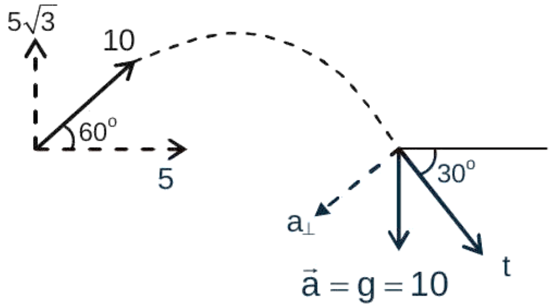
1. (b)



at $t = 1$

$u_x = 5, u_y = 5\sqrt{3}$

$v_y = 5\sqrt{3} - 10;\ v_x = 5$

$\tan\ \theta = -(2-\sqrt{3}) \Rightarrow \theta = -30^\circ$

$$R = \frac{v^2}{a_\perp} = \frac{10^2}{(10\cos 30^\circ)}$$

$$= \frac{10}{\sqrt{3}} \times 2 = \frac{20}{\sqrt{3}}\ \mathrm{m}$$

$$\frac{5^2 + (10-5\sqrt{3})^2}{10\cos\ \theta} = \frac{200-100\sqrt{3}}{10 \times 0.965} = 2.8\ \mathrm{m}$$

2. (c) Energy supplied

$$E = \frac{12400}{900} = 12.65\mathrm{eV}$$

$\therefore \mathrm{E_n - E_1} = 12.65$

$\Rightarrow (13.6)\left(1 - \frac{1}{n^2}\right) = 12.65$

$\Rightarrow \mathrm{n}^2 \approx 14.3$

$\Rightarrow \mathrm{n} \approx 4$

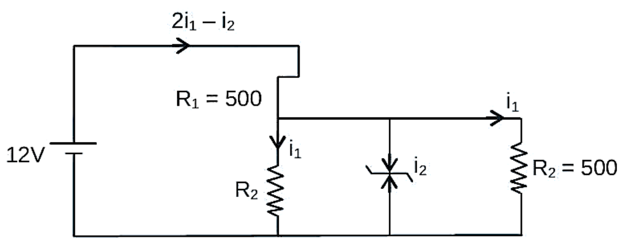
$r \propto n^2$

3. (a) $12 - 500(2\mathrm{i}_1 + \mathrm{i}_2) - 10 = 0$

$\Rightarrow\ 2\mathrm{i}_1 + \mathrm{i}_2 = \frac{2}{500} = \frac{1}{250}$

$< \mathrm{i}_1$ when zenor has break down.

So, $\mathrm{i}_2 = 0$.



4. (d) $\frac{M}{L} = \frac{\mu_0 n n_1 n_2 n_1^2 \ell}{\mu_0 \pi n_1^2 r_1^2 \ell}$

$= \frac{n_2}{n_1}$

5. (d) $K = \frac{1}{2}mv^2; U = \frac{1}{2}kx^2 = \frac{1}{2}\ m^2x^2$

$\therefore\ \frac{k}{U} = \frac{v^2}{\omega^2 x^2} = \left(\frac{\cos(wt)}{\sin(wt)}\right)^2$

$= \cot^2\left(\frac{\pi}{90} \times 210\right)$

$= \cot^2\left(2\pi + \frac{\pi}{3}\right)$

$= \left(\frac{1}{\sqrt{3}}\right)^2 = \frac{1}{3}.$

6. (d) $\Delta v = v_f - v_i$

$= \sqrt{\frac{2gMe}{R_e}} - \sqrt{\frac{gMe}{R_e}}$

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

7. (b) Power of e should be dimensionless.

So, $[\lambda] = (\alpha T k)$

$\Rightarrow L^2 = [\alpha](ML^2\ T^{-2})$

$\Rightarrow (\alpha) = (M^{-1}\ T^2)$

$\Rightarrow E = \frac{1}{2}KT$

$\Rightarrow (ML^2\ T^{-2}); (E) = [KT)$

$\Rightarrow (\alpha\beta) = (F)$

$\Rightarrow (M^{-1}\ T^2)(\beta) = (MLT^{-2})$

8. (b)

$\Delta x = \frac{\lambda}{8}$

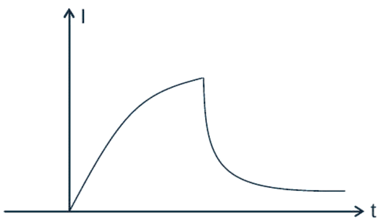
Phase $|\Delta P| = \frac{2\pi}{\lambda} \times \frac{\lambda}{8} = \frac{\pi}{4}$

$\therefore\ I_{res} = I + I + 2I\cos\left(\frac{R}{4}\right)$

$= 21\left(1 + \frac{1}{\sqrt{2}}\right) = 21 \times 1.7$

$\therefore\ \frac{I_{res}}{I_{man}} = \frac{2I \times 1.7}{4I} = 0.85$

9. (b)



Above is the correct graph for growth and decay of current.

10. (b) $U_{Total} = \frac{kQq}{a} + \frac{kq^2}{a} + \frac{kQq}{a\sqrt{2}} = 0$

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

11. (a) Prism formula

$D_m = S_m = (n-1)A$ (for thin prism)

12. (a) $I \propto m\ell^2$ (let σ = mass present area)

$\therefore\ I_1 \propto \ell^4$

and $I_2 \propto \left(\frac{\ell}{2}\right)^4$

So, $I_2 = \frac{I}{16}$

Moment of inertia of remaining sheet $= 1 - \frac{1}{16}$

$= \frac{151}{16}$

13. (b)

$\vec{\tau}_0 = \vec{\tau}_1 + \vec{\tau}_2$

$= (6\hat{\imath}) \times \left(-\frac{F}{2}\hat{\imath} + \frac{F\sqrt{3}}{2}\hat{\jmath}\right) + (2\hat{\imath} + 3\hat{\jmath}) \times (F\hat{k})$

$= -3F\hat{k}(-2F\hat{\jmath} + 3F\hat{\imath})$

$= F(3\hat{\imath} - 2\hat{\jmath} - 3\hat{k})$

14. (d)

$\times 0.5 \times 20 + (m-20) \times 80$

$= 50 \times 1 \times 40$

$\Rightarrow 90\text{ m} - 1600 = 2000$

$\Rightarrow 90\text{ m} = 3600$

$\Rightarrow \text{m} = 40\text{gm}$

15. (d) $\Delta\vec{v} = 2v\sin\left(\frac{\theta}{2}\right)$

$= 2 \times 10 \times \sin(30^\circ)$

$= 10\text{ m/s}$

16. (c) $f_{so} = f_c \pm f_m$

$= \frac{\omega_c \pm \omega_m}{2\pi}$

$= \frac{(5.5 \pm 0.22) \times 10^5}{2 \times \frac{22}{7}}$

$= 89.25, 85.75$

17. (d) $\frac{1}{v}-\frac{1}{-20}=\frac{1}{30}$

$$\Rightarrow \frac{1}{V}=\frac{1}{0.30}-\frac{1}{20}=+\frac{200-3}{60}=\frac{197}{60}$$

$$\Rightarrow -\frac{dV}{dtV^2}+\frac{du}{dtu^2}=0$$

$$\Rightarrow \frac{dV}{dt}=\frac{V^2}{u^2}\frac{du}{dt}=\left(\frac{3}{197}\right)^2\times(-5)=-0.00116\ \mathrm{m/s}$$

18. (a) $\mathrm{U_{total}}=\mathrm{U_{O_2}}+\mathrm{U_{Ar}}$

$$=\frac{3\times5\times\mathrm{RT}}{2}+\frac{5\times3\times\mathrm{RT}}{2}$$

$$=15\mathrm{RT}$$

19. (b) Assuming constant voltage supply

$$\mathrm{P}=60=\frac{\mathrm{V}^2}{\mathrm{R_1+R_2}}$$

And $P'=\frac{V^2}{R_1}+\frac{V^2}{R_2}=\frac{2V^2}{R_1}=4P=4\times60$

$=240$ W

20. (b)

$$0.5=\frac{6}{(2+\lambda L)}\lambda x$$

$$\mathrm{E_2}=\frac{6}{(6+\lambda\mathrm{L})}\lambda\mathrm{x}$$

So dividing equation (1) and (2)

$$\frac{E_2}{0.5}=\frac{2+4}{6+4}=\frac{3}{5}$$

$$\Rightarrow E_2=0.3\ \text{volt.}$$

21. (d) $\frac{E_i}{B_i}=C$

$$\frac{E_f}{B_f}=\frac{c}{n}$$

$$\Rightarrow \frac{E_iB_f}{E_fB_i}=\frac{1}{n}$$

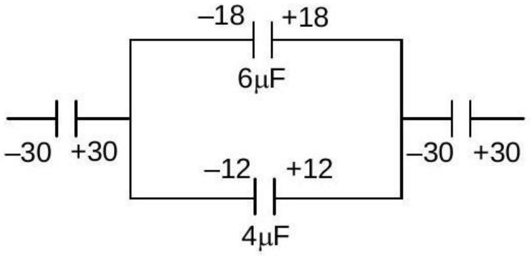
$$\Rightarrow \frac{E_i}{E_f}=\frac{1}{n}\frac{B_i}{B_f}$$

$$\left(\because \mathrm{n}=\frac{1}{\sqrt{\mu_0\mathrm{e_r}}}\right)$$

$$\frac{1}{\sqrt{n}}:\sqrt{n}$$

22. (d) $4\ \mathrm{V}+6\ \mathrm{V}=30$

$\Rightarrow V = 3$



23. (b) Equation of adiabatic process

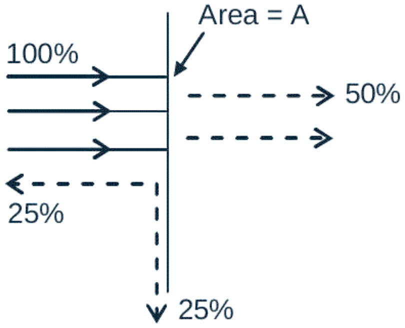
$TV^{2/f} =$ constant

$\therefore \frac{2}{f} = \frac{2}{5} = x$

24. (b)

$F = \frac{1}{4} \times \rho A v^2 + \frac{1}{4} 2\rho a v^2$

$\Rightarrow \frac{F}{A} = \frac{3}{4}\rho A v^2 = \rho$



25. (d) $\lambda_e = \lambda_{photon} \times 10^{-3}$

$\Rightarrow \frac{h}{mv} = \frac{c}{v} \times 10^{-3}$ s

$\Rightarrow v = \frac{h\nu}{mC \times 10^{-3}}$

$= \frac{6.62 \times 10^{-34} \times 6 \times 10^{14}}{9.1 \times 10^{-31} \times 3 \times 10^8 \times 10^{-3}}$

$= 1.45 \times 10^6$

26. (b) The potential inside a uniformly charged shell is constant, while it decrease hyperbolically outside.

27. (c) $y = 0.03\sin\left[450\left(t - \frac{9x}{450}\right)\right]$

So, $v = \frac{450}{9} = 50$ m/s

Also, $v = \sqrt{\frac{T}{\lambda}}$

$\Rightarrow 50 = \sqrt{\dfrac{T}{5 \times 10^{-3}}}$

$\Rightarrow T = 2500 \times 5 \times 10^{-3} = 12.5\ \text{N}$

28. (d) $k_e = \dfrac{p^2}{2M_e} = 500e$

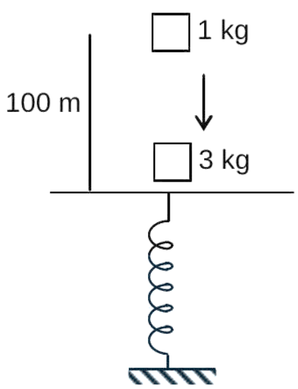
& $R = \dfrac{p}{eB} = \dfrac{1000\ m_e e}{eB} = \dfrac{1010 \times 9.1 \times 10^{-31}}{1.6 \times 10^{-19}}$

$= 100 \times 7.541 \times 10^{-6}$

29. (b) $v = \sqrt{2 \times 10 \times 100}$

$= 20\sqrt{5}$

$$\text{COLM} \rightarrow v_p = \frac{1 \times 20\sqrt{5}}{4}$$
$$= 5\sqrt{5}$$
$$\frac{1}{2} \times 4 \times (5\sqrt{5})^2 + \frac{1}{2} 1.25 \times 10^6 \left(\frac{30}{k}\right)^2$$
$$= -4 \times 10 \times \left(n - \frac{30}{k}\right) + \frac{1}{2}\text{kn}^2$$
$$\Rightarrow 250 + \frac{900}{2 \times 1.25 \times 10^6} = -40x + \frac{1200}{k} + \frac{1}{2}kx^2$$
$$\Rightarrow x \simeq 2\ \text{cm}$$



30. (d)

$$\frac{P}{Q} = \frac{400}{S}$$
$$\text{and } \frac{Q}{P} = \frac{405}{5}$$

Solving $S^2 = 400 \times 405$

$\Rightarrow S = 402.5\Omega$

31. (b)

32. (b)

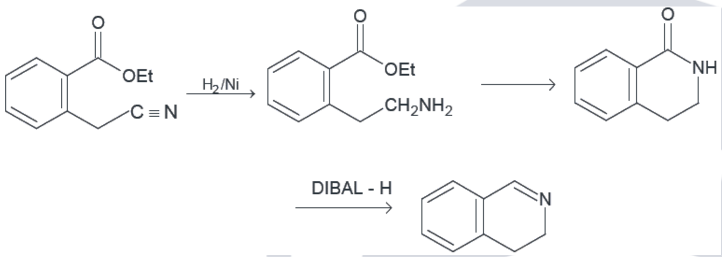
33. (a) b $\rightarrow$ antiaromatic d → Non aromatic (no cyclic conjugation)

34. (c) Density $= \frac{Z \times M}{N_{AV} \times a^3}$

Here $Z = 4, a = 200\sqrt{2}$

$N_{AV} = 6.02 \times 10^{23}$, $d = 9 \times 10^3 \frac{Kg}{m^3}$

35. (a)
36. (b)
37. (c)
38. (c) NaH is an example of saline hydride.
39. (c) Sc^{3+} has noble gas configuration hence only +3 exists.
40. (b) An example of solid sol is gem stones.
41. (c) In cold water, dissolved oxygen can reach a concentration upto 10ppm
42. (d)
43. (d)



44. (b) $0.5\alpha \frac{1}{2}, 0.2\alpha \frac{1}{x}$

Here $\frac{0.5}{0.2} = \frac{x}{2}; x = 5$, hence 3 cup

45. (d) $\ell nK = -\frac{E_a}{RT} + \ell nA$

$\therefore$ Slope $= -E_a = -y$

46. (c) Let $NaHCO_3 = x gm$

Then, $H_2C_2O_4 = (10 - x)gm$

$\therefore n_{NaHCO_3} = \frac{x}{84}$

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

$n_{H_2C_2O_4} = \left(\frac{10 - x}{90}\right)$

$H_2C_2O_4 \rightarrow H_2O + CO_2 + CO$

$\therefore n_{CO_2} = \left(\frac{10 - x}{90}\right)$

$\therefore n_{CO_2} = \frac{x}{168}$

Total $CO_2 = \frac{x}{168} + \frac{10-x}{90} = \frac{0.25}{25}$

On solving ' x '

$$\% = \frac{x}{10} \times 100 = 10x$$

47. (a) $Be - O - H$

Both bond has same dissociation energy.

48. (d)
49. (a)
50. (c) $CO_2 = 6$ mole, $N_1 = 1$ mole

$C_{atom} = 6,\ N_{atom} = 2$

Hence $C_6H_8\ N_2$

51. (a) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
equ $^{m} \times 3x\ P_1$

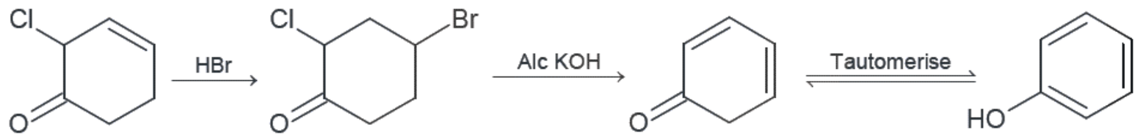
$$P_T = 4xK_p = \frac{P_1^2}{x \times 27 \times 3}$$

$$x = \left(\frac{P}{4}\right)$$

$$P_1 = \sqrt{27x^4\ K_p}$$

$$\sqrt{27}(K_p)^{1/2}\left(\frac{P_T}{4}\right)^2 = \frac{3^{3/2}K_p^{1/2}p^2}{16}$$

52. (b)



53. (a) $\Delta S_{Total} = C_P \ell n \frac{(T_1+T_2)}{2\ T_1} + C_p \ell n \frac{(T_1+T_2)}{2\ T_2}$
54. (a) Co $\rightarrow$ Vitamin B_{12}

Zn $\rightarrow$ Carbonic anhydrase

Rh $\rightarrow$ Wilkinson catalyst

Mg $\rightarrow$ Chlorophyll

55. (d) $\Delta G^\circ = \left(120 - \frac{3}{8}\ T\right) = 0$
Then $T = 320\ K$

Hence $T > 320\ KY$ formed

$T < 320\ K$ X formed

56. (b)

Siderite $\rightarrow$ Iron

Kaolinite $\rightarrow$ Aluminium

Malachite $\rightarrow$ Copper

Calamine $\rightarrow$ Zinc

57. (a) [i] 900 nm = 9000Å

It is in far infra-red region hence paschen.

58. (b)
59. (a)
60. (c)
61. (b) $2x+2y+3z=a$

$3x-y+5z=b$

$x-3y+2z=c$

$(2x+2y+3z)+(x-3y+2z)-(3x-y+5z)=0$

$\Rightarrow \mathrm{a}+\mathrm{c}-\mathrm{b}=0$

62. (a) $F_4(x)=\frac{\sin^4 x+\cos^4 x}{4}=\frac{1-2\sin^2 x\cdot\cos^2 x}{4}=\frac{1}{4}-\frac{1}{2}\sin^2 x\cdot\cos^2 x$

$$F_6(x)=\frac{\sin^6 x+\cos^6 x}{6}=\frac{1-3\sin^2 x\cdot\cos^2 x(\sin^2 x+\cos^2 x)}{6}$$

$$=\frac{1}{6}-\frac{1}{2}\sin^2 x\cdot\cos^2 x$$

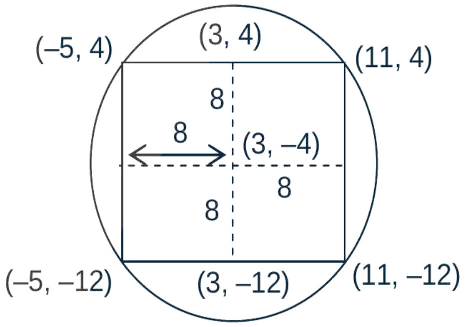
$$F_4(x)-f_6(x)=\frac{1}{4}-\frac{1}{6}=\frac{6-4}{24}=\frac{2}{24}=\frac{1}{12}$$

63. (c) Centre $(3,-4)$

Radius $=\sqrt{9+16+103}=\sqrt{128}=8\sqrt{2}$

$\therefore$ $(-5,4)$ will be nearer to the $(0,0)$

$\therefore$ Ans. $\sqrt{5^2+4^2}=\sqrt{25+16}=\sqrt{41}$



64. (b)

65. (b) $x^2 = 4y$

$x + 2 = 4y$

Solve (1) and (2)

$x + 2 = x^2$

$\Rightarrow x^2 - x - 2 = 0$

$\Rightarrow (x-2)(x+1) = 0 \Rightarrow x = 2, -1$

$$\text{Area } = \int_{-1}^{2}\left(\frac{x+2}{4} - \frac{x^2}{4}\right)dx$$
$$= \frac{1}{4}\left[\frac{x^2}{2} + 2x - \frac{x^3}{3}\right]_{-1}^{2}$$
$$= \frac{1}{4}\left[\left(2 + 4 - \frac{8}{3}\right) - \left(\frac{1}{2} - 2 + \frac{1}{3}\right)\right]$$
$$= \frac{1}{4}\left[\frac{10}{3} - \frac{3 - 12 + 2}{6}\right] = \frac{1}{4}\left[\frac{10}{3} + \frac{7}{6}\right]$$
$$= \frac{1}{4} \times \frac{27}{6} = \frac{9}{8}$$

66. (a) $\int_0^2\left(\frac{\sin^2 x}{\frac{1}{2}+\left[\frac{x}{\pi}\right]} + \frac{\sin^2 x}{\frac{1}{2}+\left[-\frac{x}{\pi}\right]}\right)dx$

$$= \int_0^2\left(\frac{\sin^2 x}{1+\left[\frac{x}{\pi}\right]} + \frac{\sin^2 x}{\frac{1}{2} - 1 - \left[\frac{x}{\pi}\right]}\right)dx = \int_0^2 dx = 0$$

67. (d) Variance remains some if same number is subtracted from each observation. (subtract 10 from each observation)

$$\therefore \frac{10(-d)^2 + 10(0)^2 + 10(\ d)^2}{30} - \left(\frac{10(-d) + 10(0) + 10(\ d)}{30}\right)^2 = \frac{4}{3}$$

$$\frac{20d^2}{30} = \frac{4}{3}$$

$\Rightarrow d^2 = 2$

68. (d) Equation of required plane is

$a(x-3) + b(y+2) + c(z-1) = 0$

[as it contains the point $(3, -2, 1)$]

$2a - b + 3c = 0$

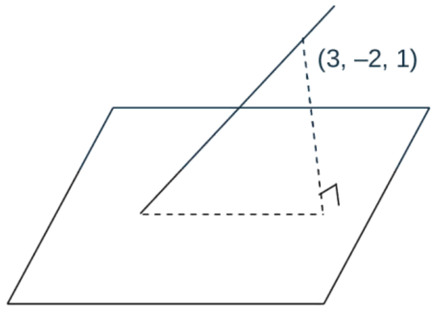
$2a + 3b - c = 0$

$$\Rightarrow \frac{a}{-8} = \frac{b}{8} = \frac{c}{8}$$

$$\Rightarrow \frac{a}{+1} = \frac{b}{-1} = \frac{c}{1}$$

∴ equation of plane is

$x - 3 - y - 2 - z + 1 = 0$



$\Rightarrow x - y - z = 4$

69. (c)

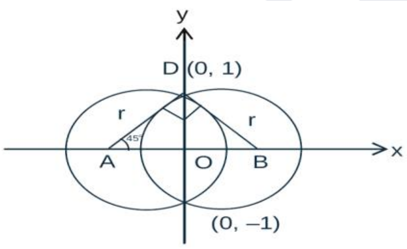
$$P = \frac{\text{both number is even}}{\text{number of ways selecting two numbers such that their sum is even.}}$$

$$= \frac{{}^5C_2}{{}^5C_2 + {}^6C_2} = \frac{10}{10 + 15} = \frac{10}{25} = \frac{2}{5}$$

70. (b) The two circle will be orthogonal $OD = 1$

$\therefore OA = OB = OD = 1$

$\Rightarrow AB = 2$



71. (b)

${}^{20}C_r \cdot {}^{20}C_0 + {}^{20}C_{r-1} \cdot {}^{20}C_1 + \cdots \ldots + {}^{20}C_0 \cdot {}^{20}C_r =$

Selecting r student from 20 boys and 20 girls $= {}^{40}C_r$

${}^{40}C_r$ will be maximum if $r = 20$.

72. (c)

Equation of tangent is

$$\frac{x}{a}\cos\theta + \frac{y}{b}\sin\theta = 1$$

A is $\left(\frac{a}{\cos\theta}, 0\right)$

B is $\left(0, \frac{b}{\sin\theta}\right)$

Let $P(h, k)$ is mid point

$2\,h=\dfrac{a}{\cos\theta}$

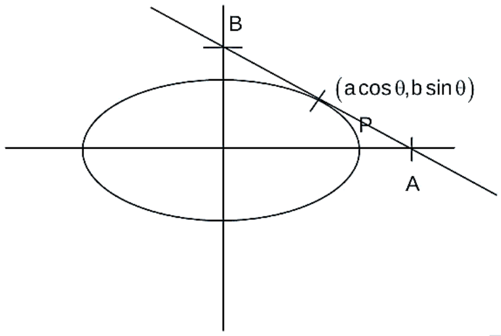
$2k=\dfrac{b}{\sin\theta}$

$\cos^2\theta+\sin^2\theta=1$

$\Rightarrow \dfrac{a^2}{4\,h^2}+\dfrac{b^2}{4k^2}=1$

$\Rightarrow \dfrac{2}{4x^2}+\dfrac{1}{4y^2}=1$

$\Rightarrow \dfrac{1}{2x^2}+\dfrac{1}{4y^2}=1$



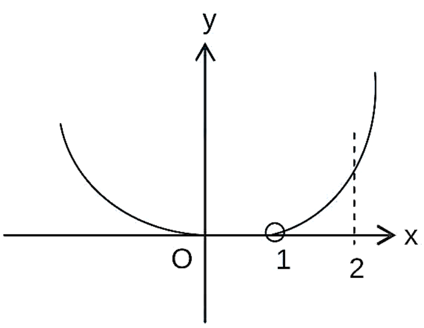
73. (d) $|f(x)|=\begin{cases}1 & -2\le x<0\\ |x^2-1| & 0\le x\le 2\end{cases}$

$f(|x|)=\begin{cases}-1 & -2\le |x|<0\\ x^2-1 & 0\le |x|\le 2\end{cases}$

$\Rightarrow f(|x|)=\{x^2-1 \quad -2\le x\le 2\}$

$g(x)=|f(x)|+f(|x|):\begin{cases}1+x^2-1 & -2\le x<0\\ |x^2-1|+x^2-1 & 0\le x\le 2\end{cases}$

$g(x)=\begin{cases}x^2 & -2<x<0\\ 0 & 0\le x<1\\ 2(x^2-1) & 1\le x<2\end{cases}$



$\therefore$ g(x) is not differentiable at $x=1$

74. (b) $x\cdot\frac{1}{\ln x}\cdot\frac{1}{x}+\log_e(\log_e x)-2x+2y\cdot\frac{dy}{dx}=0$

Put $x=e$

$1-2e+2y\dfrac{dy}{dx}=0$

$\dfrac{dy}{dx}=\dfrac{2e-1}{2y}$

Put $x=e$ in original equation

$0-e^2+y^2=4$

$y^2=4+e^2$

Now put in (i)

$\dfrac{dy}{dx}=\dfrac{2e-1}{2\sqrt{4+e^2}}$

75. (a)
76. (a)

$\mathrm{Lt}_{x\to 0}\dfrac{\tan(\pi\sin^2 x)}{\pi\sin^2 x}\cdot\dfrac{\pi\sin^2 x}{x^2}+\left(\dfrac{|x|-\sin(x[x])}{|x|}\right)^2$

$1(\pi)\cdot(1)^2+\underset{x\to 0}{\mathrm{Lt}}\left(1-\dfrac{\sin\ x[x]}{x[x]}\cdot\dfrac{x[x]}{|x|}\right)^2$

$\mathrm{Lt}_{x\to 0^-}\dfrac{x[x]}{|x|}=\dfrac{x}{-x}(-1)=1$

$\mathrm{Lt}_{x\to 0^+}\dfrac{x[x]}{[x]}=\dfrac{x(0)}{x}=0$

Put in equation (i)

∴ Limit does not exist.

77. (c)

$x^2-11x+30\le 0$

$(x-6)(x-5)\le 0$

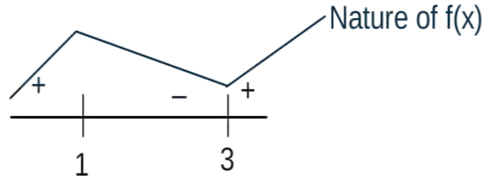
$f(x)=3x^3-18x^2+27x-40$

$5\le x\le 6$

$f'(x)=9x^2-36x+27$

$=9(x^2-4x+3)=9(x-3)(x-1)$

∴ f(x) will be maximum when x = 6



$f(6) = 3(6)^3 - 18(6)^2 + 27(6) - 40$

$= 36(18 - 18) + 162 - 40 = 122$

78. (a) $y = \frac{x}{x^2+1}$

$yx^2 - x + y = 0$

$D \geq 0$

$\Rightarrow 1 - 4y^2 \geq 0$

$\Rightarrow y^2 \leq \frac{1}{4}$

$y \in \left[-\frac{1}{2} \cdot \frac{1}{2}\right]$

79. (b) $\frac{a}{1-r} = 3$

Cube both sides

$\frac{a^3}{(1-r)^3} = 27$

and $\frac{a^3}{1-r^3} = \frac{27}{19}$

(1) / (2) gives $\frac{1-r^3}{(1-r)^3} = 19$

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

80. (a)

Equation of circle $x(x-1) + \left(y - \frac{1}{2}\right)y = 0$

$x^2 + y^2 - x - \frac{y}{2} = 0$

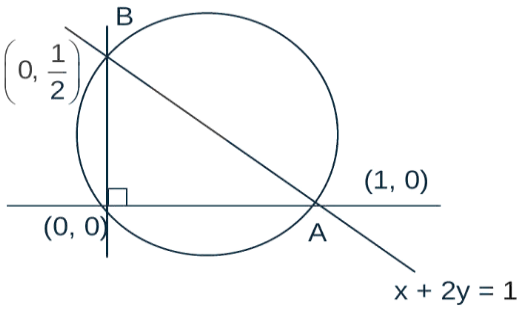
Equation of tangent at (0,0)

$x.0 + y.0 - \frac{x+0}{2} - \frac{y+0}{2 \times 2} = 0$

$2x + y = 0$

Sum of distance of A and B from Line (i) is

$\frac{2}{\sqrt{5}} + \frac{\frac{1}{2}}{\sqrt{5}} = \frac{5}{2\sqrt{5}} = \frac{\sqrt{5}}{2}$



81. (b)

$x^2 - c^2 = y$

$(a+b)^2 - c^2 = ab$

$a^2 + b^2 - c^2 = -ab$

$\dfrac{a^2 + b^2 - c^2}{2ab} = -\dfrac{1}{2}$

$\cos c = -\dfrac{1}{2}$

$c = \dfrac{2\pi}{3}$

$\sin C = \dfrac{\sqrt{3}}{2}$

$\dfrac{c}{\sin c} = 2R \Rightarrow R = \dfrac{c}{2\sin c} = \dfrac{c}{\sqrt{3}}$

82. (c) Equation of tangent to parabola $y^2 = 4x$ is $y = mx + \frac{1}{m}$

Now solve it with $xy = 2$

$\left(mx + \dfrac{1}{m}\right)x = 2$

$\Rightarrow mx^2 + \dfrac{1}{m}x - 2 = 0$

For common tangent $D = 0$

$\Rightarrow \dfrac{1}{m^2} + 8\text{ m} = 0$

$m = -\dfrac{1}{2}$

Put it in equation (i) $y = -\frac{1}{2}x - 2$

$\Rightarrow 2x + y + 4 = 0$

83. (a) 5^{th} term will be the middle term.

$t_{4+1} = {}^8C_4\left(\dfrac{x^3}{3}\right)^4\left(\dfrac{3}{x}\right)^4 = 5670$

$= {}^8C_4 \cdot x^8 = 5670$

$= \dfrac{8 \times 7 \times 6 \times 5}{4 \times 3 \times 2} x^8 = 5670$

$= x^8 = \dfrac{567}{7} = 81$

$= x^8 - 81 = 0$

$\Rightarrow$ Real value of $x = \pm\sqrt{3}$

84. (a) $\frac{a_3}{a_1} = \frac{a_1 r^2}{a_1} = r^2$

$\Rightarrow r^2 = 25$

Now $\frac{a_9}{a_5} = \frac{a_1 r^8}{a_1 r^4} = r^4 = (25)^2 = 5^4$

85. (c) A is orthogonal matrix

$\therefore 4q^2 + r^2 = p^2 + q^2 + r^2 = 1$

$p^2 - q^2 - r^2 = 0$

and $2q^2 - r^2 = 0$

Solving (1), (2) and (3)

$p^2 = \dfrac{1}{2}$

$|p| = \dfrac{1}{\sqrt{2}}$

86. (b) I.F. $= e^{\int \left(2+\frac{1}{x}\right)dx} = e^{2x} \cdot x$

Solution will be $y(xe^{2x}) = \int e^{-2x} \cdot xe^{2x} \cdot dx + c$

$xye^{2x} = \dfrac{x^2}{2} + c$

$1\left(\frac{1}{2}e^{-2}\right) \cdot e^2 = \frac{1}{2} + c$ (Put $x = 1$ and $y = \frac{1}{2}e^{-2}$)

$c = 0$

$\therefore y = \dfrac{x}{2}e^{-2x}$

$\dfrac{dy}{dx} = \dfrac{-2xe^{-2x} + e^{-2x}}{2} = \dfrac{e^{-2x}}{2}(1 - 2x)$

$\dfrac{dy}{dx} = 0 \Rightarrow x = \dfrac{1}{2}$

$\frac{dy}{dx} < 0$ if $x \in \left(\frac{1}{2}, 1\right)$

87. (b, c)

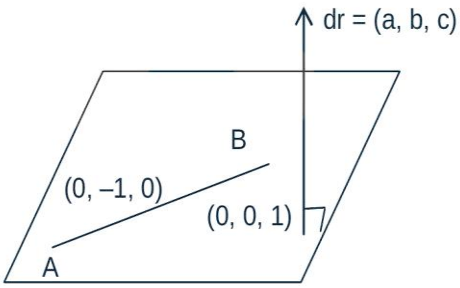
d. r. of AB

$= (0,1,1)$

$\mathrm{a}.0+\mathrm{b}.1+\mathrm{c}.1=0$

$\mathrm{b}+\mathrm{c}=0$

$\mathrm{b}+\mathrm{c}=0$



$\cos\frac{\pi}{4}=\frac{a\cdot 0+b(1)+c(-1)}{\sqrt{a^2+b^2+c^2}\cdot\sqrt{2}}$

$\frac{1}{\sqrt{2}}=\frac{b-c}{\sqrt{a^2+b^2+c^2}}\cdot\sqrt{2}$

$=b^2+c^2-2bc$

$\Rightarrow a^2=-2bc$

$\Rightarrow \mathrm{a}^2=-2\ \mathrm{b}(-\mathrm{b})$

$a^2=2b^2 \Rightarrow a=\pm\sqrt{2b}$

$\frac{\mathrm{a}}{\sqrt{2}}=\frac{\mathrm{b}}{1}$

From (i) $\frac{a}{\sqrt{2}}=\frac{b}{1}=\frac{c}{-1}$

OR $\frac{a}{-\sqrt{2}}=\frac{b}{1}$

$\Rightarrow \frac{\mathrm{a}}{-\sqrt{2}}=\frac{\mathrm{b}}{1}=\frac{\mathrm{c}}{-1}$ from (i)

$\frac{\mathrm{a}}{\sqrt{2}}=\frac{\mathrm{b}}{-1}=\frac{\mathrm{c}}{1}$

dr. will be $(\sqrt{2},1,-1)$ or $(\sqrt{2},-1,1)$

88. (d)

$[\vec{a}\quad \vec{b}\quad \vec{c}]=0$

$$\begin{vmatrix}1 & 2 & 4\\ 1 & \lambda & 4\\ 2 & 4 & \lambda^2-1\end{vmatrix}_{R_3\to R_3-2R_1}=0$$

$$\begin{vmatrix} 1 & 2 & 4 \\ 1 & \lambda & 4 \\ 0 & 0 & \lambda^2-9 \end{vmatrix} = 0$$

$(\lambda^2 - 9)(\lambda - 2) = 0$

$\Rightarrow \lambda = 2$ OR $\lambda^2 = 5$

$$\vec{a} \times \vec{c} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & 2 & 4 \\ 2 & 4 & \lambda^2-1 \end{vmatrix}$$

$= \hat{\imath}(2\lambda^2 - 2 - 16) - \hat{\jmath}(\lambda^2 - 1 - 8)$

$= (\lambda^2 - 9)(2\hat{\imath} - \hat{\jmath}) = -5(2\hat{\imath} - \hat{\jmath})$ (put $\lambda = 2$)

89. (d) $\alpha + \alpha^3 = -\frac{K}{81}$

$$\alpha^4 = \frac{256}{81}$$

$$\alpha = \pm\frac{4}{3}$$

From (1) and (2)

$$\frac{4}{3} + \frac{64}{27} = \frac{-K}{81}$$

$K = -300$

90. (a)

$$\left(-2 - \frac{i}{3}\right)^3 = \left(\frac{x+iy}{27}\right)$$

$$(-1)^3\left(2^3 + \frac{i^3}{27} + 3(2)\frac{i^2}{9} + 3(2)^2 \cdot \frac{i}{3}\right) = \frac{x-iy}{27}$$

$$-\left[8 - \frac{i}{27} - \frac{2}{3} + 4i\right] = \frac{x+iy}{27}$$

$$\Rightarrow \frac{x}{27} = -8 + \frac{2}{3}$$

and $\frac{y}{27} = \frac{1}{27} - 4$

$$\frac{y-x}{27} = \frac{1}{27} - 4 + 8 - \frac{2}{3}$$

$$= \frac{1 + 27 \times 4 - 18}{27}$$

$$= \frac{109 - 18}{27}$$

$$= \frac{91}{27}$$

$\Rightarrow y - x = 91$