Paper Code : 0000CJA103118014

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

path to success

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

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	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										

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SOLUTION

1. Ans. (2)

Sol. In diffraction pattern

First minima = $\frac{\lambda D}{a}$

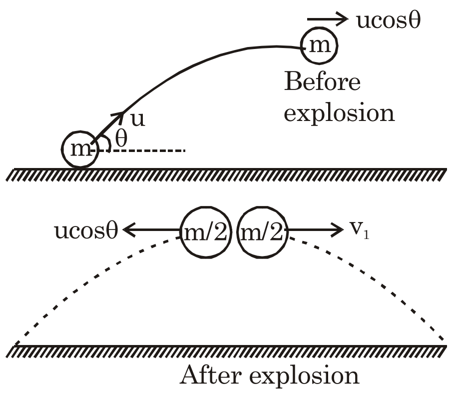
First maxima = $\frac{3\lambda D}{2a}$

$\Rightarrow \frac{3\lambda D}{2a} = \frac{(540)D}{a}$

$\Rightarrow \lambda = 360$ nm

2. Ans. (3)

Sol.



from momentum conservation

$mu\cos\theta = -\frac{m}{2}u\cos\theta + \frac{m}{2}v_1$

$v_1 = 3u\cos\theta$

$\lambda_D = \frac{h}{mv}$

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

3. Ans. (2)

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

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

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

$V_{CE} = 3V = 11 - I_C R_C$

$3 = 11 - 32 \times 10^{-4} R_C$

$\Rightarrow R_C = \frac{8}{32 \times 10^{-4}}$

$R_C = 2.5$ kΩ

4. Ans. (2)

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

$\frac{dI}{I} = \frac{dM}{M} + 2\frac{dR}{R}$

$= 1\% + 2(1.5\%) = 1\% + 3\% = 4\%$

5. Ans. (4)

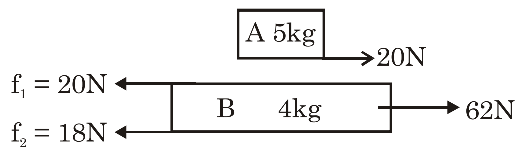
Sol. Magnetic field cannot change speed and since magnetic field is along z axis, velocity cannot be in z axis at any instant i.e.. it cannot have $\hat{k}$ component.

6. Ans. (2)

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

7. Ans. (3)

Sol.



$\Rightarrow$ $a_A = 4$ m/s² (Right)

$a_B = 6$ m/s² (Right)

$a_{A/B} = 2$ m/s² towards left

$\Rightarrow$ $16 = \frac{1}{2} 2\, t^2 \Rightarrow t = 4$ sec

8. Ans. (3)

Sol. velocity when string becomes horizontal

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

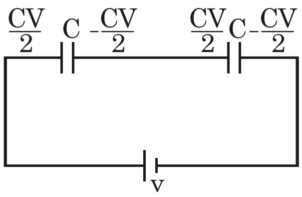
$v = \sqrt{40}$

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

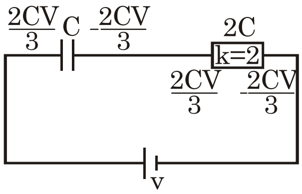
$\Rightarrow \; T = 40\text{ N}$

9. Ans. (1)

Sol.



initially



finally

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

$= \frac{CV}{6}$

$\Rightarrow$ 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

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

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

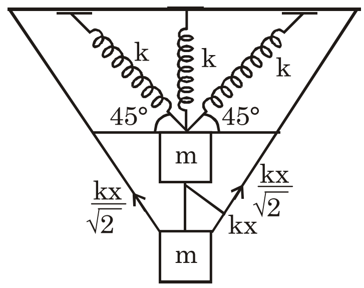
$W_b = \Delta U$ + Heat loss

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

$\Rightarrow$ Heat loss = $\frac{CV^3}{12}$

10. Ans. (2)

Sol.



Net vertical force

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

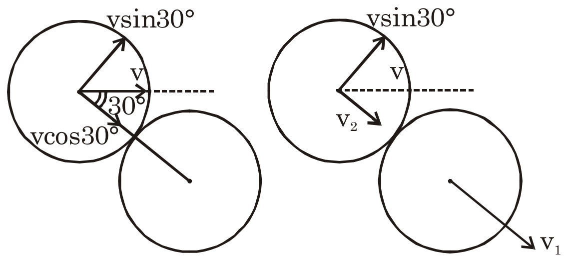
$a = \frac{2k}{m}x$

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

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

11. Ans. (4)

Sol.



$mv\cos 30 = mv_2 + 2mv_1$

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

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

12. Ans. (3)

13. Ans. (3)

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)

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

$v_{min} = v_c - v_m$

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

15. Ans. (4)

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

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

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

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

$\Rightarrow \phi = 45°$

16. Ans. (1)

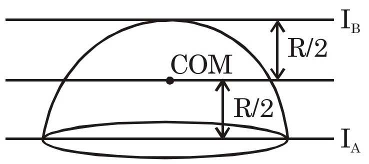
Sol. Initially $\frac{R_1}{R_2} = \frac{2}{3} = \frac{\ell}{100-\ell} \Rightarrow \ell = 40$ cm

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

shift = 20 cm

17. Ans. (2)

Sol.



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

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

λ : wavelength

f : focal length

By immersing objective lens in oil, resolving power increases.

20. Ans. (4)

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

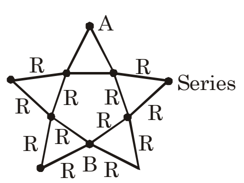
$P_{max} = \frac{V_{rms}^2}{2R} = \frac{V_0^2}{4R} = \frac{(20)^2}{4\times 10} = 10W$

21. Ans. (3)

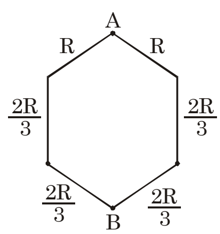
Sol. Stopping distance $= \frac{u^2}{2a} = \frac{(20)^2}{2(5)} = 40m$

22. Ans. (1)

Sol.



$\Rightarrow$



23. Ans. (2)

Sol. $v = 8$ m/s $= R\omega$

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

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

$\Rightarrow t = 2$sec

24. Ans. (3)

Sol. KE $\propto e^2.\ (Ze)^2$

if e alone is doubled, charge on nucleus i.e. (Ze) will remain constant

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

25. Ans. (1)

Sol. $R = 50\ \Omega$

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

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

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

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

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

26. Ans. (3)

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

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

$PV^{3/2}$ = constant

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

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

$\because$ C is negative

$\Delta Q = nC\Delta T$

$\Rightarrow$ if ΔQ is +ve, ΔT is –ve

$\Rightarrow$ temperature will decrease

27. Ans. (2)

Sol. If length halved, area is doubled

$\Rightarrow$ 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[rd] overtone

$f = \frac{4V}{2L} = \frac{2V}{L} = \frac{2}{1}\sqrt{\frac{200}{(5/1000)}} = 2(200)$

f = 400 Hz

29. Ans. (1)

Sol. Momentum is conserved in all types of collision.

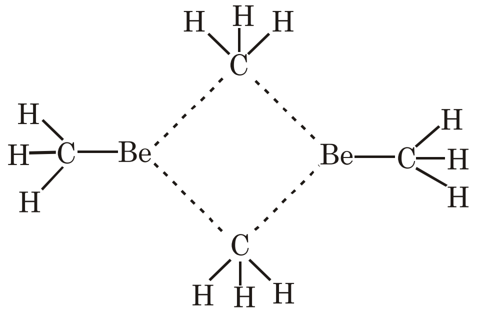
30. Ans. (2)

31. Ans.(1)

32. Ans.(3)

33. Ans.(2)

Sol.



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.

$$\underset{\text{(white suspension)}}{CaCO_3} \xrightarrow{AeOH} \underset{\text{(water soluble)}}{Ca(OAc)_2} \xrightarrow{Na_2C_2O_4} \underset{\text{(white ppt.)}}{CaC_2O_4}$$

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) C_2^{2-} on hydrolysis gives C_2H_2

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

49. Ans. (3)

50. Ans. (2)

51. Ans. (1)

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

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

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

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

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. $[Zn(en)_2]\ [Zn(OH)_4]$

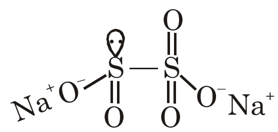
$[Zn(en)(OH)_2]\ [Zn(en)(OH)_2]$ not possible

58. Ans. (1)

59. Ans. (1)

60. Ans. (1)

Sol. $2NaHSO_3 \xrightarrow{-H_2O} Na_2S_2O_5$



61. Ans. (4)

62. Ans. (2)

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

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

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

Now $a^2 + b^2 = 100$

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

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

63. Ans. (3)

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

$\Rightarrow\ x = 1 \pm a$

Let $f(x) = x^2 - 2(a + 1)x + a(a - 1)$

$f(a + 1) < 0$

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

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

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

$f(1-a) < 0$

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

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

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

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

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

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

68. Ans. (1)

$S_k = \sum a_1a_2....a_k$ and $S_{n-k} = \sum a_1a_2....a_{n-k}$

$$= a_1a_2.......a_n \sum \frac{1}{a_1a_2....a_k}$$

Now apply AM $\geq$ HM

$$\frac{\sum a_1a_2......a_k}{\binom{n}{k}} \geq \frac{\binom{n}{k}}{\sum \frac{1}{a_1a_2.....a_k}}$$

$$\Rightarrow \frac{S_k}{\binom{n}{k}} \geq \frac{\binom{n}{k},(a_1a_2......a_n)}{S_{n-k}}$$

$$\Rightarrow S_kS_{n-k} \geq \binom{n}{k}^2 (a_1a_2.....a_n)$$

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)

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

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

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 and RHD = 2

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

72. Ans. (2)

Given $2x^2 + y^2 = 12$

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

$\Rightarrow$ Slope of tangent = –2

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

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

Solving with the ellipse

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

73. Ans. (4)

$f(x)$ is periodic with period π.

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

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

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

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

74. Ans. (1)

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

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

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

75. Ans. (4)

Second integral vanishes

or its integrand is odd function.

Now, cosx + cos3x + cos5x + cos7x

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

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

+ (cos4x + cos2x) + (cos6x + cos4x)

+ (cos8x + cos6x)

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

76. Ans. (1)

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

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

$=2\sin 18°$

77. Ans. (3)

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

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

Hence, DE becomes

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

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

$\Rightarrow \frac{1}{\ell ny}=\frac{1}{2x}+Cx$

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, $c_1c_2 = 4\sqrt{2}$

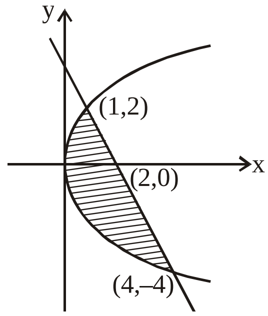
$\Rightarrow |r_1-r_2|<c_1c_2<r_1+r_2$

$\Rightarrow$ 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 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

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

$\Rightarrow \quad \beta = -3$

So $\alpha + \beta = -9$

84. Ans. (2)

Family of plane is

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

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

So $2 + \lambda + 3 + \lambda + 4 + \lambda = 0 \;\Rightarrow\; \lambda = -3.$

So, required plane is $-x + z + 20 = 0$

$x - z = 20$

85. Ans. (1)

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

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

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

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

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

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

from (i)

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

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

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

$$\left|(\vec{a}\times\vec{b})\times\vec{c}\right| = \left|(\vec{a}\times\vec{b})\right|.|\vec{c}|.\sin\theta$$

$$= 3.1 \times \frac{1}{2} = \frac{3}{2}$$

86. Ans. (4)

Required probability

$$= \frac{{}^{13}C_3}{{}^{15}C_3} = \frac{\dfrac{13\times12\times11\times10!}{3!\times10!}}{\dfrac{15\times14\times13\times12!}{3!\times12!}}$$

$$= \frac{13\times12\times11}{15\times14\times13} = \frac{12\times11}{15\times14} = \frac{22}{35}$$

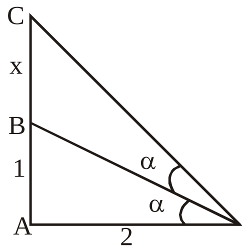
87. Ans. (2)

New mean

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

$$= \frac{\sum x_i + \dfrac{10\times11}{2}}{10} = 3 + \frac{11}{2} = \frac{17}{2}$$

88. Ans. (1)



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

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

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

$$= \frac{1\times4}{3} = \frac{1+x}{2}$$

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

89. Ans. (3)

<u>$x > 0$</u>

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

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

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

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

<u>$x < 0$</u>

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

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

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

90. Ans. (1)

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

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

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

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