ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

DISTANCE LEARNING PROGRAMME

(Academic Session : 2015 - 2016)

LEADER TEST SERIES / JOINT PACKAGE COURSE

TARGET : JEE (MAIN) 2016

Test Type : **ALL INDIA OPEN TEST** (MAJOR) Test Pattern : JEE-Main

TEST # 07 **TEST DATE : 27 - 03 - 2016**

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	1	4	2	4	3	1	1	2	1	1	2	3	2	1	2	3	4	4	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	2	2	3	1	2	2	2	4	1	2	4	3	1	3	1	1	3	1	4	4
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	2	4	1	4	2	4	4	4	4	3	4	3	3	2	4	3	2	3	4
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	4	2	4	4	4	4	3	3	3	1	2	2	4	2	1	1	3	4	3	1
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	4	1	1	2	1	2	4	3	1	2										

HINT – SHEET

1. Ans. (2)

Sol. Amplitude modulation $\mu = \frac{A_M}{A_C} = \frac{1}{2}$ or 50%

2. Ans. (1)

3. Ans. (4)

Sol. Area in a-t graph = change in velocity

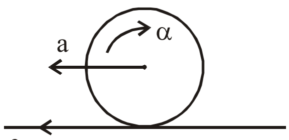
$v_f - 3 = 4 \Rightarrow v_f = 7$ m/s

4. Ans. (2)

Sol. $I = \frac{MR^2}{2} + MR^2 = \frac{3}{2}MR^2$

5. Ans. (4)

Sol.



$a = \mu g$

time at which V become zero

$$0 = V - \mu gt \Rightarrow t = \frac{V}{\mu g}$$

$$\text{by } \tau = I\alpha \Rightarrow \mu mgR = \frac{2}{3}mR^2\alpha \Rightarrow \alpha = \frac{3\mu g}{2R}$$

$$\omega = \frac{3V}{R} - \frac{3\mu g}{2R}\cdot\frac{V}{\mu g} = \frac{3V}{2R}$$

6. Ans. (3)

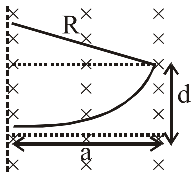
Sol. $0 + mg\,(L\cos\alpha - \ell) = mg(L - \ell)\cos\alpha$

7. Ans. (1)

Sol. $\vec{v}$ is parallel to length so induce emf = 0

8. Ans. (1)

Sol.



$d = R(1 - \cos\theta) \Rightarrow R\cos\theta = R - d$

$R\sin\theta = a \Rightarrow R^2 = R^2 - 2Rd + d^2 + a^2$

$$\Rightarrow R = \frac{d^2 + a^2}{2d}$$

$$p = \frac{d^2 + a^2}{2d} qB$$

9. Ans. (2)

Sol. $$-\left[2\int_1^4 dx - 3\int_0^2 dy + 4\int_4^6 dz\right]$$

$= -[2 \times 3 - 3 \times 2 + 4] = -4$

10. Ans. (1)

Sol. $$\text{Magnetisation} = \frac{\text{Magnetic moment}}{\text{volume}}$$

$$= \frac{9.27\times10^{-24} \times \dfrac{\text{Volume}\times\text{density}}{\text{Molar mass}} \times N_a}{\text{Volume}}$$

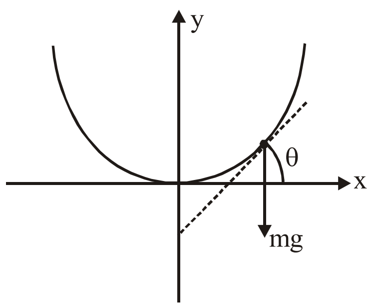
$$= \frac{9.27\times10^{-24} \times 8000 \times 6.023\times10^{23}}{56\times10^{-3}}$$

$= 8 \times 10^5$ A-m

11. Ans. (1)

Sol. $y = \dfrac{x^2}{5}$ $\quad \dfrac{dy}{dx} = \dfrac{2x}{5}$

$$-mg\sin\theta = m\frac{d^2x}{dt^2}$$



$$\Rightarrow -g\frac{2x}{5} = \frac{d^2x}{dt^2}$$

12. Ans. (2)

Sol. $P = \vec{P}_1 + \vec{P}_2$

$$P = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos\theta}$$

$$P_{max} = (P_1 + P_2) \Rightarrow \lambda_{min} = \frac{h}{P_{max}}$$

$$P_{min} = (P_1 - P_2) \Rightarrow \lambda_{max} = \frac{h}{P_{min}}$$

13. Ans. (3)

Sol. By theory

14. Ans. (2)

15. Ans. (1)

Sol. $$T = \frac{2\pi}{\sqrt{GM}} R^{3/2} = 1\text{yr}$$

$$T' = \frac{2\pi}{\sqrt{G(2M)}} (2R)^{3/2} = 2\text{yr}$$

16. Ans. (2)

Sol. $$T_i V^{\gamma-1} = T_f\left(\frac{V}{8}\right)^{\gamma-1}$$

$$\frac{T_f}{T_i} = 8^{\gamma-1}$$

$$\gamma = \frac{nC_{P_1} + nC_{P_2}}{nC_{V_1} + nC_{V_2}} = \frac{\frac{7}{2} + \frac{5}{2}}{\frac{5}{2} + \frac{3}{2}}$$

$$= \frac{12}{8} = \frac{3}{2}$$

17. Ans. (3)

Sol. $m = \dfrac{F}{a} = 1\text{kg}$

$$\frac{dm}{m} = \frac{dF}{F} + \frac{da}{a}$$

$$= \frac{0.1}{2} + \frac{0.1}{2} = 0.1$$

18. Ans. (4)

Sol. $$\frac{1}{10} = (1.5 - 1)\left(\frac{1}{R} + \frac{1}{R}\right) \Rightarrow \frac{1}{10} = 0.5 \times \frac{2}{R}$$

$\Rightarrow R = 10$ cm.

Refraction from I[st] surface,

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

$\Rightarrow \frac{1.5}{v_1} - \frac{1}{-20} = \frac{1.5-1}{+10}$

$\Rightarrow v_1 = \infty$

for the second surface, $\frac{2}{v} - \frac{1.5}{\infty} = \frac{2-1.5}{-10}$

$\Rightarrow$ v = -40 cm

19. Ans. (4)

Sol. $f_1 = \frac{3}{4L}C$

$f_2 = \frac{2}{2\left(L - \frac{L}{6}\right)}C = \frac{6}{5L}C$

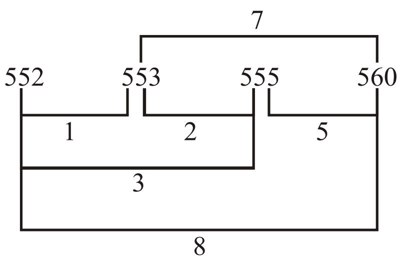
$\frac{f_1}{f_2} = \frac{3}{4} \times \frac{5}{6} = \frac{5}{8}$

20. Ans. (3)

Sol. $V = 2 = \sqrt{\frac{mg}{1}}$

21. Ans. (2)

Sol.



22. Ans. (2)

Sol.

d_2	$\lvert d_1 - \langle d \rangle \rvert$
1.002	+0.002
1.004	0.0000
1.006	+0.002
$\Sigma d_i = 3.012$	0.004
$\langle d \rangle = 1.004$	$\frac{0.004}{3}$

23. Ans. (3)

Sol. Ratio $= \frac{T \cdot K \cdot E}{R \cdot K \cdot E} = \frac{\frac{3}{2}kT}{\frac{2}{2}kT}$

24. Ans. (1)

Sol. $\frac{P_1}{P_2} = \frac{0.6}{0.8} \times \left(\frac{300}{400}\right)^4$

25. Ans. (2)

Sol. $\vec{E}_0 = \frac{k}{r^3}\left[-P\hat{i} - P\hat{j}\right]$

$\vec{E}_A = \frac{k}{\left(\sqrt{2}r\right)^3}\left[-P\hat{i} - P\hat{j}\right]$

26. Ans. (2)

Sol. $\frac{i^2R}{AR} = \frac{i^2 s\ell}{A\ell.A} = \left(\frac{i}{A}\right)^2 s$

$= sJ^2 = J^2/s$

27. Ans. (2)

Sol. $\vec{B}_{net} = B\hat{i} + B\hat{j} + B\hat{k} \Rightarrow B_{net} = \sqrt{3}B = \frac{\sqrt{3}\mu_0 i}{2R}$

28. Ans. (4)

Sol. $T = \frac{2m_1 m_2 g}{m_1 + m_2} = \frac{4}{3}g$

29. Ans. (1)

30. Ans. (2)

Sol. At terminal speed

$F_{net} = 0$

$\Rightarrow$ viscous force = mg – F_b

$= mg - \rho\left(\frac{m}{\sigma}\right)g = mg\left(\frac{1-\rho}{\sigma}\right)$

31. Ans.(4)

$\Lambda_m = \frac{K}{C} = \frac{Scm^{-1}}{mol\,cm^{-3}} = Scm^2mol^{-1}$

32. Ans.(3)

Total nodes = n – 1

for initial orbit = n –1 = 2 + 1 $\Rightarrow$ n = 4

for final orbit = n –1 = 1 $\Rightarrow$ n = 2

$\Delta E = 13.6\ Z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)eV = 13.6 \times 1^2$

$\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = 2.55$ eV

$\therefore \lambda = \frac{1240}{2.55}nm$

33. Ans.(1)

* for adsorption $\Delta G < 0$.

* Gold sol in –ve colloid so dispersed phase move toward anode

* size of colloids vary from 1nm to 1000 nm.

34. Ans.(3)

$W = -10\ (10-5)$

$= -10 \times 5$ bar litre

$= -50 \times 100$ J

$= -5000$ J

35. Ans.(1)

$2A \rightarrow$	B	$+\ 2C$
5	1	0
1	3	4

$K = \frac{3 \times 16}{1} = 48$

36. Ans.(1)

Ion having higher reduction potential will reduce first.

37. Ans.(3)

Truncated octahedron has 24 corners and 36 edges

$\therefore$ simplest formula : $A_{24}B_{36} = A_2B_3$

38. Ans.(1)

* $t_{1/2} = \frac{[A_0]}{2K}$ for zero order.

* For 1st order, $\frac{-d[A]}{dt} = k[A]_0 e^{-kt}$ rate decreases with time.

* For 2nd order, $t_{1/2} = \frac{1}{[A]_0 k}$, $t_{1/2}$ decreases with increase in initial conccentration.

39. Ans.(4)

S-I : effective molarity = 0.4 M

S-II : effective molarity = 0.2 + x = 0.24 M

S-III : effective molarity = 0.2 M

$BOH \rightleftharpoons B^+ + OH^-$

BOH	B^+	OH^-
0.2-x	x	x

$\frac{x^2}{0.2-x} = 0.01 \Rightarrow x = 0.04$

	HCl +	BOH $\rightleftharpoons$	BCl +	H_2O
	0.2 mole	0.2 mol	0	
Final	0	0	0.2 mole	

$\therefore$ [BCl] $\frac{0.2}{2} = 0.1M$

Now, conc. S- III < S - II < S- I

40. Ans.(4)

let mmoles of each is = x

n-factor of FeO = 1

n-factor of $Fe_{0.80}O = 0.4$

m_{eq} of FeO + $m_{eq\ of}$ $Fe_{0.80}O$ = eq of $KMnO_4$

$x \times 1 + x \times 0.4 = 70 \times 0.3 \times 5$

x = 75 mmoles

mmoles of Fe^{3+} produced = 75 + 75 × 0.8 = 135 mmoles

41. Ans. (4)

42. Ans. (2)

43. Ans. (4)

44. Ans. (1)

45. Ans. (4)

46. Ans. (2)

47. Ans. (4)

48. Ans. (4)

49. Ans. (4)

50. Ans. (4)

51. Ans. (3)

52. Ans. (4)

53. Ans. (3)

54. Ans. (3)

55. Ans. (2)

56. Ans. (4)

57. Ans. (3)

58. Ans. (2)

59. Ans. (3)

60. Ans. (4)

61. Ans. (4)

$$\lim_{x\to\infty}\frac{1+\frac{5g(x)}{f(x)}}{10\frac{g(x)}{f(x)}-5}=-\frac{2}{3}$$

62. Ans. (2)

$A = xy \Rightarrow \frac{dA}{dt}=x\frac{dy}{dt}+y\frac{dx}{dt}$

$= 29(-2) + 14.3 = -16$

As $x = 20 + 3 \times 3 = 29$ & $y = 20 + 3(-2) = 14$

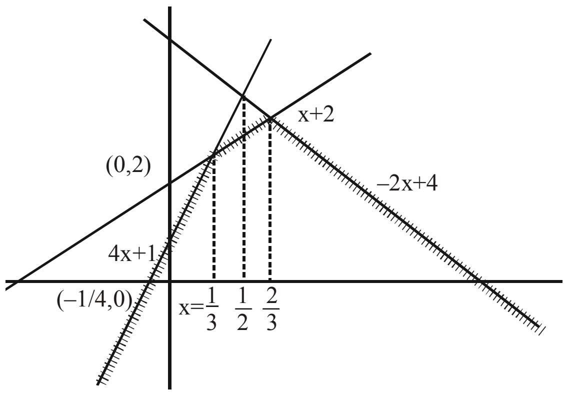
63. Ans. (4)

Let $f(x)=1+\frac{x}{2}+\frac{x^2}{4}+\frac{x^3}{8}+...=\frac{1}{1-\frac{x}{2}}=\frac{2}{2-x}$

Now, $\int_0^1\frac{2}{2-x}dx=-2\ell n|2-x|\Big|_0^1 = 2\ell n2=\ell n4$

$\therefore e^{\ell n4} = 4$

64. Ans. (4)



$\therefore$ Maximum value $=-2.\frac{2}{3}+4=\frac{8}{3}$

65. Ans. (4)

$\det((\text{adj } A^T)^T) = \det(\text{adj}A^T) = (\det(A^T))^2$

$= (\det A)^2 = 9$

$\det((\text{adj } A^{-1})^{-1})$

$$=\frac{1}{\det(\text{adj}A^{-1})}=\frac{1}{\left(\det\left(A^{-1}\right)\right)^2}=(\det A)^2=9$$

66. Ans. (4)

$$\begin{vmatrix}(1+ap)^2 & (1+bp)^2 & (1+cp)^2\\(1+aq)^2 & (1+bq)^2 & (1+cq)^2\\(1+ar)^2 & (1+br)^2 & (1+cr)^2\end{vmatrix}$$

$$=\begin{vmatrix}1 & a^2 & 2a\\1 & b^2 & 2b\\1 & c^2 & 2c\end{vmatrix}\begin{vmatrix}1 & 1 & 1\\p^2 & q^2 & r^2\\p & q & r\end{vmatrix}=2.4.\frac{1}{2}.4=16$$

67. Ans. (3)

$\text{tr.}(AB) = 4\,\text{cosec}^2\theta + 9\sec^2\theta + 7$

$= 20 + 4\cot^2\theta + 9\tan^2\theta \geq 32$

68. Ans. (3)

$$\lim_{n\to\infty}\frac{\left(1+\frac{1}{n}\right)^a+\left(1+\frac{2}{n}\right)^a+....+\left(1+\frac{n}{n}\right)^a}{\left(\frac{1}{n}\right)^a+\left(\frac{2}{n}\right)^a+.....+\left(\frac{n}{n}\right)^a}$$

$$=\lim_{n\to\infty}\frac{\int_0^1(1+x)^a\,dx}{\int_0^1 x^a dx}=\frac{\left.\frac{(1+x)^{a+1}}{a+1}\right|_0^1}{\left.\frac{x^{a+1}}{a+1}\right|_0^1}$$

$= 2^{a+1} - 1 = 15$

$2^{a+1} = 2^4$

$a = 3$

69. Ans. (3)

Put $x = r\cos\theta$ & $y = r\sin\theta$

$\therefore (5\cos\theta + 12\sin\theta)^2 = 169$

70. Ans. (1)

P(x). Q(x). R(x)

$=\left(x-\sqrt{2}\right)\left(x+\sqrt{2}\right)\left(x^2+2\right)\left(x^2-2x+2\right)$

$(x^2 + 2x + 2)(x^8 + 16)$

$= x^{16} - 256$

71. Ans. (2)

The coin can turn up heads 0,2,4,...,50 times to satisfy the condition.

Hence probability is :

$$P={}^{50}C_0\left(\frac{2}{3}\right)^0\left(\frac{1}{3}\right)^{50}+{}^{50}C_2\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^{48}+...+{}^{50}C_{50}\left(\frac{2}{3}\right)^{50}$$

$$=\frac{\left(\frac{1}{3}+\frac{2}{3}\right)^{50}+\left(\frac{1}{3}-\frac{2}{3}\right)^{50}}{2}=\frac{3^{50}+1}{2.3^{50}}$$

72. Ans. (2)

Use A.M. $\geq$ G.M.

$x_1 = x_1$

$x_2^2 + 1 \geq 2x_2$

$x_3^3 + 1 + 1 \geq 3x_3$

$x_5^5 + 1 + 1 + 1 + 1 \geq 5x_5$

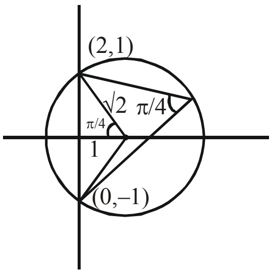
Adding we get
$(x_1 x_2^2 + ... + x_5^5) + 10 \geq x_1 + 2x_2 + ... + 5x_5$
equality holds
$\therefore x_1 = x_2 = x_3 = x_4 = x_5 = 1$

73. Ans. (4)

$y - 2 = m(x - 1) \Rightarrow (x-1)\dfrac{dy}{dx} - (y-2) = 0$

$y = (x-1)\dfrac{dy}{dx} + 2$

74. Ans. (2)



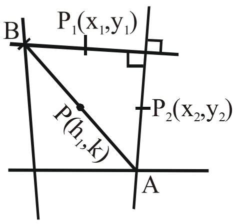
Ploting the locus on argand plane, we get

$\therefore$ Perimeter $= \dfrac{3}{4} \times 2\pi.\sqrt{2} = \dfrac{3\pi}{\sqrt{2}}$

75. Ans. (1)

Let $f(x) = (x - \sin\beta)(x - \sin\gamma)$
$+ (x - \sin\alpha)(x - \sin\gamma) + (x - \sin\alpha)(x - \sin\beta)$
$f(\sin\alpha) = (\sin\alpha - \sin\beta)(\sin\alpha - \sin\gamma) > 0$
$f(\sin\beta) = (\sin\beta - \sin\alpha)(\sin\beta - \sin\gamma) < 0$
$f(\sin\gamma) = (\sin\gamma - \sin\alpha)(\sin\gamma - \sin\beta) > 0$
$\therefore$ One root lie in $(\sin\alpha, \sin\beta)$ and other root lie in $(\sin\beta, \sin\gamma)$

76. Ans. (1)



Equation of line through P_1.
$y - y_1 = m(x - x_1)$

similarly through P_2, $y - y_1 = -\dfrac{1}{m}(x - x_1)$

$\therefore B \equiv (0, y_1 - mx_1)$
$A \equiv (x_1 + my_1, 0)$
Now, $2k = y_1 - mx_1$ & $2h = x_1 + my_1$

$\dfrac{y_1 - 2k}{2h - x_1} = \dfrac{x_1}{y_1}$

$\therefore$ Locus is straight line.

77. Ans. (3)

Let $E = \left|2\hat{a} - 3\hat{b}\right|^2 + \left|2\hat{b} - 3\hat{c}\right|^2 + \left|2\hat{c} - 3\hat{a}\right|^2$

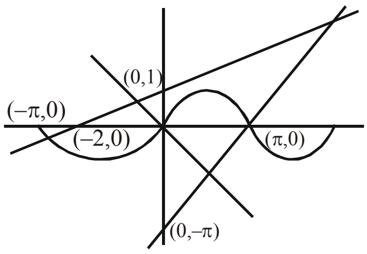
$= 39 - 12\sum \hat{a}.\hat{b}$

Now, $\sum \hat{a}.\hat{b} \in \left[-\dfrac{3}{2}, 3\right]$

$\therefore E \in [3, 57]$

78. Ans. (4)

Plotting the given lines and the curve $y = \sin x$, we get



Clearly, $\lambda \in (0, \pi)$

79. Ans. (3)

$\lambda(2x - y) + x + 3y + z - 4 = 0$
clearly it denotes family of planes containing the line of intersection of
$P_1 : x + 3y + z - 4 = 0$
& $P_2 : 2x - y = 0$
Let $x = \alpha \quad \therefore y = 2\alpha$ & $z = 4 - 7\alpha$

$\therefore \dfrac{x}{1} = \dfrac{y}{2} = \dfrac{z-4}{-7}$

80. Ans. (1)

$$\vec{a}.\left(\vec{b} \times \vec{c}\right) = \begin{vmatrix} t & -3 & 2t \\ 1 & -2 & 2 \\ 3 & t & -1 \end{vmatrix} = 7(2t - 3)$$

$\therefore 7\int_1^2 (2t - 3)\,dt = 0$

81. Ans. (4)

It is obvious.

82. Ans. (1)

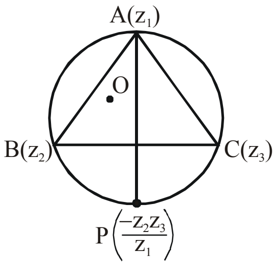
Clearly, $\sigma^2 = \dfrac{\Sigma(x_i - \bar{x})^2}{2n}$

clearly $\bar{x} = 0$

$\therefore \sigma^2 = \dfrac{\Sigma x_i^2}{2n} = \dfrac{2n \times \alpha^2}{2n} = \alpha^2$

$\therefore$ S.D $= |\alpha| = 2$

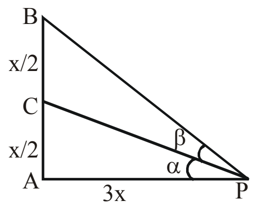
83. Ans. (1)



Point P is on circle, Hence it must be reflection of ortho centre i.e. $z_1 + z_2 + z_3$

84. Ans. (2)

$\therefore \tan\beta = \tan((\alpha+\beta)-\alpha)$



$$= \frac{\frac{1}{3}-\frac{1}{6}}{1+\frac{1}{3}\cdot\frac{1}{6}} = \frac{3}{19}$$

85. Ans. (1)

Distance $= \sqrt{x^2+y^2+z^2}$

$$\therefore\ x^2+y^2+\frac{2}{xy} = x^2+y^2+\frac{1}{xy}+\frac{1}{xy} \geq 4$$

$\therefore$ Minimum distance = 2

86. Ans. (2)

Put $\frac{x}{2} = t \Rightarrow dx = 2dt$

$$2\int e^t \sec 4t\left(1+4\tan 4t\right)dt$$

$$2e^t \sec 4t + c$$

$$2e^{\frac{x}{2}} \sec 2x + c$$

87. Ans. (4)

xRx $\therefore$ reflexive

0R2 but $2 \not{R}\, 0 \Rightarrow$ not symmetric

if xRy, yRz then xRz $\Rightarrow$ transistive

88. Ans. (3)

$$\tan\left[\frac{\pi}{4}+\theta\right]+\tan\left[\frac{\pi}{4}-\theta\right], \theta = \frac{1}{2}\cos^{-1}\frac{5}{7}$$

$$\frac{1+\tan\theta}{1-\tan\theta}+\frac{1-\tan\theta}{1+\tan\theta}$$

$$2\left[\frac{1+\tan^2\theta}{1-\tan^2\theta}\right]$$

$$\frac{2}{\cos 2\theta}$$

$$\frac{14}{5}$$

89. Ans. (1)

$$7\left(\frac{\sin x}{4}\right) = 1$$

$$\sin x = \frac{4}{7}$$

$\therefore$ sum of solutions 6π

90. Ans. (2)

If Kapil is dishonest then he is not rich.