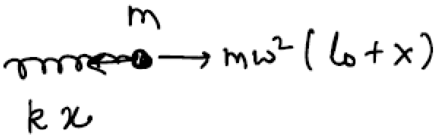
**IIT – JEE: 2025** **TW TEST (ADV)** **DATE: 22/10/23**

**TOPIC: CIRCULAR MOTION & WPE**

**SOLUTIONS**

1. (C)




$$kx = m\omega^2 (l_0 + x)$$

$$(k - m\omega^2)x = m\omega^2 l_0$$

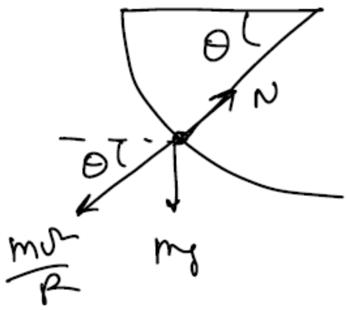
$$x = \frac{m\omega^2 l_0}{k - m\omega^2}$$

$$r = l_0 + x$$

$$r = l_0 + \frac{m\omega^2 l_0}{k - m\omega^2} = \frac{kl_0 - \cancel{m\omega^2 l_0} + \cancel{m\omega^2 l_0}}{k - m\omega^2}$$

$$= \frac{kl_0}{k - m\omega^2}$$

2. (D)




$$v = \sqrt{2gR\sin\theta}$$

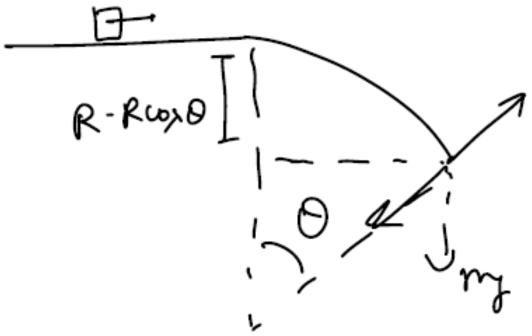
$$N = mg\sin\theta + \frac{mv^2}{R}$$

$$\cancel{mg} = \cancel{mg}\sin\theta + \cancel{m}\,2g\sin\theta$$

$$\Rightarrow 1 = 3\sin\theta$$

$$\Rightarrow \sin\theta = 1/3$$

3. (B)




$$\cancel{\tfrac{1}{2}}m\left(\frac{1}{4}gR\right) + 2mgR(1-\cos\theta) = \cancel{\tfrac{1}{2}}mv^2$$

$$\frac{mg}{4} + 2mg(1-\cos\theta) = \frac{mv^2}{R}$$

$$mg\cos\theta = \frac{mv^2}{R}$$

$$\cancel{mg}\cos\theta = \frac{\cancel{mg}}{4} + 2\cancel{mg}(1-\cos\theta)$$

$$4\cos\theta = 1 + 8(1-\cos\theta)$$

$$12\cos\theta = 9$$

$$\cos\theta = 3/4$$

4. (A)

$U = \frac{1}{2}kx^2 \qquad x < 0$

$U = 0 \qquad x \geq 0$

$\because x < 0, \; U = \frac{1}{2}k\left(\frac{2E}{k}\right)$

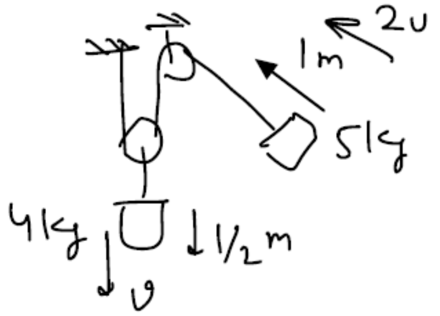
$= E$

$U + K = E$

$\Rightarrow K = E - U = 0$

5. (C)

$$W_{50N} + W_{40N} + \cancel{W_T}^{\,0} = K_f - \cancel{K_i}^{\,0}$$




$$-50\sin\theta(1) + 40\times\frac{1}{2} = \cancel{\frac{1}{2}}\times5\times\overset{2}{\cancel{4}}v^2 + \frac{1}{2}\times4v^2$$

$$-30 + 20 = 10v^2 + 2v^2$$

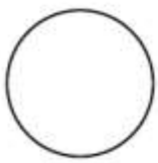
$$10 = 12v^2$$

$$v = \sqrt{\frac{5}{6}} = \sqrt{\frac{10}{12}} = \sqrt{\frac{8}{12}} = \frac{\sqrt{8}}{2\sqrt{3}}$$

6. (C)

$$\cancel{\frac{1}{2}}(200)\times6^2 = \cancel{\frac{1}{2}}\times2v^2$$

$$v = 60$$

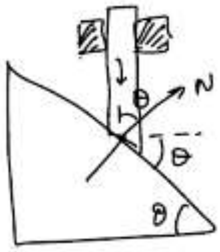


$$N = \frac{mv^2}{R} = \frac{2\times\overset{720}{\cancel{(3600)}}}{\cancel{5}}$$

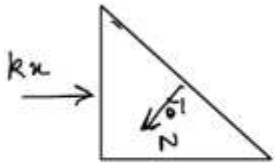
$$= \underline{\underline{1440\,N}}$$

7. (D)

8. (C)




$$N\cos\theta = mg$$




$$N\sin\theta = kx$$

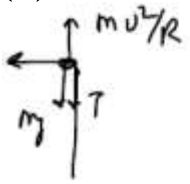
$$\frac{mg}{\cos\theta}\sin\theta = kx$$

$$x = \left(\frac{mg\tan\theta}{k}\right)$$

$$U = \frac{1}{2}kx^2$$

$$= \frac{1}{2}\cancel{k}\,\frac{m^2g^2\tan^2\theta}{k^{\cancel{2}}}$$

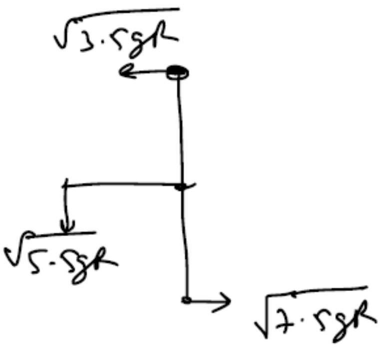
9. (D)

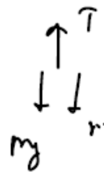



$$\frac{mv^2}{R} = T + mg$$

$$\frac{\cancel{m}v^2}{R} = 3.5\cancel{m}g$$

$$v = \sqrt{3.5gR}$$

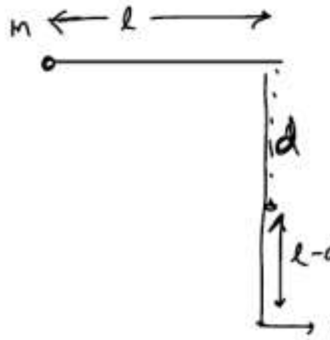



$$m\frac{(7.5gR)}{R}$$

$$T = 8.5\,mg$$

10. (C)




$$v = \sqrt{2gl} = \sqrt{5g(l-d)}$$

$$\Rightarrow 2l = 5(l-d)$$

$$\Rightarrow 5d = 3l$$

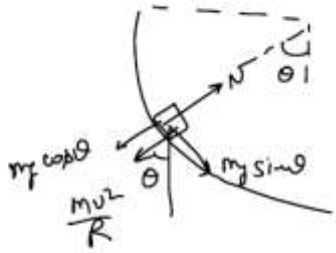
$$\Rightarrow d = 3l/5$$

11. (B, C, D)

$$f = mg\sin\theta$$

$$N - mg\cos\theta = mv^2/R$$

$$\Rightarrow \mu = \frac{\sin\theta}{\cos\theta + \frac{v^2}{Rg}}$$




$$\mu\left(mg\cos\theta + \frac{mv^2}{R}\right) = mg\sin\theta$$

$$\mu = \frac{g\sin\theta}{g\cos\theta + \frac{v^2}{R}}$$

$$= \frac{\sin\theta}{\cos\theta + \frac{v^2}{Rg}}$$

$$P = F\cdot v = -mg\sin\theta\, v$$

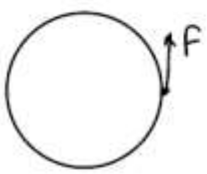
$$W_f = -\int_{90}^{0} mg\sin\theta\, R\,d\theta$$

$$= -mgR\left[\cos\theta\right]_{90}^{0}$$

$$= -mgR\,[1-0)$$

$$= \underline{-mgR}$$

12. (B, D)




a) ×

b)

c) Resultant of other force + applied force $= \frac{mv^2}{r}$ towards center

13. (A, C)

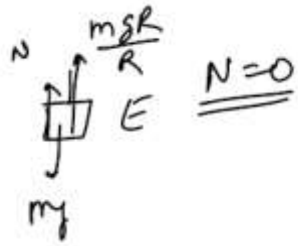
$$F = 3x^2 - 2x$$

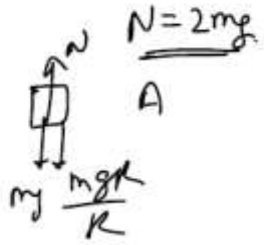
$$3x^2 - 2x = 0$$

$$x(3x-2) = 0$$

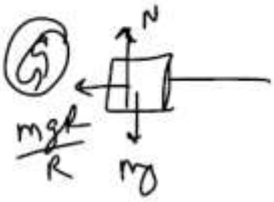
$$x = 0,\ 2/3$$

14. (A, B, C, D)




(a)




$N=mg$ (b)

$\frac{N_E = 0}{N_A = 2mg} \rightarrow 0$ (c)

$N_A = 2mg$ (d)

$N_C = mg$

15. (C, D)

Speed is constant direction is changing

$\Rightarrow$ c, d

16. (1.17)

$$W_{mg} + W_f + \cancel{W_N}^{0} = K_f - K_i$$

$$-\cancel{m}g(1.1) - 4\cancel{m}gd = 0 - \frac{1}{2}\cancel{m}(6)^2$$

$$-11 - 0.6(10d) = -18$$

$$7 = 6d$$

$$d = \frac{7}{6} = 1.17.$$

17. (3)

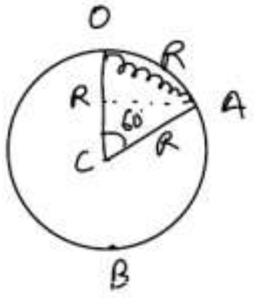
I ✓ Work done in closed path = 0

II There may be other forces due to which work done by all the forces $= \Delta K$

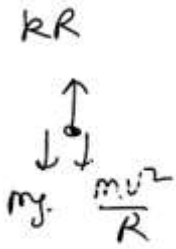
III ✓ Force will obey Newton's $2^{nd}$ law

IV Work depends on end points.

18. (500)




$r = 20\,cm$




$$W_{mg} + W_s = K_f - \cancel{K_i}^{\,0}$$

$$mg\,\frac{3R}{2} - \frac{1}{2}k\left(R^2 - 0\right) = \frac{1}{2}mv^2$$

$$\frac{3mgR}{2} - \frac{1}{2}kR^2 = \frac{1}{2}\left(kR - mg\right)R$$

$$\Rightarrow \frac{3mgR}{2} - \frac{1}{2}kR^2 = \frac{1}{2}kR^2 - \frac{mgR}{2}$$

$$= 2mg\cancel{R} = kR^{\cancel{2}}$$

$$k = \frac{2mg}{R} = \frac{2 \times 5 \times 10}{0.2} = 500$$

19. (52.5)

$$u_z = 0$$

$$a_z = -9.8$$

$$s_z = -3.6$$

$$-3.6 = \frac{1}{2} \times 9.8\ t^2$$

$$\Rightarrow \quad t = \sqrt{\frac{3.6}{4.9}} = \frac{6}{7}\,s$$

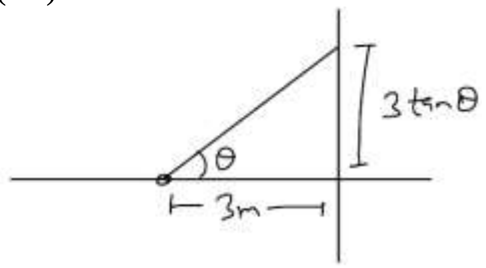
$$u_x \times t = s_x$$

$$\Rightarrow \quad u_x \times \frac{6}{7} = 9$$

$$\Rightarrow \quad u_x = \frac{9 \times 7}{6} = \frac{3}{2} \times 7 = \frac{21}{2}$$

$$a = \frac{21 \times \cancel{21}^{\,10}}{4 \times \cancel{21}} = \frac{210}{4} = 52.5$$

20. (0.6)




$$y = 3\tan\theta$$

$$\frac{dy}{dt} = 3\sec^2\theta\left(\frac{d\theta}{dt}\right)$$

$$= 3 \times (2) \times \left(\frac{d\theta}{dt}\right)$$

$$= 6 \times 0.1 = 0.6$$

## SOLUTIONS

21. (B)

Van der Waal's equation for one mole of a real gas is

$$\left(P+\frac{a}{V^2}\right)(V-b)=RT$$

Or $PV=RT+Pb+\frac{ab}{V^2}-\frac{a}{V}$

At high pressures, the van der Waal's gas equation reduces to PV = RT + Pb

Or $\frac{PV}{RT}=1+\frac{Pb}{RT}$

$\therefore$ Compressibility factor $Z=\frac{PV}{RT}=1+\frac{Pb}{RT}$

22. (D)

Critical temperature, $T_C=\frac{8a}{27Rb}$

23. (D)

$$\frac{P_{H_2}}{P_{Total}}=x_{H_2}=\frac{\frac{w}{2}}{\frac{w}{2}+\frac{w}{30}}=\frac{15}{16}$$

24. (A)

$$r_{SO_2}:r_{O_2}:r_{CH_4}::\frac{1}{\sqrt{64}}:\frac{1}{\sqrt{32}}:\frac{1}{\sqrt{16}}$$

$$=\frac{1}{2}:\frac{1}{\sqrt{2}}:1=1:\sqrt{2}:2$$

25. (C)

Teacher $\left|\underset{d}{\leftrightarrow}\right|\left|\underset{d}{\leftrightarrow}\right|$....... Student [12 d distance]

$$\frac{x}{12d-x}=\sqrt{\frac{179}{44}}\simeq 2$$

$\Rightarrow x=8d$

So, at 9th row this event occurs first.

26. (C)

$$\frac{3}{2} \times 1.38 \times 10^{-23} \times T \times 10^{20} = 0.629$$

$$T = 30.8^{o} C$$

27. (C)

$$d_A = 2d_B ; 2M_A = M_B ; PM = dRT$$

$$\Rightarrow \quad \frac{P_A}{P_B} \times \frac{M_A}{M_B} = \frac{d_A}{d_B} \times \frac{RT}{RT}$$

$$\Rightarrow \quad \frac{P_A}{P_B} \times \frac{1}{2} = 2$$

$$\frac{P_A}{P_B} = \frac{4}{1}$$

28. (A)

$$PV = \frac{1}{3} mu^2$$

$$P \times 1 = \frac{2}{3} \times \frac{1}{2} mu^2$$

$$P = \frac{2}{3} E$$

29. (C)

$$300 = \sqrt{\frac{3RT}{4 \times 10^{-3}}} ; RT = 120$$

Total K.E. of He gas = $\frac{3}{2} nRT$

$$= \frac{3}{2} \times \frac{8}{4} \times 120 \text{ J}$$

$$= 360 \text{J}$$

30. (B)

$$d = \frac{PM}{RT}$$

31. (A, B, C)

32. (B, D)

Boyle's law $P \propto \frac{1}{V}$

$$\therefore \left( \frac{\partial P}{\partial V} \right)_T = -K / V^2$$

33. (B, D)

$$\mu_{av} = \sqrt{\frac{8RT}{\pi M}} \text{and} \, \mu_{rms} = \sqrt{\frac{3RT}{M}}$$

34. (A, C)

35. (B, D)

36. (10)

We must first understand that the gas in the cylinder is at 20 atm and $27^\circ C$, while it has to be filled in the balloon at STP conditions. First we calculate the volume of the gas at STP using Boyle's law, we have

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Where $P_1 = 20 \text{atm}, V_1 = 2.82\,\text{L}, T_2 = 273\,\text{K},$

$P_2 = 1 \text{atm}, \text{and}\, T_1 = 300\text{K}$

$$\therefore V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2} = \frac{20 \times 2.82}{300} \times \frac{273}{1} = 51.324\,\text{L}$$

This volume $V_2$ of the gas is used to fill the balloons.

Volume of one balloon $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$

$= 4851 \text{mL} = 4.851\text{L}$

Number of balloons filled $= \left(\frac{\text{V of gas} - \text{V of cylinder}}{\text{V of one balloon}}\right)$

Therefore, the number of balloons filled up is

$$= \left(\frac{51.324 - 2.82}{4.851}\right) \simeq 10$$

The number of balloons that can be completely filled is only 10.

37. (14)

$$\frac{r}{r_{Kr}} = \sqrt{\frac{M_w(Kr)}{M}}$$

$1.16 = \sqrt{\frac{84}{M}}$ $\quad \therefore M = 62.28$

(Molar weight of $Cl_2$ and mixture $= 62.28$)

$$Cl_2 \rightleftharpoons 2Cl$$

| | $Cl_2$ | $2Cl$ |
|---|---|---|
| Initial | 1 | 0 |
| Final | $1-x$ | $2x$ |

Total moles $= 1 - x + 2x = 1 + x$

$$\therefore \frac{2x(35.5) + (1-x) \times 71}{1+x} = 62.28$$

$$\frac{71}{1+x} = 62.28$$

$x = 0.14 = 14\%$ dissociated

38. (40)

Charles laws is applicable as the pressure and amount remains constant

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \text{ or } V_1 = \frac{T_1}{T_1} \times V_2$$

$$V_1 = \frac{320\text{K}}{300\text{K}} \times 600\text{mL} = 640\,\text{mL}$$

Increase in volume of air is

$640\,mL - 600\,mL = 40\,mL$

39. (45)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2};\frac{5}{273}\times 819\times 3 = P_2;P_2 = 45atm$$

40. (1)

$$\frac{n_1.t_2}{n_2.t_1} = \sqrt{\frac{M_2}{M_1}};\frac{w_1}{M_1}\times\frac{M_2}{w_2} = \sqrt{\frac{M_2}{M_1}}$$

$$\frac{w_1}{w_2} = \sqrt{\frac{M_1}{M_2}};\frac{w_1}{4} = \sqrt{\frac{4}{64}}$$

$$\Rightarrow w_1 = 1gm$$

**IIT – JEE: 2025** **TW TEST (ADV)** **DATE: 22/10/23**

**TOPIC: SEQUENCE & SERIES**

## SOLUTIONS

41. (D)

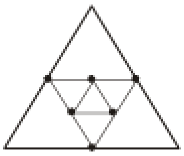
$$S=\frac{2p+1}{2}\left[2\left(p^2+1\right)+2p\right]=\left(2p+1\right)\left(p^2+1+p\right)=2p^3+3p^2+3p+1=p^3+\left(p+1\right)^3$$

42. (C)

$$A_1^2 - A_2^2 + A_3^2 - A_4^2 + A_5^2 - A_6^2 = -d\,(A_1 + A_2 + .....+ A_6) = -\left(\frac{b-a}{7}\right)(3(b+a)) = 3\left(\frac{a^2-b^2}{7}\right) = \text{Prime}$$

$\Rightarrow a = 4, b = 3$

43. (A)



$$=3\left[24+12+6+.....\infty\right]=3\frac{24}{1-\frac{1}{2}}=144$$

44. (C)

$x^3-11x^2+36x-36=0$

If roots are in H.P., then roots of new equation

$\frac{1}{x^3}-\frac{11}{x^2}+\frac{36}{x}-36=0$ are in A.P.

$36x^3+36x^2-11x+1=0$

$36x^3-36x^2+11x-1=0$

Let the roots be $\alpha,\beta,\gamma$

$\alpha+\beta+\gamma=1$

$3\beta=1\left(2\beta,=\alpha+\gamma\right)\beta=\frac{1}{3}$

So middle roots is 3.

45. (A)

$$n\left(\frac{a+b}{2}\right)=n\left(\frac{a+b}{2ab}\right) \quad\Rightarrow\quad ab=1$$

46. (B)

If first and last term of A.P. and H.P. are same the product of x terms beginning in A.P. and kth term from end in H.P. is constant and equal = first term $\times$ last term

$$a_7h_{24}+a_{14}h_{17}=ab+ab=2ab=2(25)(2)=100$$

47. (B)

$$S=\frac{3^{10}}{\left(1-\frac{1}{6}\right)}+\frac{3^{10}\left(\frac{1}{6}\right)}{\left(1-\frac{1}{6}\right)^2}=\frac{6^2.3^{10}}{5^2}\Rightarrow\left(\frac{25}{36}\right)S=3^{10}$$

48. (A)

Taking A.M. and G.M. of number, $\frac{a}{2},\frac{a}{2},\frac{b}{3},\frac{b}{3},\frac{b}{3},\frac{c}{2},\frac{c}{2}$

We get A.M $\geq$ G.M. $\quad \frac{2.\frac{a}{2}+3.\frac{b}{3}+2.\frac{c}{2}}{7}\geq\left(\left(\frac{a}{2}\right)^2\left(\frac{b}{2}\right)^3\left(\frac{c}{2}\right)^2\right)^{1/7}$

Or $\frac{3}{7}\geq\left(\frac{a^2b^3c^2}{2^2.3^3.2^2}\right)^{1/7}$ or $\frac{3^7}{7^7}\geq\frac{a^2b^3c^2}{2^4.3^3}$ or $a^2b^3c^2\leq\frac{3^{10}.2^4}{7^7}$

$\therefore$ Greatest value of $a^2b^3c^2=\frac{3^{10}.2^4}{7^7}$

49. (A)

$$H_n=1+\frac{1}{2}+\frac{1}{3}+.......+\frac{1}{n}$$

$$1+\frac{3}{2}+\frac{5}{3}+.......+\frac{2n-1}{n}=(2-1)+\left(2-\frac{1}{2}\right)+\left(2-\frac{1}{3}\right)+......+\left(2-\frac{1}{n}\right)=2n-H_n$$

50. (A)

$$\sum_{r=1}^{n}\frac{1}{\sqrt{a+1-x}+\sqrt{a+(r-1)}};\ \sum_{r=1}^{n}\frac{\sqrt{(a+rx)}-\sqrt{(a+(r-1)\ \ x)}}{(a+rx)-(a+(r-1)\ \ x)};$$

$$=\frac{1}{x}\left[\left(\sqrt{a+x}-\sqrt{a+0.x}\right)+\left(\sqrt{a+2x}-\sqrt{a+x}\right)+\left(\sqrt{a+3x}-(a+2x)+.......+\left(\sqrt{a+nx}-\sqrt{a+(n-1)\ \ x}\right)\right)\right]$$

$$=\frac{1}{x}\left[\sqrt{a+nx}-\sqrt{a}\right]=\frac{n}{\sqrt{a}+\sqrt{a+nx}}$$

51. (B, D)

$a_1+4a_2+6a_3-4a_4+a_5=0\Rightarrow a-4(a+d)+6(a+2d)-4(a+3d)+(a+4d)=0-0=0$

Like wise we can check other options

52. (A, B, C)

$a + b + c = 25 \quad\Rightarrow\quad 2a = 2 + b \quad\Rightarrow\quad c^2=18b$

$$\Rightarrow\quad\frac{1}{2}\left(2+\frac{c^2}{18}\right)+\frac{c^2}{18}+c=25$$

$$\Rightarrow c=12,-24\quad\Rightarrow\quad c\neq-24\quad\Rightarrow\quad b=\frac{c^2}{18}=8\quad\Rightarrow\quad a=5$$

53. (A, C)

$\frac{a_{k+1}}{a_x}$ is constant $\therefore$ G.P.

$a_n > a_m$ for $n > m$ $\therefore$ increasing G.P.

$a_1 + a_n = 66$ $\quad a_2 a_{n-1} = 128$

$a + ar^{n-1} = 66$ $\quad a.ar^{n-1} = 128$ ......(2)

$a\left(1 + r^{n-1}\right) = 66$ ......(1)

$a\left(66 - a\right) = 128 \Rightarrow a^2 - 66a + 128 = 0$

$\left(a - 2\right)\left(a - 64\right) = 0 \Rightarrow a = 2, a = 64$

$\therefore \quad r^{n-1} = 32$

$\sum_{i=1}^{n} a_i = 126 \Rightarrow \frac{a\left(r^n - 1\right)}{r - 1} = 126 \Rightarrow \frac{2\left(32r - 1\right)}{r - 1} = 126$

$\Rightarrow 64r = 126 + 124 \Rightarrow n = 6$

54. (A, B, C)

$\frac{\frac{a+b}{2}}{\sqrt{ab}} = \frac{2}{1} \Rightarrow \frac{a+b}{2\sqrt{ab}} = \frac{2}{1}$ use compendendo and dividend rule

$\Rightarrow \frac{a + b + 2\sqrt{ab}}{a + b - 2\sqrt{ab}} = \frac{3}{1} \Rightarrow \frac{\sqrt{a} + \sqrt{b}}{\sqrt{a} - \sqrt{b}} = \frac{\sqrt{3}}{1} \Rightarrow \frac{2\sqrt{a}}{2\sqrt{b}} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$

$\Rightarrow \frac{a}{b} = \frac{3 + 1 + 2\sqrt{3}}{3 + 1 - 2\sqrt{3}} \Rightarrow \frac{a}{b} = \frac{2 + \sqrt{3}}{2 - \sqrt{3}} = \frac{\left(2+\sqrt{3}\right)\left(2+\sqrt{3}\right)}{4 - 3} = 7 + 4\sqrt{3}$

55. (A, D)

Roots are $\alpha_1, \alpha_2, \alpha_3, \alpha_4$; A.M. = G.M. = 2

Hence, all the roots are equal.

56. (2.00)

AP (1, 3) = {1, 4, 7, 10, 13, 16,…..}
AP (3, 5) = {3, 8, 13, 18,…..}
AP (5, 7) = {5, 12, 19, 26, 33,…..}

$AP\left(1,3\right) \cap AP\left(3,5\right) = AP\left(13,15\right) = \left\{13, 28, 43, 58, 73, 88, 103, .....\right\}$

$AP\left(1,3\right) \cap AP\left(3,5\right) \cap AP\left(5,7\right) = AP\left\{103, 105\right\}$

57. (1.66 or 1.67)

$\log_2 x + \log_2\left(\sqrt{x}\right) + \log_2\left(\sqrt{x}\right)^{1/4} + \log_2\left(\sqrt{x}\right)^{1/8} + .... = 4$

$\Rightarrow \log_2 x \frac{1}{2} + \log_2 x + \frac{1}{4}\log_2 x + .... = 4$

$\Rightarrow \frac{\log_2 x}{1 - \frac{1}{2}} = 4 \Rightarrow \log_2 x = 2 \Rightarrow x = 4$

$$\frac{\left(\frac{x^2 + 3x + 2}{x + 2}\right) + 3x - \frac{x\left(x^3 + 1\right)}{\left(x + 1\right)\left(x^2 - x + 1\right)}\log_2 8}{\left(x - 1\right)\left(\log_2 3\right)\left(\log_3 4\right)\left(\log_4 5\right)\left(\log_5 2\right)} = \frac{x + 1}{x - 1}$$

58. (0)

$$\frac{a+b}{2}=6 \qquad G^2+3H=48 \qquad ab+3\frac{2ab}{a+b}=48 \Rightarrow ab+\frac{3ab}{6}=48$$

$$\Rightarrow \frac{3}{2}ab=48 \quad \Rightarrow ab=32 \quad \Rightarrow a=4, b=8$$

59. (9)

$$\frac{S_3(1+8\ S_1)}{S_2^2}=\frac{\left[\frac{n(n+1)}{2}\right]\left[1+\frac{8n(n+1)}{2}\right]^2}{\left[\frac{n(n+1)(2n+1)}{6}\right]^2}=\frac{[1+4n(n+1)]9}{(2n+1)^2}=9$$

60. (0.50)

$$T_n=\frac{n}{1+n^2+n^4}=\frac{1}{2}\left[\frac{(2n)}{(1+n+n^2)(1-n+n^2)}\right]; T_n=\frac{1}{2}\left[\frac{1}{1-n+n^2}-\frac{1}{1+n+n^2}\right]$$

$$T_1=\frac{1}{2}\left[\frac{1}{1}-\frac{1}{3}\right], ; T_2=\frac{1}{2}\left[\frac{1}{3}-\frac{1}{7}\right], T_3=\frac{1}{2}\left[\frac{1}{7}-\frac{1}{13}\right],$$

$$\vdots$$

$$T_n=\frac{1}{2}\left[\frac{1}{1-n+n^2}-\frac{1}{1+n+n^2}\right]$$

$$S_n=\sum T_n=\frac{1}{2}\left[1-\frac{1}{1+n+n^2}\right]=\frac{n+n^2}{2(1+n+n^2)}$$