1. (b) $y = u_y t + \frac{1}{2} a_y t^2$

$y = 5t + \frac{1}{2}(\mathrm{d})t^2$

$y = 5\mathrm{t} + 2\mathrm{t}^2$

and $x = 0 + \frac{1}{2}(10)(t^2) = 20$

$\mathrm{t} = 2\ \mathrm{s}$

$\Rightarrow \mathrm{y} = 10 + 8 = 18\ \mathrm{m}$

2. (a) $\tau = \mathrm{MB}\sin 30^\circ$

$0.018 = \mathrm{MB}\left(\frac{1}{2}\right)$

$\mathrm{MB} = 0.036$

$\mathrm{W} = \Delta\mathrm{U} = 2\mathrm{MB} = 0.072\ \mathrm{J}$

3. (a) By property of electromagnetic wave spectrum.

4. (b) $\mathrm{E_x} = \frac{Ax}{(\mathrm{x}^2+\mathrm{a}^2)^{3/2}}$

$\frac{-dv}{dx} = \frac{Ax}{(\mathrm{x}^2 + \mathrm{a}^2)^{3/2}}$

$\int_0^V dv = -\int_\infty^x \frac{Ax}{(\mathrm{x}^2 + \mathrm{a}^2)^{3/2}} dx$

$\mathrm{v} = \frac{A}{(\mathrm{x}^2 + a^2)^{1/2}}$

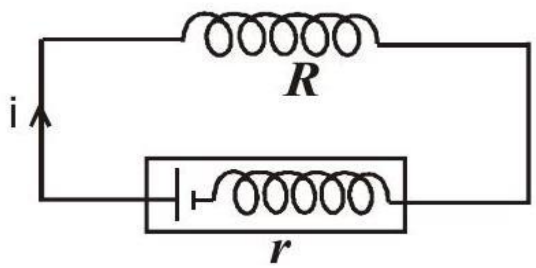
5. (a)

6. (b)

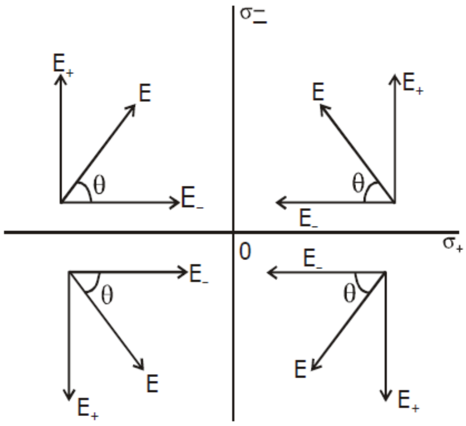
$\mathrm{P_0} = 0.5\ \mathrm{W}$
$\mathrm{i}.\ (2.5) = 0.5$

$\mathrm{i} = 1/5\ \mathrm{A}$

$\mathrm{P_r} = \left(\frac{1}{5}\right)(0.5) = 0.1\ \mathrm{W}$



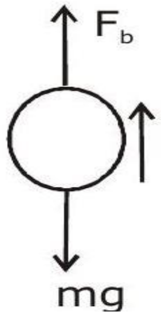
7. (a)



$|\vec{E}_+| > |\vec{E}_-|$

$\theta > 45°$

8. (d)



$F_b - mg = ma \Rightarrow m = \dfrac{F_b}{g + a}$

$m = \dfrac{v \cdot \rho_w g}{g + a}$

$m = \dfrac{(4/3)\pi r^3 \cdot \rho_w \cdot g}{g + a} = 4.15\text{gm}$

9. (b)

$B_A = \dfrac{\mu(b)\left(\frac{3\pi}{2}\right)}{2(a)(2\pi)} = \dfrac{3\mu}{4a}$

$B_B = \dfrac{\mu(c)\left(\frac{5\pi}{3}\right)}{2(2a)(2\pi)} = \dfrac{5\mu}{8a}$

$\dfrac{B_A}{B_B} = \dfrac{3\mu}{4a} \times \dfrac{8a}{5\mu} = 6:5$

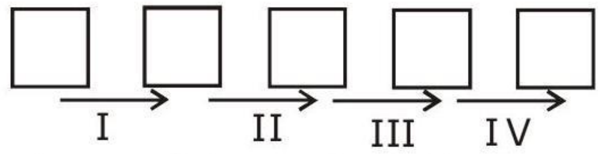
10. (c) $V_1 = \frac{m_1 - m_2}{m_1 + m_2} \cdot u_1 + \frac{2m_2}{m_1 + m_2} \cdot u_2$

$V_1 = \dfrac{\frac{m}{2} - m/3}{\frac{m}{2} + m/3} V_0 = V_0/5$

$$\lambda' = \frac{h}{\frac{m}{2} \cdot \frac{V_0}{5}} = 5 \cdot \frac{h}{\frac{m}{2} \cdot V_0} = 5\lambda_0$$

$\Delta\lambda = 4\lambda_0$

11. (a)

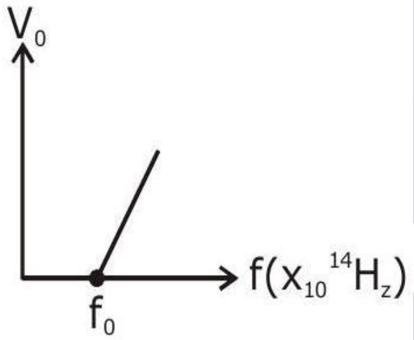


There will be total 4 collisions in each collision K.E. decreasing by 50%

$$E_f = \frac{1}{2^4} E_i = \frac{E_i}{16} = 6.25\%$$

i.e. 93.75% loss

12. (b)



$\phi = hf_0 = 6.62 \times 10^{-34} \times 5.5 \times 10^{14}$

$= 36.41 \times 10^{-20}\ J = 2.27eV$

13. (c) Heat loss by water

$Q = m_w s \Delta\theta$

$$= \left(\frac{200}{1000}\right) \cdot (4200)(25) = 21000\ J$$

and $\Delta m_i L = 21000$

$$\Delta m_i = \frac{21000}{3.4 \times 10^5} \times 10^3 gm = 61.7 grams$$

14. (a) $p = p_0 \cos^2 \omega t$

$$E_{avg} = \langle p >\cdot T = \frac{p_0}{2}\ T$$

$$E_{avg} = \langle P \rangle . T = \frac{p_0}{2} \cdot \frac{2\pi}{\omega} = \frac{10^{-3} \times 3.14}{31.4} = 10^{-4}\ J$$

15. (d)

$1.5 = (2\mathrm{n}_1 + 1)\lambda/2$

$5 = n_2\lambda$

$n_1 \& n_2$ are integer

$\mathrm{n}_1 = 1, \mathrm{n}_2 = 5$

$\mathrm{n}_1 = 2, \mathrm{n}_2$ is not integer

$\mathrm{n}_1 = 3, \mathrm{n}_2$ is not integer

$n_1 = 4, n_2 = 15,\ \lambda = 1/3$

16. (d)
17. (b)

$$\Delta \mathrm{q}\ \mathrm{q}/\frac{\mathrm{q}}{+\mathrm{q}}$$

$$\Delta \mathrm{U} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{4q\cdot q}{(3\ \mathrm{d}/2)} - \frac{1}{4\pi\varepsilon_0}\cdot\frac{4q\cdot q}{(d/2)}$$

$$= \frac{4q^2}{4\pi\varepsilon_0}\left(\frac{2}{d}\right)\left(-\frac{2}{3}\right)$$

$$= (-)\frac{4q^2}{3\pi\varepsilon_0\cdot d}$$

$=$ decrease by $(-)$

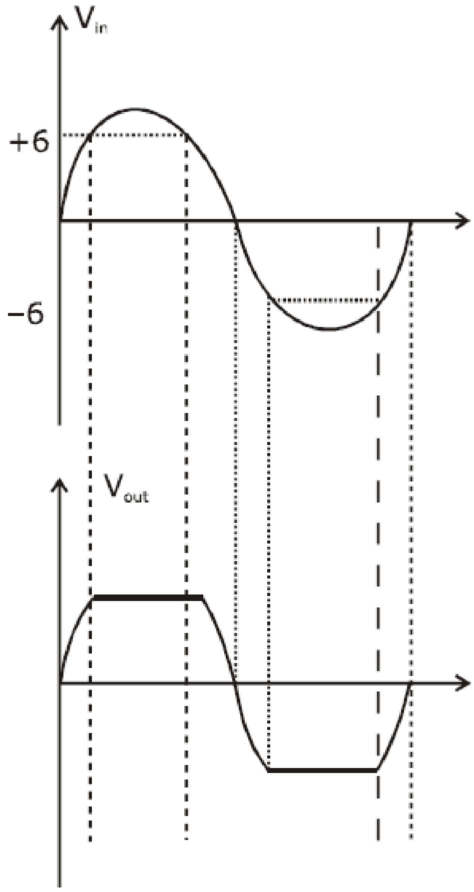
18. (a) → V, h curve will be parabolic

→ downward velocity is negative and upward is positive

→ when ball is coming down graph will be in IV quadrant and when going up graph will be in I quadrant

19. (a) $\frac{dQ}{dt} = \frac{Kl\Delta T}{A}$

20. (c)



21. (10553) $\frac{1}{R} = 912\text{Å}$

in Paschen series

$$\frac{1}{\lambda_s} = R\left(\frac{1}{3^2}\right) = \frac{R}{9}$$

$$\frac{1}{\lambda_l} = R\left(\frac{1}{3^2} - \frac{1}{4^2}\right) = \frac{7R}{144}$$

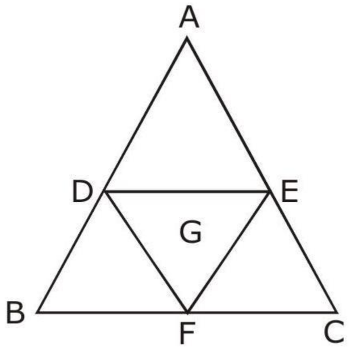
$$(\lambda, -\lambda_s) = \left(\frac{144}{7} - 9\right)\text{R} = 10553\text{Å}$$

22. (266)

$$(0.1)\left(\frac{3}{2}R\right)(\text{T} - 200) = (0.05)\left(\frac{3}{2}R\right)(400 - \text{T})$$

$$\text{T} = 266.6\ \text{K}$$

23. (11)



Let $I_0 = kmc^2$

$$I_{DEF} = K\left(\frac{m}{\ell}\right)\left(\frac{\ell}{2}\right)^2 = \left(\frac{I_0}{16}\right)$$

and $I_{ADE} = I_{BDE} = I_{EFC} = I$

$$3I = I_0 - \frac{I_0}{16} = \frac{15I_0}{16}$$

$$\Rightarrow I = \frac{5I_0}{16}$$

$$I_{remaining} = 2I + \frac{I_0}{16} = \frac{11I_0}{16}$$

24. (6.25) $L = 20, f_0 = 1\text{ cm}, M = 100$

$$M = \frac{v_0}{u_0}\left(1 + \frac{D}{f_e}\right)$$

$$M = \frac{L}{f_0}\left(1 + \frac{D}{f_e}\right)\ [v_0 \approx L, u_0 \approx f_0]$$

on solving we get

$f_e = 6.25$ cm

25. (20) $I_f\omega_f = I_i\omega_i$

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

$$I_f = \frac{MR^2}{2} + \frac{M(R/2)^2}{2}$$

$$= \frac{5}{4} \cdot \frac{MR^2}{2}$$

$$\left[\frac{MR^2}{2} + \frac{M}{2}\left(\frac{R}{2}\right)^2\right]\omega' = \left(\frac{MR^2}{2}\right) \cdot \omega$$

$$\left[\frac{MR^2}{2} \cdot \left(\frac{5}{4}\right)\right]\omega' = \frac{MR^2}{2}\omega$$

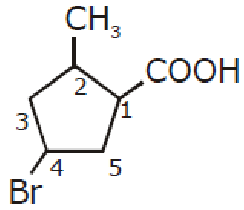
$\omega' = \frac{4}{5}\omega$

loss of K.E. $= \frac{\text{Loss}}{K_i} \times 100 = \frac{\omega^2 - \omega'^2(5/4)}{\omega^2} \times 100$

$\frac{\omega^2 - \frac{16}{25}\omega^2\left(\frac{5}{4}\right)}{\omega^2} = \left(1 - \frac{80}{100}\right) \times 100$

$= 20\%$

26. (b)

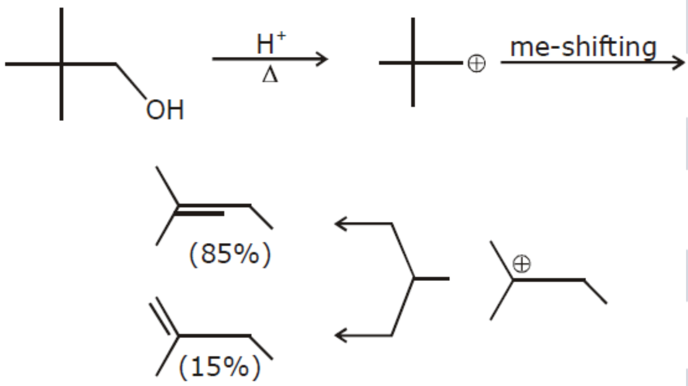


4-Bromo-2-methylcyclopentane carboxylic acid

27. (a)

28. (c) $O^{2-} > F^- > Na^{\oplus} > Mg^{2+}$

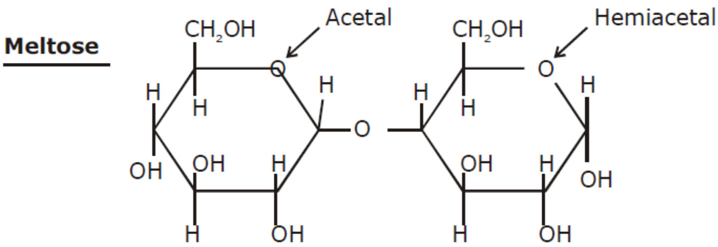
29. (c)



30. (d)

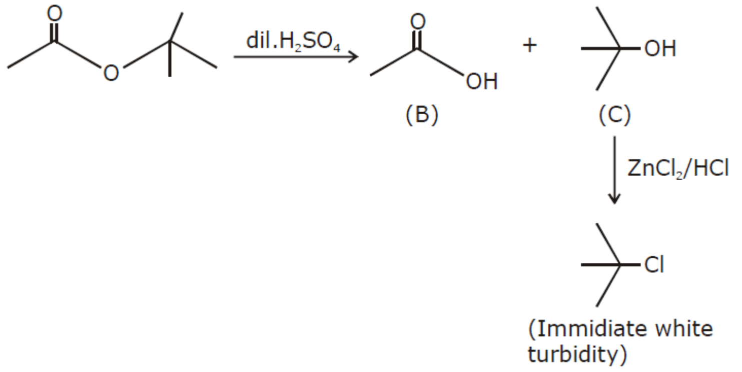
31. (b)

32. (a)



33. (A)

34. (d)



35. (c) Lime stone finally goes to slag formation

$CaCO_3 \rightarrow CaO + CO_2$

$CaO + SiO_2 \rightarrow CaSiO_3$

slag

36. (a) For ideal gas

$$\left.\frac{\delta \mathrm{v}}{\delta \mathrm{v}}\right|_T = 0 \& \left.\frac{\delta \mathrm{H}}{\delta \mathrm{v}}\right|_T = 0$$

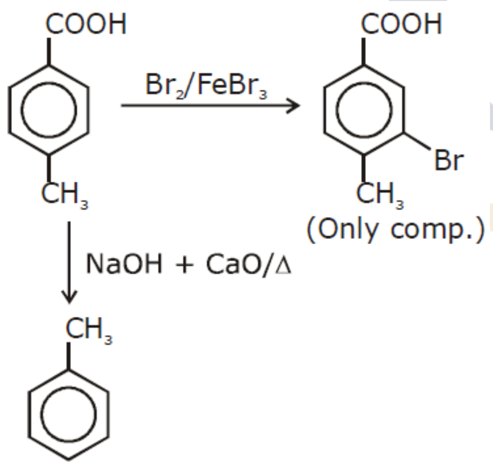
(a) Hence function of temp. only.

(b) Compressibility factor $(z) = 1$ Always

(c) $C_{p,m} - C_{v,m} = R$

(d) $dv = nC_{v,m}^{m} dT$ for all process

37. (b)

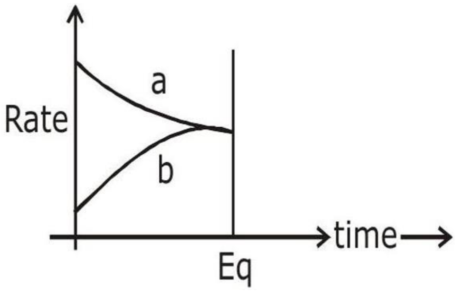


38. (b) At equilibrium

Rate of forward = Rate of backward

$a = b$

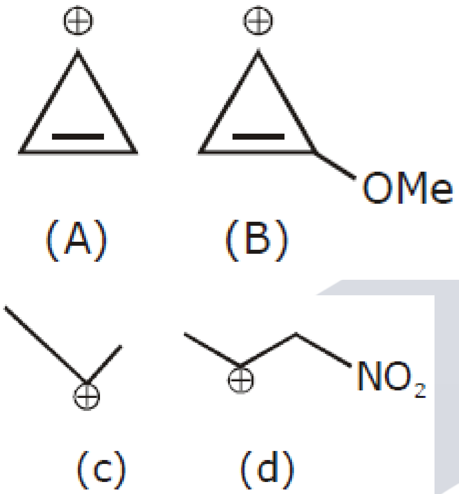
Hence



39. (d)

40. (b) Three linkage isomer NO_2^-; ONO^-

41. (a)



Order or stability

$(B) > (A) > (C) > (D)$

42. (d)

43. (c)

44. (d) $Z = 101 \rightarrow [R_n]^{86} 7s^2 5f^{13}$

Actinoids

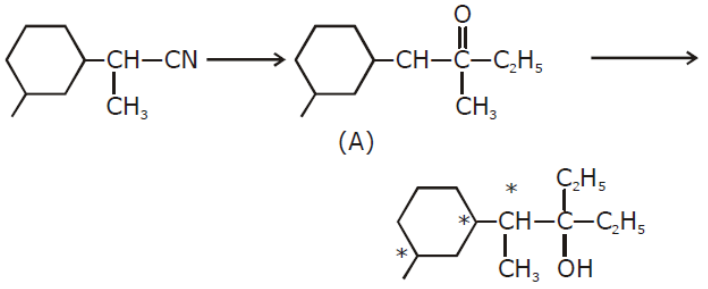
$Z = 104 \rightarrow [R_n]^{86} 7s^2 5f^{14} 6d^2$

4^{th} group element

Ans Actinoids & 4^{th} group

45. (b) Li_2O, Na_2O_2 K_2O_2

46. (3)



3 chiral center is present in final products

47. $550 = \frac{1}{4} \times p^0_{c_6H_{14}} + \frac{3}{4} \times p^0_{c_7H_{16}}$

$560 = \frac{1}{5} \times p^0_{c_6H_{14}} + \frac{4}{5} \times p^0_{c_7H_{16}}$

$p^0_{c_7H_{16}} = [560 \times 5 - 550 \times 4]$

$= 550 + 50 = 600$ mm of Hg

48. $N_2 + 3H_2 \longrightarrow 2NH_3$

2800 g1000 g

100 mol500 mol

L.R.

mole of NH_3 produced $= 200$ mol

mass $= 3400$ g

49. (60)

$t_{75\%} = 90 \text{ min} = 2 \times t_{1/2}$

$t_{1/2} = 45$ min

$\frac{\ln(b)}{45} \times t_{60\%} = \ln\left\{\frac{100}{40}\right\}$

$t_{60\%} = 45 \times \frac{0.4}{0.3}$

$t_{60\%} = 60$ min

50. (85)

$H_2O_2 + KmnO_4 \rightarrow Mn^{+2} + O_2$

[moles of H_2O_2] $\times 2 = \frac{0.316}{158} \times 5$

moles of $H_2O_2 = 5 \times 10^{-3}$

mass of $H_2O_2 = 170 \times 10^{-3}$ g

% purity $= \frac{170\times10^{-3}}{0.2} \times 100 = 85\%$

51. (b)

$xy' - y = x^2(x\cos x + \sin x)x > 0, y(\pi) = \pi$

$y' - \frac{1}{x}y = x\{x\cos x + \sin x\}$

I.F. $= e^{-\int \frac{1}{x}dx} = e^{-\ell nx} = \frac{1}{x}$

$\therefore y \cdot \frac{1}{x} = \int \frac{1}{x} \cdot x(x\cos x + \sin x)dx$

$\frac{y}{x} = \int (x\cos x + \sin x)dx$

$\frac{y}{x} = \int \frac{d}{dx}(x\sin x)dx$

$\frac{y}{x} = x\sin x + C$

$\Rightarrow y = x^2 = \sin x + cx$

$\mathrm{x} = \pi, \mathrm{y} = \pi$

$\pi = \pi\mathrm{C} \Rightarrow \mathrm{C} = 1$

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

$y' = 2x\sin x + x^2\cos x + 1$

$\mathrm{y}'' = 2\sin \mathrm{x} + 2\mathrm{x}\cos \mathrm{x} + 2\mathrm{x}\cos \mathrm{x} - \mathrm{x}^2\sin \mathrm{x}$

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

52. (a) $\sum_{r=0}^{20} {}^{50-r}\mathrm{C}_6$

$\Rightarrow {}^{50}\mathrm{C}_6 + {}^{49}\mathrm{C}_6 + {}^{48}\mathrm{C}_6 + \cdots . + {}^{31}\mathrm{C}_6 + {}^{30}\mathrm{C}_6$

add and subtract ${}^{30}\mathrm{C}_7$

Using

${}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r \Rightarrow {}^{30}C_6 + {}^{30}C_7 = {}^{31}C_7$

${}^{31}\mathrm{C}_6 + {}^{31}\mathrm{C}_7 = {}^{32}\mathrm{C}_7$

Similarly solving

${}^{51}\mathrm{C}_7 - {}^{30}\mathrm{C}_7$

53. (b)

$[x]^2 + 2[x+2] - 7 = 0$
$[x]^2 + 2[x] - 3 = 0$
let $[x] = y$
$y^2 + 3y - y - 3 = 0$
$(y-1)(y+3) = 0$
$[x] = 1$ or $[x] = -3$
$x \in [1,2) \& x \in [-3,-2)$

54. (c) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

$$\frac{9}{a^2} - \frac{9}{b^2} = 1$$

Equation of normal $\Rightarrow \frac{a^2x}{3} + \frac{b^2y}{3} = a^2e^2$

at x - axis $\Rightarrow y = 0$

$$\frac{a^2x}{3} = a^2e^2 \Rightarrow x = 3e^2 = 9$$

$\mathrm{e}^2 = 3$

$\mathrm{e} = \sqrt{3}$

$$\mathrm{e}^2 = 1 + \frac{\mathrm{b}^2}{\mathrm{a}^2} = 3$$

$b^2 = 2a^2$

put in equation 1

$$\frac{9}{a^2} - \frac{9}{2a^2} = 1 \Rightarrow \frac{9}{2a^2} = 1 \Rightarrow a^2 = \frac{9}{2}$$
$$\therefore (a^2, e^2) = \left(\frac{9}{2}, 3\right)$$

55. (c) L. $R = \frac{2b^2}{a} = 10$

$$\phi(t) = \frac{5}{12} - \left(t - \frac{1}{2}\right)^2 + \frac{1}{4} = \frac{8}{12} - \left(t - \frac{1}{2}\right)^2$$

$$\therefore \phi(\mathrm{t})_{\max} = \frac{2}{3} = \mathrm{e}$$

$$\mathrm{e}^2 = 1 - \frac{\mathrm{b}^2}{\mathrm{a}^2} = \frac{4}{9} \Rightarrow \frac{\mathrm{b}^2}{\mathrm{a}^2} = \frac{5}{9}$$

$\frac{\mathrm{b}^2}{\mathrm{a.a}} = \frac{5}{9}$ from (a)

$$\frac{5}{a} = \frac{5}{9} \Rightarrow a = 9$$

$\therefore \mathrm{b}^2 = 45$

$a^2 + b^2 = 45 + 81 = 126$

56. (d) $f(x) = \int \frac{\sqrt{x}}{(1+x)^2} dx$

$x = \tan^2 \mathrm{t}$

$dx = 2\mathrm{tant}\sec^2 tdt$

$f(x) = \int \frac{\tan t . 2\tan t \sec^2 tdt}{\sec^4 t}$

$= 2\int \sin^2 \mathrm{tdt}$

$x = 3 \Rightarrow t = \frac{\pi}{3}$

$x = 1 \Rightarrow t = \frac{\pi}{4}$

$\therefore f(\mathrm{c}) - f(\mathrm{a}) = \int_{\frac{\pi}{4}}^{\frac{\pi}{3}} (1 - \cos 2t)dt \Rightarrow \left(t - \frac{1}{2}\sin 2t\right)_{\frac{\pi}{4}}^{\frac{\pi}{3}} = \frac{\pi}{12} + \frac{1}{2} - \frac{\sqrt{3}}{4}$

57. (b) $T_n = 1 - (2n)^2(2n-1)$

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

$= 1 - 8n^3 + 4n^2$

$S_n = \sum_{n=1}^{10} T_n = n - \sum 8n^3 + \sum 4n^2$

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

$= 10 - 2 \times 100 \times 121 + \frac{2}{3} \times 10 \times 11 \times 21$

$= 10 - 24200 + 1540$

$= 10 - 22660$

$\therefore$ Sum of series $= 11 - 22660 = \alpha - 220\beta$

$\alpha = 11, \beta = 103$

58. (a)

$$\int \left(\frac{x}{x\sin x + \cos x}\right)^2 dx$$

$$\int \underbrace{x\sec x}_{I} \cdot \underbrace{\frac{x\cos x}{(x\sin x + \cos x)^2}}_{II} dx$$

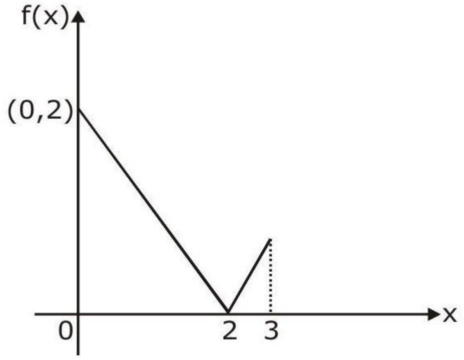
$$x\sec x\left(\frac{-1}{x\sin x + \cos x}\right) + \int \frac{\sec x + x\sec x\tan x}{(x\sin x + \cos x)} dx$$

$$\Rightarrow \frac{-x\sec x}{x\sin x + \cos x} + \int \frac{(\cos x + x\sin x)}{\cos^2 x(x\sin x + \cos x)} dx \Rightarrow \frac{-x\sec x}{x\sin x + \cos x} + \tan x + C$$

59. (c) $f(x) = |x-2|$

$$g(x) = ||x-2|-2| = \begin{cases} \text{if } x \ge 2 & \Rightarrow |x-4| \\ \text{if } x < 2 & \Rightarrow |-x| \end{cases}$$

$\therefore \int_0^3 (g(x) - f(x))dx$



$= \int_0^3 g(x) - \int_0^3 f(x)dx$

$= \int_0^2 x dx + \int_2^3 (4-x)dx - \int_0^2 (2-x)dx - \int_2^3 (x-2)dx$

$$\Rightarrow \left(\frac{x^2}{2}\right)_0^2 + \left(4x - \frac{x^2}{2}\right)_2^3 + \left(\frac{x^2}{2} - 2x\right)_0^2 - \left(\frac{x^2}{2} - 2x\right)_2^3$$

$$\Rightarrow 2 + \left\{12 - \frac{9}{2} - 8 + 2\right\} + \{2-4\} - \left(\frac{9}{2} - 6 - 2 + 4\right)$$

$$= 2 + \left\{6 - \frac{9}{2}\right\} - 2 - \left\{\frac{9}{2} - 4\right\} = 2 + \frac{3}{2} - \left(2 + \frac{1}{2}\right) = \frac{7}{2} - \frac{5}{2} = 1$$

60. (a)

$$\vec{a} \cdot (\vec{b} \times \vec{c}) = \begin{vmatrix} x & -2 & 3 \\ -2 & x & -1 \\ 7 & -2 & x \end{vmatrix}$$

$\Rightarrow x\{x^2 - 2\} + 2\{-2x + 7\} + 3\{4 - 7x\}$

$= x^3 - 2x - 4x + 14 + 12 - 21x$

$f(x) = x^3 - 27x + 26$

$f'(x) = 3x^2 - 27 = 0 \Rightarrow x = \pm 3$

Max at $x_0 = -3$

$\therefore \vec{a} = (-3, -2, 3), \vec{b} = (-2, -3, -1), \vec{c} = (7, -2, -3)$

$\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a} = 6 + 6 - 3 - 14 + 6 + 3 - 21 + 4 - 9$

$= 25 - 47 = -22$

61. (b) $AB = \sqrt{4+1} = \sqrt{5}$

$\frac{1}{2} \times \sqrt{5} \times x = 5\sqrt{5}$

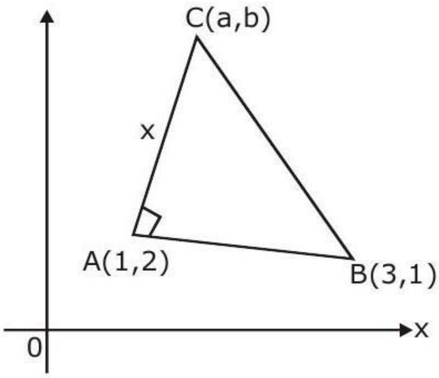
$x = 10$

$m_{AB} = \frac{1}{-2}$

$m_{AC} = 2 = \tan\theta$

$\therefore \sin\theta = \frac{2}{\sqrt{5}}, \cos\theta = \frac{1}{\sqrt{5}}$

by parametric co - ordinates $a = 1 + 10 \times \frac{1}{\sqrt{5}} = 1 + 2\sqrt{5}$



62. (a)

$f(b) = 8, f'(b) = 5, f'(x) \geq 1, f''(x) \geq 4$

$x \in (1,6)$

$\int_2^5 f'(x) \geq \int_2^5 1dx$

$f(5) - f(b) \geq 3$

$f(5) \geq 11$

also $\int_2^5 f''(x)dx \geq \int_2^5 4dx$

$f(5) + f'(5) \geq 28$

$f'(5) - f'(b) \geq 12$

$f'(5) \geq 17$

63. (b)

64. (b) $u = \frac{2z+i}{z-ki}$, $z = x + iy$

$= \frac{2x + i(2y+1)}{x + i(y-k)} \times \frac{x - i(y-k)}{x - i(y-k)}$

$\Rightarrow \frac{2x^2 + (2y+1)(y-k) + i\{2xy + x - 2xy + 2xk\}}{x^2 + (y-k)^2}$

$\text{Re}(u) + \text{Img}(u) = 1$

$2x^2 + (2y+1)(y-k) + x + 2xk = x^2 + (y-k)^2$

at y - axis, x = 0

$(2y+1)(y-k)=(y-k)^2$

$2y^2+y-2yk-k=y^2+k^2-2yk$

$\mathrm{y}^2+\mathrm{y}-(\mathrm{k}+\mathrm{k}^2)=0(\mathrm{y}_1,\mathrm{y}_2)$

diff. of roots = 5

$\sqrt{1+4\mathrm{k}+4\mathrm{k}^2}=5$

$4\mathrm{k}^2+4\mathrm{k}=24$

$\mathrm{k}^2+\mathrm{k}-6=0$

$(\mathrm{k}+3)(\mathrm{k}-2)=0$

$\mathrm{k}=2$

65. (d)

$\begin{bmatrix} c & \text{is} \\ \text{is} & c \end{bmatrix}\begin{bmatrix} c & \text{is} \\ \text{is} & c \end{bmatrix}=z\begin{bmatrix} c^2-s^2 & 2ics \\ 2ics & c^2-s^2 \end{bmatrix}=\begin{bmatrix} \cos 2\theta & i\sin 2\theta \\ i\sin 2\theta & \cos 2\theta \end{bmatrix}$ (where $c=\cos\theta, s=\sin\theta$))

$A^5=\begin{bmatrix} \cos(2^4\theta) & i\sin(2^4\theta) \\ i\sin(2^4\theta) & \cos(2^4\theta) \end{bmatrix}$

$a=d=\cos(16\theta)$

$\mathrm{b}=\mathrm{c}=\mathrm{i}\sin(16\theta)$

$a^2-b^2=\cos^2(16\theta)+\sin^2 16\theta=1$

66. (c)

$\frac{5+7+10+12+14+15+x+y}{8}=10$

$x+y=17$

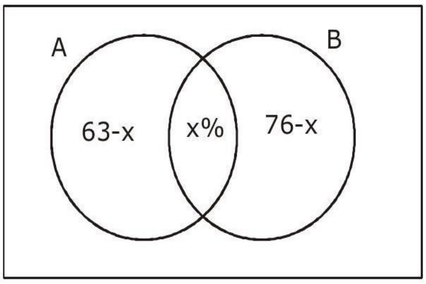
variance $=\frac{739+x^2+y^2}{8}-100=13.5$

$x^2+y^2=169$

$\therefore x=12, y=5$

$|x-y|=7$

67. (d)



$A \cup B = 13 - x \leq 100$

$x \geq 39$

also $x \leq 63$

68. (d)

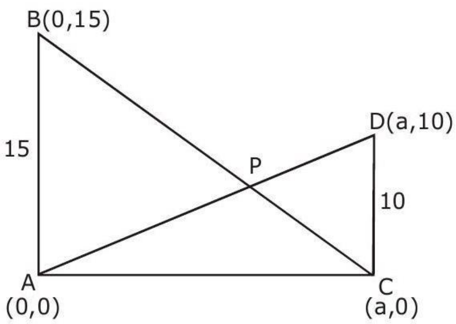
	p	q	~ q	q ∨ p	p ↔~ q	(qvp) → (p ↔~ q)
	T	T	F	T	F	F
$S_1 =$	T	F	T	T	T	T
	F	T	F	T	T	T
	F	F	T	F	F	T

S_1 is not correct

p	q	~ q	~ p	~ p ↔ q	~ q ∧ (~ p ↔ q)
T	T	F	F	F	F
T	F	T	F	T	T
F	T	F	T	T	F
F	F	T	T	F	F

S_2 is false

69. (d)



equation of $AD: y = \frac{10x}{a}$

equation of $BC: \frac{x}{a} + \frac{y}{15} = 1$

$$\Rightarrow \frac{a.y}{10a} + \frac{y}{15} = 1 \Rightarrow \frac{3y + 2y}{30} = 1$$

$5y = 30 \Rightarrow y = 6$

70. (a) $(a + \sqrt{2}b\cos x)(a - \sqrt{2}b\cos y) = a^2 - b^2$

diff both sides w.r.t y

$$-\sqrt{2}b\sin x \cdot \frac{dx}{dy}(a-\sqrt{2}b\cos y)+(a+\sqrt{2}b\cos x)(\sqrt{2}b\sin y)=0$$

$$x=y=\frac{\pi}{4}\Rightarrow \frac{-bdx}{dy}(a-b)+(a+b)(b)=0$$

$$\frac{dx}{dy}=\frac{a+b}{a-b}$$

71. $f(x+y)=f(x)+f(y)+xy^2+x^2y$

$x=y=0$

$f(0)=2f(0)\Rightarrow f(0)=0$

Partially diff. w.r.t. x

$f(x+y)=f(x)+y^2+2xy$

$x=0, y=x$

$f'(x)=f'(0)+x^2$

$f'(x)=1+x^2$

given $\lim_{x\to 0}\frac{f(x)}{x}=1$

$$\therefore f(x)=x+\frac{x^3}{3}+c$$

by L' hospital

put x = 0 ⇒ c = 0

$$\lim_{x\to 0}\frac{f'(x)}{1}=1$$

$f'(3)=10$

72. $p_1+\lambda p_2=0$

$(x+4y-z+7)+\lambda(3x+y+5z-8)=ax+by+6z-15$

$$\frac{1-3\lambda}{a}=\frac{4+\lambda}{b}=\frac{-1+5\lambda}{6}=\frac{7-8\lambda}{-15}$$

$\therefore 15-75\lambda=42-48\lambda$

$-27=27\lambda$

$\lambda=-1$

$\therefore$ plane is $-2x+3y-6z+15=0$

$$d=\left|\frac{-6+6+6+15}{\sqrt{4+9+36}}\right|=3$$

73.

$$\begin{vmatrix} 1 & -2 & 3 \\ 2 & 1 & 1 \\ 1 & -7 & a \end{vmatrix} = 0$$
$1(a+7)+2(2a-1)+3(-14-1)=0$
$a+7+4a-2-45=0$
$5a=40$
$a=8$
$$D_1 = \begin{vmatrix} 9 & -2 & 3 \\ b & 1 & 1 \\ 24 & -7 & 8 \end{vmatrix} = 0$$
$\Rightarrow 9(8+7)+2(8b-24)+3(-7b-24)=0$
$\Rightarrow 135+16b-48-21b-72=0$
$15=5b \Rightarrow b=3$
$a-b=5$

74. (8)

$(2x^2+3x+4)^{10} = \sum_{r=0}^{20} a_r x^r$

$a_7 =$ coeff of x^7

$a_{13} =$ coeff of x^{13}

$$\frac{10!}{p!\,q!\,r!}(2x^2)^p(3x)^q(4)^r$$

for x^7

p	q	r
3	1	6
2	3	5
1	5	4
0	7	3

$$a_7 = \frac{2^3\cdot 3\cdot 10!}{3!\,6!} + \frac{10!\,2^2\cdot 3^3}{2!\,3!\,5!} + \frac{10!\,2\cdot 3^5}{5!\,4!} + \frac{10!\cdot 3^7}{7!\,3!}$$

for x^{13}

p	q	r
6	1	3
5	3	2
4	5	1
3	7	0

$$a^{13} = \frac{2^6\cdot 3\cdot 10!}{6!\,3!} + \frac{2^5\cdot 3^3\cdot 10!}{5!\,3!\,2!} + \frac{2^4\cdot 3^5\cdot 10!}{4!\,5!} + \frac{2^3\cdot 10!}{3!\,7!} \quad \therefore \ \frac{a_7}{a_{13}} = 8$$

75. (3)

$P(H)=\frac{1}{10}; P(M)=\frac{9}{10}$

$P(H)+P(M)\cdot P(H)+P(M)\cdot P(M)\cdot P(H)+\cdots\ldots\ldots\ldots....$

$=1-P(M)^n\geq\frac{1}{4}$

$=1-\left(\frac{9}{10}\right)^n\geq\frac{1}{4}$

$\left(\frac{9}{10}\right)^n\leq\frac{3}{4}; n\geq 3$