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CLASSROOM CONTACT PROGRAMME
(ACADEMIC SESSION 2014-2015)

TARGET : JEE (Main) 2015 | **LEADER & ENTHUSIAST COURSE : SCORE**

ALLEN JEE (Main) TEST | **DATE : 18 - 03 - 2015**

ANSWER KEY

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

SOLUTION

1. Ans. (4)

Sol. When a battery is connected between A and B, no current will pass through the upper triangle and the equivalent resistance between A and B is $4\,\Omega$.

2. Ans. (4)

Sol. The electric field is produced at S by the induced charge on the surface of the conductor and it will be unaffected due to movement of charge within the cavity.

3. Ans. (3)

Sol. $TP^{-2/5}$ = constant; Using gas equation we can write $PV^{5/3}$ = constant

It implies $\gamma = \frac{5}{3}$; The process is adiabatic, thus

$Q = 0$

4. Ans. (2)

Sol. $H = \int_0^4 \frac{E^2}{R}\,dt = \int_0^4 \frac{(6t)^2}{12}dt = 64\,J$

5. Ans. (4)

Sol. There will be no current through the branch BC. and $i_{AB} = i_{AC}$

and net magnetic field due to AB & $AC = 0$.

Because AB produces magnetic field inwards & AC produces magnetic field outwards at O.

Net magnetic field is zero.

6. Ans. (3)

Sol. Loudness (in dB) $= 10\log_{10}\left(\frac{I}{I_o}\right) = 10$

$\Rightarrow I = 10\,I_o$

When all four sources are sounded together total intensity $I_{max} = 4I = 40\,I_o$

$\therefore$ Loudness in (dB) $= 10\log_{10}\left(\frac{40I_o}{I_o}\right)$

$= 10\log_{10}(40) \approx 16$ dB

7. Ans. (3)

Sol. Since $V_{liquid} > V_{Air}$

i.e. liquid is rarer than air for sound waves

Angle of total internal reflection (critical angle)

$= \sin^{-1}\left(\frac{v_{liq}}{v_{air}}\right) = \sin^{-1}\left(\frac{1}{2}\right) = 30^o$

Hence sound wave is totally reflected back.

8. Ans. (2)

Sol. PV^γ = constant $\Rightarrow \ln P = \ln C - \gamma \ln V$

$\Rightarrow \gamma_x > \gamma_y \Rightarrow f_1 < f_2$

9. Ans. (2)

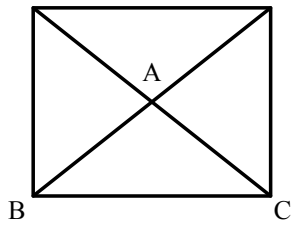
Sol. Initial $V_{cm} = \frac{4\times1+2\times0}{1+2} = \frac{4}{3}$ m/s upwards

a_{cm} = g downward

$\therefore$ centre of mass first moves up and then comes down.

10. Ans. (3)

Sol.



M.I. of the square plate (mass = 4M)

$= \frac{1}{6}\,4M\,.\,(a)2$

$\therefore$ M.I. of the Δ plate ABC $= \frac{1}{6}Ma^2$

11. Ans. (2)

Sol. Applying KVL, we get

$100 - \frac{120}{4} - \frac{q_2}{4} = 0 \Rightarrow q_2 = 280\ \mu C$

Also $q_2 + q_3 = q_1 \Rightarrow q_3 = -160\ \mu C$

12. Ans. (3)

Sol. $N = (F + Mg)\cos\theta$

$\therefore$ Friction force $= \mu_k (F + mg)\cos\theta$

13. Ans. (1)

Sol. When wave travels in a medium then the displacement and velocity at a point varies with time. Hence, for an elemental length, its K. E. and P. E., both vary with time. But the total energy remains constant.

14. Ans. (2)

Sol. Focal length of each part will be 2f

15. Ans. (1)

Sol. Path difference $= \left(\sqrt{2}\ \ d - d\right)$ should be equal to $t(\mu - 1)$

$\Rightarrow t = 2\left(\sqrt{2} - 1\right)d$ in front of S_1

16. Ans. (3)

Sol. Filament current is increased

$\Rightarrow$ more electrons are emitted

$\Rightarrow$ intensity increases

Potential difference decreases

$\Rightarrow \lambda_{min} = \frac{hc}{eV}$ increases

17. Ans. (4)

Sol. Each block completes half the oscillation

18. Ans. (1)

Sol. $|r - i| = 0$

$\Rightarrow \mu_1 = \mu_2 \Rightarrow k_o = 1$

For values of $k < 1$, T.I.R. can occur

at $k = k_1$, $r = 90^o$

$\Rightarrow |r - i| = \frac{\pi}{6}$

Also $\frac{\sin\frac{\pi}{3}}{\sin 90^o} = \frac{\mu_1}{\mu_2} = k_1$

$\Rightarrow k_1 = \frac{\sqrt{3}}{2}$

For large values of k, $r \to 0$

$\Rightarrow |r - i| \to \pi/3$

19. Ans. (2)

Sol. Fractional change $= \frac{N_o - N_o e^{-\lambda t}}{N_o} = 1 - e^{-\lambda t}$

Substituting the values

fractional change = 0.63

20. Ans. (4)

Sol. $SL_2 - SL_1 = 10 \log$

$$\frac{I_{max}}{I_{min}} = 10\log\frac{\left(\sqrt{I_1} + \sqrt{I_2}\right)^2}{\left(\sqrt{I_1} - \sqrt{I_2}\right)^2} = 10\log\frac{\left(\frac{a_1}{a_2} + 1\right)^2}{\left(\frac{a_1}{a_1} - 1\right)^2}$$

$= 20$ dB

21. Ans. (3)

Sol. The initial PE is mgh. This has been used against work against friction. In the return journey the force performs the same work and in addition imparts to the object the initial P.E.

22. Ans. (3)

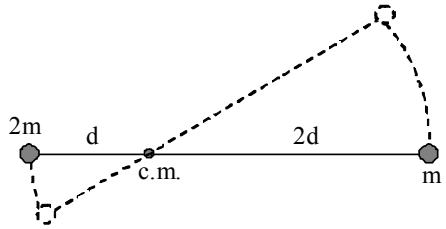
23. Ans. (2)

Sol. Energy of photon for K_β = Energy of photon for K_α + Energy of photon for L_α

$\Rightarrow r_2 = r_1 + r_3$

24. Ans. (2)

Sol. The centre of mass will be located as shown. Both the stars rotate about their common centre of mass with same angular speed.



$$\frac{L_1}{L_2} = \frac{m\omega(2d)^2}{2m\omega(d)^2} = 2$$

$\therefore$ (2) is correct

$$\frac{v_1}{v_2} = \frac{\omega 2d}{\omega d} = 2$$

$\therefore$ (3) is not correct

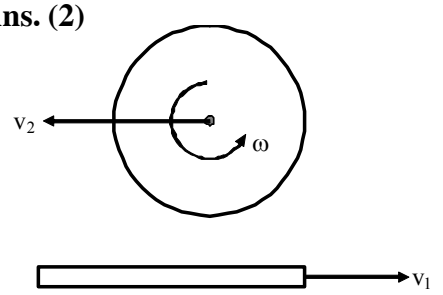
$$\frac{KE_1}{KE_2} = \frac{\frac{1}{2}m}{\frac{1}{2}2m}\left(\frac{v_1}{v_2}\right)^2 = \frac{1}{2}.4 = 2$$

Hence (4) is not correct

$\therefore$ (2)

25. Ans. (2)

Sol.



The condition for no slipping here will be

$R\omega - v_2 = v_1$

($\because$ point of contact remains at rest)

In terms of displacement

$R\Delta\theta - s_2 = s_1$

$\therefore \Delta\theta = \frac{s_1 + s_2}{R} = \frac{100+75}{150} = \frac{7}{6}$ rad

$\therefore$ (2) is correct.

26. Ans. (1)

Sol. $t(\mu - 1) = n\lambda$

$$t = \frac{n\lambda}{\mu - 1} = \frac{4\times 6\times 10^{-7}}{0.5}$$

$t = 4.8\ \mu m$

27. Ans. (2)

Sol. $\because \frac{\Delta Q}{Q} = \pm\left(n\frac{\Delta x}{x} + m\frac{\Delta y}{y}\right)$

or $\Delta Q = \pm\left(n\frac{\Delta x}{x} + m\frac{\Delta y}{y}\right)Q$

28. Ans. (2)

Sol. Water will not come out of tube as its radius of meniscus increases by the rule,

$h_1R_1 = h_2R_2$

$\therefore$ (2)

29. Ans. (3)

Sol. Since diode in forward bias so it behaves as short circuit.

$\therefore$ equivalent resistance of circuit

$= \left(10 + \frac{10\times 10}{10+10}\right)\ k\Omega = 15\ k\Omega$

$\therefore$ current through cell $= \frac{30\ \ V}{15\ \ k\Omega} = 2$ mA

$\therefore$ current between A and B = 1 mA

$\therefore V_{AB} = 10\ k\Omega \times 1\ mA = 10\ V$

$\therefore$ (3)

30. Ans. (1)

31. Ans. (4)

32. Ans. (4)

$$\ln k = \ln A - \frac{Ea}{RT}$$

$$\log K = \log A - \frac{Ea}{2.3RT}$$

$$\frac{Ea}{2.3R} = 2000$$

$$Ea = 2000 \times 2.3 \times \frac{8}{1000} = 36.8$$

33. Ans. (2)

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(\ell)$; $\Delta H = -890$ kJ

$CO_2(g) \longrightarrow C_{(graphite)} + O_2(g)$; $\Delta H = 393$ kJ

$2H_2O(\ell) \longrightarrow 2H_2(g) + O_2(g)$; $\Delta H = 571$ kJ

$2H_2(g) \longrightarrow 4H(g)$; $\Delta H = 871$ kJ

$C_{(graphite)} \longrightarrow C(g)$; $\Delta H = 716$ kJ

$CH_4(g) \longrightarrow 4H(g) + C(g)$; $\Delta H = 1661$

50 C—H $= \frac{1661}{4} = 415.25$

34. Ans. (2)

$W = nC_{vm}\Delta T$

35. Ans. (3)

36. Ans. (2)

M_{eq} of H_2SO_4 needed for 20 M_{eq} of NaOH =20

Thus volume of H_2SO_4 needed = V_{ml}

or $V \times 0.25 \times 2 = 20$ $\therefore$ V = 40 ml

37. Ans. (2)

$$\Delta T = \frac{1000\times K_b \times Y}{250\times M} = \frac{4K_bY}{M}$$

38. Ans. (1)

$$\Lambda_m^{\infty}(AgCl) = \frac{K\times 1000}{S}$$

$$S = \frac{K\times 1000}{\Lambda_m^0(AgCl)}$$

$$= \frac{2\times 10^{-6}\times 1000}{140} = 1.428\times 10^{-5}\ M$$

39. Ans. (4)

40. Ans. (1)

41. Ans. (4)

42. Ans. (1)

43. Ans. (1)

44. Ans. (2)

45. Ans. (4)

46. Ans. (2)

47. Ans. (3)

48. Ans. (1)

49. Ans. (3)

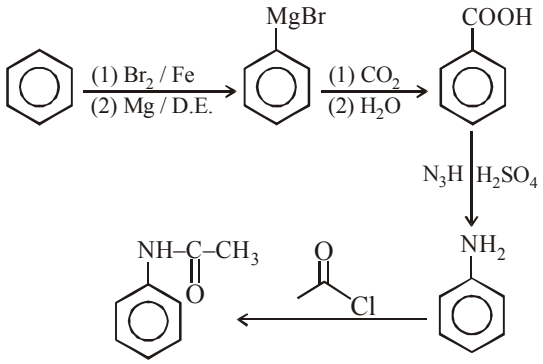
50. Ans. (2)

51. Ans. (2)

Rate of nucleophilic attack on carbonyl group $\propto$

Electrophilic nature of $-\overset{\overset{O}{\|}}{C}-$ group

52. Ans. (4)



53. Ans. (2)

Buna-S $\longrightarrow$ Styrene + butadiene

Copolymer & Addition Polymer

Gutta Percha $\longrightarrow$ Isoprene $\rightarrow$ Homopolymer & Addtion Polymer

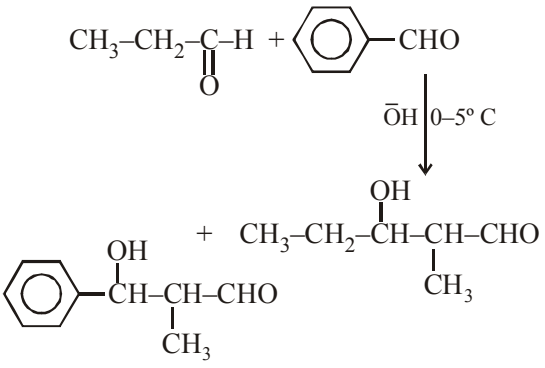
Nylon-610 $\rightarrow$ co-polymer & Condensation polymer

Nylon-6, 6 $\longrightarrow$ Adipic acid + Hexametylene diamine copolymer & condensation polymer

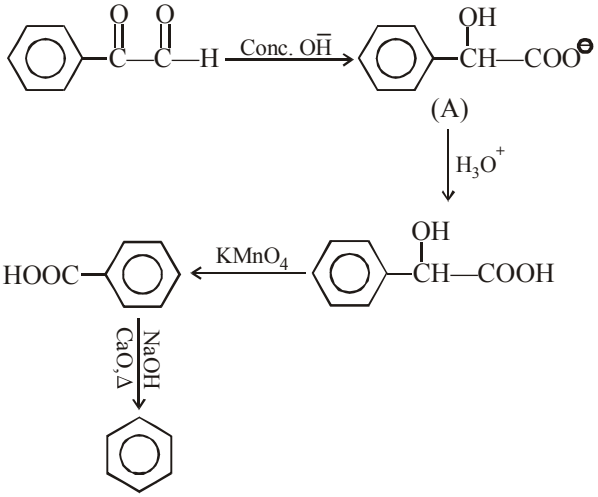
54. Ans. (1)

Glycine is the only optically inactive amino acid

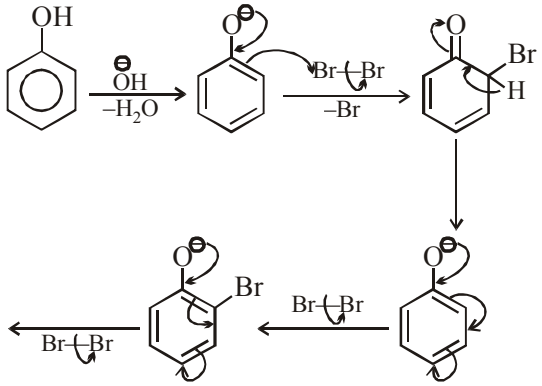
55. Ans. (1)



56. Ans. (1)

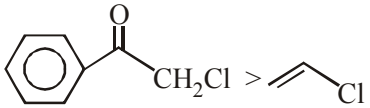


57. Ans. (4)



58. Ans. (4)

Rate of S_N2

(1) 

(2) $CH_3-CH_2-O-H \xrightarrow{NaOI} CHI_3 + HCOONa$

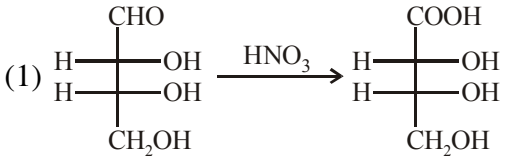
(3) Rate of EAR $\propto$ Stability of carbocation

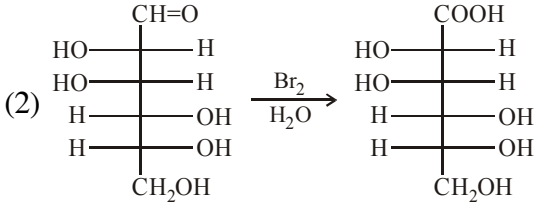
(4) 

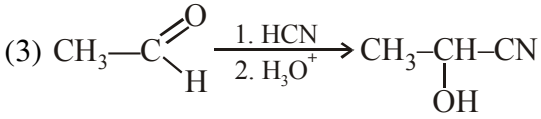
59. Ans. (3)

Any acid which is stronger than H_2CO_3 can give CO_2 with $NaHCO_3$

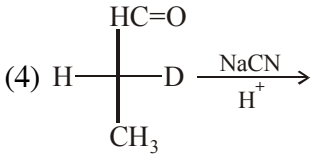
60. Ans. (4)

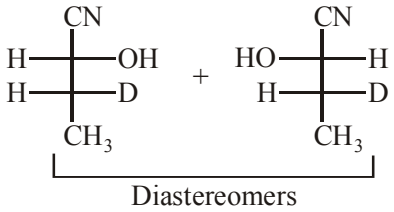
(1) 

(2) 

(3) 

Racemic Mixture

(4) 



Diastereomers

61. Ans. (3)

$$= \sum_{n=1}^{5} \sin^{-1}\left(\sin\left(2n\pi - \frac{\pi}{6}\right)\right) + \sum_{n=1}^{5} \sin^{-1}\left(\sin(2n-1)\pi - \frac{\pi}{6}\right)$$

$$= \sum_{n=1}^{5} \sin^{-1}\left(-\sin\frac{\pi}{6}\right) + \sum_{n=1}^{5} \sin^{-1}\left(\sin\frac{\pi}{6}\right)$$

$$= -\frac{5\pi}{6} + \frac{5\pi}{6} = 0$$

62. Ans. (4)

$$\text{limit} = \frac{f'(1)}{2} = \frac{\pi - 4}{16\sqrt{2}}$$

63. Ans. (4)

$\because\ x \geq \sin x\ \forall x \in [0, 10\pi]$

$\Rightarrow x + 2^x \geq \sin x + 2^{\sin x}\ \ \forall x \in [0, 10\pi]$

& equality holds only at x = 0

64. Ans. (1)

$$|\vec{a}||\vec{b}|\sin\theta + |\vec{a}||\vec{b}|\cos\theta = \sqrt{2}\,|\vec{a}||\vec{b}|$$

$$\Rightarrow \sin\theta + \cos\theta = \sqrt{2}$$

$$\Rightarrow \theta = \frac{\pi}{4}$$

Area of ABCD = $|\vec{a} \times \vec{b}| = 2\sqrt{2}$

65. Ans. (2)

Let $A(\vec{0}), B(\vec{a}), c(\vec{b})$ & $D(\vec{c})$

$$\Rightarrow G_1\left(\frac{\vec{a}+\vec{b}}{3}\right), G_2\left(\frac{\vec{b}+\vec{c}}{3}\right), G_3\left(\frac{\vec{c}+\vec{a}}{3}\right)$$

$$\Rightarrow \text{volume of } AG_1G_2G_3 = \frac{1}{6}\left[\frac{\vec{a}+\vec{b}}{3}\ \frac{\vec{b}+\vec{c}}{3}\ \frac{\vec{c}+\vec{a}}{3}\right]$$

$$= \frac{2}{27}\frac{1}{6}\left[\vec{a}\ \vec{b}\ \vec{c}\right] = \frac{2}{27} \times 81$$

66. Ans. (2)

Let plane is

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

$\because$ plane is parallel to $\frac{x-1}{1} = \frac{y-2}{-1} = \frac{z-3}{1}$

$\Rightarrow 1(1 + 3\lambda) - 1(2 + 2\lambda) + 1(3 + \lambda) = 0$

$\Rightarrow \lambda = -1$

67. Ans. (3)

$A^{-1} + B^{-1} = 2I$

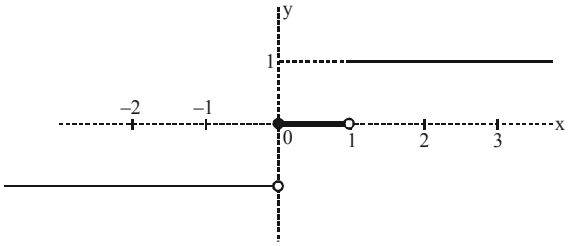
$\Rightarrow I + AB^{-1} = 2A$

$\Rightarrow B + A = 2AB$ or $2AB = I$

68. Ans. (1)

requird sum is coefficientof x^{10} in the expansion of $(1 + x)^{30}(1 + x)^{20}(1 + x)^{10}$ i.e. ${}^{60}C_{10}$

69. Ans. (3)



70. Ans. (2)

$$\text{Area} = (2\alpha)\sin\left(\frac{\pi}{2} + \alpha\right) = 2\alpha\cos\alpha$$

$$\frac{dA}{d\alpha} = 2(-\alpha\sin\alpha + \cos\alpha) = 2\sin\alpha(-\alpha + \cot\alpha)$$

$$\frac{dA}{d\alpha} = 0 \Rightarrow \alpha = \cot\alpha\ \ \left\{\because \alpha \in \left(0, \frac{\pi}{2}\right)\right\}$$

71. Ans. (3)

$$\lim_{x\to 0}\frac{f(x).\frac{x^2}{2}+x\int_0^x f(t)dt}{x^2}$$

$$=\frac{f(0)}{2}+\lim_{x\to 0}\frac{\int_0^x f(t)dt}{x}=1+f(0)=3$$

72. Ans. (1)

$f^{-1}(x) = g(x) \Rightarrow x = f(g(x))$

$\Rightarrow f'(g(x))\, g'(x) = 1$

$$\Rightarrow \int_1^3\left(g(x)+\frac{x}{f'(g(x))}\right)dx$$

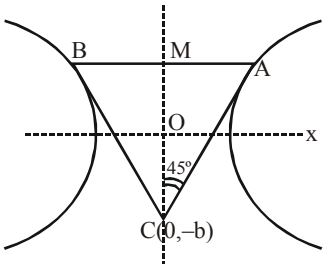
$$=\int_1^3\left(g(x)+xg'(x)\right)dx = xg(x)\Big|_1^3 = 0$$

73. Ans. (2)

$$\int 2ydy=\int(1+x)dx \Rightarrow \frac{(x+1)^2}{2}-\frac{y^2}{1}=1$$

$$\Rightarrow e=\sqrt{1+\frac{1}{2}}=\sqrt{\frac{3}{2}}$$

74. Ans. (3)



Let A(a secθ, btanθ)

tangent at A is $\frac{x\sec\theta}{a}-\frac{y\tan\theta}{b}=1$

$\because$ tangent passes through (0,–b) $\Rightarrow \tan\theta = 1$

$\therefore\ A\left(a\sqrt{2}, b\right)$

$\Rightarrow CA\cos45^\circ = CM$

$$\Rightarrow \sqrt{2a^2+4b^2}.\frac{1}{\sqrt{2}}=2b$$

$\Rightarrow a^2 = 2b^2$

75. Ans. (4)

$(36, -24) \equiv (at_2^2, 2at_2) \Rightarrow t_2 = -3$

$$\because\ t_2=-t-\frac{2}{t}\Rightarrow t^2-3t+2=0\Rightarrow t=1 \text{ or } 2$$

focal distance $= a + at^2 = 8$ or 20

76. Ans. (1)

Two parabolas opening upwards do not intersect, if they have same axis

$$\Rightarrow -\frac{b}{2a}=\frac{-q}{2p} \text{ or } aq = bp$$

$\Rightarrow$ maximum value is given by $(c - r)^2$

77. Ans. (3)

$n(A \times B) = 9$

${}^9C_1 + {}^9C_3 + \ldots + {}^9C_9 = 2^8 = 256$

78. Ans. (2)

$$P\left(\frac{\bar{A}}{B}\right)=\frac{2}{5}\Rightarrow\frac{P(\bar{A})P(B)}{P(B)}=\frac{2}{5}$$

$$\Rightarrow P(A)=\frac{3}{5}$$

$$P(A\cap B)=P(A)P(B)=\frac{3}{5}\left(\frac{3}{4}-\frac{3}{5}\right)=\frac{9}{100}$$

79. Ans. (2)

$$\frac{z+\bar{z}}{2}=|z-1|$$

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

Let $z_1\left(\frac{t_1^2+1}{2}, t_1\right)$ & $z_2\left(\frac{t_2^2+1}{2}, t_2\right)$

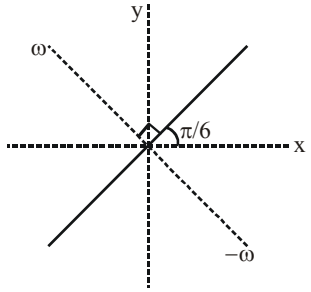
$$\because\ \arg(z_1-z_2)=\frac{\pi}{3}\Rightarrow\frac{t_2-t_1}{\frac{t_2^2-t_1^2}{2}}=\sqrt{3}$$

$$\Rightarrow\frac{2}{t_1+t_2}=\sqrt{3}$$

$$\Rightarrow \text{Im}(z_1+z_2)=\frac{2}{\sqrt{3}}$$

80. Ans. (3)

Locus of z is perpendicular bisector of line segment joining ω & -ω



81. Ans. (2)

Let circle is $x^2 + y^2 - 2\alpha x - 2\beta\gamma = 0$

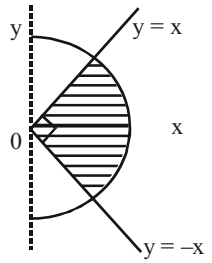
$\because$ OA + 2OB = K $\Rightarrow 2\alpha + 4\beta = k$

$\Rightarrow$ circle is $x^2 + y^2 - (k - 4\beta)x - 2\beta\gamma = 0$

$(x^2 + y^2 - kx) + 2\beta(2x - y) = 0$

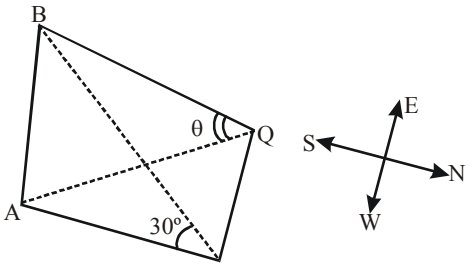
$\Rightarrow$ Fixed point lies on $2x = y$

82. Ans. (1)



$$\text{Area} = \frac{1}{4} \text{ area of circle} = \frac{\pi}{2}$$

83. Ans. (2)



$$\tan 30° = \frac{AB}{3} \ \& \ \tan\theta = \frac{AB}{AQ}$$

$$\Rightarrow AB = \sqrt{3} \ \& \ \tan\theta = \frac{AB}{\sqrt{AP^2 + PQ^2}}$$

$$\Rightarrow \tan\theta = \frac{\sqrt{3}}{2\sqrt{3}} = \frac{1}{2}$$

84. Ans. (1)

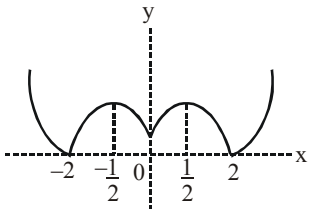
Reflexive because $A^2 = A^2$

symmetric because $AB = BA \Rightarrow BA = AB$

not transitive because $AB = BA$

& $BC = CB \not\Rightarrow AC = CA$

85. Ans. (3)

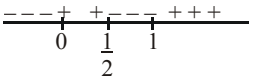


86. Ans. (2)

$f'(x) = 4x^3 + 3\lambda x^2 + 2x$

$\because \ f'\left(\frac{1}{2}\right) = 0 \Rightarrow \lambda = -2$

$\Rightarrow f'(x) = 2x\,(2x-1)(x-1)$



minimum value = $f(0) = f(1) = 0$

87. Ans. (2)

$$\bar{x} = \frac{\sum x_i}{100} = 0 \ \&$$

$$\frac{\sum|x_i - \bar{x}|}{100} = 5 \Rightarrow \sum|x_i| = 500$$

$$\Rightarrow \sum x_i^2 + 2\sum_{1\le i<j\le 100}|x_i x_j| = (500)^2$$

$$\Rightarrow \frac{\sum x_i^2}{100} = \frac{(500)^2 - 2\sum|x_i x_j|}{100} = 2500 - 1600$$

$$\text{S.D.} = \sqrt{\frac{\sum(x_i - \bar{x})^2}{100}} = \sqrt{900} = 30$$

88. Ans. (1)

$p \to q$ must be true & $q \to r$ must be false

$\therefore$ q must be true, r must be false but p can be true or false.

89. Ans. (1)

$\because \ f(x)\,y^2 + ay + g(x) = 0$ has real roots.

$\therefore \ D \ge 0 \Rightarrow a^2 \ge 4f(x)\,g(x)$

$\Rightarrow \ a^2 \ge 4 \sin x \cos x$

$\Rightarrow \ a^2 \ge 2\sin 2x \Rightarrow a^2 \ge 2$

$\Rightarrow \ a \in \left(-\infty, -\sqrt{2}\right] \cup \left[\sqrt{2}, \infty\right)$

90. Ans. (1)

$\because$ sum of two A.P's is also an A.P.

$\therefore \ x_4 + y_4 + z_4 + w_4 = A + 3D = 8$ &

$x_{10} + y_{10} + z_{10} + w_{10} = A + 9D = 20$

$\Rightarrow A = 2, D = 2$

$\Rightarrow x_{20} + y_{20} + z_{20} + w_{20} = A + 19D = 40$

Now $\frac{x_{20} + y_{20} + z_{20} + w_{20}}{4} \ge \left(x_{20}.y_{20}.z_{20}.w_{20}\right)^{1/4}$

$\Rightarrow \left(x_{20}.y_{20}.z_{20}.w_{20}\right) \le 10^4$