**JEE MAIN - 11** **Full Syllabus** **Date : 10-01-2025**

# KEY SHEET

## PHYSICS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | **2** | 2 | **4** | 3 | **1** | 4 | **3** | 5 | **2** |
| 6 | **1** | 7 | **2** | 8 | **1** | 9 | **1** | 10 | **3** |
| 11 | **1** | 12 | **3** | 13 | **3** | 14 | **2** | 15 | **1** |
| 16 | **3** | 17 | **1** | 18 | **1** | 19 | **2** | 20 | **1** |
| 21 | **412** | 22 | **10** | 23 | **4** | 24 | **6** | 25 | **2** |

## CHEMISTRY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 26 | **3** | 27 | **3** | 28 | **4** | 29 | **1** | 30 | **1** |
| 31 | **1** | 32 | **3** | 33 | **3** | 34 | **4** | 35 | **1** |
| 36 | **3** | 37 | **3** | 38 | **4** | 39 | **1** | 40 | **1** |
| 41 | **1** | 42 | **2** | 43 | **3** | 44 | **2** | 45 | **2** |
| 46 | **15** | 47 | **5** | 48 | **3** | 49 | **4** | 50 | **560** |

## MATHEMATICS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 51 | **4** | 52 | **4** | 53 | **4** | 54 | **1** | 55 | **4** |
| 56 | **3** | 57 | **2** | 58 | **3** | 59 | **4** | 60 | **3** |
| 61 | **1** | 62 | **1** | 63 | **1** | 64 | **4** | 65 | **3** |
| 66 | **4** | 67 | **3** | 68 | **3** | 69 | **3** | 70 | **1** |
| 71 | **2** | 72 | **2** | 73 | **7999** | 74 | **8** | 75 | **2** |

# SOLUTIONS

## PHYSICS

1. When light ray is going from rarer to denser medium at polarising angle $(i_p)$ $\mu_{\frac{D}{R}} = \tan i_p$

2. Resistance R is independent on $\omega$

   $X_L = \omega L$, $X_C = \frac{1}{\omega c}$

3. $V = u + gt$

   $V = 100 + 10 \times 10 = 200 \, m/s$

4. Electric field at a distance r from line charge $E = \frac{\lambda}{2\pi\varepsilon r} = \frac{-dV}{dr}$ ($\lambda$ = linear charge density of wire)

   $dV = -\frac{\lambda}{2\pi\varepsilon r} dr$

   Current through the elemental shell

   $$I = \frac{|dV|}{dR} = \frac{\frac{\lambda}{2\pi\varepsilon r}dr}{\frac{1}{\sigma} \times \frac{dr}{2\pi r\ell}} = \frac{\lambda\sigma\ell}{\varepsilon}$$

   $$\left(\because R = \rho\frac{\ell}{A} \quad \therefore dR = \rho\frac{dr}{2\pi r\ell} = \frac{1}{\sigma}\frac{dr}{2\pi r\ell}\right)$$

   This current is radially outwards,

   $$\therefore \frac{d}{dt}(\lambda\ell) = \frac{-\lambda\sigma\ell}{\varepsilon} \Rightarrow \int_{\lambda_0}^{\lambda} \frac{d\lambda}{\lambda} = -\left(\frac{\sigma}{\varepsilon}\right)\int_0^t dt$$

   $$\Rightarrow \lambda = \lambda_0 e^{-(\sigma/\varepsilon)t}$$

   $$\therefore J = \frac{I}{2\pi r\ell} = \frac{\lambda\sigma\ell}{2\pi r\ell \in} = \frac{\lambda\sigma}{2\pi\varepsilon r}$$

   Or, $J = \left(\frac{\lambda_0\sigma}{2\pi r \in}\right)e^{-(\sigma/\varepsilon)t} \Rightarrow J = J_0 e^{-(\sigma/\varepsilon)t}$.

5. $p = mv = \frac{\lambda}{2}a^2t^3$

   $F = \frac{dp}{dt} = \frac{3}{2}\lambda a^2 t^2$

   $W = \frac{3}{2}\lambda a^3 \int_0^t t^3 dt$

6. For interference to take place the two sources must be coherent
   For good observation band width must be more.

If slit width is narrow then we can see only YDSE pattern. YDSE pattern will be within the central Bright of single slit diffraction.

7. $V=\sqrt{\frac{Gm}{r}}$ $\qquad$ $TE=-KE=-E$

$V_e=\sqrt{\frac{2Gm}{r}}$ $\quad$ $KE_e=\frac{1}{2}mV_e^{\,2}=\frac{1}{2}m2V_o^{\,2}=mV_o^{\,2}$

$V_e=\sqrt{2}V_0$ $\qquad$ $KE_e-KE=2\left(\frac{1}{2}mV_o^{\,2}\right)-\frac{1}{2}mV_o^{\,2}=\frac{1}{2}mV_o^{\,2}=E$

$\Delta V=\left(\sqrt{2}-1\right)V_0=0.41V_0$

8. Conceptual

9. In case of $+$Ve charge direction of Electric field is directed away, in case of $-$Ve charge towards

10. When non polar material is placed in a electric field, the centre of positive and negative charge is being separated. This is called polarization.

11.

$$\frac{h}{\lambda}=\frac{-h}{\lambda^1}+p \longrightarrow (1)$$

$$\frac{hc}{\lambda}=\frac{hc}{\lambda^1}+\frac{p^2}{2m}$$

$$\frac{hc}{\lambda}=c\left(p-\frac{h}{\lambda}\right)+\frac{p^2}{2m}$$

$$\frac{2hc}{\lambda}=pc+\frac{p^2}{2m}$$

$$p^2+2mpc-\frac{4mhc}{\lambda}=0$$

$$p^2+2mpc-\frac{4mhc}{4h}\times 3mc=0$$

$$p^2+2mpc-3m^2c^2=0$$

Solving we get $p=mc$

12. In first process $P$ constant

$W_1=nR\left(2T_0-T_0\right)=nRT_0$

In second process

$$W_2=\int PdV=\int\frac{nRT}{V}dV$$

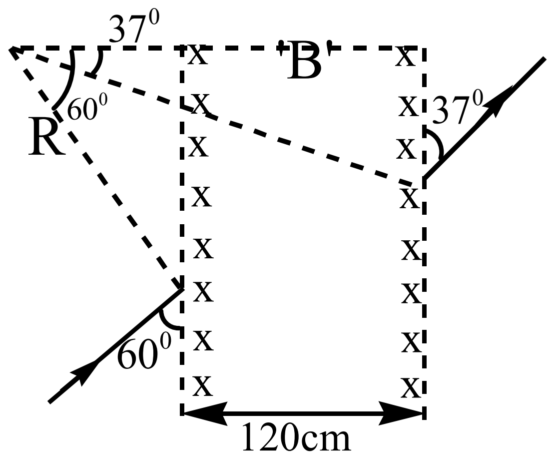
$VT=cons\tan t(c)$ $\qquad$ $W=cnR\int_{V_0}^{2V_0}\frac{dV}{V^2}=nRc\left(\frac{-1}{V}\right)_{Vo}^{2V_0}$

$$W_2=nRC\left(\frac{1}{2Vo}\right)=\frac{nRTo}{2}$$

13. Buoyant force is a real force and is same in all frames.

14. $\lambda_m = \frac{hc}{Vq}$ $\lambda_b = \frac{h}{\sqrt{2mVq}}$ $\frac{\lambda_m}{\lambda_b} = \frac{c}{\sqrt{\frac{Vq}{2m}}}$

15.




$d = R\cos 37^0 - R\cos 60^0$ $R = 4m$.

16. *Velocity* $LT^{-1}$

*Work* : $ML^2T^{-2}$

Moment of Inertia : $ML^2$

17. Given $\frac{dp}{dv} = -ap$

Intergrating both sides we get

$\Rightarrow \int_{P_0}^{P} \frac{dp}{P} = -a\int_0^v dv \Rightarrow \ell n\left(\frac{P}{P_0}\right) = -av \Rightarrow p = P_0 e^{-av}$

Using ideal gas equation $pv = nRT$

$T = \frac{pv}{nR} = \frac{P_0 ve^{-av}}{R}(\because n = 1)$

$\frac{dT}{dv} = 0 \Rightarrow \frac{P_0}{R}\left(e^{-av} + ve^{-av}(-a)\right)$

$\Rightarrow \frac{P_0 ve^{-av}}{R}\{1 - av\} = 0 \Rightarrow v = \frac{1}{a}$

$\therefore T_{max} = \frac{P_0}{Rae}$.

18. Zenear diode is used as a voltage regulator. So always connected in reverse bias.

19. $K = FV = P = cons\tan t$

$W = P2t = FV2t = K2t$

20. $3mg - mg = ma_1$

$$a_1 = 2g = 20\,m/s^2$$
$$3mg + mg - 3mg = 2ma_2$$
$$a_2 = 5\,m/s^2$$
$$Ta_1 + Ta_2 - 2Ta_p = 0$$
$$a_p = \frac{a_1 + a_2}{2} = \frac{20+5}{2} = \frac{25}{2}\,m/s^2$$

21. $LC = \frac{1mm}{10} = 0.1mm = 0.01cm$

Zero error $= +4$

Zero correction $= -4$

Diameter $D = 4.1cm + (6-4) \times 0.01cm$

$= 4.12cm = 412 \times 10^{-2}\,cm$

22. Conservation of linear momentum

$$(75+25)4 = 75(v_p + 2) + 25v_p$$
$$v_p = 2.5\,m/s$$
$$d = 2.5 \times \frac{8}{2} = 5m \qquad \left(t = \frac{l}{v} = \frac{8}{2}\right)$$

23. $f_0 = \frac{R_0}{2},\ f = \frac{R}{2} = \frac{R_0(1+\alpha\Delta T)}{2}$

$$f = f_0(1+\alpha\Delta T)$$
$$\left(\frac{f}{f_0} - 1\right) = \alpha\Delta T = 2\times10^{-3}\times20 = 4\times10^{-2}$$

24. $\beta = 10\log\frac{I}{I_0} \Rightarrow 30 = 10\log\frac{I}{I_0} \Rightarrow I = 10^{-9}\,W/m^2$

$$I = \frac{1}{2}\rho V\omega^2 A^2 \qquad V = \sqrt{\frac{B}{\rho}}$$

25. Just after Impact, $L_i$ =when pure rolling begins, $L_f$

$$L_i = L_f$$
$$\Rightarrow \quad \frac{2}{5}(mR^2)\omega = \frac{2}{5}(mR^2)\omega' + mv'R$$
$$\Rightarrow \quad v' = \frac{2}{7}R\omega.$$

# CHEMISTRY

26. Conceptual

27. 1) Total no. of atoms $= atomacity \times n \times No$ $\quad = 3 \times \frac{64}{64} \times No$

2) $M = \frac{n}{v} = n \Big/ \frac{100}{100} \quad \Rightarrow n = 0.001$

Molecules $= n \times No = 6.023 \times 10^{23} \times 0.001 = 6.023 \times 10^{20}$

3) $x_{Nacl} = \dfrac{\frac{5.85}{58.5}}{\frac{5.85}{58.5} + \frac{90}{18}} \Rightarrow 0.0196$

4) $6.023 \times 10^{23} - 1\,gm$

$1\,atom = 1/6.023 \times 10^{23} = 1.66 \times 10^{-24}$

28.

| | Fe | Co | Ni | C4 |
|---|---|---|---|---|
| KJ/ml | 762 | 758 | 736 | 745 |

29. Partial Charge $= \frac{Dipolemoment}{Bond\ distance}$

$= \frac{1.2 \times 10^{-18} esucm}{1.0 \times 10^{-8} cm}$

$= 1.2 \times 10^{-10} esu$

The fraction of an electronic charge is $= \frac{1.2 \times 10^{-10}}{4.8 \times 10^{-10}} = 0.25 = 25\%\ of\ e$

30. Conceptual

31. At stage $A$ $P = \frac{1 \times 0.0821 \times 300}{24} = 1.023\ atm$

At stage $B$ $P = 2 \times 1.026 = 2.052\ atm$

Volume remains saggage but temperature changes from $300K\ to\ 600K$. $(P \propto T)$

At stage $C$ $2 \times 1.026 = 2.052\ atm$

$\downarrow$ $Tem\ is\ 300K\ and\ volume\ is\ half$

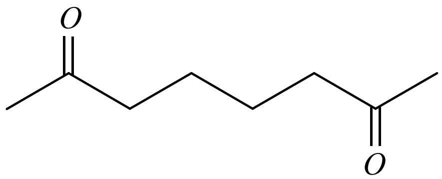
32. Conceptual
33. Conceptual
34. Conceptual
35. $4NH_3 + 5O_2 \xrightarrow[750^0, 6atm]{gauze} 4\underset{(A)}{NO} + 6H_2O$

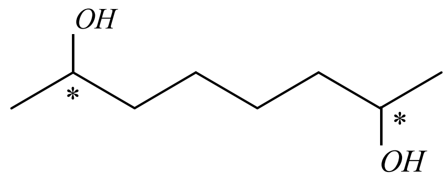
$3SnCL_2 + 6HCl + 2NO \longrightarrow 3SnCl_4 + 2NH_2OH$

36. Conceptual
37. Conceptual
38. Conceptual
39. Conceptual
40. Conceptual

41. maximum energy required from reactant is known as RDS

42.

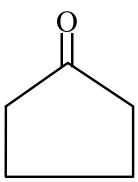
$A =$ 

$B =$ 

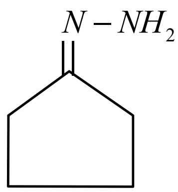
2-stereo isomers are optically active where as 1- stereo isomer is optically inactive which is meso from

43.

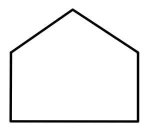
A)



B)



C)



44.

$X = CH_3 - CH_2 - CH_2 - OH \qquad Y = CH_3 - CH_2 - CH_2 - MgBr$

$$Z = CH_3 - CH_2 - \underset{}{CH_2} - COOH$$

45. It is characteristic of secondary amiro familiar as Lieberman's nitroso amine test

46. Amount of $A$ left in $n_1$ half lives $= \left(\frac{1}{2}\right)^n [Ao]$

Amount of $B$ left $n_2$ half-lives $= = \left(\frac{1}{2}\right)^{n_2} [Bo]$

At the end, $\frac{[Ao]}{2^{n_1}} = \frac{[Bo]}{2^{n_2}} \qquad \Rightarrow \frac{4}{2^{n_1}} = \frac{1}{2^{n_2}} \{[A_0] = 4[B_0]\}$

$\frac{2^{n_1}}{2^{n2}} = 4 \Rightarrow 2^{n_1 - n_2} = (2)^2$

$n_1 - n_2 = 2 \Rightarrow n_2 = n_1 - 2$

$$t = n_1 x t_{\frac{1}{2}}(A) \Rightarrow t = n_2 t_{\frac{1}{2}}(B) — (1)$$

(Let concentration of both become equal after $time t$)

$\frac{n_1 \times t_{\frac{1}{2}}(A)}{n_2 \times t_{\frac{1}{2}}(B)} = 1 \qquad \frac{n_1 \times 5}{n_2 \times 15} = 1 \qquad \Rightarrow \frac{n_1}{n_2} = 3 — (2)$

For $eq\,(1)$ & $(2)$

$n_1 = 3 \qquad n_2 = 1$

$t = 3 \times 5 = 15 \text{ min} utes$

47. $K_{sp} = \left[Ag^{+}\right]^{2}\left[Cro_{4}^{-2}\right]$ $= \left[10^{-5}\right]^{2}\left[\frac{10^{-5}}{2}\right]$ $= 5\times10^{-16} mol^{3}L^{-3}$

48.

$$\frac{w_{gold}}{E_{gold}} = \frac{W_{silver}}{E_{silver}} \Rightarrow E_{gold} = \frac{E_{silver}\times W_{gold}}{W_{silver}}$$

$$= \frac{107.9\times1.314}{2.158} = 65.7$$

$$Eq.wt\ mass = \frac{Atomic\ \ mass}{Oxidation\ \ no.of\ \ AV\ in\ salt}$$ .

$$o.x\ AU = \frac{Atomic\ mass}{E_{gold}} = \frac{197}{65.7} = 3$$

49. $P = P_M \times x_A$

$27 = 760\times\frac{w_2/123}{\frac{w_1}{18}+\frac{w_2}{123}}$ for nitrobenzene $\frac{w_1}{w_2} = 4$

50. $100\ ml\ aq\ sol = 17\ gm\ H_2o_2$

$10\ ml = ?$

$= 10\times\frac{17}{100}\ \ 1.7gH_2O_2$

$1.7g\ H_2O_2 = \frac{1.7\times22400}{2\times34} = 560$

$2H_2O_2 \rightarrow O_2 + 2H_2O$

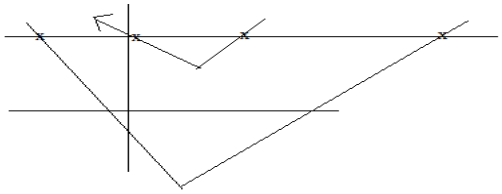
$2H_2O_2 \rightarrow O_2 + 2H_2O$

$2\ mol\ H_2O_2 = 1\ mol\ O$ .

# MATHEMATICS

51. Conceptual

52. $a=|x-2|-3 \quad or \quad a=|x-2|+3$



$a>3$

$\Rightarrow \; a=4,5,6,7,8,9,10$

$\sum a=4+5+6+7+8+9+10$

53. Clearly B is skew symmetric matrix of order 3

$\therefore |B|=0 \;\Rightarrow\; |adj\ B|=0$

$|adj\ A|=|A|^2$

$|A|=(2k-1)\left\{-1+4k^2\right\}-2\sqrt{k}\left\{-2\sqrt{k}-2\sqrt{k}(2k)\right\}+2\sqrt{k}\left\{4k\sqrt{k}+2\sqrt{k}\right\}$

$=\left(4k^2-1\right)(2k-1)+4k+8k^2+8k^2+4k$

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

$8k^3+12k^2+6k+1$

$=(2k+1)^3=10^3$

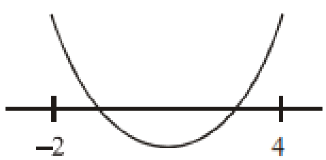
$2k+1=10$

$k=\frac{9}{2}=4.5 \;\Rightarrow [k]=4$

54. $f'(x)=3x^2-3\alpha(2x)+3\left(\alpha^2-1\right)=3x^2-6\alpha x+3\left(\alpha^2-1\right)$

Since, extrema lie in (-2, 4)

So roots of $f'(x)$ lie in (-2, 4)




$f'(x)=3\left(x-(\alpha-1)\right)\left(x-(\alpha+1)\right)$

$\Rightarrow -2<\alpha-1$ and $\alpha+1<4$

$\Rightarrow -1<\alpha<3$

Second method

$f'(-2)>0$

$\Rightarrow 12+12\alpha+3\alpha^2-3>0$

$\Rightarrow 3\alpha^2+12\alpha+9>0$

$\Rightarrow (\alpha+1)(\alpha+3)>0$

also, $f'(4)>0$

55. Conceptual

56. Conceptual

57. $I_2=\int_0^1(1-x^n)^{m+1}dx=\int_0^1(1-x^n)^m.(1-x^n)dx$

$=\int_0^1(1-x^n)^m dx-\int_0^1 x.x^{n-1}.(1-x^n)^m dx$

$=I_1-\left\{-x.\frac{(1-x^n)^{m+1}}{(m+1)^n}\right\}_0^1+\int_0^1\frac{(1-x^n)^{m+1}}{n(m+1)}dx$

$I_2=I_1+\frac{I_2}{n(m+1)}$

$I_2\left[1-\frac{1}{n(m+1)}\right]=I_1$

$I_2\left\{\frac{mn+n-1}{n(m+1)}\right\}=I_1$

$\frac{I_1}{I_2}=\frac{mn+n-1}{mn+n}$

58. $S_1=\sum_{j=1}^{10}j(j-1)\,{}^{10}C_j=9\times10\sum_{j=1}^{10}\ {}^{8}C_{j-2}=90\times2^8 S_2=10\sum_{j=1}^{10}\ {}^{9}C_{j-1}=10\times2^9$

$S_3=S_1+S_2$

59. We know $A(\text{adj}A)=|A|I_n$

(adj A) (adj (adj A)) = |adj A| $I_n=|A|^{n-1}.I_n$

adj(adj A) (adj adj adj A) = |adj adj (A)| $I_n=|A|^{(n-1)^2}\ I_n$

$\Rightarrow\underbrace{(\text{adj}\,\text{adj}\,\text{adj}...\text{adj}A)}_{n-1\,\text{times}}\underbrace{(\text{adj}\,\text{adj}\,\text{adj}...\text{adj}A)}_{n\,\text{times}}=|A|^{(n-1)^{(n-1)}}\ I_n$

60. $\sum_{i=1}^{n}(x_i+1)^2=9n\Rightarrow\Sigma x_i^2+2\Sigma x_i+n=9n$

$\Sigma x_i^2+2\Sigma x_i=8n$ ….(1)

$\sum_{i=1}^{n}(x_i-1)^2=5n\Rightarrow\Sigma x_i^2-2\Sigma x_i+n=5n$

$\Sigma x_i^2-2\Sigma x_i=4n$ … (2)

From (1) & (2) $\Sigma x_i^2=6n$ & $\Sigma x_i=n$

Hence standard deviation

$=\sqrt{\frac{\Sigma x_i^2}{h}-\left(\frac{\Sigma x_i}{h}\right)^2}=\sqrt{\frac{6n}{h}-\left(\frac{n}{n}\right)^2}=\sqrt{5}$

61. Equation of plane is $\begin{vmatrix}x-1 & y-2 & z-2\\ 2 & 3 & 4\\ 3 & 4 & 5\end{vmatrix}=0\Rightarrow x-2y+z=0$

$\therefore$ Distance $b/w$ parallel planes is $\frac{|d|}{\sqrt{6}} = \sqrt{6} \Rightarrow |d| = 6$

62. Any vector along bisector is $\lambda\left(\frac{\bar{a}}{|\bar{a}|} + \frac{\bar{b}}{|\bar{b}|}\right)$

63. $Q = PAP^T$

$P^T Q = AP^T \qquad (\therefore PP^T = I)$

$P^T Q^{2005} P = AP^T Q^{2004} P$

$= A^2 P^T Q^{2003} P = A^3 P^T Q^{2002} P = ....$

$= A^{2004} P^T (QP) = A^{2004} P^T (PA)$

$(\because Q = PAP^T \Rightarrow QP = PA) \quad = A^{2005} = \begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$

64. Let $E_1$ and $E_2$ be the events, that selected matrix is symmetric and skew - symmetric respectively $P(E_1) = \frac{7^6}{7^9}; P(E_2) = \frac{7^3}{7^9}; P(E_1 \cap E_2) = \frac{1}{7^9}$

$\therefore$ Required probability $= \frac{1}{7^3} + \frac{1}{7^6} - \frac{1}{7^9}$

65. Differential equation can be written as, $(p - x)(p - 2\sin x)(2p + \cos x) = 0$ which has solution as $(2y - x^2 - c)(y + 2\cos x - c)(2y + \sin x - c) = 0$

66. $P\left(\frac{\overline{A}}{\overline{B}}\right) = \frac{1 - P(A \cup B)}{P(\overline{B})} = \frac{1-x}{x^2} \le 1 \Rightarrow x^2 + x - 1 \ge 0$

$\Rightarrow x \ge \frac{\sqrt{5}-1}{2}$ or $x \le \frac{-1-\sqrt{5}}{2}$ $\therefore$ x is positive $x \ge \frac{\sqrt{5}-1}{2}$

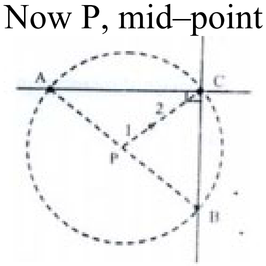
67. LHS $\ge 2$, RHS $\le 2 \Rightarrow \cot^2 x = 0$ and $|\sin x| = 1$

68. $(a, a) \notin R$

If $(a, b) \in R \Rightarrow (b, a) \in R$

If $(a, b) \in R, (b, c) \in R \Rightarrow (a, c) \notin R$

69. As lines are perpendicular to each other 'C' moves on a circle with AB as diameter. Now P, mid–point of AB (which is fixed) when joined with C is median.




$\Rightarrow$ Centroid is moving at a constant distance $\frac{1}{3}(PA)$ from P

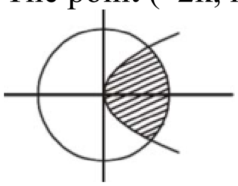
$\Rightarrow$ Locus is a circle

A is point of intersection of x + 4y + 2 = 0 and x – y + 1 = 0 i.e., i.e., $\left(-\frac{6}{5}, -\frac{1}{5}\right)$

B is point of intersection of 4x – y + 6 = 0 and x + y + 3 = 0 i.e., i.e., $\left(-\frac{9}{5}, -\frac{6}{5}\right)$

$\Rightarrow P = \left(-\frac{3}{2}, \frac{-7}{10}\right)$ therefore locus is $\left(x+\frac{3}{2}\right)^2 + \left(y+\frac{7}{10}\right)^2 = \frac{17}{50}$

70. The point (–2k, k + 1) is the interior point of the circle and parabola



$$\text{so}(2k)^2 + (k+1)^2 - 4 < 0$$

$$\Rightarrow 4k^2 + k^2 + 2k + 1 - 4 < 0 \Rightarrow 5k^2 + 2k - 3 < 0$$

$$(k+1)\left(k-\frac{3}{5}\right) < 0 \Rightarrow k \in \left(-1, \frac{3}{5}\right) \rightarrow (1)$$

$$\text{now, } (k+1)^2 - 4(-2k) < 0$$

$$k \in \left(-5-2\sqrt{6}, -5+2\sqrt{6}\right) \rightarrow (2)$$

$$\text{so from } (1) \& (2)\ k \in \left(-1, -5+2\sqrt{6}\right)$$

71. $d\left(e^{y^2}\sin x\right) + d\left(e^x \cos y^2\right) = 0$

$e^y \sin x = e^x \cos y^2 + c$ If is through (0, 0) $\Rightarrow$ c = 1

$e^{y^2}\sin x = -e^{-x}\cos y^2 + 1$

Put $y = \sqrt{\frac{\pi}{2}} \Rightarrow \sin x = \frac{1}{e^{\pi/2}}$ $\rightarrow$ 2 solutions exist

72. $\int \frac{x^2-1}{\left(x^2+1\right)\sqrt{x^4+1}}\,dx = \int \frac{1-\frac{1}{x^2}}{\left(x+\frac{1}{x}\right)\sqrt{x^2+\frac{1}{x^2}}}\,dx$

$= \frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{1}{\sqrt{2}}\sqrt{x^2+\frac{1}{x^2}}\right) + c$ Then A = 2

73. $\sum_{r=1}^{19} \frac{3(r+1)r+1}{(r+1)\left(r^5+2r^4+r^3\right)} = \sum_{r=1}^{19} \frac{1}{r^3} - \frac{1}{(r+1)^3}$

$$T_r = \frac{1}{r^3} - \frac{1}{(r+1)^3}$$

$$S = 1 - \frac{1}{20^3} = \frac{8000-1}{8000} = \frac{7999}{8000}$$

$$1000K = \frac{7999}{8} = 999.875$$

74. $\lim_{x\to\frac{\pi}{2}} \dfrac{4\sqrt{2}(\sin 3x+\sin x)}{\left(2\sin 2x.\sin\frac{3x}{2}+\cos\frac{5x}{2}\right)-\left(\sqrt{2}+\sqrt{2}\cos 2x+\cos\frac{3x}{2}\right)}$

$= \lim_{x\to\frac{\pi}{2}} \dfrac{8\sqrt{2}(\sin 3x+\sin x)}{\left(\cos\frac{x}{2}-\cos\frac{7x}{2}+\cos\frac{5x}{2}\right)-\left(\sqrt{2}.2\cos^2 x+\cos\frac{3x}{2}\right)}$

$= \lim_{x\to\frac{\pi}{2}} \dfrac{16\sqrt{2}\sin x.\cos^2 x}{2\sin x.\sin\frac{x}{2}+2\sin 3x.\sin\frac{x}{2}-2\sqrt{2}\cos^2 x}$

$= \lim_{x\to\frac{\pi}{2}} \dfrac{16\sqrt{2}\sin x.\cos^2 x}{8\sin\frac{x}{2}\sin x-2\sqrt{2}} = \dfrac{16\sqrt{2}}{8\left(\frac{1}{\sqrt{2}}\right)(1)-2\sqrt{2}} = 8$

75. Use graph of $y=\dfrac{e^x}{x^2}=c$