

Q. 3. $h = ut + \frac{1}{2}(-g)t^2$

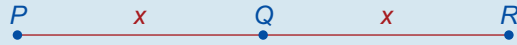
$$2h = 2ut - gt^2$$

$$gt^2 - 2ut + 2h = 0$$

$$\text{Product of roots} = \frac{c}{a}$$

$$\therefore t_1 t_2 = \frac{2h}{g} \quad \text{QED}$$

Q. 4. Let $|PQ| = |QR| = x$



(i) The journey $P \rightarrow R$: $u = u, v = 7u,$
 $s = 2x, a = a$

$$\therefore v^2 = u^2 + 2as$$

$$\therefore 49u^2 = u^2 + 2(a)(2x)$$

$$\therefore 48u^2 = 4ax$$

$$\therefore 12u^2 = ax$$

$$\therefore a = \frac{12u^2}{x}$$

The journey $P \rightarrow Q$: $u = u, v = v,$

$$s = x, a = \frac{12u^2}{x}$$

$$v^2 = u^2 + 2as$$

$$\therefore v^2 = u^2 + 2\left(\frac{12u^2}{x}\right)(x)$$

$$\therefore v^2 = u^2 + 24u^2$$

$$\therefore v^2 = 25u^2$$

$$\therefore v = 5u$$

(ii) P to Q : $u = u, v = 5u, s = x,$
 $t = t_1, a = a$

$$v = u + at$$

$$\therefore 5u = u + at_1$$

$$\therefore t_1 = \frac{4u}{a}$$

Q to R : $u = 5u, v = 7u, t = t_2,$
 $a = a$

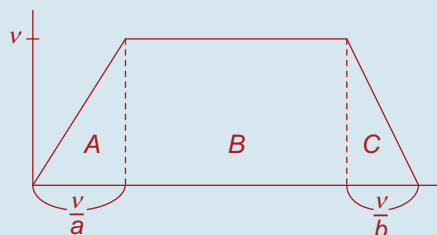
$$v = u + at$$

$$\therefore 7u = 5u + at_2$$

$$\therefore t_2 = \frac{2u}{a}$$

$$\therefore t_1 = 2t_2 \quad \text{QED}$$

Q. 5. (i)



$$\text{Distance } A = \frac{1}{2}\left(\frac{v}{a}\right)v = \frac{v^2}{2a}$$

$$\text{Distance } C = \frac{1}{2}\left(\frac{v}{b}\right)v = \frac{v^2}{2b}$$

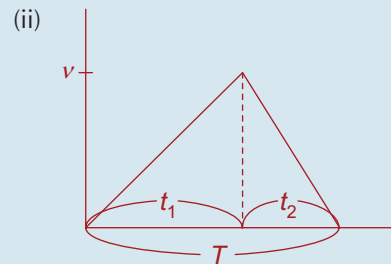
$$\text{Remainder} = s - \frac{v^2}{2a} - \frac{v^2}{2b}$$

$$\text{Time taken in } B = \left(s - \frac{v^2}{2a} - \frac{v^2}{2b}\right) \div v$$

$$= \frac{s}{v} - \frac{v}{2a} - \frac{v}{2b}$$

$$\text{Total time taken} = \frac{v}{a} + \left(\frac{s}{v} - \frac{v}{2a} - \frac{v}{2b}\right) + \frac{v}{b}$$

$$= \frac{v}{2a} + \frac{v}{2b} + \frac{s}{v} \quad \text{QED}$$



Let $T =$ the total time

$$t_1 : t_2 = b : a = \frac{b}{a+b} : \frac{a}{a+b}$$

$$\therefore t_1 = \frac{bT}{a+b}, \quad t_2 = \frac{aT}{a+b}$$

$$v = u + at$$

$$v = 0 + (a)\left(\frac{bT}{a+b}\right) = \frac{abT}{a+b}$$

Area = s

$$\frac{1}{2}(T)\left(\frac{abT}{a+b}\right) = s$$

$$T = \sqrt{2s\left(\frac{a+b}{ab}\right)} \quad \text{QED}$$

Q. 6. (a) $t = n - 1, u = u, a = a, s = s_1$

$$s = ut + \frac{1}{2}at^2$$

$$s_1 = u(n - 1) + \frac{1}{2}a(n - 1)^2$$

$$= un - u + \frac{1}{2}an^2 - an + \frac{1}{2}a$$

$$t = n, u = u, a = a, s = s_2$$

$$s = ut + \frac{1}{2}at^2$$

$$s_2 = un + \frac{1}{2}an^2$$

Distance travelled, $s = s_2 - s_1$

$$= u + an - \frac{1}{2}a \quad \text{QED}$$