

Hillside College of Engineering Balkumari, Ktm Nepal Tel: 01-5147207, 5147010
2083-04-05 Hints & Solution

Section – I

- 1.(c) $\frac{t_1}{t_2} = \sqrt{\frac{2h_1/g}{2h_2/g}} = \sqrt{\frac{h_1}{h_2}}$
- 2.(c) $10 = \frac{1}{2} k s^2 \dots (i)$
 Again, $10 + w = \frac{1}{2} k (2s)^2$
 or, $10 + w = 4 \times 10$
 or, $w = 30 \text{ J}$
- 3.(d) $F = G \frac{mm}{(2r)^2} = G \frac{\frac{4\pi}{3} r^3 \times \frac{4\pi}{3} r^3}{4r^2}$
 $\therefore F \propto r^4$
- 4.(c) % increase in volume $\left(\frac{\Delta V}{V}\right) = \gamma \Delta \theta \times 100\%$
 $= 3\alpha \Delta \theta \times 100\%$
 $= 3 \times 10^{-5} \times 100 \times 100\%$
 $= 0.3\%$
- 5.(d) When fan run it increases the rate of evaporation & feel cold.
- 6.(d) cos wave lead sine wave by 90°
 $\phi = \frac{\pi}{2}$
- 7.(b) When charge is placed on soap bubble then it's radius increases.
- 8.(b) $F = k \frac{8 \times 5}{r^2} \dots (i)$
 $F' = k \frac{5 \times 8}{r^2} = F$
- 9.(a) $V = E - Ir$
 or, $1.8 = 2.2 - \frac{E}{5+r} \cdot r$
 or, $\frac{2.2r}{5+r} = 2.2 - 1.8$
 or, $2.2r = 2 + 0.4r$
 or, $1.8r = 2$
 $r = \frac{20}{1.8} = \frac{10}{9} \Omega$
- 10.(d) $P = \frac{P_1 P_2}{P_1 + P_2}$
 or, $P_1 P_2 = 25 \times (P_1 + P_2) \dots (i)$
 In parallel $P_1 + P_2 = 100 \dots (ii)$
 $P_1 P_2 = 2500$
 Check from option.
- 11.(c) Intensity of normal light doesnot change while passing through polaroid.
- 12.(b) $P = P_1 + P_2$
 or, $P_2 = 2 - 5 = -3D$
 $\frac{f_1}{f_2} = \frac{\omega_1}{\omega_2}$
 or, $\frac{\omega_1}{\omega_2} = \frac{f_1}{f_2} = \frac{P_2}{P_1} = \frac{3}{5}$
- 13.(c) Depletion layer is layer of ion.
- 14.(c) No of photo electrons $\propto$ intensity of radiation.
- 15.(b) Molecular mass = $2 \times$ vapor density = 60. Empirical formula mass = 30. $n = 60/30 = 2$
- 16.(b) 2 moles Al need 3 moles Cl_2 , but only 4 moles available. For complete reaction, need 3 moles Cl_2 , so Cl_2 is limiting.
- 17.(c) Average kinetic energy depends only on temperature, not pressure.
- 18.(b) Total electrons = $18 + 10 + 2 + 3 = 33$. Element is As (Arsenic), Group 15, Period 4.
- 19.(d) All are isoelectronic with 10 electrons. Higher nuclear charge = smaller radius. Mg^{2+} has highest nuclear charge (12).
- 20.(b) HNO_3 is reduced (N: $+5 \rightarrow +2$ in NO), so it's the oxidizing agent.
- 21.(b) $\text{pH} = \text{pK}_a + \log\left(\frac{[\text{salt}]}{[\text{acid}]}\right) = -\log(1.8 \times 10^{-5}) + \log(0.2/0.1) = 4.74 + 0.30 = 5.04$
- 22.(b) $\alpha = \sqrt{(K_a/C)} = \sqrt{(1.0 \times 10^{-4}/0.1)} = \sqrt{(1.0 \times 10^{-3})} = 0.032$
- 23.(b) $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}}$
 $E^\circ_{\text{cell}} = E^\circ_{\text{Cu}^{2+}/\text{Cu}} - E^\circ_{\text{Zn}^{2+}/\text{Zn}}$
 $E^\circ_{\text{cell}} = (+0.34 \text{ V}) - (-0.76 \text{ V}) = +1.10 \text{ V}$
- 24.(b) $t_{1/2} = 0.693/k = 0.693/0.693 = 1.0 \text{ min}$
- 25.(b) Fe is surrounded by 6 CN^- ligands, so coordination number is 6.
- 26.(b) Longest chain has 5 carbons. Numbering from right: 2, 2,4-trimethylpentane
- 27.(c) SN_1 rate depends on carbocation stability. Tertiary carbocation is most stable.
- 28.(b) Two chiral centers, but one isomer is meso compound. Total stereoisomers = 3 (2 enantiomers + 1 meso)
- 29.(a) Here $n(A) = 6, n(B) = 9$
 $n(A \cup B)$ will be maximum when A and B are disjoint. So maximum value of $n(A \cup B) = 6 + 9 = 15$
 Also, $n(A \cap B)$ is maximum when $A \subseteq B$. So maximum value of $n(A \cap B) = 6$.
- 30.(c) The matrix is skewsymmetric if $a_{ij} = -a_{ji}$.
 So, $K + 1 = -(-5)$ or $K = 5 - 1$ i.e., $K = 4$
- 31.(d) Here $AB = AC \Rightarrow A^{-1}AB = A^{-1}AC \Rightarrow B = C$
 So, this is possible only when A^{-1} exists for which A must be non singular.
- 32.(c) Here the points are collinear if slope of join of (a, 0) and (0, b) = slope of join of (a, 0) and (x, y)
 or, $\frac{b-0}{a-a} = \frac{y-0}{x-a}$ or, $b(x-a) = -ay$
 or, $\frac{b}{-a} = \frac{-y}{x-a}$ or, $bx - ab = -ay$
 $\therefore bx + ay = ab$
- 33.(d) Given circle is $x^2 + y^2 - 6x - 8y = 0$
 So, centre = (3, 4). Thus there infinitely normals can be drawn from (3, 4) to the circle $x^2 + y^2 - 6x - 8y = 0$.
- 34.(b) Here, $PS + PS' = \text{constant}$, S and S' are fixed. Hence the locus is ellipse, by definition.
- 35.(c) Here conic sections are $xy = c^2, x^2 - y^2 = a^2$ which are rectangular hyperbolas. So $e = \sqrt{2}, e' = \sqrt{2}$. Then $e^2 + e'^2 = 2 + 2 = 4$
- 36.(b) We have $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$
 Now, $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$
 $= 2\cos^2 \alpha + 1 + 2\cos^2 \beta - 1 + 2\cos^2 \gamma - 1$
 $= 2(\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma) - 3$
 $= 2 - 3 = -1$

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- 37.(b)** The equation of plane parallel to $2x + 3y + 4z = 16$ is
 $2x + 3y + 4z = K$
 If it passes through the point (2, 3, 4) then
 $2 \times 2 + 3 \times 3 + 4 \times 4 = K$ i.e. $K = 29$
 $\therefore$ Required plane is $2x + 3y + 4z = 29$
- 38.(a)** Given, $\vec{a} = \vec{i} + 2\vec{j} + 2\vec{k}$, $\vec{b} = 6\vec{i} - 2\vec{j} + 3\vec{k}$
 Now, $\vec{a} \cdot \vec{b} = 1 \times 6 + 2 \times -2 + 2 \times 3 = 6 - 4 + 6 = 8$
 and $|\vec{a}| = |\vec{i} + 2\vec{j} + 2\vec{k}| = 3$, $|\vec{b}| = |6\vec{i} - 2\vec{j} + 3\vec{k}| = 7$
 $\therefore$ Projection of $\vec{b}$ on $\vec{a} = \frac{\vec{a} \cdot \vec{b}}{|\vec{a}|} = \frac{8}{3}$
- 39.(c)** $\frac{c - a \cos B}{b - a \cos C} = \frac{a \cos B + b \cos A - a \cos B}{c \cos A + a \cos C - a \cos C} = \frac{b \cos A}{c \cos A}$
 $= \frac{2R \sin B}{2R \sin C} = \frac{\sin B}{\sin C}$
- 40.(b)** Given $\text{Cov}(X, Y) = 18$, $\text{Var}(X) = 16$, $\text{Var}(Y) = 81$
 $\therefore r = \frac{\text{Cov}(X, Y)}{\sqrt{\text{Var}(X)} \sqrt{\text{Var}(Y)}} = \frac{18}{\sqrt{16} \sqrt{81}} = \frac{18}{4 \times 9} = 0.5$
- 41.(d)** Given $P(A) = 0.25$, $P(B) = 0.32$, $P(\bar{A} \cap \bar{B}) = 0.55$
 Now, $P(A \cup B) = 1 - P(\bar{A} \cap \bar{B}) = 1 - 0.55 = 0.45$
 and $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
 or, $0.45 = 0.25 + 0.32 - P(A \cap B)$
 i.e., $P(A \cap B) = 0.57 - 0.45 = 0.12$
 Then $P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{0.12}{0.32} = \frac{12}{32} = \frac{3}{8} = 0.375$
- 42.(d)** We have, $p \Leftrightarrow q \equiv (p \Rightarrow q) \wedge (q \Rightarrow p)$
 So, $\sim(p \Leftrightarrow q) \equiv \sim[(p \Rightarrow q) \wedge (q \Rightarrow p)]$
 $\equiv \sim(p \Rightarrow q) \vee \sim(q \Rightarrow p)$
 $\equiv [p \wedge (\sim q)] \vee [q \wedge (\sim p)]$
 So the negation is
 $\triangle ABC$ is right angled triangle right angle at B and
 $AB^2 + BC^2 \neq AC^2$
 or, $AB^2 + BC^2 = AC^2$ and $\triangle ABC$ is not right
 angled triangle right angle at B.
- 43.(d)** $Ax = B$ cannot be solved by inverse matrix method
 when A^{-1} doesnot exist. So we must have $|A| = 0$.
- 44.(c)** $\lim_{x \rightarrow 0} \frac{\sin 5x}{\sin kx} = \frac{1}{3}$
 or, $\lim_{x \rightarrow 0} \frac{5 \cos 5x}{k \cos kx} = \frac{1}{3}$ or, $\frac{5 \cos 0}{k \cos 0} = \frac{1}{3} \therefore k = 15$
- 45.(c)** Since the function is continuous at $x = 1$, so
 $\lim_{x \rightarrow 1^-} f(x) = \lim_{x \rightarrow 1^+} f(x)$
 or, $\lim_{x \rightarrow 1^-} (3x + 1) = \lim_{x \rightarrow 1^+} (kx - 2)$
 or, $3 \times 1 + 1 = k \times 1 - 2$
 or, $3 + 1 = k - 2 \therefore k = 4 + 2 = 6$
- 46.(d)** $\log_{\sqrt{x}} x = \frac{1}{\log_x \sqrt{x}} = \frac{1}{\frac{1}{2} \log_x x} = 2$ and $\frac{dx}{dx} = 0$
- 47.(b)** Actual change $= (x + \Delta x)^2 - x^2 = (2.01)^2 - 2^2$
 $= 4.0401 - 4 = 0.0401$
- 48.(b)** Given differential equation is $\frac{dy}{dx} + y \tan x = \sec x$
 Here, integrating factor $= e^{\int \tan x dx} = e^{\log \sec x} = \sec x$

- 49.(a)** **50.(b)** **51.(d)** **52.(c)** **53.(a)** **54.(c)**
55.(b) **56.(c)** **57.(d)** **58.(d)** **59.(a)** **60.(b)**

Section – II

- 61.(d)** Vel. of ball relative to balloon $= (u + v)$
 $0 = (u + v) - gt$
 or, $t = \frac{u + v}{g}$
 Time to meet balloon $(2t) = \frac{2(u + v)}{g}$
- 62.(b)** For hammer & nail
 $Mu = (M + m)v'$
 $v' = \frac{Mu}{M + m}$
 After impact
 $0 = v'^2 + 2as$
 or, $a = \left(\frac{Mu}{M + m} \right)^2 \times \frac{1}{2s}$
 Force (F) $= (M + m)a$
 $= \frac{M^2 u^2}{(M + m)} \times \frac{1}{2s}$
- 63.(c)** $Wt = \text{upthrust}$
 $V\rho g = \frac{V}{2} \sigma_1 g + \frac{V}{2} \sigma_2 g$
 or, $\rho = \frac{\sigma_1 + \sigma_2}{2}$
 $= \frac{0.8 + 13.6}{2} = 7.2 \text{ g/cc}$
- 64.(a)** $\alpha = \frac{\Delta I}{I \Delta \theta} = \frac{0.08 \times 10^{-3}}{0.1 \times 100} = 8 \times 10^{-6} / ^\circ \text{C}$
 $\Delta V = V_0 \gamma \Delta \theta = 1000 \times 3 \times 8 \times 10^{-6} \times 100$
 $= 2.4 \text{ cc}$
 $\therefore \text{Volume} = V + \Delta V = 1002.4 \text{ cc}$
- 65.(b)** **1st case:**
 $40\% = \left(1 - \frac{T_2}{500} \right) \times 100\%$
 or, $\frac{2}{5} = 1 - \frac{T_2}{500}$
 or, $T_2 = \frac{3}{5} \times 500 = 300\text{K}$
2nd case:
 $\eta_2 = \left(1 - \frac{T_2}{T_1'} \right) \times 100\%$
 or, $\frac{50}{100} = 1 - \frac{300}{T_1'}$
 or, $\frac{300}{T_1'} = \frac{1}{2}$
 $\therefore T_1' = 600\text{K}$
- 66.(c)** $f' = \frac{v}{v - v_s} \times f$
 or, $\frac{10000}{9500} = \frac{300}{300 - v_s}$
 or, $300 - v_s = \frac{300 \times 9500}{10000}$
 or, $300 - v_s = 285$
 or, $v_s = 15 \text{ m/s}$

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- 67.(d)** $Q_1 = 4\pi R^2 \sigma$, $Q_2 = 16\pi R^2 \sigma$
 After connection
 $Q_1 + Q_2 = 4\pi \epsilon_0 (R + 2R) V$
 or, $V = \frac{20\pi R^2 \sigma}{4\pi \epsilon_0 \times 3R} = \frac{5\sigma R}{3\epsilon_0}$
For bigger:
 $\sigma' = \frac{4\pi \epsilon_0 2R \times 5\sigma R}{4\pi (2R)^2 3\epsilon_0} = \frac{5\sigma}{6}$
- 68.(b)** $ms\Delta\theta = P_1 \times T_1 \dots (1)$
 $ms\Delta\theta = P_2 \times T_2 \dots (2)$
 In series $(P_1 + P_2) \times T = ms\Delta\theta$
 or, $ms\Delta\theta \left(\frac{1}{T_1} + \frac{1}{T_2} \right) T = ms\Delta\theta$
 or, $T = \frac{T_1 T_2}{T_1 + T_2}$
- 69.(b)** $E = \frac{d\phi}{dt} = AN \frac{d\phi}{dt}$
 $= 0.1^2 \times 500 \times 1 = 5V$
- 70.(a)** For convex lens
 $V = \frac{fu}{u-f} = \frac{10 \times 15}{15-10} = 30 \text{ cm}$
 For mirror
 $r = 2f = 2 \times 12 = 24 \text{ cm}$
 $d = V - r = 30 - 24 = 6 \text{ cm}$
- 71.(c)** $1.5 \beta = 1 \times 10^{-3}$
 or, $1.5 \frac{D\lambda}{d} = 10^{-3}$
 or, $\lambda = \frac{10^{-3} \times 0.9 \times 10^{-3}}{1.5 \times 1}$
 $= 6 \times 10^{-7} \text{ m}$
 $= 6000 \text{ \AA}$
- 72.(b)** $P = \frac{n}{t} \frac{hc}{\lambda} = \frac{nhc}{t \times \lambda} \times P$
 or, $\frac{np}{t} = \frac{P}{C}$
 Rate of change in momentum $= \frac{P}{C}$
 $F = 1.6 \frac{P}{C} = 1.6 \times \frac{60}{3 \times 10^8} = 3.2 \times 10^{-7} \text{ N}$
- 73.(b)** **2nd case:**
 $\frac{A}{A_0} = \left(\frac{1}{2} \right)^{t/T_{1/2}}$
 or, $\frac{3000}{6000} = \left(\frac{1}{2} \right)^{140/T_{1/2}}$
 or, $T_{1/2} = 140 \text{ days}$
1st case:
 $\frac{A}{A_0} = \left(\frac{1}{2} \right)^{t/T_{1/2}}$
 or, $\frac{6000}{A_0} = \left(\frac{1}{2} \right)^{280/140}$
 or, $A_0 = 24000 \text{ dps}$
- 74.(b)** $PH_2 = (nH_2 \times R \times T)/V = (2 \times 0.082 \times 300)/10 = 4.92 \text{ atm}$
- 75.(a)** Initial $[PCl_5] = 1 \text{ M}$. Let $x \text{ mol/L}$ dissociate. $K_c = [PCl_3][Cl_2]/[PCl_5] = x^2/(1-x) = 0.04$ Solving: $x^2 + 0.04x - 0.04 = 0$, $x = 0.2 \text{ M}$
- 76.(a)** In K_2MnO_4 : $2(+1) + x + 4(-2) = 0$, $x = +6$ In MnO_2 : $x + 2(-2) = 0$, $x = +4$ Difference $= 6 - 4 = 2$
- 77.(a)** Mass of H_2SO_4 in $1000 \text{ mL} = 1400 \times 0.49 = 686 \text{ g}$
 Moles $= 686/98 = 7.0 \text{ mol}$ Molarity $= 7.0 \text{ M}$
- 78.(b)** $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ Each $K_2Cr_2O_7$ accepts 6 electrons
- 79.(c)** Xe has 8 valence electrons + 4 from F atoms = 12 electrons 6 electron pairs arranged octahedrally, 4 bonding + 2 lone pairs Hybridization $= sp^3d^2$
- 80.(d)** For octahedral $[Ma_2b_2c_2]$ complex with three different types of ligands Total geometrical isomers = 15 (considering all possible arrangements)
- 81.(a)** In presence of peroxides, HBr follows anti-Markovnikov addition Br goes to less substituted carbon, forming 1-bromo-2-methylpropane
- 82.(d)** $6N = \{6, 12, 18, 24, 30, 36, 42, 48, \dots\}$
 $8N = \{8, 16, 24, 32, 40, 48, \dots\}$
 $6N \cap 8N = \{24, 48, \dots\} = 24N$
 Also, LCM of 6 and 8 = 24
 So $6N \cap 8N = 24N$
- 83.(c)** x^{th} term of the series $= \frac{1^3 + 2^3 + 3^3 + \dots \text{ to } n \text{ terms}}{1 + 3 + 5 + \dots \text{ to } n \text{ terms}}$
 $= \frac{\frac{n^2(n+1)^2}{4}}{\frac{n^2}{2}} = \frac{(n+1)^2}{4} = \frac{n^2 + 2n + 1}{4}$
- 84.(d)** Given $|ZW| = 1$ i.e., $|Z| |W| = 1$
 Also, $\arg(Z) - \arg(W) = \frac{\pi}{2}$ or, $\arg\left(\frac{Z}{W}\right) = \frac{\pi}{2}$ So, $\frac{Z}{W} = i$
 and $\left(\frac{\bar{Z}}{\bar{W}}\right) = -i$ i.e., $\frac{\bar{Z}}{\bar{W}} = -i$
 Now, $\frac{Z}{W} + \frac{\bar{Z}}{\bar{W}} = i - i = 0$
 or, $\frac{Z}{W} = -\frac{\bar{Z}}{\bar{W}}$
 i.e. $\bar{Z}W = -Z\bar{W}$
 So, $\bar{Z}W = -Z\frac{\bar{W}}{W}W$
 $= -\frac{Z}{W}|W|^2 = -\frac{Z}{W} = -i$
- 85.(b)** Let α be the root of $x^2 - x + k = 0$. So $\alpha^2 - \alpha + k = 0$
 Also 2α will be the root of $x^2 - x + 3k = 0$.
 So $4\alpha^2 - 2\alpha + 3k = 0$
 On solving
 $\frac{\alpha^2}{-3k+2k} = \frac{\alpha}{4k-3k} = \frac{1}{-2+4}$
 i.e. $\frac{\alpha^2}{-k} = \frac{\alpha}{k} = \frac{1}{2}$ i.e., $\alpha^2 = -\frac{k}{2}$, $\alpha = \frac{k}{2}$
 Then $\left(\frac{k}{2}\right)^2 = -\frac{k}{2} \Rightarrow \frac{k^2}{4} = -\frac{k}{2} \Rightarrow k = -2$ ($\because k \neq 0$)
- 86.(c)** $C(2n+1, 1) + C(2n+1, 2) + \dots + C(2n+1, n) = 255$... (i)
 Also, $C(2n+1, 0) + C(2n+1, 1) + C(2n+1, 2) + \dots + C(2n+1, n) = 256$... (ii)
 Using $C(n, r) = C(n, n-r)$, we have,
 $C(2n+1, 2n+1) + C(2n+1, 2n) + C(2n+1, 2n-1) + \dots + C(2n+1, n+1) = 256$... (iii)

- Adding (ii) and (iii), we have
 $C(2n+1, 0) + C(2n+1, 1) + C(2n+1, 2) + \dots + C(2n+1, n) + C(2n+1, n+1) + C(2n+1, n+2) + \dots + C(2n+1, 2n+1) = 512$
 or, $2^{2n+1} = 512$
 or, $2^{2n+1} = 2^9$
 or, $2n+1 = 9$ or, $2n = 8$ $\therefore n = 4$
- 87.(c)** Given $(1+3) \log_e 3 + \frac{1+3^2}{2!} (\log_e 3)^2 + \frac{1+3^3}{3!} (\log_e 3)^3 + \dots$
 $= \left[\log_e 3 + \frac{(\log_e 3)^2}{2!} + \frac{(\log_e 3)^3}{3!} + \dots \right]$
 $+ \left[3 \log_e 3 + \frac{(3 \log_e 3)^2}{2!} + \frac{(3 \log_e 3)^3}{3!} + \dots \right]$
 $= \left[1 + \frac{\log_e 3}{1!} + \frac{(\log_e 3)^2}{2!} + \frac{(\log_e 3)^3}{3!} + \dots - 1 \right]$
 $+ \left[1 + \frac{3 \log_e 3}{1!} + \frac{(3 \log_e 3)^2}{2!} + \frac{(3 \log_e 3)^3}{3!} + \dots - 1 \right]$
 $= (e^{\log_e 3} - 1) + [e^{3 \log_e 3} - 1]$
 $= 3 - 1 + 3^3 - 1 = 3 - 1 + 27 - 1 = 28$
- 88.(b)** Given pairs are $x^2 - 2mxy - y^2 = 0$... (i) $x^2 - 2nxy - y^2 = 0$... (ii)
 Equation of bisectors of angle between the lines (i) is
 $-m(x^2 - y^2) = [1 - (-1)] xy$
 $-mx^2 + my^2 = (1+1) xy$
 i.e., $mx^2 + 2xy - my^2 = 0$ (ii)
 According to question (ii) and (iii) are identical, so,
 $\frac{m}{1} = \frac{2}{-2n} = \frac{-m}{-1}$
 Taking first two $\frac{m}{1} = \frac{2}{-2n} \Rightarrow mn = -1$
- 89.(d)** Given line is $lx + my + n = 0$... (i) and parabola is $x^2 = y$... (ii)
 Solving (i) and (ii),
 $mx^2 + lx + n = 0$... (iii)
 Line (i) is a tangent to (ii) if discriminant of (iii) is zero.
 $l^2 - 4mn = 0$
 i.e. $l^2 = 4mn$
- 90.(c)** Given $|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$, $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{c} = \vec{c} \cdot \vec{a} = 0$
 Now, $|\vec{a} + \vec{b} + \vec{c}|^2 = (\vec{a} + \vec{b} + \vec{c}) \cdot (\vec{a} + \vec{b} + \vec{c})$
 $= |\vec{a}|^2 + |\vec{b}|^2 + |\vec{c}|^2 + 2\vec{a} \cdot \vec{b} + 2\vec{b} \cdot \vec{c} + 2\vec{c} \cdot \vec{a}$
 $= 1 + 1 + 1 + 0$
 $= 3$
 $\therefore |\vec{a} + \vec{b} + \vec{c}| = \sqrt{3}$
- 91.(a)** $\tan^{-1} x + \tan^{-1} y = \frac{\pi}{4}$
 or, $\tan^{-1} \frac{x+y}{1-xy} = \frac{\pi}{4}$
 or, $\frac{x+y}{1-xy} = \tan \frac{\pi}{4}$

- or, $\frac{x+y}{1-xy} = 1$
 or, $x+y = 1-xy$
 $\therefore x+y+xy = 1$
- 92.(b)** Given $f(x+y) = f(x) f(y)$
 Now, $f'(5) = \lim_{h \rightarrow 0} \frac{f(5+h) - f(5)}{h} = f(5)$
 $= \lim_{h \rightarrow 0} \frac{f(5) f(h) - f(5) f(0)}{h}$
 $= \lim_{h \rightarrow 0} \frac{f(5) [f(h) - f(0)]}{h} = f(5) f'(0)$
 $= 2 \times 3 = 6$
- 93.(a)** Given, $f(x) = \frac{e^{2x} - 1}{e^{2x} + 1} = \frac{e^x \cdot e^x - e^x \cdot e^{-x}}{e^x \cdot e^x + e^x \cdot e^{-x}}$
 $= \frac{e^x(e^x - e^{-x})}{e^x(e^x + e^{-x})} = \tanh x$
 So, $f'(x) = \text{sech}^2 x > 0$ for all real x . Thus the function is increasing.
- 94.(c)** Put $\tan^{-1} x^4 = z$ $\therefore dz = \frac{1}{1+(x^4)^2} \cdot 4x^3 dx$
 i.e. $\frac{1}{4} dz = \frac{4^3 dx}{1+x^8}$
 Then $I = \int \sin z \frac{dz}{4} = -\frac{\cos z}{4} + c = -\frac{1}{4} \cos(\tan^{-1} x^4) + c$
- 95.(b)** $I + J = \int_0^{\pi/4} \sin^2 x dx + \int_0^{\pi/4} \cos^2 x dx$
 $= \int_0^{\pi/4} (\sin^2 x + \cos^2 x) dx = \int_0^{\pi/4} 1 dx = [x]_0^{\pi/4} = \frac{\pi}{4}$
 $\therefore I = \frac{\pi}{4} - J$
- 96.(d)** Required area
 $= \int_1^3 y dx$
 $= \int_1^3 |x-2| dx$
 $= \int_1^2 |x-2| dx + \int_2^3 |x-2| dx$
 $= \int_1^2 -(x-2) dx + \int_2^3 (x-2) dx$
 $= -\left[\frac{(x-2)^2}{2}\right]_1^2 + \left[\frac{(x-2)^2}{2}\right]_2^3$
 $= -\left[0 - \frac{1}{2}\right] + \left[\frac{1}{2} - 0\right]$
 $= \frac{1}{2} + \frac{1}{2}$
 $= 1 \text{ sq. unit}$
- 97.(c)** **98.(b)** **99.(d)** **100.(a)**

...Best of Luck...