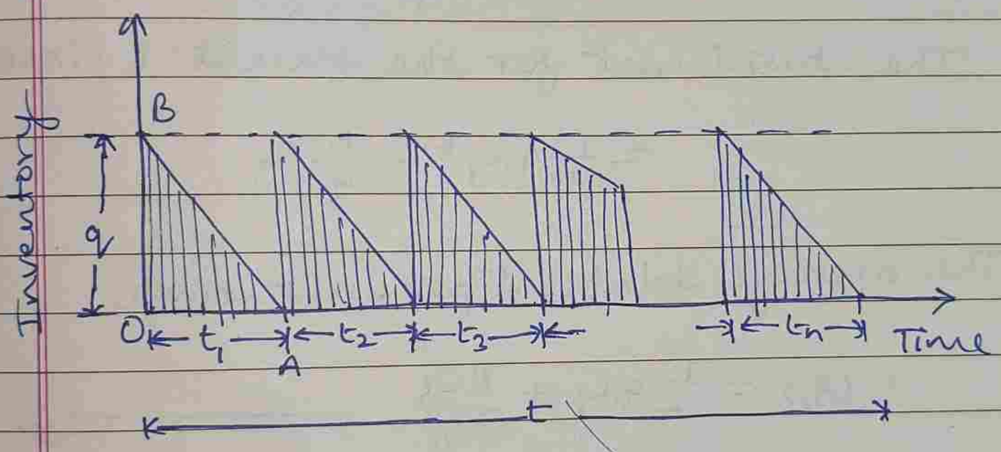
Model II

Here to derive an economic lot size formula and minimum average cost under the same assumptions as in model I except the demand rates are different in different production cycles.

Let q be the units of quantity produced per production run.



If R is the total demand in the total period t (fixed) then the no. of production cycles

$$= R/q = n \text{ (say)}$$

Let $t_1, t_2, \ldots, t_n$ be the times of the successive production cycles s.t.

$$t = t_1 + t_2 + t_3 + \cdots + t_n \qquad (1)$$

Thus q, the quantity produced at the begining of each production run

The cost of holding inventory for period t

$= C_1$ (Sum of areas of n triangles in fig.)

$= C_1 \left(\frac{1}{2} q t_1 + \frac{1}{2} q t_2 + \frac{1}{2} q t_3 + \cdots + \frac{1}{2} q t_n\right)$

$= \frac{1}{2} q C_1 (t_1 + t_2 + t_3 + \cdots + t_n) = \frac{1}{2} C_1 q t$

and set up cost $n C_3 = \frac{R}{q} C_3$

$\therefore$ The total cost for the time t (fixed)

$= \frac{1}{2} q C_1 t + \frac{R}{q} C_3$.

$\therefore$ The average total cost per unit time

$$C(q) = \frac{1}{2} q C_1 + \frac{R C_3}{t q} \quad \text{——— (2)}$$

for minimum value of $C(q)$

$$\frac{dC}{dq} = \frac{1}{2} C_1 - \frac{R C_3}{t q^2} = 0$$

$$\therefore \boxed{q = q^* = \sqrt{\left(\frac{2 R C_3}{C_1 t}\right)}} \quad \text{——— (3)}$$

Since $\frac{d^2 C}{dq^2} = \frac{2 R C_3}{t q^3}$ is +ve for $q^* = \sqrt{\left(\frac{2 R C_3}{C_1 t}\right)}$

Equ-(3) is the required economic lot size formula.

from (2) the minimum cost per unit time is given by

$$C_{min} = \frac{1}{2} C_1 \sqrt{\left(\frac{2RC_3}{C_1 t}\right)} + \frac{RC_3}{t} \sqrt{\left(\frac{C_1 t}{2RC_3}\right)}$$

or

$$\boxed{C_{min} = \sqrt{\left(\frac{2C_1 C_3 R}{t}\right)}} \quad \text{——— (4)}$$