BYJU'S CLASSES

JEE MAINS SAMPLE PAPER– 1
PHYSICS SOLUTIONS AND ANSWR KEY

1. a	2. b	3. a	4. b	5. a	6. a	7. a	8. c	9. c	10. b
11. a	12. a	13. a	14. b	15. b	16. a	17. a	18. c	19. a	20. d
21. a	22. a	23. b	24. c	25. a	26. c	27. b	28. d	29. d	30. a

1. Let $F \,\alpha P^aV^bT^c$

$\Rightarrow [F] = [P]^a[V]^b\,[T]^c$

$[F] = [ML^{-1}T^{-2}]^a[LT^{-1}]^b[T]^c$

$[MLT^{-2}] = \left[M^aL^{-a+b}T^{-2a-b+c}\right]$

Comparing, a = 1,

$-a + b = 1 \Rightarrow b = 2$

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

$[F] = [P^1V^2T^2]$

2. $\vec{u} = (\hat{i} + 2\hat{j})\ ms^{-1} \Rightarrow u_x = 1\ \ v_y = 2$

$\Rightarrow \tan\theta = \frac{v_y}{u_x} = 2$

Range; $R = \frac{2v_xv_y}{g}$

$= \frac{2(1)(2)}{10}$

$= \frac{2}{5}m$

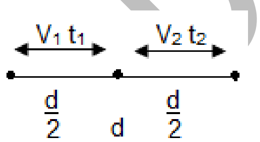
Trajectory,

$y = x\tan\theta\left(1 - \frac{x}{R}\right)$

$y = 2x\left(1 - \frac{5x}{2}\right)$

$y = 2x - 5x^2$

3. $V_{ang} = \frac{\text{Total displacement}}{\text{Total time}}$



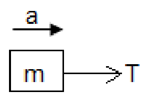
$V = \frac{d}{\frac{d}{2V_1}+\frac{d}{2V_2}}$

After some rearranging we get

$\Rightarrow \frac{2}{V} = \frac{1}{V_1} + \frac{1}{V_2}$

4. For the system a = $\frac{F}{2m}$

For the second block



T = ma

= m$\times$ $\frac{F}{2m}$

= $\frac{F}{2}$

5. F = $\frac{mv_f - mv_i}{t}$

$$\frac{0.1(0) - 0.1(10)}{0.1}$$

= –10N magnitude wise F = 10N

6. U_1 = $\frac{1}{2}kx_1^2$

= $\frac{1}{2}$ (240)$\times$ $(10 \times 10^{-2})^2$

= 0.12 J

U_1 = $\frac{1}{2}kx_1^2$

= $\frac{1}{2}$ (240)$\times$ $(10 \times 10^{-2})^2$

= 0.12 J

$U_1 - U_2 = 0$

7.The radius is r_n and the velocity is v_n.The de-broglie wavelength is

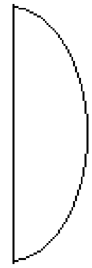
$\frac{\frac{r_n}{h}}{mv_n}$=$\frac{mv_n r_n}{h}$

But $mv_n r_n$ = $\frac{nh}{2\pi}$

Therefore, $\frac{\frac{r_n}{h}}{mv_n}$ =$\frac{n}{2\pi}$

8. f = 30 cm

R_0 = 10 c



$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$\frac{1}{30} = (n-1)\left(\frac{1}{\infty} - \left(\frac{1}{-10}\right)\right)$

$\Rightarrow n - 1 = \frac{1}{3}$

$\Rightarrow n = \frac{4}{3} = 1.33$

9. $E_k = \frac{1}{2} mu^2$

At the highest point of the trajectory,

U = mg H

$= mg \times \frac{u^2 \sin^2\theta}{2g}$

$= \frac{1}{2} mv^2 \sin^2\theta$

$= E_k \sin^2\theta$

10. Initial energy E_1 = (1) (–80) + 1(640) = 560 cal

Let the final state be completely liquid state (water)

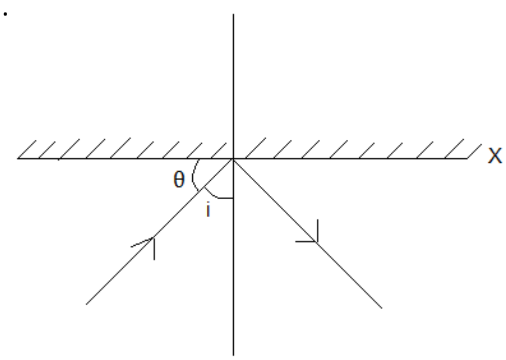
E_f = mct

= (2) (1)t

⇒ 2t = 560

⇒ t = 280°C. Water cannot exist at 280°C. Thus all steam has not condensed. The final temperature is thus 100°C.

11. The following is the reflection diagram.



$\vec{r_i} = \frac{1}{2}(\hat{\imath} + \sqrt{3}\hat{\jmath})$

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

⇒ θ = 60°

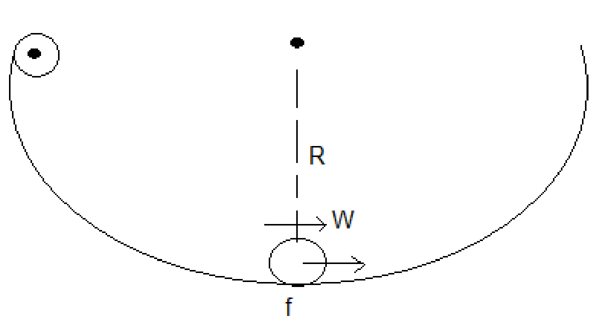
i = 30°

12. For every α particle emission neutrons and protons both decrease by two and for every positron emission proton number decreases by 1.
Initial neutron number: A – Z
Initial proton number: Z

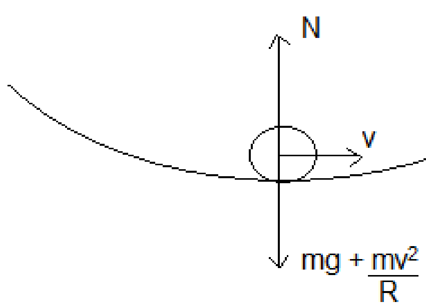
$$Z^{X^{A}} \xrightarrow{3\alpha} Z-6^{X^{A-12}} \xrightarrow{2ct} Z-4^{X^{A-12}}$$

Number of neutrons is A – 12 – (Z – 4) = A – Z – 8
Number of protons is Z – 4

13.



The forces acting at the lower most point are,



Where ; v = R

$k_i + U_i + W_{NC} = k_f + U_f$

$O + mg\,R + O = \frac{1}{2} \times \frac{1}{2}\, m\, R^2 \times \left(\frac{v}{R}\right)^2 + O$

$mg\,R = \frac{3}{4}\, mv^2 \Rightarrow v^2 = \frac{4g\,R}{3}$

$N = mg + \frac{mv^2}{R}$

$= mg + \frac{m}{R} \times \frac{4}{3}\, g\,R$

$= \frac{7}{3}\, mg$

14. The acceleration is ;a = $\frac{qE}{m}$

Aslo, v = u + at

$v = 0 + \frac{qE}{m} t$

$v = \frac{qE}{m} t$

The kinetic energy is

$k = \frac{1}{2} mv^2$

$= \frac{1}{2} \times m \left(\frac{qEt}{m}\right)^2$

$= \frac{q^2E^2t^2}{2m}$

15. Motorcyclist listens to two apparent frequencies police car:

$f_1 = f_{01}\left(\frac{330+v}{330}\right)$

$=165\left(\frac{330+v}{330}\right)$

$=\left(\frac{330+v}{2}\right)$

Since no beats are present,

$f_1 = f_2$

$\frac{330-v}{2} = \frac{330+v}{2}$

$\Rightarrow v = 22\ ms^{-1}$

16. Since the voltage across the resistor is 40V, we have

$20i = 40 \Rightarrow i = 2A$

Applying KVL to the loop

$-40 - 10R - 20 + 100 = 0$

$\Rightarrow R = 4\Omega$

17. The intensity at a point on the screen where the path difference is Δx is given by

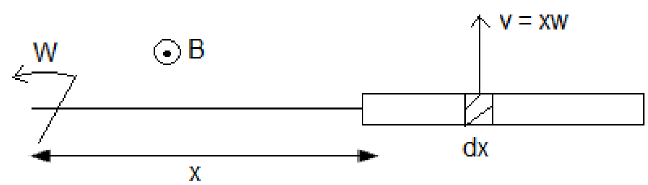
$$I = I_0 \cos^2\left(\frac{\pi}{\lambda} \times \Delta x\right)$$

$$I = I_0 \cos^2\left(\frac{\pi}{\lambda} \times \frac{\lambda}{6}\right)$$

$$\Rightarrow \frac{I}{I_0} = \frac{3}{4}$$

18. The emf induced in the element is ,

$d\in = B\,dx\,v$



$$\int d\in = B \int_{2l}^{3l} x\,dx$$

$$\in = \frac{5B \quad l^2}{2}$$

19. The initial angular velocity is $⍰_0 = 300 \times \frac{\pi}{30}$

$= 10 \text{ rad s}^{-1}$

We have,

$$⍰^2 = {}^2_0 + 2$$

$O = (10\pi)^2 - 2\alpha\,(25\times 2\pi)$

$\Rightarrow \alpha = \pi$

Also,

$= I\,\alpha$

$= \frac{10}{\pi} \times \pi$

$= 10$ Nm

20. Using the expression for the reactances, we have

$X_L = 2\pi fL$

$= 2\times \pi \times 50 \times \frac{200}{\pi} \times 10^{-3}$

$= 20\ \Omega$

$X_C = \frac{1}{2\pi fC} = \frac{10^3}{2\,\square\,\frac{50}{\;}}$

$= 10\ \Omega$

$R = 10\ \Omega$

We have $\tan\phi = \frac{X_L - X_C}{R}$

$= \frac{20-10}{10}$

$= 1$

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

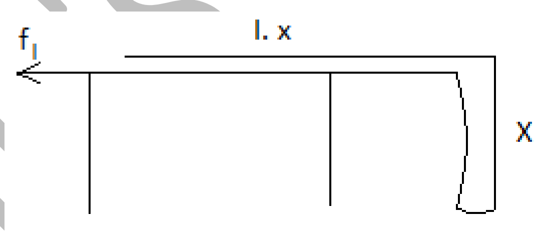
21. $R = \frac{mV}{qB} = \frac{p}{qB}$

Since p remains the same for both

$R_{e^-} = \frac{p}{e_B}\ R_p = \frac{p}{e_B}$

$\therefore R_{e^-} = R_p$

22.



Chain has a mass 'm' and length 'l'. Let a maximum length x of the chain project over the table. The length of the chain on the table is $\square\ x$. Then the pulling force due to the length x should be balanced by the limiting friction acting to the left.

$\frac{m}{l} xg = \mu \frac{m}{l} (l - x)\ g$

$x = \frac{\mu R}{1+\mu}$

$= \frac{0.25l}{1.25}$

$= 0.2l$

Therefore, it is 20%.

23. For the open tube

$f_0 = \frac{v}{2l}$

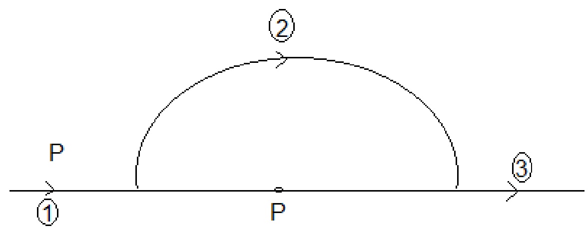
For the closed tube

$f_0^1 = \frac{v}{4\left(\frac{l}{2}\right)} = f_0$

24. At P, $\vec{B}_1 = 0$

$\vec{B}_3 = 0$

$B_2 = \frac{\mu_0 i}{4R} = \frac{\mu_0 \pi i}{4\pi R}$



25. A and B are axial points

$|V_A| = |V_B| = \frac{kp}{r^2} \cos 0°$

$= \frac{kp}{r^2}$

C and D are equatorial points. Thus,

$V_C = V_D = \frac{kp}{r^2} \cos 90°$

$= 0$

26. $\phi = \frac{\pi}{3}$

$V_{rms} = \frac{100}{\sqrt{2}}$

$i_{rms} = \frac{100}{\sqrt{2}}$

$P_{avg} = V_{rms} i_{rms} \cos \phi$

$= \frac{100}{\sqrt{2}} \times \frac{100}{\sqrt{2}} \times \frac{1}{2}$

$= 2500$ W

27. $\phi = 8t^2 - 4t + 1$

We have

$\in = -\frac{d\phi}{dt}$

$= -16t + 4$

$\in|_{t = 0.1s} = -1.6 + 4$

$= 2.4$ V

$i = \frac{\in}{R}$

$= \frac{2.4}{10}$

$= 0.24$ A

28. Using dimensional analysis, we have

$\left[\frac{L}{R}\right] = [T] \Rightarrow \left[\frac{R}{L}\right] = [T^{-1}]$

$[RC] = [T] \Rightarrow \left[\frac{1}{RC}\right] = [T^{-1}]$

$\left[\frac{1}{\sqrt{LC}}\right] = [T^{-1}]$

Only $[RCL] \neq [T^{-1}]$

29. We can write the following truth table from the graph

A	B	C
0	0	0
1	1	1
0	1	0
1	0	0

This truth table belongs to the AND gate

30. 15 years is three half lives

Thus, $N = \frac{N_0}{2^3} = \frac{N_0}{8}$

CHEMISTRY
SOLUTION AND ANSWER KEY

31.b	**32. d**	**33.c**	**34.c**	**35.b**	**36.d**	**37.b**	**38.c**	**39.b**	**40.d**
41.a	**42.c**	**43.c**	**44.b**	**45.b**	**46.c**	**47.c**	**48.a**	**49.d**	**50.d**
51.d	**52.d**	**53.c**	**54.c**	**55.b**	**56.c**	**57.c**	**58.d**	**59.c**	**60.c**

31. (b)
Sol: Conceptual

32. (d)
Sol: $CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$
or 64g -------------- 26g
64kg ------------ 26kg
$C_2H_2 + H_2 \rightarrow C_2H_4$
26kg ------- 28kg
$\therefore$ 64kg of CaC_2 gives 28kg of ethylene or polyethylene

33. (c)
Sol: EWG increases reactivity towards nucleophilic substitution, EDG decreases reactivity towards nucleophilic substitution.

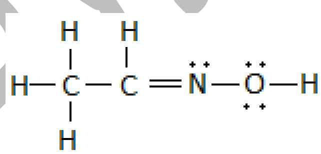
34. (c)
Sol: $\underset{(A)}{C_2H_5OH} + SOCl_2 \xrightarrow{\text{pyridine}} \underset{(B)}{C_2H_5Cl} + SO_2 + HCl$

$\underset{(X)}{C_2H_5OH} + Na \rightarrow \underset{(C)}{C_2H_5ONa} + 1/2\ H_2$

$\underset{(B)}{C_2H_5Cl} + \underset{(C)}{NaOC_2H_5} \rightarrow C_2H_5 - O - C_2H_5 + NaCl$

35. (b)

36. (d)
Sol:
$CH_3 - CH = N - OH$



σ8, 1π, 3lp.

37. (b)
Sol: Acidity α - I effect

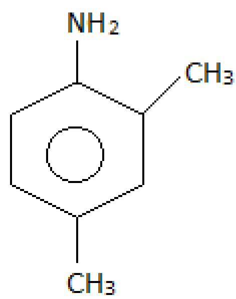
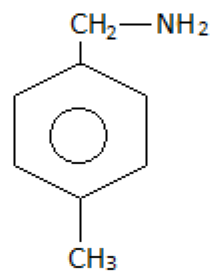
38. (c)
Sol: I $(CH_3\ COO)_2Ca \xrightarrow{\Delta} \underset{(A)}{CH_3COCH_3}$

II $CH_3COOH \xrightarrow[\text{Red P}]{\text{HI}} C_2H_6$
(B)

III $2CH_3COOH \xrightarrow{P_4O_{10}} (CH_3CO)_2O$
(C)

39. (b)

Sol:

(ii)  (iv)  Are primary amines

40. Ans: (d)

Sol: Rate = K $[N_2O_5]$

$$2.4 \times 10^{-5} = 3 \times 10^{-5} \times [N_2O_5]$$
$$[N_2O_5] = \frac{2.4 \times 10^{-5}}{3 \times 10^{-5}} = 0.8\, mol/L$$

41. Ans: (a)

Sol: d = $\frac{\sqrt{3}}{2} a \Rightarrow a = \frac{2}{\sqrt{3}} d = \frac{2}{1.732} \times 365.9 = 422.5\, pm$

For bcc, Z = 2

$$\int = \frac{z \times m}{a^3 \times N_A \times 10^{-30}} = \frac{2 \times 23}{(422.5)^3 \times (6.02 \times 10^{23}) \times 10^{-30}}$$

= 1.51 g/cm^3

42. (c)

Sol:ΔH = Δu +Δn RT

ΔH = 30Kcal

$3H_2o \rightarrow 3H_2o$
(l) (v)

Δn = 3-0 = 3

⇒ 30 = Δ U + 3×2×500×10^{-3}

ΔU= 27Kcal

43.Ans: (c)

Sol: $Br_2 + 2e^- \longrightarrow 2Br^{\ominus}$ $(reduction)$

$$Br_2 \longrightarrow BrO_3^{\ominus} + 10e^-s\ (Oxidation)$$
$$Eq.wt = \frac{M}{2} + \frac{M}{10}$$

44. (b)

Sol:K_{Agcl}=$K_{Agcl\ solution}$ $— K_{H_2o}$

= 1.86×10^{-6} - 6×10^{-8} = 1.8 ×10^{-6} ohm^{-1} cm^{-1}

$\Lambda^0_{Agcl} = \frac{K \times 1000}{s}$

$s = \frac{K \times 1000}{\Lambda^0_{Agcl}} = \frac{1.86 \times 10^{-6} \times 1000}{137.2} = 1.31 \times 10^{-5}$M

45. (b)

Sol:

46. (c)

Sol: Ionisation energy = -(energy of the 1st orbit)

Energy of 1st orbit of Li^{+2} = -13.6×9 (∵ ~~Z~~ for Li^{+2} =3)

= -122.4ev

Ionisation energy of Li^{+2} = -(-122.4) = 122.4ev

47.(C)

Sol: Ka= $Ka_1 \times Ka_2 = 1 \times 10^{-5} \times 5 \times 10^{-10} = 5 \times 10^{-15}$

48.(a)

Sol:$\frac{P_1 d_1}{T_1} = \frac{P_2 d_2}{T_2}$

49.(d)

Sol: $[Ni(CN)_4]^{2-}$ is with dsp^2 hybridization and $\mu = 0$

$[Ni(CN)_4]$is with sp^3 hybridization and $\mu = 0$ BM

$[Cu(NH_3)_4]^{2+}$is with dsp^2 hybridization with μ = 1.732 BM

$[Pd(CI)_4]^{2-}$ is with dsp^2 hybridization with μ = 0 BM

50.Ans(d)

Sol: boiling point of $NH_3 > PH_3$ due intermolecular hydrogen bonding

51. Ans(d)

Sol: Acidic nature of hydrides increases from H_2O to H_2Te

52. Ans(d)

Sol: conceptual

53. Ans(c)

Sol: it is an application of micro cosmic salt

54. Ans:(c)

Sol: Conceptual

55. Ans(b)

Sol: acidic nature of oxides increases in a period from left to right

56. Ans(c)

Sol: Dichromate salts react with hydrogen peroxide in acid medium and gives blue colour

57. Ans (c)

Sol. 50,000

58. Ans (d)

Sol: Since it is obtained by condensation polymensation of only one type of monomer i.e., capvolactam.

59. Ans (c)

Sol: Conceptual

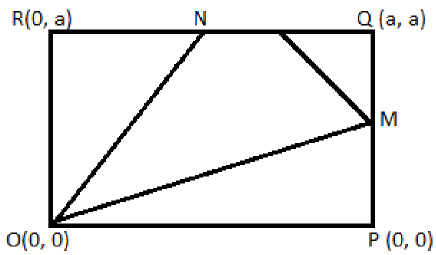
60. Ans (c)

Sol: Oxides of sulphur and nitrogen with dust and smoke combine with condensed water vapors andforms smog.

MATHEMATICS
SOLUTION AND ANSWER KEY

61. b	62. c	63. b	64. c	65. b	66. a	67. d	68. a	69. c	70. a
71. b	72. d	73. d	74. a	75. b	76. a	77. c	78. c	79. c	80. a
81. c	82. d	83. d	84. b	85. a	86. b	87. a	88. d	89. c	90. c

61. **Sol: (b)**



M = $\left(a, \frac{a}{2}\right)$, N = $\left(\frac{a}{2}\ ,\ a\right)$

Area ΔOMN = $\frac{1}{2}\begin{vmatrix} 0 & 0 & 1 \\ a & a/2 & 1 \\ a/2 & a & 1 \end{vmatrix} = \frac{3a^2}{8}$, Area of square = a^2

∴ Ratio is $a^2 : \frac{3a^2}{8}$ ⇒ 8 : 3

62. **Sol: (c)**

The line 5x – 2y + 6 = 0 cuts y-axis at Q(0, 3). Clearly PQ is the length of the tangent drawn from Q on the circle

$x^2 + y^2 + 6x + 6y = 2$ ⇒ PQ = $\sqrt{0+9+6\times 0+6\times 3-2} = 5$

63. **Sol: (b)**

Equation of tangent of slope m is $y = mx + \frac{1}{m}$ which passes through (1, 4) ⇒ $m^2 - 4m + 1 = 0$

$\tan\theta = \left|\frac{m_1 - m_2}{1+m_1m_2}\right| \Rightarrow \tan\theta = \frac{\sqrt{(m_1+m_2)^2 - 4m_1m_2}}{1+m_1m_2} \Rightarrow \tan\theta = \frac{\sqrt{16-4}}{2} = \sqrt{3}$

∴θ = 60°

64. **Sol: (c)**

Sum of 100 items = $49 \times 100 = 4900$
Sum of items = 60 + 70 + 80 = 210
Sum of items replaced = 40 + 20 + 50 = 110
$\therefore$ New sum = 4900 – 110 + 210 = 5000
$\therefore$ Correct mean = $\frac{5000}{100} = 50$

65. **Sol: (b)**

Equation of the pair of Asymptotes is $3x^2 - y^2 + k = 0$ But passes through origin
$\Rightarrow k = 0$
$\therefore$ Asymptotes are $3x^2 - y^2 = 0$
$\therefore$ Angle α between them $\alpha = 2\text{Tan}^{-1}\left\{\frac{2\sqrt{0+3}}{3-1}\right\}$

$\therefore \alpha = \frac{2\pi}{3}$

66. **Sol: (a)**

P → (∼ ∨ r) is F ⇒ P is T, ∼ ∨ r is F

⇒ P is T, ∼ is F, r is F

⇒ P is T, is T, r is F

67. **(d)** $\underset{x \to 0}{Lt} \frac{(1-\cos x)(1+\cos x+\cos^2 x)}{\sin 3x \cdot \sin 5x} = \frac{3/2}{3.5} = \frac{1}{10}$

Sol:

68. **(a)** $x^2 + y^2 = 1 \quad \Rightarrow 2x + 2y\frac{dy}{dx} = 0$

$\Rightarrow \frac{dy}{dx} = \frac{-x}{y}$

69.**(c)** $\frac{dy}{dx} = m = 3x^2 - 4x = 12 - 8 = 4$

$AT = \left|\frac{y_1\sqrt{1+m^2}}{m}\right| = \frac{4\cdot\sqrt{17}}{4} = \sqrt{17}$

70. **(a)** $a\cos x + \frac{1}{3} \cdot 3\cos 3x = 0 \quad$ for $x = \frac{\pi}{3}$

$a\,\frac{1}{2} + (-1) = 0$

$a = 2$

71. **(b)** Let $f(x) = ax^3 + bx^2 + cx$
$f(0) = 0 = f(1) \Rightarrow a + b + c = 0$

72. **(d)** $\int e^x \left(\frac{x+2}{x+3} + \frac{1}{(x+3)^2}\right)dx = e^x \cdot \left(\frac{x+2}{x+3}\right) + C$

73. **(d)** $f(x) = \log\left(\frac{2 - \sin x}{2 + \sin x}\right)$ is an odd function

$\therefore \int_{-\pi/2}^{\pi/2} f(x)dx = 0$

74. **(a)** Area = 4

75. **(b)** $y = vx \Rightarrow \sin^{-1}\left(\frac{y}{x}\right) = \log x$

$\Rightarrow y = x = e^{\pi/2}$

76. **Sol: (a)**

$\bar{a} \cdot \bar{b} > 0 \Rightarrow 2\lambda^2 - 3\lambda + 1 > 0 \Rightarrow \lambda < \frac{1}{2}$ or $\lambda > 1$ . . . .(1)

$\bar{b} \cdot i < 0$, $\bar{b} \cdot j < 0$, $\bar{b} \cdot k < 0 \Rightarrow \lambda < 0$ . . . . (2)

Form (1) and (2), $\lambda \in (-\infty, 0)$

77. **Sol: (c)**

$[\bar{U}, \bar{V}, \bar{W}] = \bar{U} \cdot (\bar{V} \cdot \bar{W}) = \bar{U} \cdot (3i - 7j - k)$

$= |\bar{U}||3i - 7j - k| \cos\theta$

$= \sqrt{59} \cos\theta$

$\therefore$Maximum value of $[\bar{U}, \bar{V}, \bar{W}] = \sqrt{59}$. $(\because \cos\theta \le 1)$

78. **Sol: (c)**

Equation of the plane is $3(x - 1) + (y - 1) + 4(z - 1) = 0$

$\Rightarrow 3x + 4y - 7 = 0$

$\therefore$Dist. from origin = $\frac{|-7|}{\sqrt{3^2 + 4^2}} = \frac{7}{5}$

79. **Sol: (c)**

Let P be the required point on AB. Let P divides AB in the ratio $\lambda : 1$

$P = \left(\frac{11\lambda - 9}{\lambda + 1}, \frac{4}{\lambda + 1}, \frac{5 - \lambda}{\lambda + 1}\right)$, OP$\perp$ AB $\Rightarrow 20\left(\frac{11\lambda - 9}{\lambda + 1}\right) - 4\left(\frac{4}{\lambda + 1}\right) - 6\left(\frac{5 - \lambda}{\lambda + 1}\right) = 0$

$\therefore \lambda = 1 \Rightarrow P = (1, 2, 2)$

80. **Sol: (a)**

$$\begin{vmatrix} 3 & -2 & 1 \\ 4 & -3 & 4 \\ 2 & -1 & m \end{vmatrix} = 0 \qquad \Rightarrow m = -2$$

81. **Sol: (c)**

$n(s) = 3^5 = 243$

$n(E) = 3({}^5C_2 \cdot {}^3C_2 \cdot {}^3C_1) + 3({}^5C_1 \cdot {}^4C_1 \cdot {}^3C_3) = 150$

$P(E) = \frac{n(E)}{n(S)} = \frac{50}{81}$

82. **Sol: (d)**

$P(W) = \frac{1}{6}$, $P(L) = \frac{5}{6}$

$P(A) = \frac{1}{6} + \left(\frac{5}{6}\right)^2 \cdot \frac{1}{6} + \left(\frac{5}{6}\right)^4 \cdot \frac{1}{6} + \ldots\ldots = \frac{6}{11}$

83. **Sol: (d)**

Sol: $\left(x^2 + (x^6 - 1)^{1/2}\right)^5 + \left(x^2 - (x^6 - 1)^{1/2}\right)^5$

$= 2\,({}^5C_0\,(x^2)^5 + {}^5C_2\,(x^2)^3\,(x^6 - 1) + {}^5C_4 x^2 (x^6 - 1)^2)$

Here last term is of 14 degree.

84. Sol. (**b**) $|z| = \left|z - \frac{4}{2} + \frac{4}{2}\right|$

$\leq \left|z - \frac{4}{2}\right| + \left|\frac{4}{2}\right|$

$= \left|z - \frac{4}{2}\right| + \frac{4}{|2|}$

$|z| \leq 2 + \frac{4}{|2|}$

$|z|^2 - 2|2| \leq 4$

$|z|^2 - 2|2| + 1 \leq 5$

$\Rightarrow |z| \leq \sqrt{5} + 1$

85. Ans. (a) $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$

$= (1 - \log_z y \log_y z) - \log_x y(\log_y x - \log_z x \log_y z)$

$+ \log_x z(\log_y x \log_z y - \log_z x)$

$= (1-1) - (1 - \log_x y \log_y x) + (\log_x z \log_z x - 1) = 0$

{Since $\log_x y . \log_y x = 1$} .

86. **Sol: (b)**

Last digit is zero and the remaining from digits are 1,2,4,5. Number of arrangements = 4! =24

87. **Sol: (a)**

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

$$\Rightarrow x^2 - x - 2 = x - 1 - 2$$

$$\Rightarrow x^2 - 2x + 1 = 0$$

$$\Rightarrow (x-1)^2 - 0$$

$$\Rightarrow x - 1 = 0 \Rightarrow x = 1$$

But when x = 1 (1) is not divined $\therefore No\ root$

88. **Sol: (d)**

$$\tan 9° - \tan 27° - \tan 63° + \tan 81°$$
$$= \tan 9° + \cot 9° - (\tan 27° + \cot 27°)$$
$$= \frac{1}{\sin 9°.\cos 9°} - \frac{1}{\sin 27° \cos 27°}$$
$$= \frac{2[\sin 54° - \sin 18°]}{\sin 18°.\sin 54°} = 4$$

89. **Sol: (c)**

$$2^{78} + 2^3.2^{75} = 8\,(2^5)^{15} = 8(1+31)^{15} = 8\{{}^{15}C_0 + {}^{15}C_1\,31 + \dots\dots\dots + {}^{15}C_{15}(31)^{15}\}$$
$$2^{78} = 8 + \text{an integer multiple of } 31$$
$$\frac{2^{78}}{31} = \frac{8}{31} + \text{an integer}$$

90. Sol: (c) $|z_1 + z_2|^2 = |z_1 - z_2|^2$

$$\Rightarrow z_1.\bar{z}_2 + \bar{z}_1 z_2 = 0$$

i.e $z_1.\bar{z}_2 + \overline{z_1.\bar{z}_2} = 0$

$\Rightarrow$ Re$(z_1.\bar{z}_2) = 0$

Cut $z_1 = r,\ e^{i\theta_1}$, $z_2 = r_2 e^{i\theta_2}$

$\Rightarrow$ Re $z_1.\bar{z}_2 = r_1 r_2 e^{i(\theta_1 - \theta_2)} = 0$

$\Rightarrow$ can$(\theta_1 - \theta_2) = 0$

$\Rightarrow \theta_1 - \theta_2 = \pm \frac{\pi}{2}$