



AVIRAL CLASSES

IIT-JEE | NEET | FOUNDATIONS

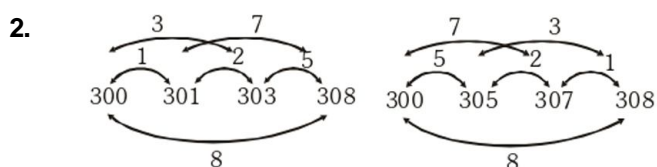
ULTIMATE TEST SERIES JEE MAIN -2020

XII TEST-03 ANSWER KEY

Test Date :22-03-2020

[PHYSICS]

1. $PV = nRT$ & $PV^2 = \text{constant} \Rightarrow V \propto \frac{1}{T}$
 \Rightarrow gas can expand only if it cools .
 As temperature decreases during expansion so internal energy will decrease.



3. $W_{\text{net}} = W_{1-2} + W_{2-3} + W_{3-4} + W_{4-1}$
 $= 0 + \mu R (T_3 - T_2) + 0 + \mu R (T_1 - T_4)$
 $= \mu R [T_3 - T_2 + T_1 - T_4] = 20 \text{ kJ}$

4. $V = \frac{\omega}{K} = \frac{\frac{\pi}{2} \times 8}{\frac{\pi}{2} \times \frac{1}{8}} = 64$

5. B

6. $A = 2$ and $KA = 8 \Rightarrow K = \frac{8}{2} = 4$

$$T = 2\pi \sqrt{\frac{M}{K}} = 2\pi \sqrt{\frac{0.01}{4}}$$

7. $n_1 = 256 \times \frac{V}{V - \frac{V}{20}} = 256 \times \frac{20}{19} = 269.5 \text{ Hz}$

$$n_2 = 256 \times \frac{V}{V + \frac{V}{20}} = 256 \times \frac{20}{21} = 243.8 \text{ Hz}$$

8. The force is determined from the relation

$$F = - \frac{dU}{dx} = - \frac{d}{dx} (2.5x^2 + 100)$$

$$F = - 5x \text{ newton}$$

The motion is simple harmonic because $F \propto -x$

compare the above relation with $F = - Kx$

$$\text{force constant } K = 5 \frac{\text{N}}{\text{m}}$$

Therefore time period

$$T = 2\pi \sqrt{\frac{0.2}{5}} = \frac{2\pi}{5} \approx 1.26 \text{ sec.}$$

9. $\frac{n_1}{n} = \sqrt{\frac{T_1}{T}} = \sqrt{\frac{15}{16}}$

$$n_1 = 320 \sqrt{\frac{15}{16}} \approx 310 \text{ Hz}$$

10. C

11.

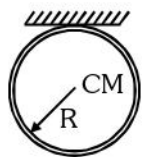
$$\text{slope} \propto \frac{1}{M_w} \quad (M = \text{const.})$$

12. $dU_I = dU_{II}$
 $\Delta Q_I - \Delta W_I = \Delta Q_{II} - \Delta W_{II}$
 $8 \times 10^5 - 6.5 \times 10^5 = 10^5 - \Delta W_{II}$
 $\Delta W_{II} = -0.5 \times 10^5 \text{ J}$
 work done on the gas = $0.5 \times 10^5 \text{ J}$

13. $v = \omega \sqrt{a^2 - x^2} \Rightarrow x = \sqrt{a^2 - \frac{v^2}{\omega^2}} \left(\because \omega^2 = \frac{k}{m} \right)$
 $x = \sqrt{a^2 - \frac{v^2 m}{k}} = \sqrt{(0.5)^2 - \frac{(0.4)^2 \times (10)}{(10)}}$
 $= \sqrt{0.25 - 0.16} = \sqrt{0.09} = 0.3 \text{ m}$

14. K.E. = $\frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2 - x^2)$
 at $x = 0$, K.E. = $\frac{1}{2}mv^2_{\text{max}} = \frac{1}{2}m\omega^2 A^2$
 at $x = \frac{A}{2}$, K.E. = $\frac{1}{2}mv^2 = \frac{1}{2}m\omega^2 \left[A^2 - \left(\frac{A}{2} \right)^2 \right]$
 $= \frac{3}{4} \left[\frac{1}{2}m\omega^2 A^2 \right] \Rightarrow \frac{KE_{x=0}}{KE_{x=A/2}} = \frac{4}{3}$

15. $I \propto A^2$
 $\therefore \frac{I_{\text{max}}}{I_{\text{min}}} = \frac{(A_1 + A_2)^2}{(A_1 - A_2)^2} = \frac{16}{4} = 4:1$

16.  $T = 2\pi \sqrt{\frac{\ell + \frac{K^2}{m}}{g}}$
 Here $\ell = R$, $MK^2 = MR^2 \Rightarrow K = R$
 $\Rightarrow T = 2\pi \sqrt{\frac{R+R}{g}} = 2\pi \sqrt{\frac{2R}{g}}$

17. $PV = \frac{M}{M_w}RT$
 $P \propto MT$
 $\Rightarrow \frac{P_1}{P_2} = \frac{M_1 T_1}{M_2 T_2}$
 $\Rightarrow \frac{720}{P_2} = \frac{M}{3M/4} \times \frac{313}{626}$
 $P_2 = 1080 \text{ kPa}$

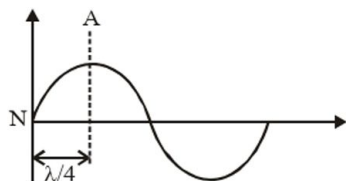
18. $\eta = \frac{W}{Q} = 1 - \frac{T_2}{T_1}$
 $= \frac{W}{6} = 1 - \frac{400}{500}$
 $\Rightarrow W = 1.2 \text{ Kcal}$

19. $\Delta Q = \Delta W + dU$
 $100 = 20 + dU$
 $dU = 80 \text{ J}$
 For Reverse
 $dU_r = -80$
 $\Rightarrow \Delta Q_r = \Delta W_r + dU_r$
 $-20 = \Delta W_r - 80$
 $\Delta W_r = 60 \text{ J}$

20. $\frac{Q}{t} = e_r \sigma A (T_4 - T_0^4)t$
 $= 0.4 \times 5.67 \times 10^{-8} \times 200 \times 10^{-4} [800^4 - 300^4]$
 $= 182 \text{ J/sec.}$

INTEGER

21.



$$n = \frac{1}{2\ell} \sqrt{\frac{T}{\pi r^2 d}}$$

22. D

$$23. \frac{E_T}{V} = \frac{3}{2} \quad P = \frac{3}{2} \times 2 \times 10^5 = 3 \times 10^5 \text{ J}$$

$$24. \quad n_1 \sim n_2 = 4$$

$$T_b = \frac{1}{n_1 - n_2} = \frac{1}{4} \text{ sec.}$$

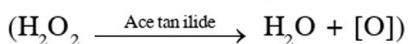
$$25. \quad \eta = \frac{W}{Q_1} = \frac{T_1 - T_2}{T_1}$$

$$\Rightarrow \frac{W}{1000} = \frac{684 - 342}{684}$$

$$\Rightarrow W = \dots$$

[CHEMISTRY]

26. Acetanilide act as negative catalyst for decomposition of H_2O_2

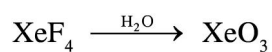


27. B
28. D
29. B
30. C
31. A
32. D
33. D
34. D
35. B
36. D
37. B
38. A

39. ALUM : $\text{M}'_2\text{SO}_4 \cdot \text{M}''_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ ($x = 24$)

40. B

41. D



42. on complete hydrolysis

43. A

44. D

45. A

INTEGER

46. 1

47. 4

48. 1

49. 1

50. 6

[MATHEMATICS]

51

Ans. (2)

$$PA \times PB = (PT)^2$$

where PT = length of tangent

$$(PT)^2 = (-1)^2 + 3^2 - 2(-1) + 4(3) - 8 = 16$$

$$P(A)P(B) = 16$$

$$\therefore AM \geq GM$$

$$PA + PB \geq 8$$

52 **Ans. (4)**

$$ax + by + c = 0$$

$$a + c = 2b \Rightarrow a - 2b + c = 0$$

$$x = 1, y = -2$$

$$(1, -2) = (\alpha, \beta)$$

$$(x - 1)^2 + (y + 2)^2 = \gamma$$

$$\Rightarrow x^2 + y^2 - 2x + 4y + 5 - \gamma = 0$$

$$\text{it is orthogonal to } x^2 + y^2 - 4x - 4y - 1 = 0$$

$$\Rightarrow 4 - 8 = 5 - \gamma - 1$$

$$\gamma = 8$$

$$\alpha + \beta + \gamma = 1 - 2 + 8 = 7$$

53 **Ans. (1)**

The normal at the extremities of focal chord meet at right angle. So orthocentre is the point of intersection of normals.

$$\text{If } P(at_1^2, 2at_1), Q(at_2^2, 2at_2) \text{ then } t_1 t_2 = -1.$$

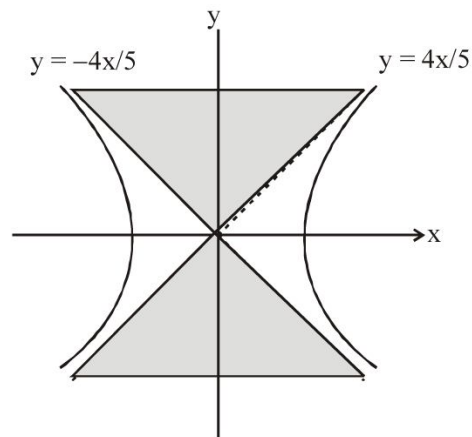
Point of intersection of normals

$$h = a(t_1^2 + t_2^2 + t_1 t_2 + 2)$$

$$k = -at_1 t_2 (t_1 + t_2)$$

54 **Ans. (2)**

Region where 2 tangents to two different branches can be drawn.



$$\therefore (1, 6), (1, 3)$$

But from (1, 6) 2 tangents to circle can be drawn

$$\therefore \text{Ans. (1, 3)}$$

55 **Ans. (2)**

$$\text{ends of L.R } \left(\pm ae, \pm \frac{b^2}{a} \right)$$

$$\Rightarrow \text{tangents are } \pm \frac{e}{a}x \pm \frac{1}{a}y = 1$$

$$\Rightarrow \text{Area} = \frac{2a^2}{e} - a^2 e^2$$

56. Ans. (2)

$$\lim_{x^2 \rightarrow a} \frac{b - \cos(x^2 - a)}{(x^2 - a) \sin(x^2 - a)}$$

Let $x^2 - a = t$

$$\lim_{t \rightarrow 0} \frac{b - \cos t}{t \sin(c(t+a) - a)}$$

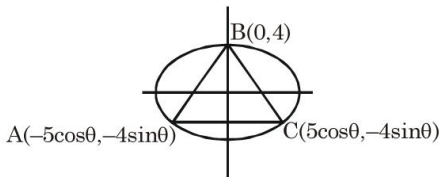
$$\Rightarrow \frac{b-1}{0} \Rightarrow b=1$$

$$\lim_{t \rightarrow 0} \frac{1 - \cos t}{t \sin(ct + a(c-1))} = \lim_{t \rightarrow 0} \frac{2 \sin^2 \frac{t}{2}}{t \sin(ct + a(c-1))}$$

$$\lim_{t \rightarrow 0} \frac{\sin \frac{t}{2}}{\sin(ct + a(c-1))} = \frac{0}{\sin a(c-1)} \Rightarrow c=1$$

$$\lim_{t \rightarrow 0} \frac{\sin \frac{t}{2}}{\sin t} = \frac{1}{2} \Rightarrow L = \frac{1}{2}$$

57. Ans. (3)

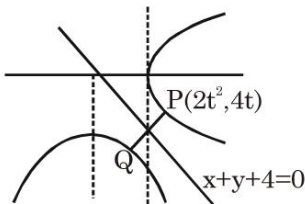


$$\text{Area} = \frac{1}{2} \cdot 10 \cos \theta (4 + 4 \sin \theta)$$

$$\frac{dA}{d\theta} = 0 \Rightarrow \theta = \frac{\pi}{6}$$

$$A_{\max} = 15\sqrt{3}$$

58. Ans. (1)



for minimum distance $\left. \frac{dy}{dx} \right|_P = -1$

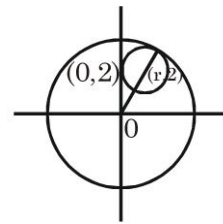
$$\Rightarrow t = -1$$

$$\Rightarrow \text{min distance} = PQ = 2\sqrt{2}$$

59. Ans. (2)

$$4 = \sqrt{r^2 + 4} + r$$

$$\Rightarrow r = \frac{3}{2}$$



60. Ans.(2)

Given conic C is parabola

focus : (1,-1)

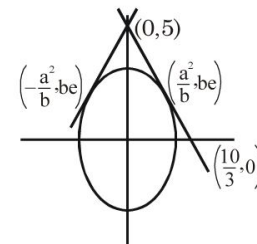
$$E : 3x - 4y = 0$$

minimum distance is \perp distance

$$\Rightarrow \text{distance} = \left| \frac{6+4}{5} \right| = 2$$

61. Ans. (4)

Let ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$



tangent $\frac{x}{b} + \frac{ye}{b} = 1$

$$\therefore \frac{b}{e} = 5$$

and $b = \frac{10}{3} \Rightarrow e = \frac{2}{3}$

$$\Rightarrow a^2 = \frac{500}{81} \therefore L.R = \frac{2a^2}{b} = \frac{100}{27}$$

62. **Ans. (2)**

If circle intersect at 4 points then

sum of x coor = 0

∴ Points (17,289), (-2,4), (13,169),(-28,784)

directrix is $y = -\frac{1}{4}$

sum of perpendicular distances

$$= \left(289 + \frac{1}{4}\right) + \left(4 + \frac{1}{4}\right) + \left(169 + \frac{1}{4}\right) + \left(784 + \frac{1}{4}\right) = 1247$$

63. **Ans. (3)**

Differentiate both sides wrt 'x',

$$(e-1)e^{xy} \left(\frac{xdy}{dx} + y \right) + 2x = e^{x^2+y^2} \left(2x + 2y \frac{dy}{dx} \right)$$

$$(e-1) \left(\frac{dy}{dx} \right) \Big|_{(1,0)} + 2 = e(2)$$

$$\frac{dy}{dx} \Big|_{(1,0)} = 2$$

64. **Ans. (4)**

$\alpha = 135^\circ$

$$\lim_{\theta \rightarrow \frac{3\pi}{4}} \frac{\tan \theta - 1}{\sin \theta + \cos \theta} = \frac{-2}{-1} = 2$$

65. **Ans. (3)**

$$h(x) = f(g(f(x)))$$

$$h'(x) = f'(g(f(x))) \cdot g'(f(x)) \cdot f'(x)$$

$$h'(2) = 64.$$

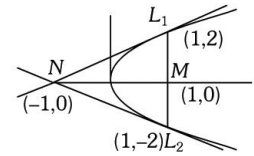
66. **B**

67. **-**

68. **A**

69. Equation to the tangent at (x_1, y_1) on the parabola $y^2 = 4ax$ is $yy_1 = 2a(x + x_1)$. In this case, $a = 1$

The co-ordinates at the ends of the latus rectum of the parabola $y^2 = 4x$ are $L(1,2)$ and $L_1(1,-2)$.



Equation of tangents at L and L_1 are $2y = 2(x + 1)$

and $-2y = 2(x + 1)$, which gives $x = -1, y = 0$.

Thus the required point of intersection is $(-1, 0)$.

70. Equation of focal chord for the parabola $y^2 = 4ax$, passes through the point $(au^2, 2au)$ and $(av^2, 2av)$

$$\Rightarrow y - 2au = \frac{2av - 2au}{av^2 - au^2} (x - au^2)$$

$$\Rightarrow y - 2au = \frac{2a(v-u)}{a(v-u)(v+u)} (x - au^2)$$

$$\Rightarrow y - 2au = \frac{2}{(v+u)} (x - au^2)$$

If this is focal chord, so it would pass through focus $(a,0)$.

$$\Rightarrow 0 - 2au = \frac{2}{v+u} (a - au^2) \Rightarrow -uv - u^2 = 1 - u^2,$$

$$\therefore uv + 1 = 0.$$

INTEGER

71. **Ans. (4)**

$$\lim_{x \rightarrow \frac{1}{2}} \frac{ax^2 + bx + c}{(2x-1)^2} = \frac{1}{2}$$

$$\Rightarrow ax^2 + bx + c = \frac{1}{2}(2x-1)^2$$

$$\Rightarrow ax^2 + bx + c = 2x^2 - 2x + \frac{1}{2}$$

$$\therefore a = 2, b = -2, c = \frac{1}{2}$$

$$\therefore \lim_{x \rightarrow 2} \frac{(x-2)(x+2) \left(x - \frac{1}{2} \right)}{x-2} = 4 \times \frac{3}{2} = 6$$

72. **Ans. (4)**

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

$$\frac{d}{dx} \left[\frac{2x^3 + 3x^2 + x - 3}{x^2 + x - 2} \right] = 2 - \frac{1}{(x - 1)^2} - \frac{3}{(x + 2)^2}$$

$$\therefore A = 2, B = -1, C = -3$$

$$\therefore A + B + C = 0$$

73. Solving $3x + 4y = 9, y = mx + 1$ we get $x = \frac{5}{3 + 4m}$

x is an integer if $3 + 4m = 1, -1, 5, -5$

$\therefore m = \frac{-2}{4}, \frac{-4}{4}, \frac{2}{4}, \frac{-8}{4}$. So, m has two integral values.

74. The given lines are $\pm x \pm y = 1$

i.e. $x + y = 1, x - y = 1, x + y = -1$ and $x - y = -1$

These lines form a quadrilateral whose vertices are $A(-1, 0), B(0, -1), C(1, 0)$ and $D(0, 1)$

Obviously $ABCD$ is a square.

Length of each side of this square is $\sqrt{1^2 + 1^2} = \sqrt{2}$

Hence area of square is $\sqrt{2} \times \sqrt{2} = 2 \text{ sq. units}$

The co-ordinates of foci are $(\pm ae, 0)$. Here $a = 4, b = 3$

$$\therefore b^2 = a^2(1 - e^2) \Rightarrow 9 = 16(1 - e^2) \Rightarrow \frac{9}{16} = 1 - e^2$$

75. $\Rightarrow e = \pm \sqrt{\frac{7}{4}}$; \therefore Points are $(\pm\sqrt{7}, 0)$.

$$\therefore \text{Radius} = \sqrt{(\sqrt{7} - 0)^2 + (0 - 3)^2} = \sqrt{7 + 9} = \sqrt{16} = 4.$$