T.I.M.E.
Triumphant Institute of
Management Education Pvt. Ltd.

MODEL SOLUTIONS TO IIT JEE 2011

Paper I

1	2	3	4	5	6	7
A	**D**	**A**	**B**	**D**	**C**	**C**

8	9	10	11
A, B, D	**A, D**	**A, C, D**	**A, B, C**

12	13	14	15	16
D	**B**	**B**	**A**	**C**

17	18	19	20	21	22	23
9	**5**	**5**	**4**	**6**	**5**	**7**

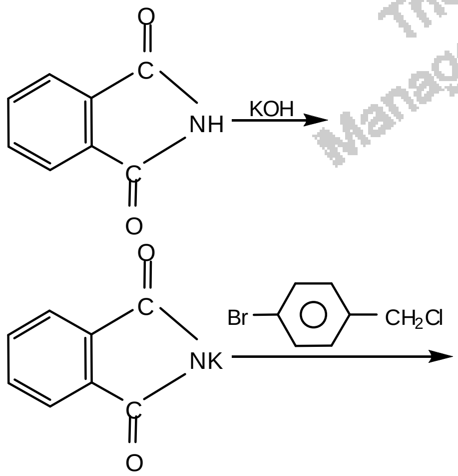
Section I

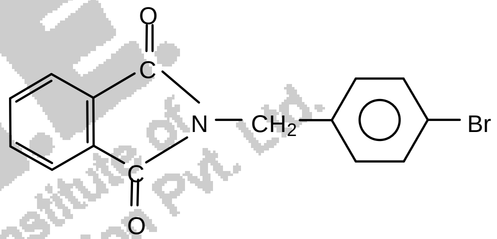
1. ${}^{27}_{13}Al + {}^{4}_{2}He \rightarrow {}^{30}_{15}P + {}^{1}_{0}n(Y)$

   $\downarrow$ $\quad\quad\quad\quad\quad$ $\downarrow$

   ${}^{30}_{14}Si + {}^{1}_{1}H(X)$ $\quad$ ${}^{30}_{14}Si + {}^{0}_{1}e(Z)$

2. Since the mobility of K^+ is nearly same as that of Ag^+ which it replaces, the conductance will remain as more or less constant and will increase only after the end point.

3. 



4. $[NiCl_4]^{2-}$ is tetrahedral, $[Ni(CN)_4]^{2-}$ is square planar & $[Ni(H_2O)_6]^{2+}$ is octahedral.

5. $Ba(N_3)_2 \rightarrow Ba + 3N_2$
   Very pure N_2 is produced by the thermal decomposition of Barium or sodium azide.

6. $M = \dfrac{2 \times 1.15 \times 1000}{1120}$
   $= 2.05$ M

7. o-hydroxy benzoic acid: pKa = 2.99
   p–hydroxy benzoic acid: 4.58
   p–toluic acid = 4.34
   p–nitrophenol = 7.15

Section II

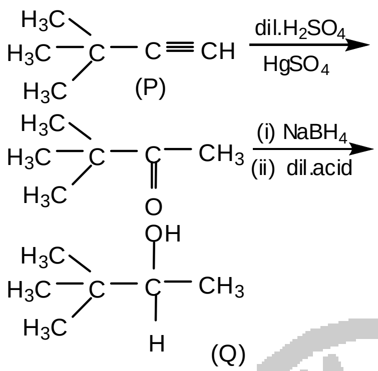
8. Adsorption is always exothermic.
   Chemisorption is more exothermic than physisoprtion and it requires activation energy.

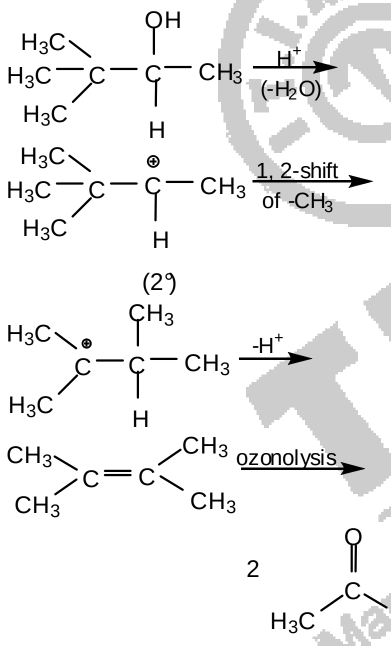
9. A, D

10. Cassiterite contain 0.5 – 10% of metal as SnO_2 the rest being impurities of pyrites of Fe, Cu & wulframite.

11. In a, b & c all atoms are in the same plane.

Section III

12. 

13. 

14. $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + \frac{1}{2} Ag$

The metal dipped is Cu.
Blue colour due to formation of Cu^{2+}

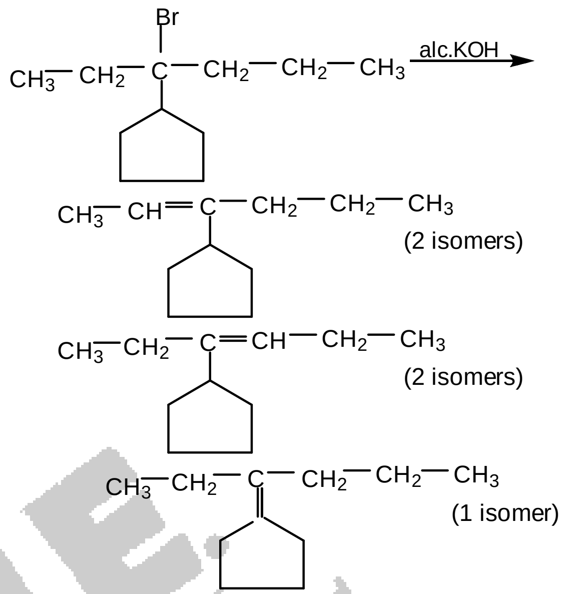
15. The solution in which the metal is dipped in $AgNO_3$.

16. The deep blue colour due to formation of $[Cu(NH_3)_4]^{2+}$ and the white precipitate of AgCl dissolve due to formation of $[Ag(NH_3)_2]^+$

Section IV

17. Maximum no. of electron with n = 3 is 18, of which are having $-\frac{1}{2}$ spin

18. $3Na_2CO_3 + 3Br_2 \rightarrow 5NaBr + NaBrO_3 + 3CO_2$

19. 

20. $h\upsilon = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{300 \times 10^{-9} \times 1.6 \times 10^{-19}}$

$= 4.14$ eV

$E = h\upsilon - h\upsilon_0$
For Li, Na, K and Mg $h\upsilon_0$ values are less than 4.14 eV

21. Let the number of glycine units be x
Total mass of the hydrolysed products
$= 796 + 9 \times 18 = 958$
% by mass of glycine $= \frac{75x \times 100}{958} = 47$
$\therefore$ x = 6

22. $S_4O_6^{2-}$ has sulphur atoms with oxidation states '0' & +5.

23. Vol. of 0.1 mole at 0.32 atm $= \frac{2.24}{0.32} = 7$ L

PART II

24	25	26	27	28	29	30
D	**D**	**D**	**A**	**A**	**A**	**B**

31	32	33	34
B, D	**A, B, C, D**	**A, B, C, D**	**A**

35	36	37	38	39
C	**B**	**D**	**C**	**B**

40	41	42	43	44	45	46
3	**5**	**6**	**3**	**9**	**4**	**1**

Section I

24. x component of area vector is

$\frac{a^2}{\sqrt{2}} \quad \therefore \phi = \frac{E_0 a^2}{\sqrt{2}}$

25. T sinθ = mω²Lsinθ

$\omega = \sqrt{\frac{324}{0.5 \times 0.5}}$

= 36

26. Position (1): Let charge on 2 μF be Q. Then

energy = $\frac{Q^2}{4}$ μJ

Position (2): C_{eq} = 10 μF

Total charge = Q. ∴ Energy = $\frac{Q^2}{20}$ μJ

Loss % = 80%

27. n = $\frac{1}{4}$ (Θ 22.4 λ = 1 mole)

W = $nC_V\Delta T = \frac{1}{4} \times \frac{3}{2} R.\Delta T$

$T_1V_1^{\gamma-1} = T_2V_2^{\gamma-1} \Rightarrow$

$T_2 = 4T_1 \therefore \Delta T = 3T_1$

28. $f' = \left(\frac{f}{1 - \frac{v_s}{c}}\right) \times \left(1 + \frac{v_0}{c}\right)$

$= \frac{8 \times (320 + 10)}{320 - 10}$

29. $\frac{1}{\lambda_1} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right)$

$\frac{1}{\lambda_2} = Z^2 R\left(\frac{1}{2^2} - \frac{1}{4^2}\right)$

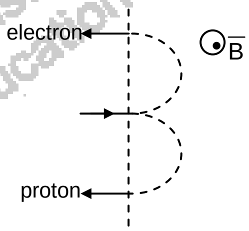
$\lambda_2 = \lambda_1 \times \frac{\frac{5}{36}}{\frac{3}{16}} \times 2^2$

= 1215 $\overset{0}{A}$

30. $\frac{X}{10} = \frac{52 + 1}{48 + 2}$

Section II

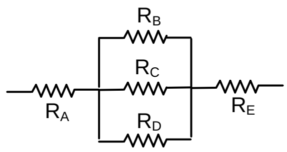
31.



$T = \frac{2\pi m}{qB}$, different for them.

32. $\frac{dQ}{dt}$ is same for A and E and both are maximum.

Thermal resistances $\left(\frac{\lambda}{KA}\right)$ are as below.



$R_A = \frac{1}{8}, R_B = \frac{4}{3}, R_C = \frac{1}{2}, R_D = \frac{4}{5}$

$R_E = \frac{1}{24}$. So C is also correct.

(Θ Eq.R (R_C, R_B, R_D) is $\frac{1}{4}$.

D also correct Θ R_B parallel

R_D is equal R_C

Note: It is assumed that there is no radiation loss.

33. On interconnecting V same

$\Rightarrow \frac{Q_A}{R_A} = \frac{Q_B}{R_B}$ $\therefore$ (B) correct.

$V = \frac{\sigma R}{\varepsilon_0}$ is standard formula

$\therefore$ (C) correct

V same $\Rightarrow E_A = \frac{V}{R_A}$, $E_B = \frac{V}{R_B}$

$\therefore$ (D) correct.

34. Under case (B) eventhough the disc is free to rotate, it will not rotate. $\therefore$ Cases (A) and (B) are identical in all respects.

Section III

35. $[N] = L^{-3}\left[\frac{e^2}{\varepsilon_0}\right]$ = Force $\times$ area

36. Find ω by the given formula

$\lambda = \frac{c}{\frac{\omega}{2\pi}}$

37. As ball goes up, x is positive and increasing, v is positive and decreasing. Symmetrical for ball coming down.

38. At x = 0, E = K.E = $\frac{p^2}{2m}$

$\therefore$ E varies as p^2

$\therefore E_1 = 4E_2$

39. Starting from positive positions (i.e. in air), amplitude in air will be more than amplitude in water. Momentum is negative for downward journey. Also water produces damping.

$\Rightarrow$ graph is spiralling in.

Section IV

40. $U = \frac{q^2}{4\pi\varepsilon_0 a}\left[4+\sqrt{2}\right] + 2a^2 r$

For equilibrium, $\frac{dU}{da} = 0$

$\Rightarrow a = \left(\frac{q^2}{r}\right)^{1/3}\left(\frac{4+\sqrt{2}}{16\pi\varepsilon_0}\right)$

$\Rightarrow$ N = 3

41. $F_d = mg\sin\theta - \mu mg\cos\theta$

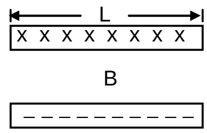
$F_u = mg\sin\theta + \mu mg\cos\theta$

$F_u = 3F_d$

$\Rightarrow \mu = \frac{1}{2}$

$\therefore N = 10\,\mu = 10 \times \frac{1}{2} = 5$

42.



$B = \frac{\mu_0 I}{L}$

$\phi_{coil} = B\pi r^2 = \frac{\mu_0 \pi r^2 g I}{L}$

$-\frac{d\phi}{dt} = E,\ i = \frac{E}{R}$; $M = i\pi r^2$

$\Rightarrow$ N = 6

43. $\Delta\lambda = \frac{MgL}{AY}$

$L' = L + \Delta\lambda$

$\Rightarrow \frac{L'}{L} = \left(1+\frac{Mg}{AY}\right)$

$\alpha = \frac{L'-L}{(L\times 40 - L'\times 30)}$

$= \frac{Mg}{AY\left[40-\left(1+\frac{Mg}{AY}\right)30\right]}$

Solving, we get M $\cong$ 3 kg

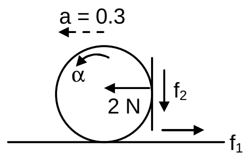
44. $N \times 10^{-4} = 2\left[\frac{2}{5}mr^2 + md^2\right] + 2\left[\frac{2}{5}mr^2\right]$;

Here $d = \frac{4\sqrt{2}}{2} \times 10^{-2} = 2\sqrt{2} \times 10^{-2}$ m

$r = \frac{\sqrt{5}}{2} \times 10^{-2}$ m; $m = \frac{1}{2}$ kg

$\Rightarrow$ N = 9

45.



$\alpha = \frac{f_1R - f_2R}{mR^2}$, $\alpha = \frac{a}{R}$

$\Rightarrow \frac{f_1 - f_2}{m} = a = 0.3 = \frac{2 - f_1}{m}$, m = 2

$\Rightarrow f_1 = 1.4$, $f_2 = 0.8 \Rightarrow \mu.2 = 0.8 \Rightarrow \mu = 0.4$

46. $A_0 = |-\lambda N_0| = 10^{10}\ s^{-1}$

$\therefore N_0 = \frac{10^{10}}{\lambda}$

$= 10^{10} \times 10^{9} = 10^{19}$

$\therefore M = mN_0 = 10^{-25} \times 10^{19}$ kg

$= 10^{-25} \times 10^{19} \times 10^{6}$ mg

= 1 mg

PART III

47	48	49	50	51	52	53
C	**B**	**B**	**A**	**C**	**D**	**C**

54	55	56	57
QUESTION INCORRECT	**B,D**	**A,D**	**B,C**

58	59	60	61	62
B	**D**	**D**	**A**	**B**

63	64	65	66	67	68	69
7	**9**	**8**	**6**	**1**	**2**	**5**

Section I

47. Let $\vec{v} = A\hat{i} + B\hat{j} + C\hat{k}$

$\bar{a} \times \bar{b} . \bar{v} = 0$

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ A & B & C \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} 2 & 0 & 2 \\ 1 & -1 & 1 \\ A & B & C \end{vmatrix} = 0$$

$\Rightarrow 2(-C - B) + 2(B + A) = 0$

$\Rightarrow A = C$

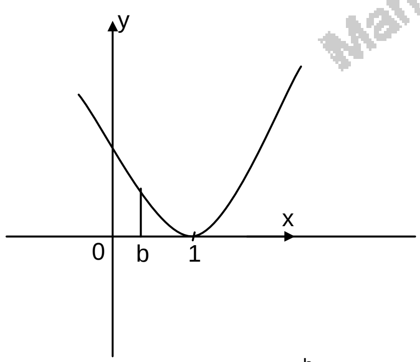
For the vector in (C),

A = C

Projection of $(3\hat{i} - \hat{j} + 3\hat{k})$ on $\bar{C}$

$= \dfrac{3+1-3}{\sqrt{3}} = \dfrac{1}{\sqrt{3}}$

48.



$R_1 = \int_0^b (x-1)^2 dx = \left[\dfrac{(x-1)^3}{3}\right]_0^b$

$= \dfrac{(b-1)^3}{3} + \dfrac{1}{3}$

$R_2 = \int_b^1 (x-1)^2 dx = \left[\dfrac{(x-1)^3}{3}\right]_b^1$

$R_1 - R_2 = \dfrac{1}{4}$ gives $= 0 - \left\{\dfrac{(b-1)^3}{3}\right\}$

$\dfrac{2(b-1)^3}{3} + \dfrac{1}{3} = \dfrac{1}{4}$

$\Rightarrow b = \dfrac{1}{2}$ satisfies the above equation.

49. $y + 2 = m(x - 3)$

and $m = \sqrt{3}$

$y + 2 = \sqrt{3}(x - 3)$

$y - \sqrt{3}x + 2 + 3\sqrt{3} = 0$

50. Let $I = \int_{\sqrt{\ln 2}}^{\sqrt{\ln 3}} \dfrac{x \sin x^2}{\sin x^2 + \sin(\ln 6 - x^2)} dx$

Set $x = \sqrt{t}$

$dx = \dfrac{1}{2\sqrt{t}} dt$

$x = \sqrt{\ln 2}$, $t = \ln 2$

$x = \sqrt{\ln 3}$, $t = \ln 3$

$\Rightarrow I = \int_{\ln 2}^{\ln 3} \dfrac{\sqrt{t}\sin t}{\sin t + \sin(\ln 6 - t)} \times \dfrac{1}{2\sqrt{t}} dt$

$= \dfrac{1}{2}\int_{\ln 2}^{\ln 3} \dfrac{\sin t \, dt}{\sin t + \sin(\ln 6 - t)}$

$$= \frac{1}{2}\int^{\ln 3} \frac{\sin(\ln 6 - t)}{\sin(\ln 6 - t) + \sin t}dt$$

$$2I = \frac{1}{2}\int_{\ln 2}^{\ln 3} dt$$

$$= \frac{1}{2}\log\frac{3}{2}$$

$$I = \frac{1}{4}\log 3/2$$

51. $\frac{\log x}{\log y} = \frac{\log 2}{\log 3}$

$\Rightarrow \log x = k \log 2 \Rightarrow x = 2^k$

$\log y = k \log 3 \Rightarrow y = 3^k$

$(2^{k+1})\log 2 = (3^{k+1})\log 3$

$2^{\log 2^{k+1}} = 3^{\log 3^{k+1}}$

$\Rightarrow (k+1)(\log 2)^2 = (k+1)(\log 3)^2$

$\Rightarrow k = -1$

$\Rightarrow x_0 = 2^{-1} = 1/2$

52. $P = \left\{\theta : \sin\left(\theta - \frac{\pi}{4}\right) = \cos\theta\right\}$

$\Rightarrow P = \left\{\theta : \cos\theta = \cos\left(\frac{3\pi}{4} - \theta\right)\right\}$

$\therefore P = \left\{\theta : \theta = 2n\pi \pm \left(\frac{3\pi}{4} - \theta\right)\right\}$

$= \left\{\theta : \theta = n\pi + \frac{3\pi}{8}\right\}$

$Q = \left\{\theta : \theta - \frac{\pi}{4} = 2n\pi \pm \left(\frac{\pi}{2} - \theta\right)\right\}$

$= \left\{\theta : \theta = n\pi + \frac{3\pi}{8}\right\}$

$\therefore P = Q$

53. $\frac{a_{10} - 2a_8}{2a_9} = \frac{\alpha^{10} - \beta^{10} - 2(\alpha^8 - \beta^8)}{2(\alpha^9 - \beta^9)}$

$= \frac{\alpha^8(\alpha^2 - 2) - \beta^8(\beta^2 - 2)}{2(\alpha^9 - \beta^9)}$

$= \frac{\alpha^8 6\alpha - \beta^8 6\beta}{2(\alpha^9 - \beta^9)}$

$= \frac{6(\alpha^9 - \beta^9)}{2(\alpha^9 - \beta^9)} = 3$

Section II

54. Skew symmetric matrix of order 3 is <u>singular.</u> Its inverse does not exist. Therefore there is **NO SOLUTION TO THIS QUESTION.**

But if

The question is reframed in the following manner;

" Let M and N be two nonsingular skew-symmetric matrices………."

<u>The solution is</u>

$M^2 N^2 (M^{-1} N)^{-1} (MN^{-1})^T$

$= M^2 N^2 (-MN)^{-1} (N^{-1})^T M^T$

$= M^2 N^2 (-N^{-1} M^{-1})^{-1} (N^T)^{-1} (-M)$

$= M^2 N^2 N^{-1} M^{-1} (-N)^{-1} M$

$= - M^2 N^2 N^{-1} M^{-1} N^{-1} M = - M^2 N M^{-1} N^{-1} M$

$= - M^2 N (N M)^{-1} M$

$= - M^2 N(M N)^{-1} M$

$= - M^2 N N^{-1} M^{-1} M$

$= - M^2$

Choice (c)

55. For $\frac{x^2}{4} + \frac{y^2}{1} = 1$

$e = \frac{\sqrt{3}}{2}$ and focus = $(\pm\sqrt{3}, 0)$

$\therefore$ for $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, e = \frac{2}{\sqrt{3}}$

$\Rightarrow \frac{b^2}{a^2} = \frac{1}{3}$

Substitution $(\sqrt{3}, 0)$, $a^2 = 3$, $b^2 = 1$

Focus (2, 0)

$\therefore$ required hyperbola is $\frac{x^2}{3} - y^2 = 1$

56. j – k = i + j + k — (i + j + 2k)

& k – j = i + j +2k — (i + 2j +k)

$\therefore$ j – k, k – j coplanar with the given vectors

and $\pm \begin{vmatrix} 1 & -1 & 0 \\ 1 & 1 & 2 \\ 1 & 2 & 1 \end{vmatrix} = \pm \begin{vmatrix} 1 & 0 & 0 \\ 1 & 1 & 3 \\ 0 & 1 & -1 \end{vmatrix} \neq 0$

(A) and (D) true.

57. f (x +y) = f (x) +f(y)

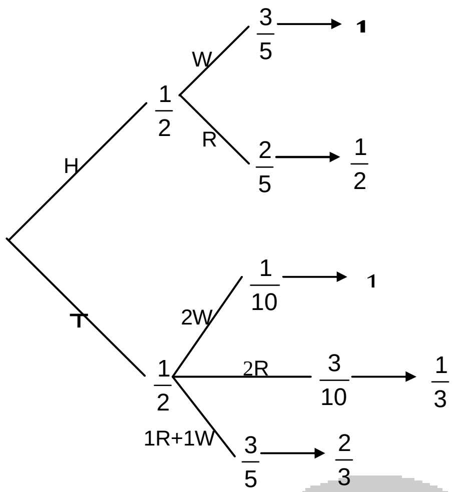
$\Rightarrow f(x) = kx$

f(x) is continuous $\forall\, x \in R$

and f' (x) = k

Section III

For problems (58) and (59)



58. Probability

$= \frac{1}{2}\left[\frac{3}{5}\times 1+\frac{2}{5}\times\frac{1}{2}+\frac{3}{10}\times 1+\frac{1}{10}\times\frac{1}{3}+\frac{3}{5}\times\frac{2}{3}\right]$

$= \frac{1}{2}\left[\frac{3}{5}+\frac{1}{5}+\frac{3}{10}+\frac{1}{30}+\frac{2}{5}\right]$

$= \frac{1}{2}\times\frac{46}{30}=\frac{23}{30}$

59. Probability = $\dfrac{\frac{1}{2}\left[\frac{3}{5}\times 1+\frac{2}{5}\times\frac{1}{2}\right]}{\frac{23}{30}}$

$= \frac{12}{23}$

60. 7(a + b+ c) = 0 , $\Rightarrow$ a + b + c = 0

also 2a + b + c = 1

$\Rightarrow$ a = 1, b + c = –1

$\therefore$ 7a + b + c = 7 – 1 = 6

61. $x^3 - 1 = 0$ and Im(ω) > 0 $\Rightarrow \omega = -\frac{1}{2}+i\frac{\sqrt{3}}{2}$

a = 2 $\Rightarrow$ 2 + 8b + 7c = 0

14 + 7b + 7c = 0

(taking first and third columns)

Solving we get b = 12 and c = – 14

$\therefore$ The equation in $\frac{3}{\omega^2}+\frac{1}{\omega^{12}}+\frac{3}{\omega^{-14}}$

$= 3\omega + 1 + 3\omega^2$

$= 3(\omega+\omega^2) + 1 = -2$

Correct choice (a)

62. b = 6. Taking 1st and 3rd columns we get

a + 48 + 7c = 0

a + 6 + c = 0

Solving a = 1 and c = - 7.

$\therefore$ The equation is $x^2 + 6x - 7 = 0$

$\therefore \frac{1}{\alpha}+\frac{1}{\beta}=\frac{\alpha+\beta}{\alpha\beta}=\frac{6}{7}<1$

$\sum_{n=0}^{\infty}\left(\frac{1}{\alpha}+\frac{1}{\beta}\right)^n$ (is an infinite geometric progression) =

$\frac{a}{1-r}=\frac{1}{1-\frac{6}{7}}=7$

Section IV

63. $\theta = \frac{\pi}{n}$

$\frac{1}{\sin\theta}=\frac{1}{\sin 2\theta}+\frac{1}{\sin 3\theta}$

$\frac{1}{\sin\theta}-\frac{1}{\sin 3\theta}=\frac{1}{\sin 2\theta}$

$\frac{\sin 3\theta-\sin\theta}{\sin\theta\sin 3\theta}=\frac{1}{\sin 2\theta}$

$\frac{2\cos 2\theta}{\sin 3\theta}=\frac{1}{\sin 2\theta}$

$\Rightarrow 2\sin 2\theta\cos 2\theta = \sin 3\theta$

$\sin 4\theta - \sin 3\theta = 0$

$\Rightarrow 2\cos\frac{7\theta}{2}\sin\frac{\theta}{2}=0$

$\Rightarrow 2\cos\frac{7\pi}{2n}\sin\frac{\pi}{2n}=0$

$\frac{7\pi}{2n}=\left((2k+1)\frac{\pi}{2}\right)$

$\Rightarrow n = \frac{7}{2k+1}$

For positive integral values of n

k = 0 or 3

put k = 0, n = 7

64. m = 5n; $\frac{s_m}{s_n}=\dfrac{\frac{5n}{2}\left[6+(5n-1)(a_2-3)\right]}{\frac{n}{2}\left[6+(n-1)(a_2-3)\right]}$

$= 5\left[\frac{9-a_2+5n(a_2-3)}{9-a_2+n(a_2-3)}\right]$

$\therefore \frac{9-a_2+5(a_2-3)}{9-a_2+a_2-3}=\frac{(9-a_2)+10(a_2-3)}{9-a_2+2(a_2-3)}$, is independent of n

$\frac{4a_2-6}{6}=\frac{9a_2-21}{a_2+3}$

$(2a_2-3)(a_2+3)=(3a_2-7)$

$2a_2^2-24a_2+54=0$

$a_2^2-12a_2+27=0$

$a_2 \neq 3$, $a_2 = 9$

65. $\frac{a^{-5}+a^{-4}+a^{-3}+a^{-3}+a^{-3}+1+a^{8}+a^{10}}{8}$

$$\ge \left(a^{-5}a^{-4}\left(a^{-3}\right)^{3}1\,a^{8}a^{10}\right)^{\frac{1}{8}} = 1$$

$\Rightarrow$ minimum value of sum = 8.

66. $6\int_{1}^{x} f(t)dt = 3x\,f(x) - x^3$

$6f(x) = 3xf'(x) + 3f(x) - 3x^2$

$f(x) = xf'(x) - x^2$

$y = x\frac{dy}{dx} - x^2$

$x\frac{dy}{dx} - y = x^2 \Rightarrow \frac{dy}{dx} - \frac{y}{x} = x$

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

$\therefore \quad y.\frac{1}{x} = \int x\frac{1}{x}dx = x + c$

$y = x(x + c) = f(x)$

$f(1) = 2 \Rightarrow 2 = 1 + c \Rightarrow c = 1$

$\therefore f(x) = x(x + 1) \Rightarrow f(2) = 6$

67. $f(\theta) = \sin\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)$

$$= \frac{\tan\tan^{-1}\left(\frac{\sin\theta}{\sqrt{\cos 2\theta}}\right)}{\sqrt{1+\tan^2(\tan^{-1}\frac{\sin\theta}{\sqrt{\cos 2\theta}})}}$$

$$= \frac{\frac{\sin\theta}{\sqrt{\cos 2\theta}}}{\sqrt{\frac{\cos 2\theta+\sin^2\theta}{\cos 2\theta}}} = \frac{\sin\theta}{\sqrt{\cos^2\theta-\sin^2\theta+\sin^2\theta}}$$

$= \tan\theta$

$\Rightarrow \frac{d(f(\theta))}{d(\tan\theta)} = 1$

68. Extremum point of latus rectum are (2,4) and (2,–4)

$\therefore$ Area of triangle so formed with $\left(\frac{1}{2},2\right)$

$\Delta_1 = \frac{1}{8a}(y_1 - y_2)(y_2 - y_3)(y_3 - y_1)$

$= \frac{1}{8.2}(4+4)(-4-2)(2-4) = 6$

Eqn. of tangent at (2,4) is $y = x + 2$ ________(1)

Eqn. of tangent at (2, –4) is $-y = x + 2$ ______(2)

Eqn. of tangent at $\left(\frac{1}{2},2\right)$ is $y = 2x + 1$ ______(3)

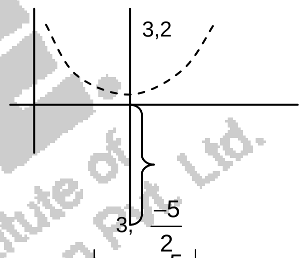
Tangent at the extremities of latus rectum intersect directrix at (–2, 0).

Point of intersection of (1) and (2) is (1,3) and of (2) and (3) is (–1, –1)

$$\Delta_2 = \frac{1}{2}\begin{vmatrix}1 & -2 & 0\\ 1 & 1 & 3\\ 1 & -1 & -1\end{vmatrix} = |-3| = 3$$

$\therefore \frac{\Delta_1}{\Delta_2} = \frac{6}{3} = 2$

69.



minimum of $2\left|z - 3 + \frac{5}{2}i\right|$

$= 2\left|\left(\frac{5}{2}+2\right)-2\right| = 5$