1. (c)

$R = R_0 e^{-\lambda t}$

$$\therefore \quad \frac{R_B}{R_A} = \frac{R_o e^{-\lambda_B t}}{R_o e^{-\lambda_B t}} = e^{-(\lambda_B - \lambda_A)t} = e^{-3t}$$

$$\Rightarrow \quad \lambda_B - \lambda_A = 3$$

$$\Rightarrow \quad \frac{\ell n^2}{T_B} - \frac{\ell n 2}{\ell n 2} = 3.$$

$$\Rightarrow \quad T_B = \frac{\ell n 2}{4}$$

2. (b) $P_s = \eta P_P$

$$\Rightarrow E_s i_s = \eta E_i i_p$$

$$\Rightarrow i_s = \frac{(0.9)(2300)(5)}{(230)} = 45 \text{ A}.$$

3. (d) $B = \frac{E}{c}$

$$\Rightarrow U_E = \frac{1}{2}\varepsilon_0 E^2$$

$$U_B = \frac{B^2}{2\mu_0} = \frac{E^2}{2\mu_0 C^2} = \frac{E^2}{2\mu_0}(\mu_0\varepsilon_0) = U_E$$

4. (d)

$x = 3t^2 + 5$

$\Rightarrow v = 6t$

$\Rightarrow \Delta W = \Delta k$

$$= \frac{1}{2}(2)(30)^2 - \frac{1}{2}2(0)^2$$

$= 900$ J

5. (d)

$eE = evB$

$$\Rightarrow E = \left(\frac{eBr}{m}\right)B$$

$$\Rightarrow m = \frac{eB^2 r}{E}$$

$$\Rightarrow m = \frac{(1.6\times10^{-19})(0.5)^2(0.5\times10^{-2})}{100} = 2\times10^{-24} \text{ kg}$$

6. (a)

$$\vec{E} = \frac{kq_1}{r_1^3}\vec{r}_1 + \frac{kq_2}{r_2^3}\vec{r}_2 = k\times10^{-6}\left[\frac{\sqrt{10}}{10\sqrt{10}}(-\hat{\imath}+3\hat{\jmath}) + \frac{(-25)}{125}(-4\hat{\imath}+3\hat{\jmath})\right]$$

$$= (9\times10^3)\left[\frac{1}{10}(-\hat{\imath}+3\hat{\jmath}) - \frac{1}{5}(-4\hat{\imath}+3\hat{\jmath})\right]$$

$= (9\times10^3)\left[\left(-\frac{1}{10}+\frac{4}{5}\right)\hat{\imath}+\left(\frac{3}{10}-\frac{3}{5}\right)\hat{\imath}\right] = 9000\left(\frac{7}{10}\hat{\imath}-\frac{3}{10}\hat{\jmath}\right)$

$= (63\hat{\imath}-27\hat{\jmath})(100)$

7. (c) $t = G^a h^b C^c$

$\Rightarrow M^0L^0T' = (M^{-1}L^3T^{-2})^a(M^2T^{-1})^b(L^{-1})^c$

$\Rightarrow -a+b=0 \Rightarrow a=b$

$\Rightarrow 3a+2b+c=0$

$\Rightarrow c=-5a$

$\Rightarrow -2a-b-c=1$

$\Rightarrow a=\frac{1}{2}; b=\frac{1}{2}; c=-\frac{5}{2}$

8. (d)

9. (b) $\frac{dV}{dt} = Av \Rightarrow \frac{dV}{dt} = A\sqrt{2gh}$

$\Rightarrow \frac{0.74}{60} = (3.14)\left(\frac{2}{100}\right)^2\sqrt{2(9.8)h}$

$\Rightarrow h = 4.92$ m

10. (b) $E_1 = -\frac{GMm}{R+h} - \left(-\frac{GMm}{R}\right)$

$E_2 = \frac{1}{2}m\left(\sqrt{\frac{GM}{R+h}}\right)^2 = \frac{GMm}{2(R+h)}$

$E_1 = E_2; h = \frac{R}{2}$

11. (d) $W_1 = W_2$

$\Rightarrow 600 - T_2 = T_2 - 400$

$\Rightarrow T_2 = 500$ K

12. (c) $E = Pt = \frac{E^2}{Z^2}Rt = \frac{(24)^2}{60^2+(8.33\pi-2\pi)^2}(60)(60) = 518$ J

13. (c) PE = KE

$\Rightarrow \frac{1}{2}m\omega^2(A^2-x^2) = \frac{1}{2}m\omega^2x^2$

$\Rightarrow x = \frac{A}{\sqrt{2}}$

14. (d) $T\cos 45^\circ = mg$

$T\sin 45^\circ = F$

$\Rightarrow F = mg = 100$ N.

15. (c) $\Delta Q = \frac{f}{2} nR\Delta T$

$= \frac{5}{2}\left(\frac{15}{28}\right)(8.3)(1200 - 300) = 10000$ J.

16. (d)

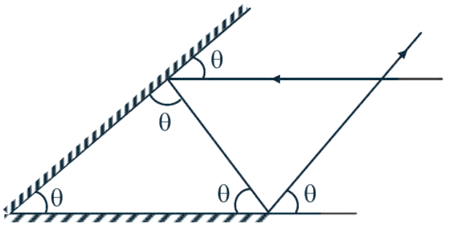
$\Delta X_{max} = d\sin\theta = 0.32\sin 30 = 0.16$ mm

$\therefore n = \frac{\Delta X_{max}}{\lambda} = \frac{0.16 \times 10^{-3}}{500 \times 10^{-9}}$

$= \frac{0.16 \times 10^{6}}{500} = \frac{1600}{5} = 320$

$\therefore$ Number of BFs $= (2n + 1) = 641$

17. (b)



$\theta = 60^{\circ}$

18. (b) $mg\frac{\ell}{2}\left(\frac{1}{2}\right) = \frac{1}{2}\left(\frac{m\ell^2}{3}\right)\omega^2$

$\Rightarrow \omega = \sqrt{\frac{3g}{2\ell}} = \sqrt{30}$

19. (a) $R = 530k\Omega \pm 5\%$

20. (d) $B_L = \frac{\mu_0 i}{2R}$

$B_C = \frac{\mu_0 N i}{2(R/N)}$

$\therefore \frac{B_L}{B_C} = \frac{1}{N^2}$

21. (c)

$f = \frac{1}{2\pi}\sqrt{\frac{C}{\left(\frac{ML^2}{3}\right)}}$ & $0.8f = \frac{1}{2\pi}\sqrt{\frac{C}{\left(\frac{ML^2}{3} + \frac{mL^2}{2}\right)}}$

$\Rightarrow \frac{25}{16} = \frac{\frac{ML^2}{3} + \frac{mL^2}{2}}{\frac{ML^2}{3}}$

$$\Rightarrow \frac{25}{16} = 1 + \frac{3\text{ m}}{2\text{M}}$$
$$\Rightarrow \frac{9}{16} = \frac{3\text{ m}}{2\text{M}}$$
$$\Rightarrow \frac{\text{m}}{\text{M}} = \frac{3}{8} = 0.37$$

22. (b)

23. (BONUS)

24. (c) Zero error $= 0 + 3 \times \frac{0.5\text{ mm}}{100} = 0.015$ mm

$$MSR = 5.5 + 48 \times \frac{0.5}{100}$$

$= 5.74$ mm.

$\therefore$ Thickness $= 5.74 - 0.015 = 5.725$ mm

25. (a) $\text{f} = \frac{2}{2\ell}\text{v}_\text{s} = \frac{330}{0.5} = 660$ Hz

$$\therefore\ f' = f\left(\frac{v_s + v}{v_s}\right) = (660)\left(\frac{330 + \frac{50}{18}}{330}\right) = 660\left(1 + \frac{50}{18 \times 330}\right)$$

$= 666$ Hz

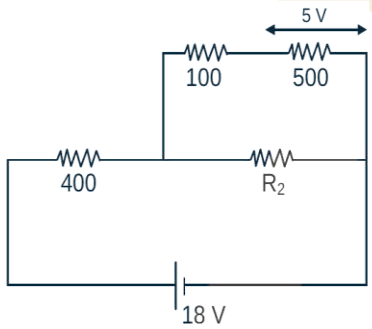
26. (c) $\sqrt{\frac{2\ell}{a_2}} - \sqrt{\frac{2\ell}{a_1}} = t \Rightarrow \frac{\sqrt{2\ell}}{t} = \frac{\sqrt{a_1 a_2}}{\sqrt{a_1} - \sqrt{a_2}}$

$$\sqrt{2a_1\ell} - \sqrt{2a_2\ell} = v \quad \Rightarrow \quad \frac{\sqrt{2\ell}}{v} = \frac{1}{\sqrt{a_1} - \sqrt{a_2}}$$
$$\Rightarrow \frac{v}{t} = \sqrt{a_1 a_2} \quad \Rightarrow \quad v = \left(\sqrt{a_1 a_2}\right)t$$

27. (d) $KE_{\text{max}} = hv_{\text{max}} - \phi$

$$= \frac{(6.6 \times 10^{-34})(6.28 \times 10^{7})(3 \times 10^{8})}{1.6 \times 10^{-19} \times 2 \times 3.14} - 4.7$$
$$= 12.37 - 4.7 = 7.67\text{eV}$$

28. (a)



$$\frac{12}{400} = \frac{6}{600} + \frac{6}{\text{R}_2}$$
$$\Rightarrow \frac{1}{200} = \frac{1}{600} + \frac{1}{\text{R}_2}$$
$$\Rightarrow R_2 = 300\Omega$$

29. (c) $f=\frac{c}{\lambda}=\frac{3\times10^{8}}{8\times10^{-7}}=\frac{3}{8}\times10^{15}$ Hz

$$\therefore\ n=\frac{(0.01)f}{6\times10^{6}}=\frac{\frac{3}{8}\times10^{13}}{6\times10^{6}}$$

$$=\frac{1}{16}\times10^{7}=6.25\times10^{5}$$

30. (a) $\mathrm{v_x}=\frac{\mathrm{dx}}{\mathrm{dt}}=-a\omega\sin\omega t$

$$v_y=\frac{dy}{dt}=a\omega\cos\omega t$$

$$\mathrm{v_z}=\frac{\mathrm{dz}}{\mathrm{dt}}=\mathrm{a}\omega$$

$$\therefore\ \mathrm{v}=\sqrt{\mathrm{v_x^2}+\mathrm{v_y^2}+\mathrm{v_z^2}}=\mathrm{a}\omega\sqrt{2}$$

31. (d)

$$H_2O(s)\longrightarrow H_2O(\ell)\longrightarrow H_2O(\ell)\longrightarrow H_2O(g)\longrightarrow H_2O(g)$$

1 kg at 273 K	1 kg at 273 K	1 kg at 373 K at 373 K

$$\Delta S=\Delta S_1+\Delta S_2+\Delta S_3+\Delta S_4$$

$$=\frac{334}{273}+4.2\ln\frac{373}{273}+\frac{2491}{373}+2\ln\frac{383}{373}=9.267\ \mathrm{kJKg^{-1}\ K^{-1}}$$

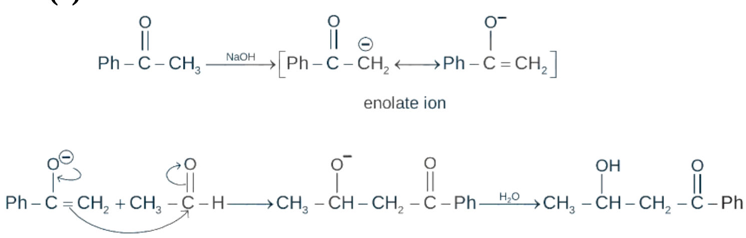
32. (c) $2C_{57}H_{110}O_6(s)+163O_2(g)\longrightarrow114CO_2(g)+110H_2O(I)$

$$\frac{\text{Moles of } C_{57}H_{110}O_6}{2}=\frac{\text{Moles of } H_2O}{110}$$

$$\frac{\frac{445}{890}}{2}=\frac{\frac{\text{Mass of } H_2O}{18}}{110}$$

Mass of H_2O = 495 g

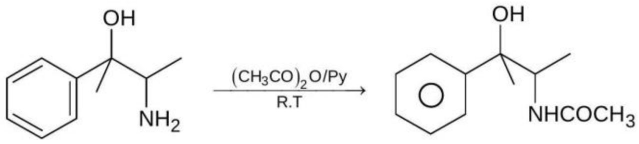
33. (c)



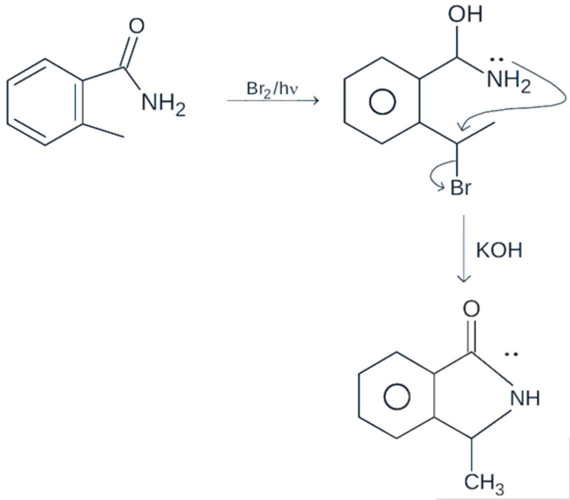
34. (c)

35. (b)

36. (d) Nucleophilicity of $NH_2 > OH$



37. (c)



38. (d)

39. (b) The only alkali metal which forms nitride by reacting directly with N_2 is 'Li'.

40. (b) $As_2\ S_3$ is a negatively charged sol. so $AlCl_3$ will be most effective.

41. (d) As CN^- is a strong field ligand. $K_3[Co(CN)_6]$ will have maximum ' Δ '.

42. (a)

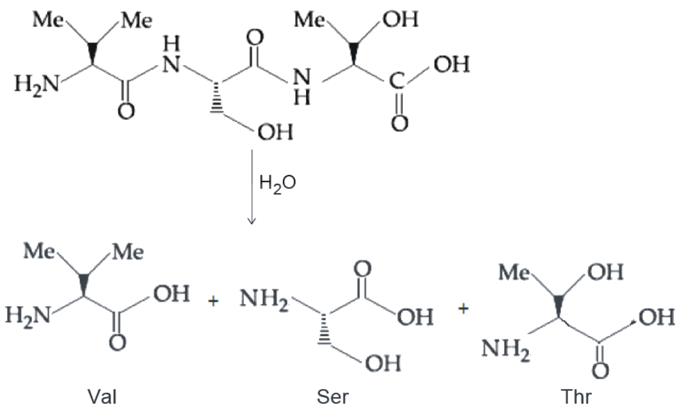
43. (c) $A_2(g) + B_2(g) \overset{K_1}{\rightleftharpoons} 2AB(g)$

$6AB(g) \overset{K_2}{\rightleftharpoons} 3\ A_2(g) + 3\ B_2(g)$

Reaction $(2) = -3 \times$ reaction (1)

$\therefore K_2 = \left(\frac{1}{K_1}\right)^3 \Rightarrow K_2 = K_1^{-3}$

44. (a)



45. (b)

$2\ A + B \longrightarrow$ products

Rate $= K[A]^x[B]^y$

$r = K[A]^x[B]^y$
$0.3 = K[A]^x[B]^y$
$2.4 = K[2A]^x[2B]^y$
$0.6 = K[2A]^x[B]^y$
From (1), (2) & (3)

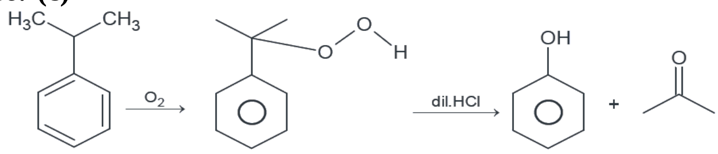
$x = 1, y = 2$

Overall order $= 2 + 1 = 3$

Order w.r.t A $= 1$

Order w.r.t $B = 2$

46. (c)



47. (b) $COCH_3$ is present it will show both $2{,}4 - DNP\&$ iodoform test.

Due to steric inhibition of resonance. I.P of ' N ' is not involved in delocalization so coupling reaction will not take place.

48. (d) $Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$

$-nFE_{cell} = -RT\ell nK$

$$\ell nK = \frac{2 \times 96500 \times 2}{8 \times 300} = 160.83$$

$K = e^{160}$

49. (c)
50. (a)

$NO \longrightarrow NO^+$
B.O 0.5 3
Para Dia

$N_2 \longrightarrow N_2^+$
B.O 3 2.5
Dia Para

$O_2 \longrightarrow O_2^+$
B.O 2 2.5
Para Para

$O_2 \longrightarrow O_2^{2-}$
B.O 2 1
Para Dia

51. (c)
52. (a)

 is anti aromatic

53. (c)
54. (a) $4Al + 6ZnO \longrightarrow 2Al_2O_3 + 6Zn$

ΔH for the above reaction is $-ve$.

55. (b) Due to weak metallic bonding

56. (b) Correct order of basic strength is

$NH_2(Et)_2 > EtNH_2 > NMC_3 > Ph - NH - CH_3$

57. (d) 2^{nd} electron gain enthalpy of oxygen is positive.

58. (d) $d = \frac{ZM}{N_a a^3}$

$$= \frac{4 \times 63.55}{6.023 \times 10^{23} \times (x \times 10^{-8})^3} = \frac{422}{x^3} \text{gm/cm}^3$$

59. (c) Let moles of H_2O separated as ice $=$ xgm

$\Delta T_f = iK_f m$

$$10 = 1 \times 1.86 \frac{\frac{62}{62}}{\frac{250 - x}{1000}}$$

x = 64gm

60. (d)

61. (a)

$$T_n = \frac{(3 + (n-1) \times 3)(1^2 + 2^2 + \cdots . + n^2)}{(2n+1)}$$

$$T_n = \frac{3 \cdot \frac{n^2(n+1)(2n+1)}{6}}{2n+1} = \frac{n^2(n+1)}{2}$$

$$S_{15} = \frac{1}{2} \sum_{n=1}^{15} (n^3 + n^2) = \frac{1}{2}\left[\left(\frac{15(15+1)}{2}\right)^2 + \frac{15 \times 16 \times 31}{6}\right]$$

$= 7820$

62. $(\boldsymbol{a})$ $\lim_{x \to 0^+} \frac{x([x]+|x|)\sin[x]}{|x|}$

$x \to 0^-$

$$\left.\begin{matrix} [x] = -1 \\ |x| = -x \end{matrix}\right\} \Rightarrow \lim_{x \to 0^-} \frac{x(-x-1)\sin(-1)}{-x} = -\sin 1$$

63. (b) $f(xy) = f(x) \cdot f(y)$

$f(0) = 1$ as $f(0) \neq 0$

$\Rightarrow f(x) = 1$

$$\frac{dy}{dx} = f(x) = 1$$

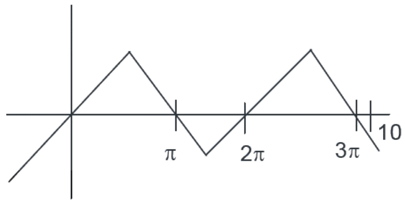
$\Rightarrow y = x + c$

At, $x = 0, y = 1 \Rightarrow c = 1$

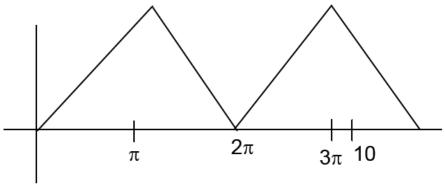
$y = x + 1$

$\Rightarrow y\left(\frac{1}{4}\right)+y\left(\frac{3}{4}\right)=\frac{1}{4}+1+\frac{3}{4}+1=3$

64. (a)



$x=\sin^{-1}(\sin 10)=3\pi-10$



$y=\cos^{-1}(\cos 10)=4\pi-10$

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

65. (a) $\sin x-\sin 2x+\sin 3x=0$

$\Rightarrow(\sin x+\sin 3x)-\sin 2x=0$

$\Rightarrow 2\sin x\cdot\cos x-\sin 2x=0$

$\Rightarrow \sin 2x(2\cos x-1)=0$

$\Rightarrow \sin 2x=0$ or $\cos x=\frac{1}{2}\Rightarrow x=0,\frac{\pi}{3}$

66. (a) $z_0=\omega$ or ω^2 (where ω is a non - real cube root of unity)

$z=3+6i(\omega)^{81}-3i(\omega)^{93}$

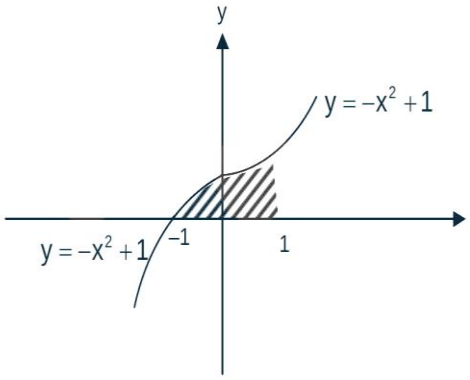
$z=3+3i$

$\Rightarrow \arg z=\frac{\pi}{4}$

67. (c) The graph is a follows

$\int_{-1}^{0}(-x^2+1)dx+\int_{0}^{1}(x^2+1)dx=2$

68. (b) $P_1=x-4y+7z-g=0$



$P_2 = 3x - 5y - h = 0$

$P_3 = -2x + 5y - 9z - k = 0$

Here $\Delta = 0$

$2P_1 + P_2 + P_3 = 0$ when $2g + h + k = 0$

69. (b) $(1 - t^6)^3(1 - t)^{-3}$

$(1 - t^{18} - 3t^6 + 3t^{12})(1 - t)^{-3}$

$\Rightarrow$ coefficient of t^4 in $(1 - t)^{-3}$ is ${}^{3+4-1}C_4 = {}^6C_2 = 15$

70. (BONUS)

71. (d) Let $A(\alpha, 0)$ and $B(0, \beta)$ be the vectors of the given triangle AOB

$\Rightarrow |\alpha\beta| = 100$

$\Rightarrow$ Number of triangles

$= 4 \times$ (number of divisors of 100)

$= 4 \times 9 = 36$

72. (b) $a = A + 6d$

$b = A + 10d$

$c = A + 12d$

a, b, c are in G.P.

$\Rightarrow (A + 10d)^2 = (A + 6d)(a + 12d)$

$\Rightarrow \frac{A}{d} = -14$

$$\frac{a}{c} = \frac{A + 6d}{A + 12d} = \frac{6 + \frac{A}{d}}{12 + \frac{A}{d}} = \frac{6 - 14}{12 - 14} = 4$$

73. (a)

$[\sim (\sim p \vee q) \wedge (p \wedge r)] \cap (\sim q \wedge r)$

$\equiv [(p \wedge \sim q) \vee (p \wedge r)] \wedge (\sim q \wedge r)$

$\equiv [p \wedge (\sim q \vee r)] \wedge (\sim q \wedge r)$

$\equiv p \wedge (\sim q \wedge r)$

$\equiv (p \wedge r) \sim q$

74. (b) ector along the normal to the plane containing the lines $\frac{x}{3}=\frac{y}{4}=\frac{z}{2}$ and $\frac{x}{4}=\frac{y}{2}=\frac{z}{3}$ is $(8\hat{i}-\hat{j}-10\hat{k})$.

Vector perpendicular to the vectors $2\hat{i}+3\hat{j}+4\hat{k}$ and $8\hat{i}-\hat{j}-10\hat{k}$ is $26\hat{i}-52\hat{j}+26\hat{k}$ So, required plane is $26x-52y+26z=0 \Rightarrow x-2y+z=0$

75. (b) $\sum(x_i+1)^2=9n$

$\sum(x_i-1)^2=5n$

$(1)+(2) \Rightarrow \sum(x_i^2+1)=7n$

$\Rightarrow \frac{\sum x_i^2}{n}=6$

$(1).(2) \Rightarrow 4\sum x_i=4n$

$\Rightarrow \sum x_i=n$

$\Rightarrow \frac{\sum x_i}{n}=1$

$\Rightarrow$ variance $=6-1=5$

$\Rightarrow$ standard diviation $=\sqrt{5}$

76. (c)

$$|A|=e^{-t}\begin{vmatrix}1 & \cos t & \sin t\\ 1 & -\cos t-\sin t & -\sin t+\cos t\\ 1 & 2\sin t & -2\cos t\end{vmatrix}$$

$=e^{-t}[5\cos^2 t+5\sin^2 t]\forall t\in R$

$=5e^{-t}\neq 0\forall t\in R$

77. (d) $\int \frac{5x^8+7x^6}{(x^2+1+2x^7)^2}dx$

$$=\int \frac{5x^{-6}+7x^{-8}}{\left(\frac{1}{x^7}+\frac{1}{x^5}+2\right)^2}dx=\frac{1}{2+\frac{1}{x^5}+\frac{1}{x^7}}+C$$

As $f(0)=0, f(x)=\frac{x^7}{2x^7+x^2+1}$

$f(1)=\frac{1}{4}$

78. (d) $|f(x)-f(y)|\leq 2|x-y|^{3/2}$

divide both side by $|x-y|$

$$\left|\frac{f(x)-f(y)}{x-y}\right| \leq 2.|x-y|^{1/2}$$

Apply limit $x \to y$

$|f'(y)| \leq 0 \Rightarrow f'(y) = 0 \Rightarrow f(y) = c \Rightarrow f(x) = 1$

$\int_0^1 1.dx = 1$

79. (d) $\frac{dx}{dt} = 3\sec^2 t$

$$\frac{dy}{dt} = 3\sec t\tan t$$

$$\frac{dy}{dx} = \frac{\tan t}{\sec t} = \sin t$$

$$\frac{d^2y}{dx^2} = \cos t\frac{dt}{dx}$$

$$= \frac{\cos t}{3\sec^2 t} = \frac{\cos^3 t}{3} = \frac{1}{3\cdot 2\sqrt{2}} = \frac{1}{6\sqrt{2}}$$

80. (b)

81. (b) $x^2 + y^2 - 16x - 20y + 164 = r^2$

$A(8,10), R_1 = r$

$(x-4)^2 + (y-7)^2 = 36$

$B(4,7), R_2 = 6$

$|R_1 - R_2| < AB < R_1 + R_2$

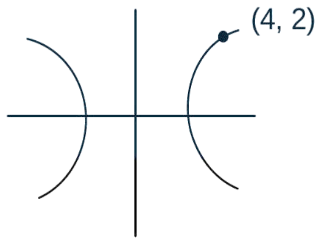
$\Rightarrow 1 < r < 11$

82. (a) Given hyperbola is

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

Satisfying the point (4,2)

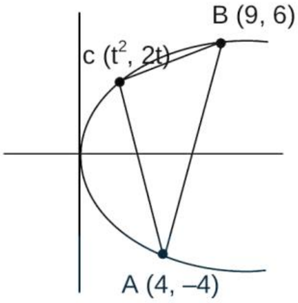
$$\Rightarrow b^2 = \frac{4}{3}$$



$$\Rightarrow e = \frac{2}{\sqrt{3}}$$

83. (d) For maximum area, tangent at the point c must be parallel to chord BC.

$\therefore t = \frac{1}{2}$



84. (d) Equation of AB is $3x - 2y + 6 = 0$

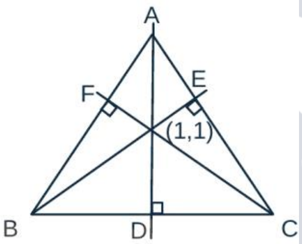
Equation of AC is $4x + 5y - 20 = 0$.

Equation of BE is $2x + 3y - 5 = 0$

Equation of CF is $5x - 4y - 1 = 0$

$\Rightarrow$ Equation of BC is

$26x - 122y = 1675$



85. (b) E_1 : Event of drawing a Red ball and placing a green ball in the bag

E_2 : Event of drawing a green ball and placing a red ball in the bag

E : Event of drawing a red ball in second draw $P(E) = P(E_1) \times P\left(\frac{E}{E_1}\right) + P(E_2) \times P\left(\frac{E}{E_2}\right) = \frac{5}{7} \times \frac{4}{7} + \frac{2}{7} \times \frac{6}{7} = \frac{32}{49}$

86. (b)

Line $x = ay + b, z = cy + d$

$\Rightarrow \frac{x-b}{a} = \frac{y}{1} = \frac{z-d}{c}$

Line $x = a'z + b', y = c'z + d'$

$\Rightarrow \frac{x-b'}{a'} = \frac{y-d'}{c'} = \frac{z}{1}$

Given both the lines are perpendicular

$\Rightarrow aa' + c' + c = 0$

87. (d) Projection of $\vec{b}$ on $\vec{a} = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|} = |\vec{a}|$

$\Rightarrow b_1 + b_2 = 2$

and $(\vec{a} + \vec{b}) \perp \vec{c} \Rightarrow (\vec{a} + \vec{b}) \cdot \vec{c} = 0$

$\Rightarrow 5\, b_1 + b_2 = -10$

from (1) and (2) $\Rightarrow b_1 = -3$ and $b_2 = 5$

then $|\vec{b}| = \sqrt{b_1^2 + b_2^2 + 2} = 6$

88. (c) D must be perfect square

$\Rightarrow 121 - 24\alpha = \lambda^2$

$\Rightarrow$ maximum value of α is 5

$\alpha = 1 \Rightarrow \lambda \notin I$

$\alpha = 2 \Rightarrow \lambda \notin 1$

$\alpha = 3 \Rightarrow \lambda \in I \;\Rightarrow 3$ integral values

$\alpha = 4 \Rightarrow \lambda \in I$

$\alpha = 5 \Rightarrow \lambda \in I$

89. (a) $f(x) = 2\left(1 + \frac{1}{x-1}\right)$

$$f'(x) = -\frac{2}{(x-1)^2}$$

$\Rightarrow f$ is one - one but not onto

90. (a)

$$\frac{1}{\sqrt{2k}}\int_0^{\pi/3} \frac{\tan\theta}{\sqrt{\sec\theta}} d\theta = \frac{1}{\sqrt{2k}}\int_0^{\pi/3} \frac{\sin\theta}{\sqrt{\cos\theta}} d\theta$$

$$= -\frac{1}{\sqrt{2k}} 2\sqrt{\cos\theta}\Big|_0^{\pi/3} = -\frac{\sqrt{2}}{\sqrt{k}}\left(\frac{1}{\sqrt{2}} - 1\right)$$

$\Rightarrow k = 2$