = 9 \Rightarrow d = 3; a = 2$

$$\therefore \sigma^2 = \frac{\sum x_i^2}{n} - (\bar{x})^2$$

$$= \frac{2^2 + 5^2 + 8^2 + 11^2 + 14^2 + 17^2}{6} - \left(\frac{19}{2}\right)^2$$

$$= \frac{699}{6} - \frac{361}{4}$$

$$= \frac{233}{2} - \frac{361}{4}$$

$8\sigma^2 = 932 - 722 = 210$

**75. (d)**

**76. (c)** $P \wedge (P \Rightarrow \sim q)$ $P \rightarrow q$

$P \wedge (\sim P \vee \sim q)$

$\therefore$ Its negation will be

$\sim P \vee [P \wedge q]$

$= [\sim P \vee P] \wedge [\sim P \vee q]$

$= \sim P \vee q$

**77. (d)**

$\lim\limits_{x\to\infty} ([x] - 5 - [2x] - 2) = 0$

$\lim\limits_{x\to\infty} ([x] - [2x]) = 7$

$[\alpha] - [2\alpha] = 7$

If $\alpha = -7.5$ $[-7.5] = -8$

$[-15] = -15$ $\therefore -8 + 15 = 7$

If $\alpha = -6.5$ $[-6.5] = -7$ $-7 + 13 = 6$

$[-13] = -13$

$\therefore$ $\alpha \in (-7.5, -6.5)$

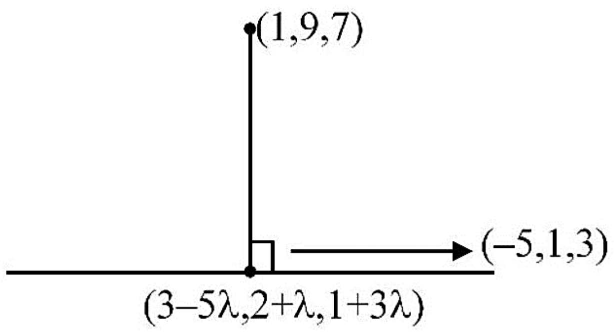
**78. (d)**

$\bar{n}_1 = (1,2,1) \bar{n}_2 = (0,3,-1)$

$$\bar{P} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 1 \\ 0 & 3 & -1 \end{vmatrix} = \hat{i}(-5) - \hat{j}(-1) + \hat{k}(c)$$

$= (-5,1,3)$

$$\therefore \text{ line} : \frac{x-3}{-5} = \frac{y-2}{1} = \frac{z-1}{3} = \lambda$$



$(2-5\lambda)\cdot -5+(\lambda-7)\cdot 1+(3\lambda-6)\cdot 3=0$

$25\lambda-10+\lambda-7+9\lambda-18=0$

$35\lambda=35$

$\lambda=1$

$\therefore$ Point is $(-2,3,4)$ $\alpha+\beta+\gamma=5$

**79. (a)**
**80. (a)**

$$\frac{\pi}{2}-\frac{2\pi}{9}$$
$$=\frac{95-4\pi}{18}=\frac{5\pi}{18}$$
$$\Rightarrow \frac{1+\cos\frac{5\pi}{18}+i\sin\frac{5\pi}{18}}{1+\cos\frac{5\pi}{18}-i\sin\frac{5\pi}{18}}$$
$$=\frac{2\cos^2\frac{5\pi}{36}+2i\sin\frac{5\pi}{36}\cdot\cos\frac{5\pi}{36}}{2\cos^2\frac{5\pi}{36}-2i\sin\frac{5\pi}{36}\cos\frac{5\pi}{36}}\Rightarrow\left(\frac{e^{i\frac{5\pi}{36}}}{e^{-i\frac{5\pi}{36}}}\right)^3$$
$$=e^{i\left(\frac{5\pi}{18}\right)^3}=e^{i\left(\frac{5\pi}{6}\right)}$$
$$\left(\cos\frac{5\pi}{6}+i\sin\frac{5\pi}{6}\right)=-\frac{\sqrt{3}}{2}+\frac{i}{2}$$

**81. (384)**

$P(-\sqrt{6},\sqrt{6},\sqrt{6})$ $Q(\lambda,2\sqrt{6},-2\sqrt{6})$
$\bar{n}_1=(2,3,4)$ $\bar{n}_2=(3,4,5)$
$$\bar{n}_1\times\bar{n}_2\Rightarrow\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\2&3&4\\3&4&5\end{vmatrix}=\hat{i}(-1)-\hat{j}(-2)+\hat{k}(-1)$$
$=(-1,2,-1)$
$$\therefore S_d\left|\frac{\overline{PQ}\cdot(-1,2,-1)}{\sqrt{6}}\right|=\frac{(\lambda+\sqrt{6},\sqrt{6},-3\sqrt{6})\cdot(-1,2,-1)}{\sqrt{6}}$$
$\Rightarrow|-\lambda+4\sqrt{6}|=6\sqrt{6}$
$-\lambda+4\sqrt{6}=6\sqrt{6}$ $(-)$ $\lambda-4\sqrt{6}=6\sqrt{6}$
$\lambda=-2\sqrt{6}$
$\therefore(8\sqrt{6})^2=384$

**82. (432)**

| | | |
|---|---|---|
| 4R | 5R | 4R |
| 6B | 5B | 4B |
| A | B | C |

$$P(\text{ Red from C}) = \frac{\frac{1}{3} \times \frac{\lambda}{\lambda+4}}{\frac{1}{3} \cdot \frac{\lambda}{\lambda+4} + \frac{1}{3} \cdot \frac{4}{10} + \frac{1}{3} \cdot \frac{5}{10}}$$

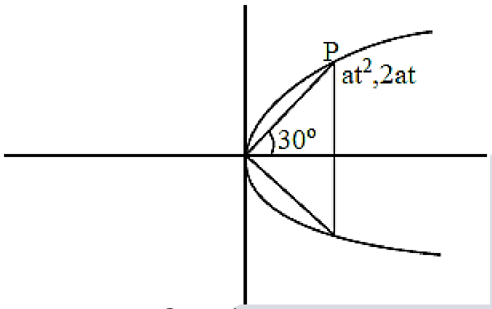
$$= \frac{\frac{\lambda}{\frac{\lambda}{\lambda}+4}}{\frac{\lambda}{\lambda+4} + \frac{9}{10}}$$

$$\Rightarrow \frac{10\lambda}{10\lambda + 9(\lambda+4)} = \frac{4}{10}$$

$$\Rightarrow 100\lambda = 40\lambda + 36\lambda + 144$$

$$24\lambda = 144$$

$$\lambda = 6$$




$$m = \frac{2}{t} = \frac{1}{\sqrt{3}}$$

$$t = 2\sqrt{3}$$

$$P(12a, 4\sqrt{3}a)$$

$$(\text{ Side })^2 = 144a^2 + 48a^2$$

$$= 192 \times \frac{9}{4} = 432$$

**83. (2)**

$$\tan(\pi\cos\theta) = \tan[-\pi\sin\theta]$$

$$\pi\cos\theta = n\pi - \pi\sin\theta \ (n \in I)$$

$$\cos\theta + \sin\theta = n$$

$$n \in [-\sqrt{2}, \sqrt{2}] \ n \in \{-1,0,1\}$$

$$\cos\left(\theta - \frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}, \cos\left(\theta - \frac{\pi}{4}\right) = 0, \cos\left(\theta - \frac{\pi}{4}\right) = \frac{-1}{\sqrt{2}}$$

$$\theta - \frac{\pi}{4} = 2\,m\pi \pm \frac{\pi}{4}, \theta - \frac{\pi}{4} = 2\,m\pi + \frac{\pi}{2}, \ \theta - \frac{\pi}{4} = 2\,m\pi \pm \frac{3\pi}{4}$$

$$\theta = 2\,m\pi + \frac{\pi}{2}, \ \theta = 2\,m\pi + \frac{3\pi}{4}, \ \theta = 2\,m\pi + \pi$$

$$\theta = 2\,m\pi,$$

$$\theta = 2\,m\pi - \frac{\pi}{2}$$

$$\theta = \left\{\frac{\pi}{2}, 0, \frac{7}{4}, \pi, \frac{3\pi}{2}, \frac{3\pi}{4}, \frac{7\pi}{4}\right\}$$

$$\sin\left(\theta + \frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}$$

**84. (5)**

$$\frac{\left(\frac{n(n+1)}{2}\right)^2}{\sum r(2r+1)}$$

$$\Rightarrow \frac{\frac{n^2(n+1)^2}{4}}{\frac{2n(n+1)(2n+1)}{6}+\frac{n(n+1)}{2}}$$

$$\Rightarrow \frac{\frac{n(n+1)}{4}}{\frac{2n+1}{3}+\frac{1}{2}} \Rightarrow \frac{n(n+1)}{4}\frac{9}{\frac{(4n+5)}{6}} = \frac{9}{5}$$

$$\Rightarrow \frac{3(n+1)n}{2(4n+5)} = \frac{9}{5}$$

$$\Rightarrow 5n^2 + 5n = 24n + 30$$

$$\Rightarrow 5n^2 - 19n - 30 = 0$$

$$5n^2 - 25n + 6n - 30 = 0$$

$$(5n+6)(n-5) = 0$$

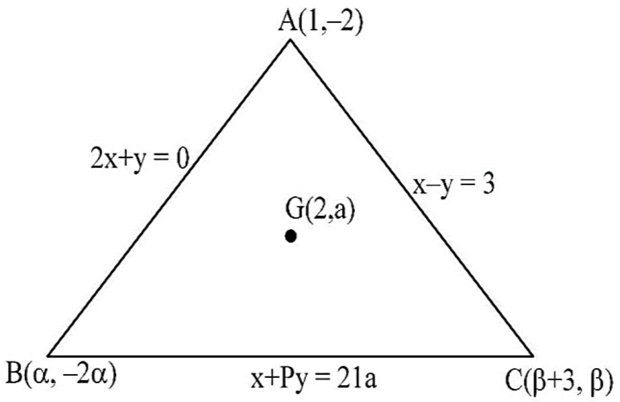
$$n = 5$$

**85. (405)**

$$^nC_0 - {}^nC_1 \cdot 3 + {}^nC_2 \cdot 3^2$$
$$1 - 3n + \frac{9n(n-1)}{2} = 376$$
$$2 - 6n + 9n^2 - 9n = 752$$
$$9n^2 - 15n - 750 = 0$$
$$3n^2 - 5n - 250 = 0$$
$$3n^2 - 30n + 25n - 250 = 0$$
$$(3n+25)(n-10) = 0$$
$$n = 10$$

$$\therefore T_{r+1} = {}^{10}C_r(x)^{10-r}\left(\frac{-3}{x^2}\right)^r$$
$$x^{10-3r} = x^4 \Rightarrow 3r = 6$$
$$r = 2$$
$$\therefore T_3 = {}^{10}C_2 \times 3^2 \Rightarrow \frac{10\times 9}{2} \times 9 = 405$$

**86. (122)**




$\frac{\alpha+\beta+4}{3} = 2 \quad \frac{-2\alpha-2+\beta}{3} = a$

$\alpha+\beta = 2 \quad -2\alpha+\beta = 3a+2$

$-2\alpha+2-\alpha = 3a+2$

$\alpha = -a$

put 'B' in BC

$\alpha - 2p\alpha = 21a$

$\alpha.(1-2p) = 21a \quad 2p-1 = 21$

$p = 11$

put ' C ' in BC

$\beta+3+11\beta = 21a$

$21\alpha+12\beta+3 = 0$

also $\beta = 2-\alpha$

Solving $\alpha = -3, \beta = 5$

$\therefore BC = \sqrt{122}$

$BC^2 = 122$

**87. (8)**

$\bar{a} = (1,2,\lambda)\ \bar{b} = (3,-5,-\lambda)$

$\bar{a}\cdot\bar{c} = 7,\ \bar{b}\cdot\bar{c} = \frac{-43}{2},$

$(\bar{a}-\bar{b})\times\bar{c} = 0$

$c = x[-2,7,2\lambda] = (-2x,7x,2\lambda x)$

now, $\bar{a}\cdot\bar{c} = -2x+14x+2\lambda^2x = 7$

$2\lambda^2x+12x = 7$

$\bar{b}\cdot\bar{c} = -6x-35x-2\lambda^2x = \frac{-43}{2}$

$-41x-2\lambda^2x = \frac{-43}{2}$

by adding (a) + (b)

$$-29x = \frac{-29}{2} \Rightarrow x = \frac{1}{2}$$
$$\therefore \lambda^2 + 6 = 7 \Rightarrow \lambda^2 = 1$$
$$|\bar{a} \cdot \bar{b}| = |3 - 10 - \lambda^2| = |-8|$$

**88. (13)**

| | a | b | c | d |
|---|---|---|---|---|
| a | 1 | ✓ | 8 | 9 |
| b | 5 | 2 | ✓ | ✓ |
| c | 10 | 6 | 3 | 11 |
| d | 12 | 7 | 13 | 4 |

1,2,3,4 → for reflexive

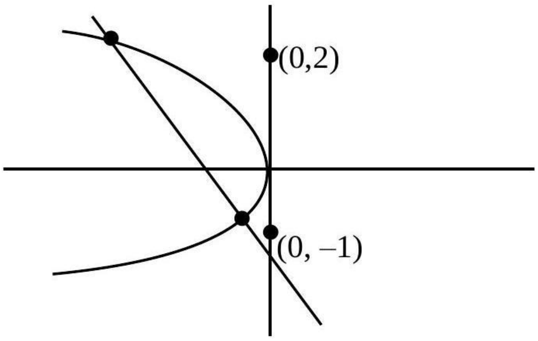
5,6,7 → for symmetric

8,9,10,11,12,13 → for transitive

**89. (36)**

$y^2 - 2y + 1 = -x + 1 \quad x + y = 0$
$(y-1)^2 = -(x-1) \quad x + 1 + y + 1 = 0$
$y^2 = -4Ax \quad x + y + 2 = 0$
$y = y - 1$
$x = x - 1$
$y^2 = -x$
$x + y = -2$

$y^2 = y + 2$
$y^2 - y - 2 = 0$
$(y-2)(y+1) = 0$
$y = 2, y = -1$




$$\text{Area} = \int_{-1}^{2} (-y^2) - (-2 - y)dy$$

$$= \left(\frac{-y^3}{3} + 2y + \frac{y^2}{2}\right)_{-1}^{2}$$

$$= \left(\frac{-8}{3} + 4 + 2\right) - \left(\frac{1}{3} - 2 + \frac{1}{2}\right)$$

$$= \frac{-8}{3} + 6 - \frac{1}{3} + 2 - \frac{1}{2}$$

$$A = -3 + 8 - \frac{1}{2} \Rightarrow \frac{9}{2}$$

$\therefore$ $8\ A = 36$

**90. (27)**

$$f'(x) + f(x) \cdot \sqrt{1 - \log^2 \cdot f(x)} = 0$$

$$\frac{dy}{dx} = -y\sqrt{1 - \log^2 y}$$

$$f(0) = e$$

$$\frac{dy}{y\sqrt{1 - \log^2 y}} = -dx$$

$$\log y = t$$

$$\frac{1}{y}dy = dt$$

$$\frac{dt}{\sqrt{1 - t^2}} = -dx$$

$$\mathrm{Sin}^{-1}(t) = -x + C$$

$$\mathrm{Sin}^{-1}[\log y] = -x + C$$

$$x = 0\ \mathrm{Sin}^{-1}(a) = C \Rightarrow \frac{\pi}{2}$$

$$\log(y) = \mathrm{Sin}\left(\frac{\pi}{2} - x\right)$$

$$x = \frac{\pi}{6}\ \log_e\left[f\left(\frac{\pi}{6}\right)\right] = \mathrm{Sin}\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$$

$$\therefore \left(6 \times \frac{\sqrt{3}}{2}\right)^2 = 27$$