



Paper Code : 0000CJA103118014

**CLASSROOM CONTACT PROGRAMME**  
(Academic Session : 2018 - 2019)

**LEADER & ENTHUSIAST COURSE**  
**TARGET : JEE (MAIN) 2019**

Test Type : ALL INDIA OPEN TEST

Test Pattern : JEE-Main

**TEST DATE : 31 - 03 - 2019**

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

## LEADER & ENTHUSIAST COURSE

### TARGET : JEE (MAIN) 2019

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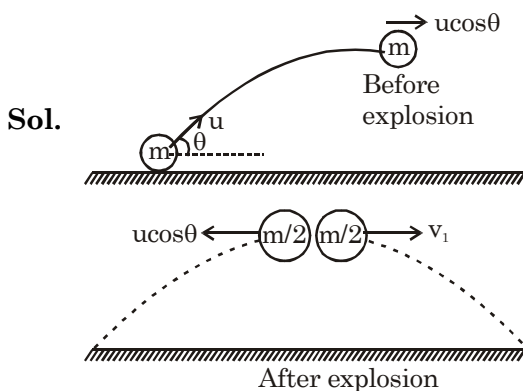
### SOLUTION

1. **Ans. (2)**

**Sol.** In diffraction pattern

$$\begin{aligned} \text{First minima} &= \frac{\lambda D}{a} \\ \text{First maxima} &= \frac{3\lambda D}{2a} \\ \Rightarrow \frac{3\lambda D}{2a} &= \frac{(540)D}{a} \\ \Rightarrow \lambda &= 360 \text{ nm} \end{aligned}$$

2. **Ans. (3)**



from momentum conservation

$$\begin{aligned} mu \cos \theta &= -\frac{m}{2} u \cos \theta + \frac{m}{2} v_1 \\ v_1 &= 3u \cos \theta \\ \lambda_D &= \frac{h}{mv} \end{aligned}$$

$$\Rightarrow \frac{(\lambda_D)}{(\lambda_D)_2} = \frac{\frac{h}{\frac{m}{2}(3u \cos \theta)}}{\frac{h}{mu \cos \theta}} = \frac{2}{3}$$

3. **Ans. (2)**

**Sol.**  $v_{BE} = 0.7V = 8.7 - I_B(200 \times 10^3)$

$$\Rightarrow I_B = \frac{8}{200 \times 10^3} = 4 \times 10^{-5} \text{ A}$$

$$\Rightarrow \beta = 80 = \frac{I_C}{I_B} \Rightarrow I_C = 32 \times 10^{-4} \text{ A}$$

$$\begin{aligned} V_{CE} = 3V &= 11 - I_C R_C \\ 3 &= 11 - 32 \times 10^{-4} R_C \\ \Rightarrow R_C &= \frac{8}{32 \times 10^{-4}} \\ R_C &= 2.5 \text{ k}\Omega \end{aligned}$$

4. **Ans. (2)**

**Sol.**  $I = \frac{5}{4} MR^2$

$$\begin{aligned} \frac{dI}{I} &= \frac{dM}{M} + 2 \frac{dR}{R} \\ &= 1\% + 2(1.5\%) = 1\% + 3\% = 4\% \end{aligned}$$

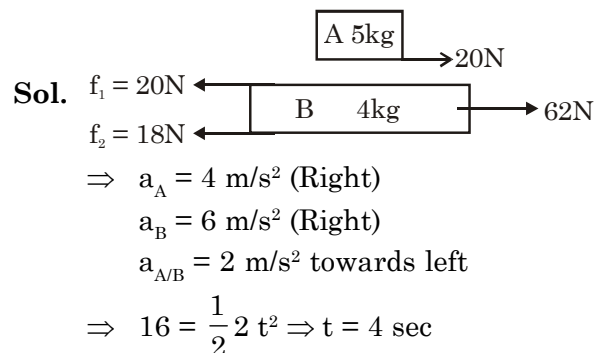
5. **Ans. (4)**

**Sol.** Magnetic field cannot change speed and since magnetic field is along z axis, velocity cannot be in z axis at any instant i.e. it cannot have  $\hat{k}$  component.

6. **Ans. (2)**

**Sol.**  $V_A = \frac{kQ}{R} + k \frac{2Q}{2R} + k \frac{8Q}{4R} = \frac{4kQ}{R}$

7. **Ans. (3)**



8. **Ans. (3)**

**Sol.** velocity when string becomes horizontal

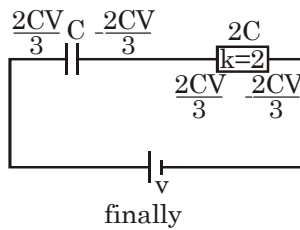
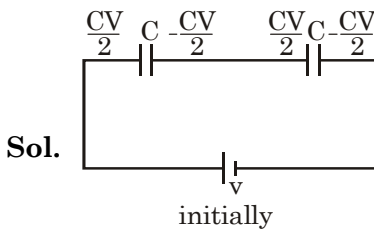
$$v = \sqrt{u^2 - 2gl} = \sqrt{60 - 20}$$

$$v = \sqrt{40}$$

$$\Rightarrow T = \frac{mv^2}{\ell} = \frac{1(40)}{1}$$

$$\Rightarrow T = 40 \text{ N}$$

9. **Ans. (1)**



$$\text{charge given by battery} = \frac{2CV}{3} - \frac{CV}{2}$$

$$= \frac{CV}{6}$$

$$\Rightarrow \text{work done by battery} = \frac{CV^2}{6}$$

Initial energy stored

$$= \left( \frac{1}{2} C \left( \frac{V}{2} \right)^2 \right) \times 2 = \frac{CV^2}{4}$$

Final energy stored

$$= \frac{1}{2} C \left( \frac{2V}{3} \right)^2 + \frac{1}{2} 2C \left( \frac{V}{3} \right)^2 = \frac{CV^2}{3}$$

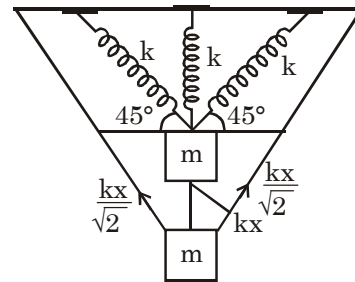
$$\Rightarrow \Delta U = \frac{CV^2}{3} - \frac{CV^2}{4} = \frac{CV^2}{12}$$

$$W_b = \Delta U + \text{Heat loss}$$

$$\frac{CV^2}{6} = \frac{CV^2}{12} + \text{Heat loss}$$

$$\Rightarrow \text{Heat loss} = \frac{CV^2}{12}$$

10. **Ans. (2)**



**Sol.**

Net vertical force

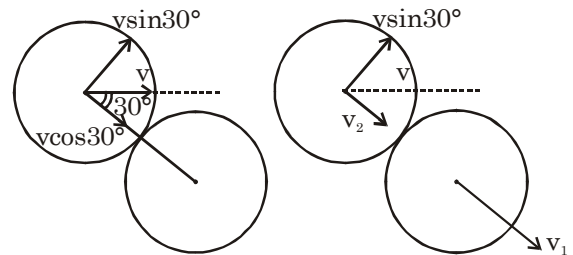
$$= kx + \frac{kx}{\sqrt{2}} \cos 45^\circ \times 2 = 2kx = ma$$

$$a = \frac{2k}{m} x$$

$$\Rightarrow \omega = \sqrt{\frac{2k}{m}}$$

$$\tau = 2\pi \sqrt{\frac{m}{2k}}$$

11. **Ans. (4)**



**Sol.**

$$m v \cos 30^\circ = m v_2 + 2m v_1$$

$$e = \frac{1}{2} = \frac{v_1 - v_2}{v \cos 30^\circ}$$

$$\text{on solving } v_1 = \frac{\sqrt{3}v}{4}$$

12. **Ans. (3)**

13. **Ans. (3)**

$$\text{Sol. } i_s R_s = i_g R_g$$

$$\frac{20 \times 50}{1000} = i_s \times 0.01$$

$$i_s = 100 \text{ A}$$

14. **Ans. (2)**

$$\text{Sol. } v_{\max} = v_m + v_c$$

$$v_{\min} = v_c - v_m$$

$$\text{modulation index} = \frac{v_m}{v_c} = \frac{v_{\max} - v_{\min}}{v_{\max} + v_{\min}}$$

15. **Ans. (4)**

$$\text{Sol. After passing through first } I = \frac{I_0}{2}$$

$$\frac{I_0}{4} = \frac{I_0}{2} \cos^2 \phi$$

$$\Rightarrow \cos^2 \phi = \frac{1}{2}$$

$$\cos \phi = \frac{1}{\sqrt{2}}$$

$$\Rightarrow \phi = 45^\circ$$

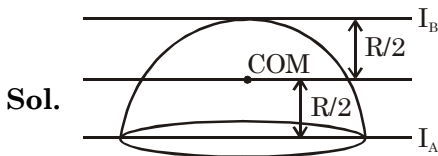
16. **Ans. (1)**

**Sol.** Initially  $\frac{R_1}{R_2} = \frac{2}{3} = \frac{\ell}{100 - \ell} \Rightarrow \ell = 40 \text{ cm}$

Now  $\frac{R_2}{R_1} = \frac{3}{2} = \frac{\ell}{100 - \ell} \Rightarrow \ell = 60 \text{ cm}$

shift = 20 cm

17. **Ans. (2)**



$$I_A = I_B = I_{CM} + M \left( \frac{R}{2} \right)^2$$

18. **Ans. (4)**

**Sol.** Since initial momentum is zero. So final momentum is also zero. So momentum of hydrogen atom and photon will be equal.

19. **Ans. (4)**

**Sol.** Resolving power  $\propto \frac{a}{\lambda f}$

a : aperture

$\lambda$  : wavelength

f : focal length

By immersing objective lens in oil, resolving power increases.

20. **Ans. (4)**

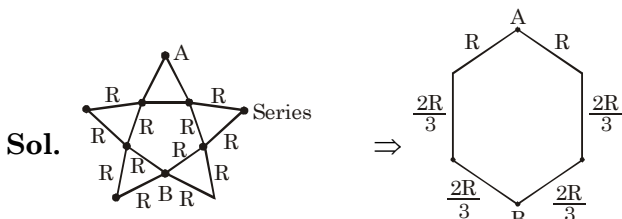
**Sol.** Powerless across circuit is maximum when  $R = X_L = 10 \Omega$

$$P_{\max} = \frac{V_{\text{rms}}^2}{2R} = \frac{V_0^2}{4R} = \frac{(20)^2}{4 \times 10} = 10 \text{ W}$$

21. **Ans. (3)**

**Sol.** Stopping distance =  $\frac{u^2}{2a} = \frac{(20)^2}{2(5)} = 40 \text{ m}$

22. **Ans. (1)**



23. **Ans. (2)**

**Sol.**  $v = 8 \text{ m/s} = R\omega$

$$\Rightarrow \omega = 4 = t^2 - 4t + 8$$

$$t^2 - 4t + 4 = 0$$

$$\Rightarrow t = 2 \text{ sec}$$

24. **Ans. (3)**

**Sol.**  $\text{KE} \propto e^2 \cdot (Ze)^2$

if e alone is doubled, charge on nucleus

i.e. (Ze) will remain constant

$\Rightarrow$  K.E. becomes 4 times.

25. **Ans. (1)**

**Sol.**  $R = 50 \Omega$

$$X_L = \omega L = 50 \Omega$$

$$X_C = \frac{1}{\omega C} = 100 \Omega$$

$$\Rightarrow Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$Z = 50\sqrt{2} \Omega$$

$$I_{\text{rms}} = \frac{V_{\text{rms}}}{Z} = \frac{200/\sqrt{2}}{50\sqrt{2}} = 2 \text{ A}$$

26. **Ans. (3)**

**Sol.**  $TP^{-1/3} = \text{constant}$

$$PVP^{-1/3} = \text{constant}$$

$$PV^{3/2} = \text{constant}$$

$$\Rightarrow x = \frac{3}{2}, \gamma = \frac{5}{3}$$

$$C = \frac{R}{\gamma - 1} + \frac{R}{1 - x} = \frac{3R}{2} + \frac{R}{1 - \frac{3}{2}} = -\frac{R}{2}$$

$\therefore$  C is negative

$$\Delta Q = nC\Delta T$$

$\Rightarrow$  if  $\Delta Q$  is +ve,  $\Delta T$  is -ve

$\Rightarrow$  temperature will decrease

27. **Ans. (2)**

**Sol.** If length halved, area is doubled

$$\Rightarrow \text{Breaking stress} = \frac{W}{A} = \frac{W'}{2A}$$

to break new wire load  $W' = 2W$

on applying W, new wire will not break.

28. **Ans. (4)**

**Sol.** III<sup>rd</sup> overtone

$$f = \frac{4V}{2L} = \frac{2V}{L} = 2 \sqrt{\frac{200}{5/1000}} = 2(200)$$

$$f = 400 \text{ Hz}$$

29. **Ans. (1)**

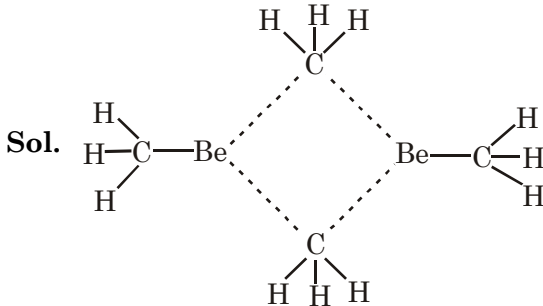
**Sol.** Momentum is conserved in all types of collision.

30. Ans. (2)

31. Ans.(1)

32. Ans.(3)

33. Ans.(2)



$$3c-2e = 2$$

$$2c-2e = 14$$

34. Ans.(2)

35. Ans.(2)

36. Ans.(1)

Sol.  $N \Rightarrow 1s^2 2s^2 2p^3 \Rightarrow N^+ \Rightarrow 1s^2 2s^2 2p^2$

$O = 1s^2 2s^2 2p^4 \Rightarrow O^+ \Rightarrow 1s^2 2s^2 2p^3$

$NO \Rightarrow \sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi_{2py}^2 = \pi_{2pz}^2, \sigma_{2px}^2, \pi_{2py}^{*1} = \pi_{2pz}^{*0}$

37. Ans.(4)

38. Ans.(4)

39. Ans.(2)

40. Ans.(3)

41. Ans.(1)

42. Ans.(3)

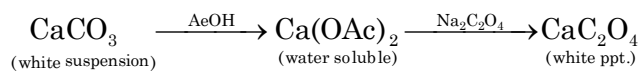
Sol. Van-Arkel process  $\Rightarrow$  Ti, Hf, Zr, B  
Mond's process  $\Rightarrow$  Ni

43. Ans. (1)

44. Ans.(4)

45. Ans.(4)

Sol.



46. Ans. (2)

47. Ans.(1)

48. Ans.(1)

Sol. (1) In f-block on moving from left to right due to lanthanide contraction size decreases, hence E.N. increases so acidic nature of hydroxides increases.

(2)  $\text{C}_2^{2-}$  on hydrolysis gives  $\text{C}_2\text{H}_2$

(3) & (4) f-block elements uses

49. Ans. (3)

50. Ans. (2)

51. Ans. (1)

Sol.  $\text{Zn} = [\text{Ar}]3d^{10} 4s^2 \Rightarrow \text{Zn}^+ \Rightarrow [\text{Ar}]3d^{10} 4s^1$

$\text{Ca} = [\text{Ar}]4s^2 \Rightarrow \text{Ca}^+ \Rightarrow [\text{Ar}]4s^1$

$\text{Cr} = [\text{Ar}]3d^5 4s^1 \Rightarrow \text{Cr}^+ \Rightarrow [\text{Ar}]3d^5$

$\text{Cu} = [\text{Ar}]3d^{10} 4s^1 \Rightarrow \text{Cu}^+ \Rightarrow [\text{Ar}]3d^{10}$

52. Ans. (3)

53. Ans. (2)

54. Ans. (1)

Sol. After sharing all valence electrons, when central atom completes its octet (without any lone pairs), then it is called electron precised hydrides.

55. Ans. (3)

56. Ans. (3)

57. Ans. (4)

Sol.  $[\text{Zn}(\text{en})_2]$   $[\text{Zn}(\text{OH})_4]$

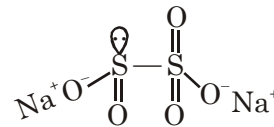
$[\text{Zn}(\text{en})(\text{OH})_2]$   $[\text{Zn}(\text{en})(\text{OH})_2]$  not possible

58. Ans. (1)

59. Ans. (1)

60. Ans. (1)

Sol.  $2\text{NaHSO}_3 \xrightarrow{-\text{H}_2\text{O}} \text{Na}_2\text{S}_2\text{O}_5$



61. Ans. (4)

62. Ans. (2)

$$|(a + ib)z - z| = |(a + ib)z|$$

$$|z| |a - 1 + ib| = |z| |a + ib|$$

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

$$\text{Now } a^2 + b^2 = 100$$

$$\Rightarrow b^2 = \frac{399}{4}$$

$$\Rightarrow p + q = 399 + 4 = 403$$

63. Ans. (3)

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

$$\Rightarrow x = 1 \pm a$$

$$\text{Let } f(x) = x^2 - 2(a + 1)x + a(a - 1)$$

$$f(a + 1) < 0$$

$$\Rightarrow (a + 1)^2 - 2(a + 1)^2 + a(a - 1) < 0$$

$$\Rightarrow -a^2 - 2a - 1 + a^2 - a < 0$$

$$\Rightarrow a > -\frac{1}{3} \quad \dots\dots(1)$$

$$f(1-a) < 0$$

$$(1-a)^2 - 2(a+1)(1-a) + a(a-1) < 0$$

$$\Rightarrow (a-1)[a-1+2a+2+a] < 0$$

$$\Rightarrow (a-1)(4a+1) < 0$$

$$\Rightarrow a \in \left(-\frac{1}{4}, 1\right) \quad \dots(2)$$

From (1), (2)  $\Rightarrow a \in \left(-\frac{1}{4}, 1\right)$

64. Ans. (4)

As  $AA^T = I_n \Rightarrow A$  is orthogonal  
 $\Rightarrow \det A \neq 0 \Rightarrow A$  is non-singular.

65. Ans. (3)

$$\Delta = \begin{vmatrix} 1 & 1 & -a \\ 2 & a & 1 \\ a & 1 & -1 \end{vmatrix} = 1(-a-1) - 1(-2-a) - a(2-a^2)$$

$$= a^3 - 2a + 1 = (a-1)(a^2 + a - 1)$$

$$= (a-1) \left( a - \frac{-1-\sqrt{5}}{2} \right) \left( a - \frac{-1+\sqrt{5}}{2} \right)$$

For  $\Delta = 0$

$$a = 1, \frac{-1 \pm \sqrt{5}}{2}$$

for each value system has no solution.

66. Ans. (1)

67. Ans. (4)

$$\sum_{0 \leq i < j \leq n} i \binom{n}{j} = \frac{n(n-1)}{2} \sum_{k=0}^n \binom{n-2}{k}$$

$$= \frac{n(n-1)}{2} 2^{n-2} = n(n-1)2^{n-3}$$

68. Ans. (1)

$$S_k = \sum a_1 a_2 \dots a_k \text{ and } S_{n-k} = \sum a_1 a_2 \dots a_{n-k}$$

$$= a_1 a_2 \dots a_n \sum \frac{1}{a_1 a_2 \dots a_k}$$

Now apply  $AM \geq HM$

$$\frac{\sum a_1 a_2 \dots a_k}{\binom{n}{k}} \geq \frac{\binom{n}{k}}{\sum \frac{1}{a_1 a_2 \dots a_k}}$$

$$\Rightarrow \frac{S_k}{\binom{n}{k}} \geq \frac{\binom{n}{k} (a_1 a_2 \dots a_n)}{S_{n-k}}$$

$$\Rightarrow S_k S_{n-k} \geq \binom{n}{k}^2 (a_1 a_2 \dots a_n)$$

69. Ans. (3)

$$T_r = \frac{\tan 2^{r-1}}{\cos 2^r} = \tan 2^r - \tan 2^{r-1}$$

$$\Rightarrow \sum_{r=1}^{100} T_r = \tan 2^{100} - \tan 1$$

70. Ans. (1)

$$\lim_{x \rightarrow \infty} \left( \frac{a^{1/x} + b}{c} \right)^x = \begin{cases} 0, & c > b+1 \\ a^{1/c}, & c = b+1 \\ \infty, & c < b+1 \end{cases}$$

$$\Rightarrow (b+1) \log_a d = 1$$

71. Ans. (1)

$$f(x) = \begin{cases} 0, & x \in [0, 1) \\ x, & x \in (1, 2] \\ 2(x-1), & x \in (2, 3) \end{cases}$$

$f(x)$  is discontinuous at  $x = 1$ , hence it is not differentiable at that point.

At  $x = 2$

$$LHD = 1 \text{ and } RHD = 2$$

$\Rightarrow f(x)$  is not differentiable at  $x = 2$ .

72. Ans. (2)

$$\text{Given } 2x^2 + y^2 = 12$$

$$\text{So, } 4x + 2yy' = 0 \Rightarrow y' = -\frac{2x}{y}$$

$$\Rightarrow \text{Slope of tangent} = -2$$

$$\Rightarrow \text{Slope of normal} = \frac{1}{2}$$

Hence, equation of normal is  $2y = x + 2$

Solving with the ellipse

$$x = \frac{-22}{9} \text{ and } y = \frac{-2}{9}$$

73. Ans. (4)

$f(x)$  is periodic with period  $\pi$ .

$$\text{Let } x \in \left(0, \frac{\pi}{6}\right)$$

$$f(x) = \lim_{n \rightarrow \infty} \frac{(2 \sin x)^{2n}}{3^n - (2 \cos x)^{2n}}$$

$$= \lim_{n \rightarrow \infty} \frac{(2 \tan x)^{2n}}{\left(\frac{\sqrt{3}/2}{\cos x}\right)^{2n} - 1} \text{ does not}$$

exist when  $x$  lies in left neighbourhood of  $\frac{\pi}{6}$

74. **Ans. (1)**

$$\int e^{x^2} \left( 2 - \frac{1}{x^2} \right) dx = \int e^{x^2} \left( 2x \cdot \frac{1}{x} - \frac{1}{x^2} \right) dx$$

$$= \frac{e^{x^2}}{x} + C$$

So,  $f(x) = \frac{1}{x}$

75. **Ans. (4)**

Second integral vanishes  
or its integrand is odd function.  
Now,  $\cos x + \cos 3x + \cos 5x + \cos 7x$   
 $= \frac{\cos 4x \sin 4x}{\sin x}$

So,  $\left( \frac{\sin 8x}{\sin x} \right) \cos x = (1 + \cos 2x)$   
 $+ (\cos 4x + \cos 2x) + (\cos 6x + \cos 4x)$   
 $+ (\cos 8x + \cos 6x)$

Hence,  $\int_0^{\pi/2} \sin 8x \cot x dx = \frac{\pi}{2}$

76. **Ans. (1)**

$$\frac{2b^2}{a} = 2ae \Rightarrow a^2(1 - e^2) = a^2e$$

$$\Rightarrow e^2 + e - 1 = 0 \Rightarrow e = \frac{\sqrt{5} - 1}{2}$$

$$= 2\sin 18^\circ$$

77. **Ans. (3)**

$$\frac{1}{y(\ln y)^2} \frac{dy}{dx} + \frac{1}{\ln y} \times \frac{1}{x} = \frac{1}{x^2}$$

Put  $\frac{1}{\ln y} = t$ , So,  $\frac{-1}{y(\ln y)^2} \frac{dy}{dx} = \frac{dt}{dx}$

Hence, DE becomes

$$\frac{dt}{dx} - \frac{t}{x} = \frac{-1}{x^2} \Rightarrow \text{IF} = \frac{1}{x}$$

$$\text{So, } \frac{t}{x} = -\int \frac{1}{x^3} dx + C = \frac{1}{2x^2} + C$$

$$\Rightarrow \frac{1}{\ln y} = \frac{1}{2x} + Cx$$

78. **Ans. (2)**

Required number of tetrahedrons  
 $= {}^3C_3 \times {}^3C_1 + {}^3C_2 \times {}^3C_2 + {}^3C_1 \times {}^3C_3 = 15$

79. **Ans. (3)**

Put  $y = 9$  in given pair of straight lines  
 $18x^2 - 81x + 81 = 0$   
 $\Rightarrow x = 3, \frac{3}{2}$

So, we have three vertices  $(0, 0)$ ,  $(3, 9)$   
and  $\left(\frac{3}{2}, 9\right)$ .

Hence  $\Delta = \frac{27}{4}$

80. **Ans. (3)**

$C_1(0, 0)$  and  $r_1 = 2$

Also,  $C_2(4, 4)$  and  $r_2 = 5$

Since,  $c_1c_2 = 4\sqrt{2}$

$\Rightarrow |r_1 - r_2| < c_1c_2 < r_1 + r_2$

$\Rightarrow$  Circles are intersecting.

$\Rightarrow$  Two direct common tangents exist.

81. **Ans. (3)**

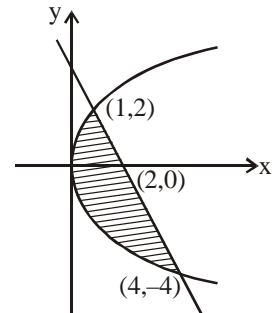
Required area

$$= \int_{-4}^2 \left( \frac{4-y}{2} - \frac{y^2}{4} \right) dy$$

$$= \left( 2y - \frac{y^2}{4} - \frac{y^3}{12} \right)_{-4}^2$$

$$= 2(2+4) - \frac{1}{4}(4-16) - \frac{1}{12}(8+64)$$

$$= 12 - (-3) - 6 = 9 \text{ sq. units}$$



82. **Ans. (1)**

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

Slope of normal is  $-\frac{a^2}{2b^2}$ .

$\therefore$  Equation of normal at  $P(6, 3)$  is

$$y - 3 = -\frac{a^2}{2b^2}(x - 6)$$

at  $(10, 0) \Rightarrow -3 = -\frac{a^2}{2b^2}(10 - 6)$

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

$$\therefore e^2 = 1 + \frac{b^2}{a^2} = 1 + \frac{2}{3} = \frac{5}{3}$$

$$\therefore e = \sqrt{\frac{5}{3}}$$

83. **Ans. (4)**

$$4 + \alpha + 2 = 0 \Rightarrow \alpha = -6$$

Also,  $x = 2\lambda + 1$ ,  $y = \alpha\lambda - \alpha = -6\lambda + 6$  and

$$z = 2\lambda + \beta.$$

lies on the plane  $2x + y + z = 5$

$$\Rightarrow 4\lambda + 2 - 6\lambda + 6 + 2\lambda + \beta = 5$$

$$\Rightarrow \beta = -3$$

$$\text{So } \alpha + \beta = -9$$

84. **Ans. (2)**

Family of plane is

$$(2x + 3y + 4z + 5) + \lambda(x + y + z - 5) = 0$$

$$\Rightarrow (2 + \lambda)x + (3 + \lambda)y + (4 + \lambda)z + (5 - 5\lambda) = 0$$

$$\text{So } 2 + \lambda + 3 + \lambda + 4 + \lambda = 0 \Rightarrow \lambda = -3.$$

$$\text{So, required plane is } -x + z + 20 = 0$$

$$x - z = 20$$

85. **Ans. (1)**

$$|\vec{c} - \vec{a}| = \sqrt{14}$$

$$\Rightarrow |\vec{c}|^2 + |\vec{a}|^2 - 2\vec{c} \cdot \vec{a} = 14 \quad \dots(1)$$

$$\vec{a} \cdot \vec{c} + 2|\vec{c}| = 0$$

$$\Rightarrow |\vec{a}| \cdot |\vec{c}| \cdot \cos \theta + 2|\vec{c}| = 0$$

$$\Rightarrow |\vec{c}| \cdot (|\vec{a}| \cdot \cos \theta + 2) = 0$$

$$\Rightarrow \cos \theta = -\frac{2}{3}, \text{ given } |\vec{a}| = 3.$$

from (i)

$$\Rightarrow |\vec{c}|^2 + 9 - 2|\vec{c}| \cdot |\vec{a}| \cdot \left(-\frac{2}{3}\right) - 14 = 0$$

$$\Rightarrow |\vec{c}|^2 + 4|\vec{c}| - 5 = 0 \Rightarrow |\vec{c}| = 1, -5$$

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & -2 \\ 1 & 1 & 0 \end{vmatrix} = 2\hat{i} - 2\hat{j} + \hat{k}$$

$$|(\vec{a} \times \vec{b}) \times \vec{c}| = |(\vec{a} \times \vec{b})| \cdot |\vec{c}| \cdot \sin \theta$$

$$= 3 \cdot 1 \times \frac{1}{2} = \frac{3}{2}$$

86. **Ans. (4)**

Required probability

$$= \frac{{}^{13}C_3}{{}^{15}C_3} = \frac{\frac{13 \times 12 \times 11 \times 10!}{3! \times 10!}}{\frac{15 \times 14 \times 13 \times 12!}{3! \times 12!}}$$

$$= \frac{13 \times 12 \times 11}{15 \times 14 \times 13} = \frac{12 \times 11}{15 \times 14} = \frac{22}{35}$$

87. **Ans. (2)**

New mean

$$= \frac{x_1 + 1 + x_2 + 2 + x_3 + 3 + x_4 + 4 + \dots + x_{10} + 10}{10}$$

$$= \frac{\sum x_i + \frac{10 \times 11}{2}}{10} = 3 + \frac{11}{2} = \frac{17}{2}$$

88. **Ans. (1)**

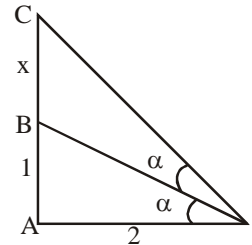
$$\tan \alpha = \frac{1}{2}$$

$$\tan 2\alpha = \frac{1+x}{2}$$

$$= \frac{2 \times \frac{1}{2}}{1 - \frac{1}{4}} = \frac{1+x}{2}$$

$$= \frac{1 \times 4}{3} = \frac{1+x}{2}$$

$$\Rightarrow 1+x = \frac{8}{3} \Rightarrow x = \frac{5}{3}$$



89. **Ans. (3)**

$$\underline{x > 0}$$

$$\cos^{-1}x + \cos^{-1}2x = \pi.$$

$$2x = \cos(\pi - \cos^{-1}x)$$

$$= -\cos(\cos^{-1}x)$$

$$= -x \Rightarrow x = 0$$

$$\underline{x < 0}$$

$$\cos^{-1}(-x) + \cos^{-1}(-2x) = \pi$$

$$\pi - \cos^{-1}x + \pi - \cos^{-1}(2x) = \pi$$

$$\cos^{-1}x + \cos^{-1}(2x) = \pi$$

90. **Ans. (1)**

Negative of  $\sim p \vee (p \vee (\sim q))$  is

$$p \wedge \sim(p \vee \sim q)$$

$$\equiv p \wedge \sim q \wedge q$$

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