SOLUTIONS

WEEKLY TEST-9

GZRS-1901

(JEE ADVANCED PATTERN)

Test Date: 29-07-2017

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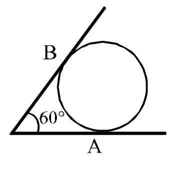
Corporate Office: Paruslok, Boring Road Crossing, Patna-01
Kankarbagh Office: A-10, 1st Floor, Patrakar Nagar, Patna-20
Bazar Samiti Office : Rainbow Tower, Sai Complex, Rampur Rd.,
Bazar Samiti Patna-06
Call : 9569668800 | 7544015993/4/6/7

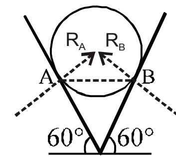
PHYSICS

1. (A, B, C)

$R_A = mg = 10$ N

$R_B = 0$





$R_A \cos 30^o = R_B \cos 30^o$

$R_A = R_B$

$2R_A \sin 30^o = 10$

$2 \cdot R_A \times \frac{1}{2} = 10$

$R_A = 10$ N

$R_B = 10$ N

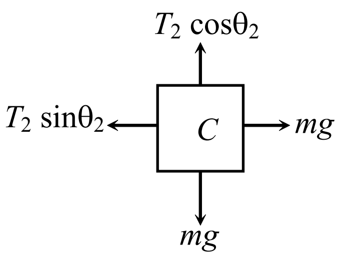
2. (A,C,D)

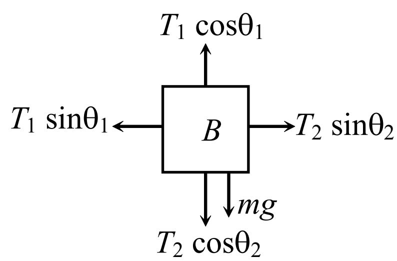
$T_2 \sin\theta_2 = mg$ … (i)

$T_2 \cos\theta_2 = mg$ …(ii)

$T_1 \cos\theta_1 = mg + T_2 \cos\theta_2$ ...(iii)

$T_1 \sin\theta_1 = T_2 \sin\theta_2$ ...(iv)





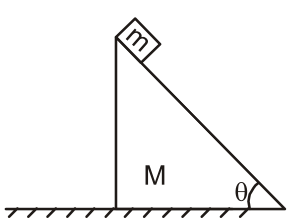
$\therefore$ **(A) (C) and (D)**

3. (A, C)

4. (A, B)

Let the acceleration of wedge be a_0 in backward direction.

Consider the motion of smaller block from the frame of wedge.



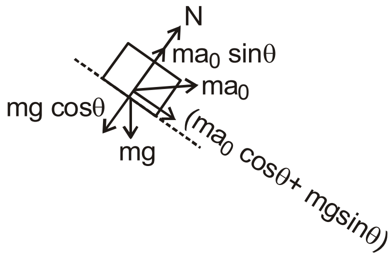
Component of force parallel to incline; $ma_0 \cos\theta + mg\sin\theta = ma$

$\Rightarrow\ a = a_0\cos\theta + g\sin\theta.$ .....(i)

Component of force perpendicular to incline

$N + ma_0\sin\theta = mg\cos\theta$ .....(ii)

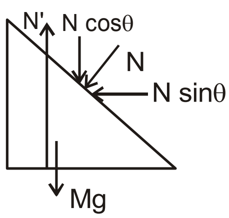
F.B.D. of block



Horizontal components give,

$N\sin\theta = Ma_0 \Rightarrow N = Ma_0/\sin\theta$ .....(iii)

F.B.D. of wedge



Putting in (ii);

$$\frac{Ma_0}{\sin\theta} + Ma_0\sin\theta = mg\cos\theta$$

$$\Rightarrow\ a_0 = \frac{mg\sin\theta\cos\theta}{M + m\sin^2\theta} \text{ and } a = \frac{(M+m)g\sin\theta}{M + m\sin^2\theta} \text{ in wedge frame.}$$

5. (A,C)

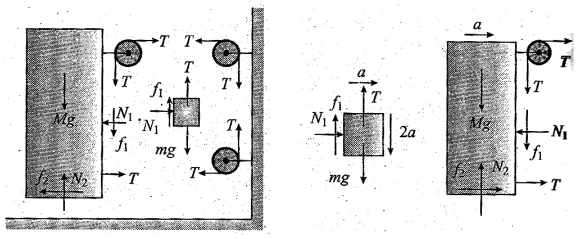
T = kx

$m_2 g = kx$

Just after cutting the string S, tension in it will be zero but spring will not loss its force instantaneously.

so $a_1 = \frac{kx}{m_1} = \frac{m_2 g}{m_1} = \left(\frac{m_2 g}{m_1}\right)$ and so block of mass m_2 will have acceleration $a_2 = 0$

6. (D)



Along horizontal direction, $N_1 = ma$

Along vertical direction, $mg - (\mu_1 N_1 + T) = m(2a)$ .....(i)

After substituting value of N_1 in Eq. (i), we have

$Mg - (\mu_1 ma + T) = m(2a)$ .....(ii)

For the motion of block M :

Along vertical direction $\sum F_V = 0$,

or $N_2 = T + \mu_1 N_1 + Mg$ .....(iii)

Along horizontal direction,

$2T - (N_1 + \mu_2 N_2) = Ma$ .....(iv)

From equation (i) and (iii), we get

$$2T - \left[N_1 + \mu_2 (T + \mu_1 N_1 + Mg)\right] = Ma$$

or $2T - \left[ma + \mu_2 T + \mu_1 \mu_2 (ma) + \mu_2 Mg\right] = Ma$ .....(v)

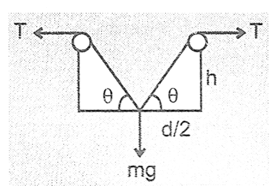
Now solving equation (ii) and (iv), we get

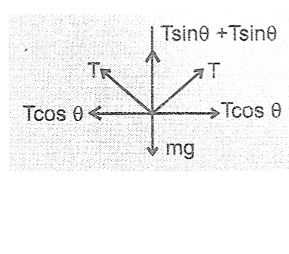
$$a = \frac{2m - \mu_2 (M + m) g}{M + m\left[5 + 2(\mu_1 - \mu_2)\right]}$$

7. (A, D)

If initially acceleration of A is greater than that of B, then there will be extension and if that of B is greater than A, then there will be compression in the spring. Otherwise the length of spring will remain same

8. (B, C)





$$\tan\theta = \frac{2h}{d}$$

$$\cos\theta = \frac{d}{2\sqrt{\frac{d^2}{4} + h^2}}$$

$$\sin\theta = \frac{h}{\sqrt{h^2 + \frac{d^2}{4}}}$$

as man moves slowly $2T\sin\theta = mg$

$$T = \frac{mg}{2\sin\theta}$$

as man moves upward θ becomes small

$\therefore$ $\sin\theta$ decreases

$\Rightarrow$ T increases

$$T = \frac{mg}{2\times h}\sqrt{h^2 + \frac{d^2}{4}} = \frac{mg\sqrt{d^2+4h^2}}{4h}$$

9. (C)

10. (D)

$F = 25t, \quad 0 \le t \le 4\,\text{sec}$ $\qquad a = \left(\frac{25t-50}{10}\right), \quad 2 < t \le 4$

$F = 40 \quad 4 \le t \le 7\,\text{sec}$ $\qquad a' = \frac{40-50}{10}, \quad 4 < t \le 7$

$F = 0 \quad t > 7\,\text{sec}$ $\qquad a'' = \frac{-50}{10}, \quad t > 7$

$v = \int_2^4 (2.5t - 5)dt = 5\,\text{m/sec} \Rightarrow$ max velocity

$v' = 5 - 1\times 3 = 2\,\text{m/sec}$, at the end of 7 sec

$$s_1 = 5\times 3 - \frac{1}{2}\times 1\times 9 = 10.5\,\text{m}, \qquad (4 < t \le 7)$$

$$s_2 = 2\times 0.4 - \frac{1}{2}\times 5(0.4)^2 = 0.4\,\text{m}, \qquad (t > 7)$$

$$\Rightarrow \quad s = s_1 + s_2 = (10.5 + 0.4)\,\text{m} = 10.9\,\text{m}$$

11. (A)

12. (A)

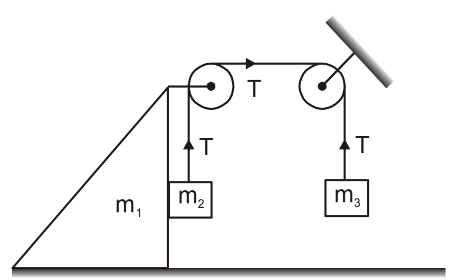
From constraint relation ;

$Tx_1 + Tx_2 + Tx_3 = 0$

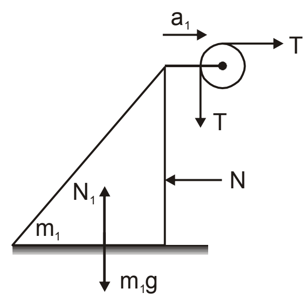
by double diff$^{n.}$

$Ta_1 + Ta_2 + Ta_3 = 0$

$\therefore \quad a_1 + a_2 + a_3 = 0 \qquad$ ...(A)



F.B.D. of wedge of mass m_1 ;



$$T - N = m_1 a_1$$

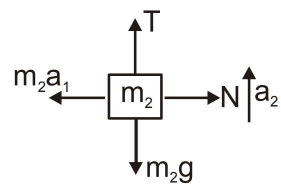
$$N = m_2 a_1$$

$$\therefore\ T = m_1 a_1 + m_2 a_1$$

$$= a_1(1+2) = 3a_1$$

$T = 3a_1$ ...(i)

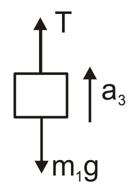
F.B.D. mass m_2 ;



$$T - m_2 g = m_2 a_2$$

$T - 2g = 2a_2$ ...(ii)

F.B.D. of mass m_3 ;



$$T - m_3 g = m_3 a_3$$

$T - 3g = 3a_3$ ...(iii)

From (i) , (ii) & (iii) and putting in equation (A)

$$\frac{T}{3} + \frac{T}{2} - g + \frac{T}{3} - g = 0$$

$$\frac{2T}{3} + \frac{T}{2} = 2g \ \Rightarrow \frac{4T+3T}{6} = 2g$$

$$\Rightarrow \quad T = \frac{6\times2\times10}{7} = \frac{120}{7}N$$

$$a_1 = \frac{T}{3} = \frac{40}{7}\ ms^{-2}$$

$$a_2 = \frac{T}{2} - g = \frac{60}{7} - 10 = \frac{-10}{7} ms^{-2}$$

so, acc^n of mass m_2;

$$\sqrt{a_2^2 + a_1^2} = \sqrt{\left(\frac{40}{7}\right)^2 + \left(\frac{10}{7}\right)^2}$$

$= \frac{10}{7}\sqrt{16+1} = \frac{\sqrt{17}}{7} g\ ms^{-2}$

acc^n of mass m_3;

$a_3 = \frac{T}{3} - g = \frac{40}{7} - 10$

$= -\frac{30}{7} ms^{-2}$

13. (A)

$at + bt^2 = ct^2 + dt^3 \quad \Rightarrow \quad t = 2s$

14. (B)

$\frac{d}{dt}(x_B - x_A) = 0$

$\Rightarrow \quad a + 2bt = 2ct + 3dt^2 \ \Rightarrow t = \frac{2}{\sqrt{3}} s$

15. (C)

$a = \frac{dv}{dt} = 2t - 4$

At $t = 0$, $a = -4\ m/s^2$

16. (D)

$x = \frac{t^3}{3} - 2t^2 = 0 \ \Rightarrow t = 0$ s or 6 s

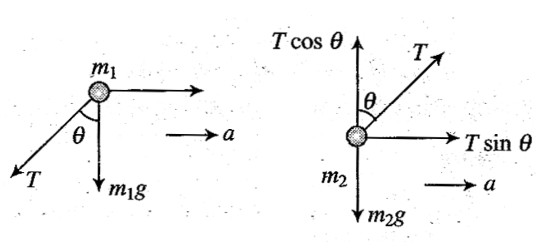
$v(t = 0) = 0$, $v(t = 6\,s) = 6^2 - 4 \times 6 = 12$ m/s

17. (A)

$F = (m_1 + m_2)a$ ...(i)

$T\sin\theta = m_2 a$ ...(ii)

$T\cos\theta = m_2 g \ \Rightarrow T = m_2 g \sec\theta$



From (ii) and (iii), $a = g\tan\theta$

Put in (i), $F = (m_1 + m_2)g\tan\theta$

Net force acting on $m_2 = m_2 a = \frac{m_2 F}{m_1 + m_2}$

Force acting on m_1 by wire.

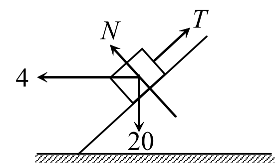
$$m_1g + T\cos\theta = m_1g + m_2g$$

18. (B)

Acceleration of 2kg block relative to wedge = 2 m/s²

Acceleration of 2 kg block relative to ground

$$= \sqrt{2^2 + 2^2 + (2\times2\times2\times\cos120^\circ)} = 2 \text{ m/s}^2$$



$$20\sin60^\circ + 4\cos60^\circ - T = 4$$

$$T = 10\sqrt{3} - 2$$

$$N = 20\cos60^\circ - 4\sin60^\circ = 10 - 2\sqrt{3} \text{ N}$$

Net force = 2 × 2 = 4 N

∴ (A) – Q , (B) – P , (C) – R , (D) – S

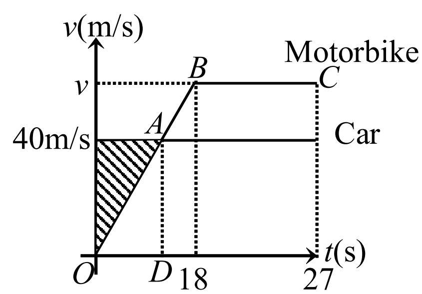
19. (C)

Let maximum speed of motorbike = v

$$40\times27 = \frac{1}{2}(27+9)v$$

v = 60 m/s

So acceleration of motorbike $= \frac{60}{18} = \frac{10}{3}$



Maximum separation = shaded area

$$= \frac{1}{2}\times40\times OD = \frac{1}{2}\times40\times12 = 240$$

Separation at $t = 18$ $= 240 - \frac{1}{2}\times20\times6$ **=180**

∴ (A) – Q , (B) - R, (C)- S, (D) - P

20. (A)

In condition (a), by constraint relation $\frac{a_1}{a_2} = 4$

In condition (b), by constraint relations $\frac{a_1}{a_2} = \frac{1}{3}$

In condition (a), tension in string of m_2 is $T = \frac{16 m_1 m_2 g}{(16 m_1 + m_2)} = 32$ N

In condition (b), tension in string connecting m_2 is $T = \frac{4 m_1 m_2 g}{(m_1 + 9 m_2)} = \frac{160}{37}$ N

$\therefore$ (A) – Q; (B) – P; (C) – R; (D) – T

CHEMISTRY

21. **(A,B)**

Higher ρ means lower h,V.P. of Hg is very low.

22. **(A,B,D)**

P = ρ gh (P independent of A) and $\rho \alpha \frac{1}{h}$

more volatile liquid means higher V.P. so more error. mg force acts always downward.

23. **(A,B,C)**

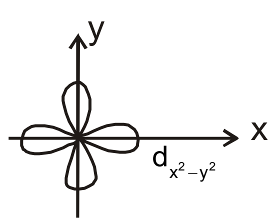
$\log_{10}^{P} = -\log_{10}^{V} + \log_{10}^{K}$

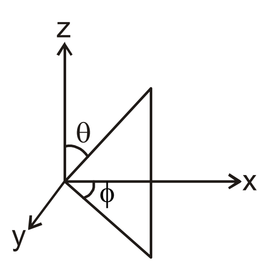
$P = \frac{K}{V}$ or $\frac{P}{V} = \frac{K}{V^2}$

PV = constant

$\frac{1}{P} \times \frac{1}{V} = \frac{1}{K}$

24. **(A,B,D)**





25. **(A,B,C)**

26. **(A,B,C)**

Electron has wave character (de-Broglie), $\lambda = \frac{h}{mv}$

27. **(A,B,C)**

28. **(A,B,C,D)**

29. **(A)** **30.** **(B)** **31.** **(A)** **32.** **(C)**

33. **(B)**

Difference in vertical height = 5 cm.

34. **(D)**

Vertical difference of height is 5 cm.

Now,

$$\rho_1 h_1 = \rho_2 h_2$$

$$5 \times \rho_{Hg} = \frac{\rho_{Hg}}{2} \times h_2$$

or, h_2 = 10 cm

$$l = \frac{10}{\sin 30^\circ} = 20\text{cm}$$

35. **(A)**

P_{bottom} = (76 + 5 + 10) cm of Hg

= 91 cm of Hg

P_X = (76 + 5) cm of Hg = 81 cm of Hg

36. **(B)**

$$V_X = \frac{P_1 V_1}{P_X}$$

$$V_Y = \frac{P_1 V_1}{P_Y}$$

$$\frac{V_X}{V_Y} = \frac{P_Y}{P_X} = \frac{76}{81}$$

37. **(A)**

(A) — (R); (B) — (P); (C) — (S); (D) — (Q)

Given ratio = $\frac{\ell}{n - \ell - 1}$

38. **(B)**

(A) — (Q); (B) — (S); (C) — (P); (D) — (R)

39. **(D)**

(A) — (R); (B) — (S); (C) — (P); (D) — (Q)

40. **(C)**

(A) — (R); (B) — (Q); (C) — (P); (D) — (S)

MATHEMATICS

41. (B, D)

A(– 5, 0); B(3, 0); C(a, a – 2)

Area $= \frac{1}{2}\begin{vmatrix} -5 & 0 & 1 \\ 3 & 0 & 1 \\ a & (a-2) & 1 \end{vmatrix} = \pm 20 \qquad \Rightarrow \begin{vmatrix} -5 & 0 & 1 \\ 8 & 0 & 0 \\ a-3 & a-2 & 0 \end{vmatrix} = \pm 40$

$\Rightarrow$ 8a – 16 = 40 or 8a – 16 = – 40 $\Rightarrow$ (a = 7) or (a = – 3)

$\therefore$ C(7, 5) or C(– 3, – 5)

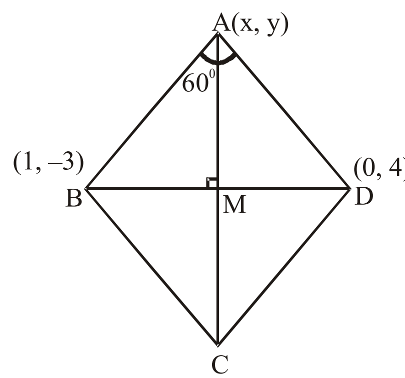
42. (A, B, D)

$$P(x) = \left(1+\cos\frac{\pi}{6x}\right)\left(1+\sin\frac{\pi}{6x}\right)\left(1-\sin\frac{\pi}{6x}\right)\left(1-\cos\frac{\pi}{6x}\right)$$

$$P(x) = \frac{1}{4}\sin^2\left(\frac{\pi}{3x}\right)$$

43. (A,B)

BD $= \sqrt{1^2+7^2} = 5\sqrt{2}$



BM = $\frac{5}{\sqrt{2}}$

$\frac{AM}{BM}$ = tan 60º

$M\left(\frac{1}{2},\frac{1}{2}\right)$

for point A

$$\frac{x-\frac{1}{2}}{\cos\theta} = \frac{y-\frac{1}{2}}{\sin\theta} = \pm\frac{5\sqrt{6}}{2}$$

m_{BD} = $\frac{7}{-1}$

$m_{AC} = \frac{1}{7} = \tan\theta$

$\sin\theta = \frac{1}{\sqrt{50}} = \frac{1}{5\sqrt{2}}$

$\cos\theta = \frac{7}{5\sqrt{2}}$

44. (B, C)

$y - y_1 = mx - mx_1$

$\Rightarrow mx - y - mx_1 + y_1 = 0$

A set of parallel lines

If $x = x_1$,

$mx_1 - y - mx_1 + y_1 = 0$

$\Rightarrow \ y = y_1$

Hence, for all values of y_1, all will intersect

$x = x_1$

45. (A, C)

The given equation can be written as

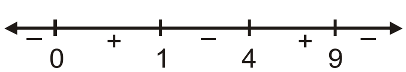
$\log_5\left(\frac{5^{1/x}+125}{6}\right) = 1 + \frac{1}{2x} \Rightarrow \frac{5^{\frac{1}{x}}+125}{6} = 5^{1+\frac{1}{2x}} \Rightarrow 5^{\frac{1}{x}} + 125 = 6.5.5^{\frac{1}{2x}}$

Let $t = 5^{\frac{1}{2x}}$, then $t^2 + 125 = 30t \Rightarrow t^2 - 30t + 125 = 0 \Rightarrow t = 25$ or $t = 5$

46. (A, B, C, D)

$|x^2 - 9x| + |x^2 - 5x + 4| > 4|x+1|$ is true if

$(9x - x^2)(x^2 - 5x + 4) < 0$



$\therefore x \in (-\infty, 0) \cup (1, 4) \cup (9, \infty)$

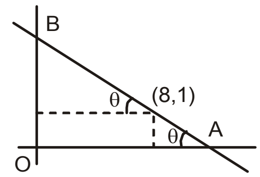
47. (A, B, C)

(B) $\log_{\cos\frac{7\pi}{4}}\left(\sin\frac{5\pi}{6}\right) = \log_{\frac{1}{\sqrt{2}}}\left(\frac{1}{2}\right) > 0$

(C) $\log_{\tan\frac{4\pi}{3}}\left(\cot\frac{7\pi}{6}\right)=\log_{\sqrt{3}}\sqrt{3}=1>0$

48. (A,C,D)

49. (D)



OA = 8 + cotθ ; OB = 1 + 8tanθ

$\Delta = \frac{1}{2}(1 + 8\tan\theta)(8 + \cot\theta)$

$= 8 + \frac{1}{2}(64\tan\theta + \cot\theta)$

For Δ to be minimum tanθ = 1/8

$\therefore\ \Delta_{min} = 16$

50. (A)

$z = AB = \text{cosec}\theta + 8\sec\theta \Rightarrow \frac{dz}{d\theta}=0$; cotθ = 2

$\therefore\ AB_{min} = 5\sqrt{5}$

51. (A)

x – 1 = 3 cosθ

y – 2 = 4sinθ

x + y = 3 + 3cosθ + 4sinθ

maximum value = 3 + 5 = 8

52. (B)

$$\sin x\cos\frac{\pi}{6}+\cos x.\sin\frac{\pi}{6}+\cos x=\frac{\sqrt{3}}{2}\sin x+\frac{1}{2}\cos x+\cos x=\frac{\sqrt{3}}{2}\sin x+\frac{3}{2}\cos x$$

maximum value $\sqrt{\frac{3}{4}+\frac{9}{4}}=\sqrt{3}$

53. (B)

Image of A(1, 3) in line x + y = 2 is $\left(1-\frac{2(2)}{2},3-\frac{2(2)}{2}\right) \equiv (-1,\ 1)$

So line BC passes through (–1, 1) and $\left(-\frac{2}{5},-\frac{2}{5}\right)$.

Equation of line BC is $y - 1 = \frac{-2/5-1}{-2/5+1}(x + 1) \Rightarrow 7x + 3y + 4 = 0$

54. (C)

Vertex B is point of intersection of 7x + 3y + 4 = 0 and x + y = 2

i.e. B = (–5/2, 9/2)

55. (B)

G1 G2 .... Gn = $\left(\sqrt{1\times 1024}\right)^{n} = 2^{5n}$

$\therefore$ $2^{5n} = 2^{45}$

$\therefore$ n = 9

56. (B)

$A_1 + A_2 + A_3 + \ldots\ldots + A_{m-1} + A_m = 1025 \times 171$

$\therefore$ $m\left(\frac{-2+1027}{2}\right) = 1025 \times 171$

$\therefore$ m = 342

57. (A)

P). Let $x = 4\cos\theta, y = 3\sin\theta$, than x + y = $4\cos\theta + 3\sin\theta \le 5$

$\therefore$ $\log_5(x+y) \le 1$

Q). $\because$ $2^{\sqrt{\log_2 3}} = \left(2^{\log_2 3}\right)^{\frac{1}{\sqrt{\log_2 3}}} = 3^{\sqrt{\log_3 2}}$ and $3^{\log_3 2} - 2^{\log_2 3} = 2 - 3 = -1$

$\therefore$ $\alpha + \beta = 3$ and $\alpha\beta = 2$

$\Rightarrow$ $\alpha^2 + \alpha\beta + \beta^2 = (\alpha+\beta)^2 - \alpha\beta = 7$

R). $3\log_{18} 96 \log_{12} 3 + \log_{18} 96 + 3\log_{12} 3$

$= \left(\log_{18} 96 + 1\right)\left(3\log_{12} 3 + 1\right) - 1$

$= \log_{18}(96\times 18).\ \log_{12}(27\times 12) - 1$

$= \left(3\log_{18} 12\right)\left(2\log_{12} 18\right) - 1 = 6 - 1 = 5$

S). $2^{\log_x 3} = y^{\log_5 y} \Rightarrow \log_x 3\ \ln 2 = \log_5 y \ln y$

$\Rightarrow (\ln x)\ (\ln y)^2 = \ln 2 \ln 3 \ln 5$

similarly, $3^{\log_y 5} = x^{\log_2 x} \Rightarrow (\ln x)^2 (\ln y) = \ln 2 \ln 3 \ln 5$

$\therefore$ $(\ln x)(\ln y)^2 = (\ln x)^2(\ln y) \Rightarrow \ln y = \ln x \Rightarrow x = y$

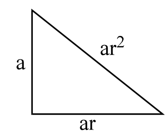
$$\therefore \quad \frac{\left(x^{\log_y x} + y^{\log_x y}\right)^2}{\left(x^{\log_x y}\right)^2 + \left(y^{\log_y x}\right)^2} = \frac{(x+x)^2}{x^2+x^2} = 2$$

58. **(B)**

(P) b + c = a + d = 2 · 10

$\Rightarrow$ a + b + c + d = 40

(Q) $(ar^2)^2 = a^2 + a^2r^2$ where a = 2



$\therefore r^4 = 1 + r^2 \Rightarrow r^4 - r^2 - 1 = 0$

let $r^2 = t$

$t^2 - t - 1 = 0 \Rightarrow t = \frac{1 \pm \sqrt{5}}{2} \Rightarrow r^2 = \frac{1+\sqrt{5}}{2}$

$\therefore$ hypotenuse is $2 \times \left(\frac{1+\sqrt{5}}{2}\right) = 1 + \sqrt{5}$

comparing with $a + \sqrt{b}$

a = 1, b = 5 $\quad \therefore a^2 + b^2 = 1 + 25 = 26$

(R) a, ar, $ar^2 \rightarrow$ G.P. | r | < 1

$a + ar + ar^2 = 70$

$\therefore 10ar = 4a + 4ar^2$

$10r = 4 + 4r^2 \Rightarrow 2r^2 - 5r + 2 = 0 \Rightarrow 2r^2 - 4r - r + 2 = 0$

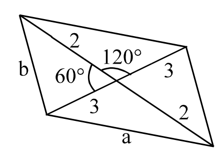
$(2r - 1)(r - 2) = 0 \Rightarrow \therefore r = 1/2$

$\Rightarrow a + \frac{a}{2} + \frac{a}{4} = 70 \Rightarrow a + \frac{3a}{4} = 70$ C $\quad \Rightarrow a = 40$

$\therefore$ series is 40, 20, 10

$\therefore$ first term of G.P. is 40 Ans.

(S) Using cosine rule



$a^2 = 9 + 4 - 2 \cdot 2 \cdot 3 \cdot \left(-\frac{1}{2}\right) = 13 + 6 = 19$

$a^2 = 19 \Rightarrow a = \sqrt{19}$

$b^2 = 9 + 4 - 2 \cdot 2 \cdot 3 \cdot \left(\frac{1}{2}\right)$

$b^2 = 7 \Rightarrow b = \sqrt{7}$

$\therefore$ P = $2\left(\sqrt{19} + \sqrt{7}\right) \Rightarrow a + b = 26$

59. (A)

(P) Lines are concurrent $\begin{vmatrix} 1 & -2 & -6 \\ 3 & 1 & -4 \\ \lambda & 4 & \lambda^2 \end{vmatrix} = 0$

$\Rightarrow \lambda^2 + 2\lambda - 8 = 0 \Rightarrow \quad \lambda = 2, -4$

(Q) points are collinear $\begin{vmatrix} \lambda+1 & 1 & 1 \\ 2\lambda+1 & 3 & 1 \\ 2\lambda+2 & 2\lambda & 1 \end{vmatrix} = 0$

$\Rightarrow 2\lambda^2 - 3\lambda - 2 = 0 \Rightarrow \quad \lambda = 2, -1/2$

(R) point of intersection of $x - y + 1 = 0$ and $3x + y - 5 = 0$ is (1, 2).

it will satisfy $x + y - 1 - \lambda = 0 \Rightarrow \lambda = 2$

(S) midpoint of (1, – 2) and (3, 4) will satisfy $y - x - 1 + \lambda = 0 \Rightarrow \lambda = 2$

60. (A)

(P) $x^{\log_{10} x} = 100\,x$

$\log_{10}x \cdot \log_{10}x = \log_{10}100 + \log_{10}x$

$\log_{10}x = t$

$t^2 - t - 2 = 0$

$t^2 - 2t + t - 2 = 0$

$t = -1, t = 2$

$x = 10^t$

$x|_{t=-1} = 10^{-1} = 1/10$

$x|_{t=2} = 10^2 = 100$

(Q) $\Rightarrow \log_2(9 - 2^x) = 3 - x$

$9 - 2^x = 2^{3-x}$

$9.2^x - 2^x 2^x = 8$; Let $2^x = t$

$t^2 - 9t + 8 = 0$

$t = 8, 1$

$2^x = 2 \quad t = 1$; $t = 8 \Rightarrow 2^x = 8$

$x = 0$; $x = 3$

(R) $\Rightarrow \log_{1/8}\log_{1/4}\log_{1/2} x = \frac{1}{3}$

$\log_{1/4}.\log_{1/2}x = (1/8)^{1/3}$

$\log_{\frac{1}{2}} x = (1/4)^{1/2}$

$x = (1/2)^{1/2}$

$= 1/\sqrt{2}$

(S) $\log_b a = 3$

$\Rightarrow a = b^3$

$\log_b c = -4 \Rightarrow c = b^{-4}$

now $a^{3x} = c^{x-1}$

$(b^3)^{3x} = (b^{-4})^{x-1}$

$9x = -4x + 4$

$13x = 4 \Rightarrow x = 4/13$

p = 4, q = 13 ; are relatively prime

$\therefore$ p + q = 17