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FINAL TEST SERIES JEE -2017 TEST-07

BRANCH OFFICE-1 : HO : World Trade Tower, 99- Rajpur Road. Dehradun (U.K.)

BRANCH OFFICE-2 : GMS Road, Ballupur Chowk, Dehradun (U.K.)

PH: 0135-6557701 / 02 / 03, **MOB.:** 9045062312 / 14 / 15 / 16 / 17 / 18 / 20. **web:** www.aviral.co.in

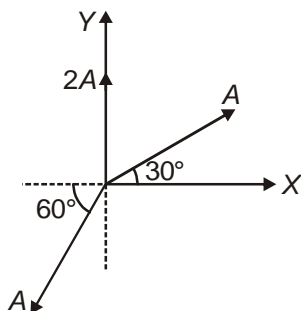
[PHYSICS]

1. Answer (3)

$$x_1 = A \sin\left(\omega t + \frac{\pi}{6}\right) \quad \dots(i)$$

$$x_2 = 2A \sin\left(\omega t + \frac{\pi}{2}\right) \quad \dots(ii)$$

$$x_3 = A \sin\left(\omega t + \frac{\pi}{3} + \pi\right) \quad \dots(iii)$$



$$A_x = (A \sin 30^\circ - A \cos 60^\circ) \hat{i}$$

$$A_x = A \left[\frac{\sqrt{3}}{2} - \frac{1}{2} \right] (+\hat{i})$$

$$A_x = \frac{A}{2} [\sqrt{3} - 1] (+\hat{i})$$

$$A_y = 2A + A \sin 30^\circ - A \sin 60^\circ$$

$$= 2A + \frac{A}{2} - \frac{A\sqrt{3}}{2}$$

$$= \frac{5A}{2} - \frac{A\sqrt{3}}{2}$$

$$A_y = \frac{A}{2} [5 - \sqrt{3}]$$

$$A_{\text{res}} = \frac{A}{2} \times \sqrt{(\sqrt{3} - 1)^2 + (5 - \sqrt{3})^2}$$

$$= \frac{A}{2} \sqrt{3 + 1 - 2\sqrt{3} + 25 + 3 - 10\sqrt{3}}$$

$$= \frac{A}{2} \sqrt{32 - 12\sqrt{3}}$$

$$A_{\text{res}} = A\sqrt{8 - 3\sqrt{3}}$$

2. Answer (3)

$$x_1 = A \sin(\omega t - kx) \quad \dots(i)$$

$$x_2 = A' \sin(\omega' t + k'x + \pi) \quad \dots(ii)$$

Clearly $\omega' = \omega$ and $k' = k$

$$\text{Now } I \propto A^2 \Rightarrow A' = 0.8 A$$

$$\text{Thus } x_1 = A \sin(\omega t - kx) \quad \dots(iii)$$

$$x_2 = 0.8 \sin(\omega t + kx + \pi) \quad \dots(iv)$$

$$\Rightarrow A_{\text{max}} = 1.8 A$$

$$A_{\text{min}} = 0.2 A$$

$$\Rightarrow \frac{A_{\text{max}}}{A_{\text{min}}} = 9$$

3. Answer (2)

$$y = 2A \sin kx \cos \omega t \quad \dots(i)$$

$$dk = \frac{1}{2} (\mu dx) \times \left(\frac{dy}{dt} \right)^2$$

$$= \frac{1}{2} (\mu dx) \times 4A^2 \sin^2 kx \omega^2 \sin^2 \omega t$$

$$k = \int 2\mu dx A^2 \omega^2 \sin^2 kx \sin^2 \omega t$$

$$k_{\text{max}} = \int 2\mu A^2 \omega^2 \sin^2 kx dx$$

$$= 2\mu A^2 \omega^2 \times \frac{1}{2} \int_0^l (1 - \cos 2kx) dx$$

$$k_{\text{max}} = \mu l^2 A^2 \omega^2 = \text{Total energy of string}$$

4. Answer (1)

$$v = \sqrt{24 - 4x^2}$$

$$\frac{dv}{dx} = \frac{1}{2\sqrt{24 - 4x^2}} \times (-8x)$$

$$\Rightarrow \frac{dv}{dx} = -\frac{4x}{v}$$

$$\Rightarrow a = v \frac{dv}{dx} = -4x$$

5. Answer (3)

The particle is moving perpendicularly to its initial direction when it lands upon ground.

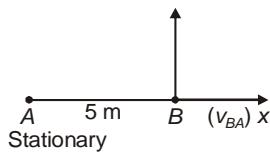
$$\omega = \frac{u \sin 45^\circ}{R} = \frac{u}{\sqrt{2}} \times \frac{g}{u^2 \sin 2\theta}$$

$$= \frac{g}{\sqrt{2} \times u} = \frac{10}{\sqrt{2} \times 5\sqrt{2}} = 1 \text{ rad/s}$$

6. Answer (1)

The acceleration of point B is $\omega^2 R (\hat{j})$.

7. Answer (3)



$$v_y = 10 \times \frac{4}{5} - 5 = 3 \text{ ms}^{-1}$$

$$v_x = 10 \times \frac{3}{5} - 5 = 1 \text{ ms}^{-1}$$

Hence closest distance = 5 m

8. Answer (4)

$$E_n = -\frac{9 \times 13.6}{n^2} \text{ eV}$$

$$K = \frac{9 \times 13.6}{9} = 13.6 \text{ eV}$$

9. Answer (3)

$$R_L = 20 \text{ k}\Omega, \quad \Delta V_i = 20 \text{ mV}$$

$$\Delta I_C = 5 \text{ mA}, \quad \Delta V_o = R_L \times \Delta I_C$$

$$\text{Voltage amplification} = \frac{\Delta V_o}{\Delta V_i} = \frac{R_L \Delta I_C}{\Delta V_i}$$

$$= \frac{(20 \times 10^3)(5 \times 10^{-3})}{20 \times 10^{-3}}$$

$$= \frac{100}{20 \times 10^{-3}} = 5000$$

10. Answer (3)

$$N = N_0 e^{-\lambda t}$$

$$\Rightarrow \rho_1 = \frac{N}{N_0} = e^{-\lambda t} \quad \dots(i)$$

$$\rho_2 = \frac{N_0 - N}{N_0} = 1 - \frac{N}{N_0} = 1 - e^{-\lambda t} \quad \dots(ii)$$

$$\frac{\rho_1}{\rho_2} = \frac{e^{-\lambda t}}{1 - e^{-\lambda t}} = \frac{1}{e^{\lambda t} - 1}$$

$$= \frac{1}{e^{t \times \frac{\log_e 2}{T_{1/2}}} - 1} = \frac{1}{(2)^{t/T_{1/2}} - 1}$$

$$= \frac{1}{(2)^4 - 1} = \frac{1}{15}$$

11. Answer (3)

Refraction of air glass

$$\frac{\mu_g}{v_1} - \frac{\mu_a}{\infty} = \frac{\mu_g - \mu_a}{R}$$

$$\Rightarrow \frac{\mu_g}{v_1} = \frac{\mu_g - \mu_a}{+|R|} \quad \dots(i)$$

Refraction at glass-water

$$\frac{\mu_w}{v_2} - \frac{\mu_g}{v_1} = \frac{\mu_w - \mu_g}{R} \quad \dots(ii)$$

From (i) and (ii)

$$\frac{\mu_w}{v_2} = \frac{\mu_w - \mu_a}{R}$$

$$\Rightarrow \frac{1}{v_2} = \frac{1 - \frac{1}{\mu_w}}{R} = \frac{\mu_w - 1}{\mu_w \times R}$$

$$= \frac{\frac{4}{3} - 1}{\left(\frac{4}{3}\right) \times 20} = \left(\frac{1}{3}\right) \times \left(\frac{3}{4}\right) \times \frac{1}{20} = \frac{1}{80}$$

$$\Rightarrow v_2 = 80 \text{ cm}$$

12. Answer (3)

$$\frac{1}{F_1} = \frac{2}{|Fe|}$$

$$\frac{1}{F_2} = \frac{2}{|Fe|} + \frac{2}{|R|}$$

$$\Rightarrow \frac{1}{F_2} = \frac{1}{F_1} + \frac{2}{R}$$

$$\Rightarrow \frac{1}{10} = \frac{1}{12} + \frac{2}{R}$$

$$\Rightarrow R = 120 \text{ cm}$$

13. Answer (2)

I_1 lags behind voltage by ϕ_1

$$\Rightarrow \tan \phi_1 = \frac{X_L}{R_1}$$

$$\Rightarrow \phi_1 = 60^\circ$$

I_2 leads voltage by ϕ_2

$$\Rightarrow \tan \phi_2 = \frac{X_C}{R_2}$$

$$\Rightarrow \phi_2 = 30^\circ$$

$$\Rightarrow \phi_1 + \phi_2 = 90^\circ$$

14. Answer (4)

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

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

$$\Rightarrow \cos \frac{\phi}{2} = \frac{1}{\sqrt{2}} = \cos \frac{\pi}{4}$$

$$\phi = \frac{\pi}{2}$$

$$\Rightarrow \frac{2\pi}{\lambda} \times d \tan \theta = \frac{\pi}{2}$$

$$\Rightarrow \tan \theta = \frac{\lambda}{4d}$$

$$\Rightarrow \frac{y}{D} = \frac{\lambda}{4d}$$

$$\Rightarrow y = \frac{D\lambda}{4d}$$

15. Answer (3)

Taking rectangular loop, enclosing ℓ length of upper and lower current sheet.

From Ampere's law

$$B \times \ell + B \times \ell = \mu_0 I \times \ell + \mu_0 I \ell$$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \Sigma I$$

$$B = \mu_0 I$$

16. Answer (3)

$$\text{Charge of capacitor} = \frac{q}{2}$$

$$\Rightarrow U = \left(\frac{q}{2}\right)^2 \times \frac{1}{2C}$$

$$= \frac{50 \times 50 \times 10^{-12}}{8 \times 2 \times 10^{-6}} \mu\text{J}$$

$$= \frac{625}{4} \mu\text{J}$$

$$= 156.25 \mu\text{J}$$

17. Answer (4)

Equivalent circuit

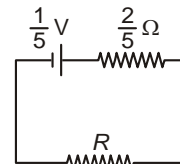
$$E = \frac{\sum E}{\sum \frac{1}{r}}$$

$$\frac{1}{r_{eq}} = \sum \frac{1}{r}$$

$$E = \frac{\frac{2}{1} + \frac{3}{2} - \frac{4}{1}}{\frac{1}{1} + \frac{1}{2} + \frac{1}{1}} = \frac{4+3-8}{\frac{5}{2}} = -\frac{1}{5} \text{ Volt}$$

$$r = \frac{2}{5} \Omega$$

$$P_{max} = \frac{E^2}{4r} = \frac{\frac{1}{5} \times \frac{1}{5}}{4 \times \frac{2}{5}} = \frac{1}{25} \times \frac{1}{4} \times \frac{5}{2} = \frac{1}{40} \text{ W}$$



18. Answer (4)

$$\frac{M}{J} = \frac{q}{2m}$$

$$\Rightarrow M = \frac{q}{2m} \times J$$

$$J = I\omega = \omega \int dl$$

$$= \omega \times \frac{m}{\pi r l} \cdot 2\pi \int x^3 dy$$

$$= \frac{2m}{r l} \tan^{+3} \alpha \cdot \frac{h^4}{4}$$

$$\Rightarrow M = \frac{q\omega h^2 \tan^{+2} \alpha}{4}$$

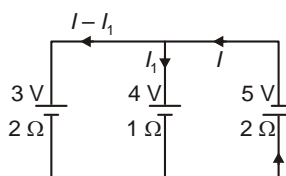
19. Answer (2)

$$2I + I_1 = -9 \quad \dots(i)$$

$$2(I - I_1) - I_1 = 4 - 3 \quad \dots(ii)$$

Solving, $I_1 = -2.5$ Amp

Potential difference = $4 - 2.5 \times 1 = 1.5$ V



20. Answer (3)

$$W_{ABCD} = 4P_0 V_0$$

$$\Delta U = 0$$

$$Q_{ABCD} = 4P_0 V_0$$

21. Answer (2)

$$TV^{2/3} = \text{constant} \quad \dots(i)$$

$$PV = nRT \quad \dots(ii)$$

$$\Rightarrow PV^{5/3} = \text{constant}$$

$$\Rightarrow C = C_V + \frac{R}{1-n} = \frac{5}{2}R + \frac{R}{1-\frac{5}{3}}$$

$$\Rightarrow C = \frac{5}{2}R - \frac{3}{2}R = R$$

22. Answer (4)

$$P_0 + \frac{1}{2}(3\rho)v^2$$

$$= P_0 + 3\rho \times 3h \times g + 2\rho \times 2h \times g + \rho \times h \times g$$

$$\Rightarrow V = \sqrt{\frac{28}{3}gh}$$

23. Answer (3)

$$B = 4 \times \frac{\mu_0}{4\pi} \cdot \frac{I}{a} \sin 45^\circ = \frac{\mu_0}{\pi} \frac{I}{a} \times \frac{1}{\sqrt{2}}$$

24. Answer (3)

$$T = 2\pi \sqrt{\frac{I}{MB}}$$

When the magnet is cut into two pieces, $M' = \frac{M}{2}$

$$I' = \frac{m'I'^2}{12} = \frac{1}{12} \left(\frac{m}{2}\right) I^2$$

$$\Rightarrow I' = \frac{I}{2}$$

$$\text{Then } T' = 2\pi \sqrt{\frac{I'}{M'B}} = T$$

25. Answer (2)

26. Answer (2)

$$J_n = mvr = \frac{nh}{2\pi} \quad \dots(i)$$

$$\Rightarrow 2\pi r = n \cdot \frac{h}{mv} = n\lambda$$

27. Answer (2)

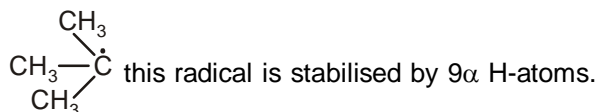
28. Answer (4)

29. Answer (2)

30. Answer (2)

[CHEMISTRY]

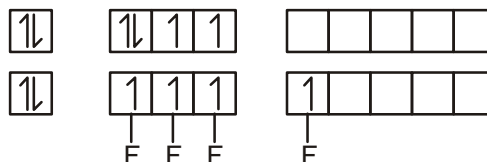
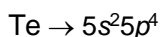
31. Answer (4)



32. Answer (3)

Sucrose has not free aldehyde group.

33. Answer (4)



Te has sp^3d hybridisation, so see-saw shaped.

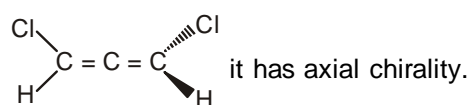
34. Answer (3)

NO^+ and CO have same number of valence electrons as well as same structures.

35. Answer (2)

The last member of group-14 element is Pb.

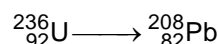
36. Answer (3)



37. Answer (1)



38. Answer (2)



39. Answer (3)

40. Answer (3)

Negative charge on metal forming strong $M \rightarrow C$ π -bond.

41. Answer (1)

Fact.

42. Answer (4)

(i) randomness increases

(ii) randomness decreases

(iii) randomness increases

(iv) no change of heat

$$\Delta S = \frac{dq}{T} \quad [\because dq = 0]$$

$$\Delta S = 0$$

43. Answer (3)

$$K_p = (2P)^2(P) = 4P^3$$

$$2.9 \times 10^{-5} = 4P^3$$

$$\frac{2.9}{4} \times 10^{-5} = P^3$$

$$7.25 \times 10^{-6} = P^3$$

$$1.9 \times 10^{-2} = P$$

$$\begin{aligned} \text{Total} &= 3P = 1.9 \times 3 \times 10^{-2} \\ &= 0.058 \end{aligned}$$

44. Answer (4)

$$\log \frac{4}{1} = \frac{\Delta H}{2.303 R} \left(\frac{15}{298 \times 313} \right)$$

$$\frac{8.31 \times 0.6 \times 2.303 \times 298 \times 314}{15} = \Delta H$$

$$\Delta H = 71.57 \text{ kJ}$$

45. Answer (2)

$$\frac{6 \times 1}{180 \times 100} = \frac{2}{M \times 100}$$

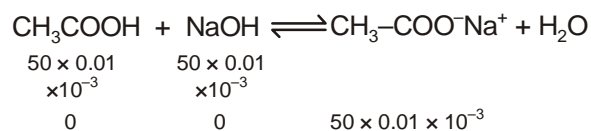
$$M = \frac{2 \times 180}{6} = 60 \text{ g/mol}$$

46. Answer (4)

$$\pi = 0.2 \times RT$$

$$\pi = 0.1 \times 2 \times RT$$

47. Answer (4)



$$\text{So, } [\text{CH}_3\text{COONa}] = \frac{50 \times 0.01 \times 10^{-5}}{0.1} = 5 \times 10^{-3}$$

$$\text{pH} = \frac{1}{2} (\text{p}K_w + \text{p}K_a - \log 5 \times 10^{-3})$$

$$= \frac{1}{2} (14 + 5 - \log 5 \times 10^{-3})$$

$$= 8.35$$

48. Answer (3)

$$2r_{+b} + 2r_a = \sqrt{3}a \Rightarrow r_{+b} + r_a = \frac{\sqrt{3}}{2}a$$

$$2r_{+F} + 2r_a = \sqrt{2}a \Rightarrow r_{+F} + r_a = \frac{\sqrt{2}}{2}a$$

$$\frac{\quad}{\quad} \quad \frac{\quad}{\quad} \quad \frac{\quad}{\quad}$$

$$r_{+b} - r_{+F} = \left(\frac{\sqrt{3} - \sqrt{2}}{2} \right) a$$

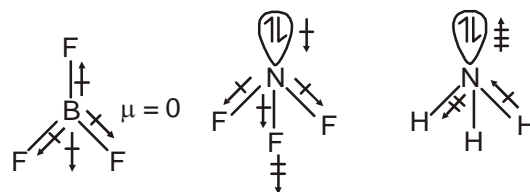
49. Answer (4)

$$\text{Rate} = K[\text{G}][\text{H}] \text{ and } K_{\text{eq}} = \frac{[\text{H}]^2}{[\text{G}]}$$

50. Answer (2)

Fact

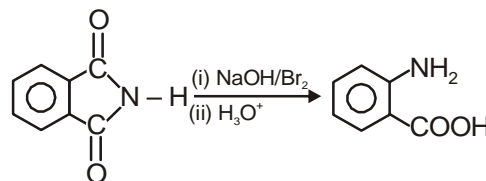
51. Answer (2)



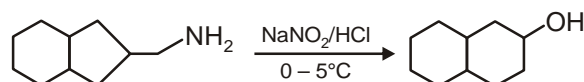
52. Answer (4)

Fact.

53. Answer (1)



54. Answer (4)



55. Answer (1)

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta H = \Delta U + \Delta n_g RT$$

56. Answer (3)

57. Answer (3)

58. Answer (4)

59. Answer (1)

60. Answer (4)

[MATHEMATICS]

61. Answer (3)

Let α, β are the roots of the given equation, then

$$\alpha + \beta = -p, \quad \alpha\beta = -2$$

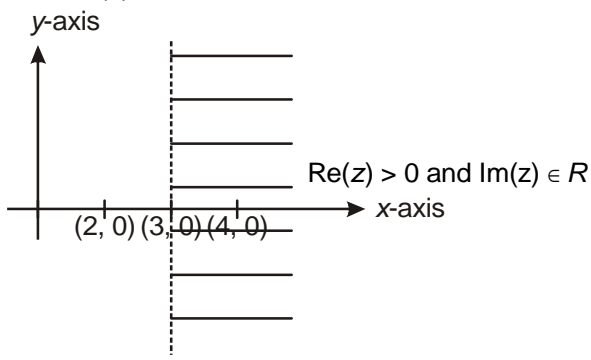
$$\alpha^2 + \beta^2 = 5$$

$$\Rightarrow (\alpha + \beta)^2 - 2\alpha\beta = p^2 + 4$$

$$p^2 = 1$$

$$p = \pm 1$$

62. Answer (4)



63. Answer (3)

$$|z_1 + z_2| = |z_1| + |z_2|$$

Squaring both sides

$$|z_1|^2 + |z_2|^2 + 2|z_1||z_2| \cos(\arg z_1 - \arg z_2) = |z_1|^2 + |z_2|^2 + 2|z_1||z_2|$$

$$\arg z_1 - \arg z_2 = 0$$

64. Answer (4)

Put $x = 0$, ω, ω^2 is the expression

$(x + 1)^n - x^n - 1$ which will become zero

Hence, $(x^3 + x^2 + x)$ will be the factor.

65. Answer (3)

The values of x satisfying are

$$a(1 - \sqrt{2}) \text{ and } a(\sqrt{6} - 1)$$

66. Answer (4)

$$a = A - D, \quad b = A, \quad c = A + D$$

$$a + b + c = \frac{3}{2}$$

$$(A - D) + A + (A + D) = \frac{3}{2}$$

$$3A = \frac{3}{2}$$

$$A = \frac{1}{2}$$

$$\left(\frac{1}{4} - D^2\right)^2 = \frac{1}{16}$$

$$D^2 = \frac{1}{2}$$

$$D = \pm \frac{1}{\sqrt{2}}$$

$$a = \frac{1}{2} \pm \frac{1}{\sqrt{2}}$$

67. Answer (1)

$$240 = 2^4 \cdot 3 \cdot 5$$

$$\text{Total number of divisors} = (4 + 1)(2)(2)$$

$$= 20$$

68. Answer (3)

69. Answer (1)

$$x - 1 > 0 \Rightarrow x > 1$$

$$\log_{(0.3)}(x - 1) < \frac{1}{2} \log_{(0.3)}(x - 1)$$

$$x - 1 > 1$$

$$x > 2$$

70. Answer (4)

Clearly 1, 2 and 3 are not correct.

71. Answer (1)

$$\lim_{x \rightarrow \frac{\pi}{4}} \frac{\int_2^{\sec^2 x} f(t) dt}{x^2 - \frac{\pi^2}{16}} = \lim_{x \rightarrow \frac{\pi}{4}} \frac{f(\sec^2 x) 2 \sec x \sec x \tan x}{2x}$$

$$= \frac{8f(2)}{\pi}$$

72. Answer (2)

$$(1^2 - 2^2) + (3^2 - 4^2) + \dots + \{(n - 2)^2 - (n - 1)^2\} + n^2 = -(1 + 2) + \dots + (n - 2) + (n - 1) + n^2$$

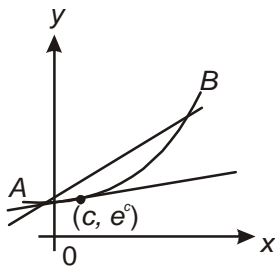
$$-\frac{(n - 1)n}{2} + n^2 = \frac{n(n + 1)}{2}$$

73. Answer (1)

Slope of the line joining the points

$(c - 1, e^{c-1})$ and $(c + 1, e^{c+1})$ is equal to

$$\frac{e^{c+1} - e^{c-1}}{2} > e^c$$



Tangent to the curve $y = e^x$ will intersect the given line to the left of the line $x = c$.

74. Answer (2)

$$f'(x) = 2\sin 2x(-\cos 2x) = -\sin 4x$$

Now, $f'(x) > 0$ if $\sin 4x < 0$

$$\pi < 4x < 2\pi$$

$$\frac{\pi}{4} < x < \frac{\pi}{2}$$

75. Answer (2)

The maximum value of $f(x) = \cos x + \cos \sqrt{2}x$ is 2 which occurs at $x = 0$. Also, there is no value of x for which this value will be attained again.

76. Answer (3)

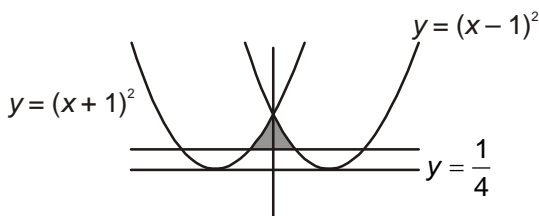
$$\text{Using } \int_0^a f(x) dx = \begin{cases} 0 & , f(a-x) = -f(x) \\ 2 \int_0^{\frac{a}{2}} f(x) dx & , f(a-x) = f(x) \end{cases}$$

$$\text{where } f(x) = e^{\cos^2 x} \cdot \cos^3 \{(2n+1)x\}$$

$$\therefore f(\pi - x) = (e^{\cos^2 x})(-\cos^3 (2n+1)x) = -f(x)$$

$$I = 0$$

77. Answer (1)



$$\text{Area} = 2 \int_0^{\frac{1}{2}} \left\{ (x-1)^2 - \frac{1}{4} \right\} dx = \frac{1}{3} \text{ sq. units}$$

78. Answer (3)

$$n(S) = 6^4$$

$$n(E) = {}^6C_4$$

$$D(E) = \frac{{}^6C_4}{6^4}$$

79. Answer (4)

$$|\vec{a}| |\vec{b}| |\vec{c}| |\sin \theta| |\cos \alpha| = 1$$

$$\theta = \frac{\pi}{2}, \alpha = 0$$

80. Answer (4)

Let x be mean

$$6 = \frac{4 \times 7.5 + 6 \times x}{10}$$

$$6x = 30$$

$$x = 5.$$

81. Answer (3)

82. Answer (4)

$$\begin{aligned} \cos 2\theta &= \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta} = \frac{1 - (2 \tan^2 \phi + 1)}{1 + 2 \tan^2 \phi + 1} \\ &= \frac{-2 \tan^2 \phi}{2 + 2 \tan^2 \phi} = \frac{-\tan^2 \phi}{\sec^2 \phi} \\ &= -\sin^2 \phi \end{aligned}$$

83. Answer (3)

$$n^2 - 4 \left(\frac{1}{2} + \frac{n}{2} \right) \geq 0$$

$$n^2 - 2 - 2n \geq 0$$

$$n^2 - 2n + 1 - 3 \geq 0$$

$$(n-1)^2 \geq 3$$

$$n = 3, 4, 5$$

$$\text{Probability} = \frac{3}{5}$$

84. Answer (2)

x, y, z are in G.P.

$\ln x, \ln y, \ln z$ are in A.P.

$1 + \ln x, 1 + \ln y, 1 + \ln z$ are in A.P.

$\frac{1}{1 + \ln x}, \frac{1}{1 + \ln y}, \frac{1}{1 + \ln z}$ are in H.P.

85. Answer (3)

$$\cot\left(\frac{\pi}{2} - \pi \cos\theta\right) = \cot(\pi \sin\theta)$$

$$\frac{\pi}{2} - \pi \cos\theta = n\pi + \pi \sin\theta, n \in \mathbb{Z}$$

$$\frac{\pi}{2} = n\pi + \pi(\sin\theta + \cos\theta)$$

$$\frac{1}{2} = n + (\cos\theta + \sin\theta)$$

$$\frac{1}{\sqrt{2}}\left(\frac{1}{2} - n\right) = \cos\left(\theta - \frac{\pi}{4}\right)$$

$n = 0, 1$ are the only possible value.

86. Answer (3)

Statement-1 is true, statement-2 is false.

87. Answer (4)

Statement-1 is false, statement 2 is true.

88. Answer (3)

Statement-1 is true, statement-2 is false.

89. Answer (2)

Statement-1 is true, statement-2 is true but not the correct explanation of statement-1.

90. Answer (3)

Statement-1 is true, statement-2 is false.