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Where Minds Pollinate

Class 12
Mathematics

Chapter 5

Exercise 5.1

Handwritten Solution

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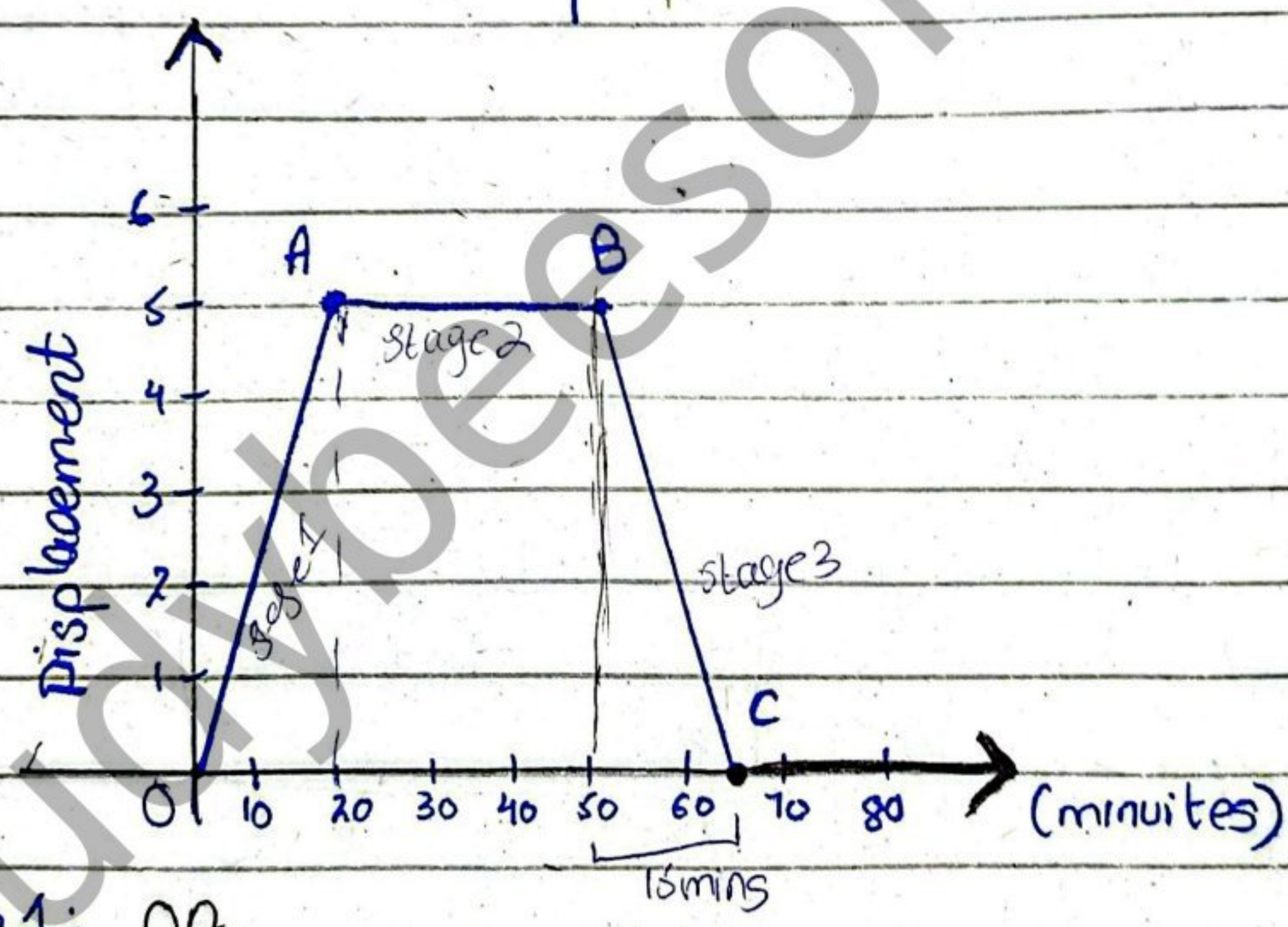
Exercise 5.1

Physics

- Classical
  - Mechanics
    - Statics
    - Dynamics
      - Kinametics: Description of motion without force
      - Kinetics: Description of motion with force

(Q1)



(i) Stage 1: OA

$V_{avg} = \frac{\Delta \text{displacement}}{\text{time}}$

$V_{Avg} = \frac{5-0}{\frac{1}{3}}$

$\boxed{V_{avg} = 15\,km/hr}$

Stage 2: AB

$\therefore t = 20\,min$

$t = \frac{20}{60} = \boxed{\frac{1}{3}\,hr}$

$min \xrightarrow[\div 60]{} hours.$

distence always +ve.

~~because stylist still on 5 km~~

$V_{avg} =$ $=$

$V_{avg} = \frac{S-S'}{t} = 0$ km/h.

$\therefore 50 - 30$
$= 30$
$= \frac{30}{60} = \boxed{\frac{1}{2} hr}$

Stage 3 $V_{avg} = \frac{0-5}{1/4} = -20$ km/hr.

$\therefore \frac{15}{60} = \frac{1}{4}$

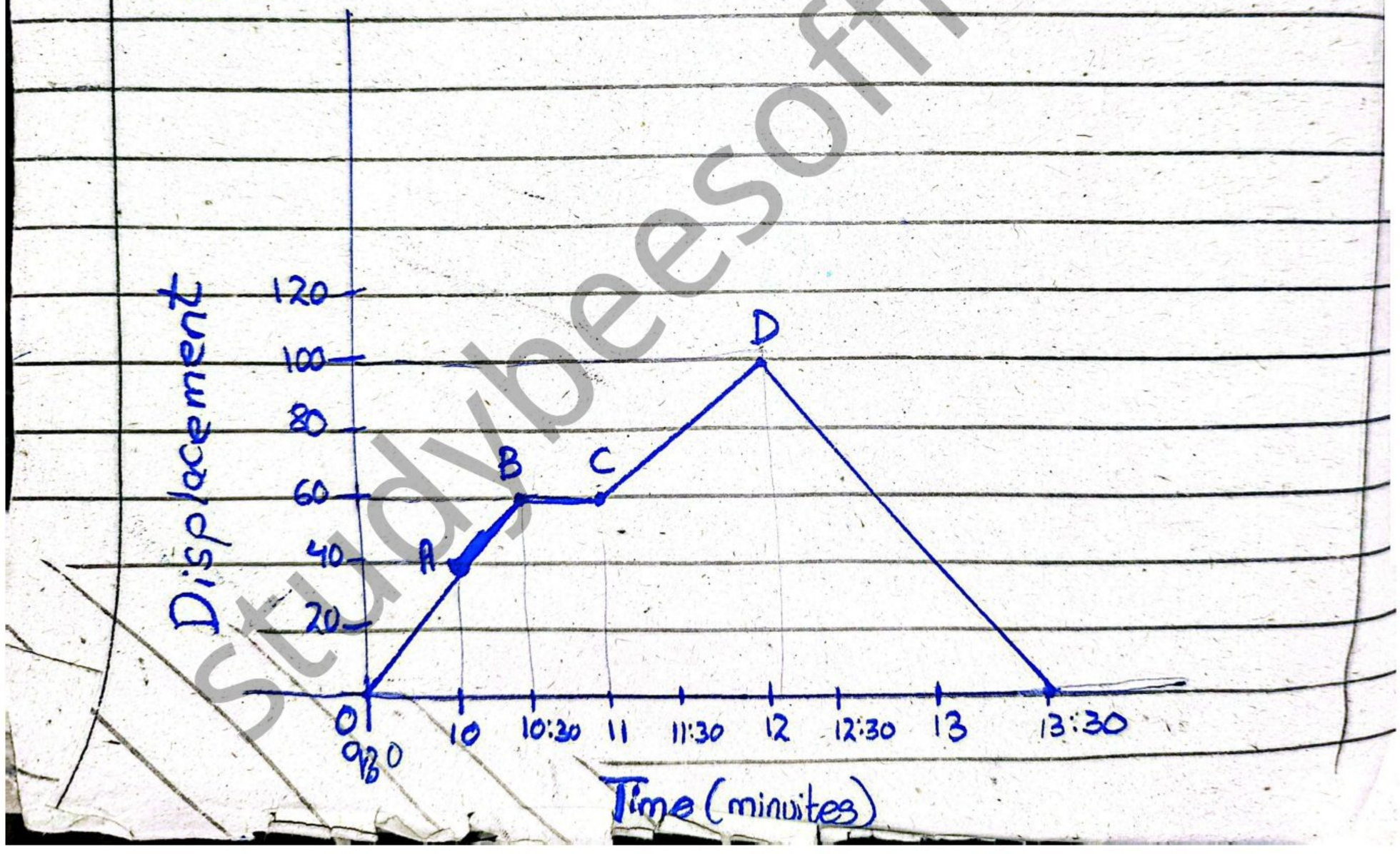
(ii) whole journey $= \frac{\text{total displacement}}{\text{total time}} = V_{avg}$

$V_{avg} = \frac{5+0-5}{\frac{1}{3}+\frac{1}{2}+\frac{1}{4}} = 0 \Rightarrow \boxed{V_{avg} = 0 \text{ km/hr}}$

(iii) $V_{avg\,speed} = \frac{\text{Distance}}{\text{Time}} = \frac{5+0+5}{\frac{1}{3}+\frac{1}{4}+\frac{1}{2}} = \frac{10}{\frac{13}{12}} = \boxed{\frac{120}{13} \text{ Km/hr}}$

Exercise 5.1

(Q2) Solution:-



(i) Stage 1 OA

$V_{AVG} = \frac{40-0}{\frac{1}{2}} = 80 km/hr$

∴ 9:30 - 10:00

$= \frac{30 min}{60} = \frac{1}{2} hr$

Stage 2:-

$V_{AVG} = \frac{60-40}{\frac{1}{2}} = 40 km/hr$

Stage 3:- $V_{AVG} = \frac{60-60}{\frac{1}{2}} = 0 km/hr$

Stage 4:- $V_{AVG} = \frac{100-60}{1} = 40 km/hr$

Stage 5 $V_{AVG} = \frac{0-100}{1.5} = -66.667 km/hr$

(ii) whole journey:-

$V_{AVG} = \frac{\text{Total displacement}}{\text{total Time}} = \frac{40+20+0+40-100}{\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+1+1.5}$

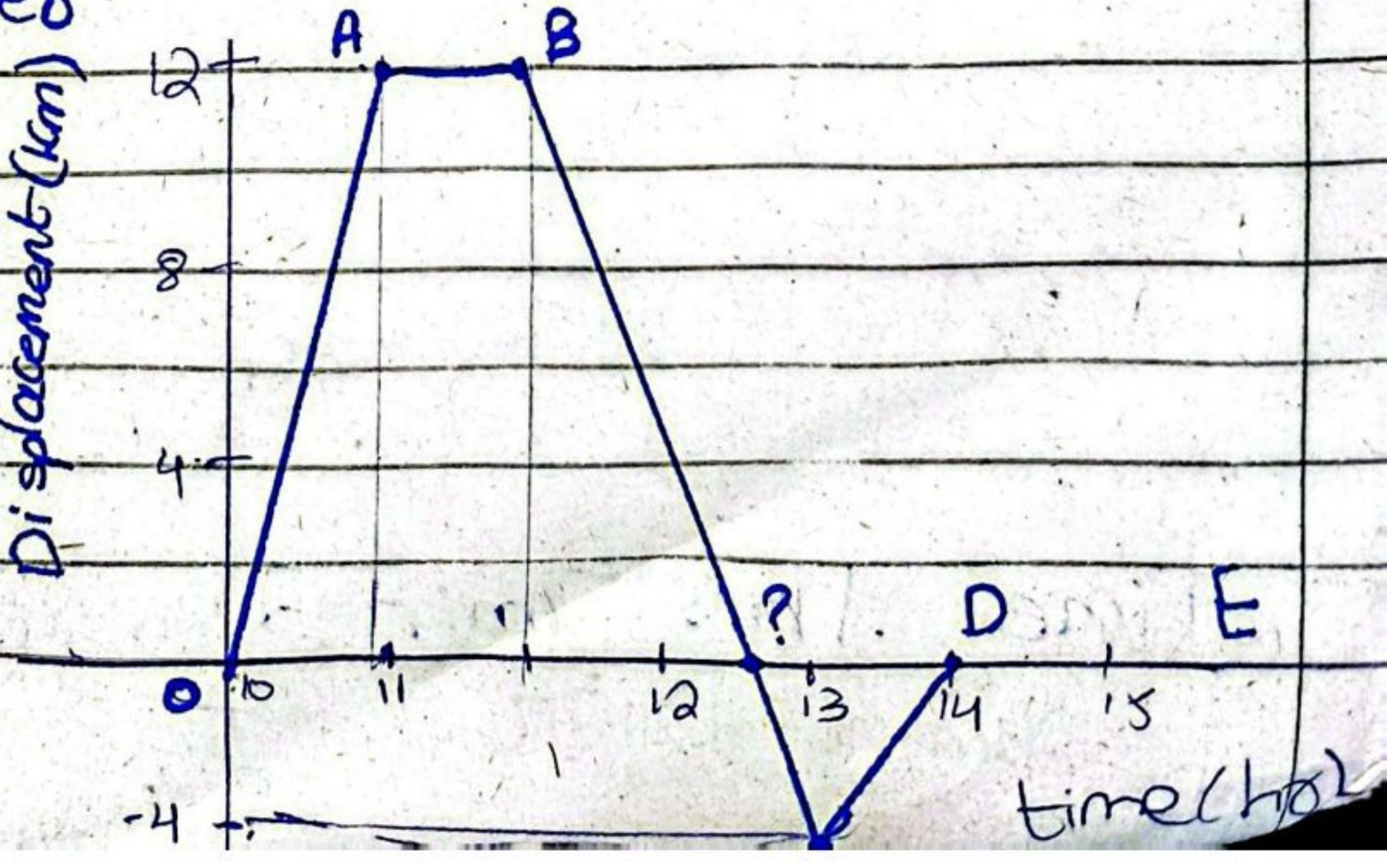
$= \frac{0}{4} = \boxed{0 km/hr}$

(iii) $S_{avg} = \frac{\text{Total distance}}{\text{total Time}} = \frac{40+20+0+40+100}{\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+1+1.5}$

$= \boxed{50 km/hr}$ Answer

(Q3) Solution:-

IMP



Solution:- velocity = $\frac{\text{change in displacement}}{\text{change in time}}$

$V = \frac{\text{final value} - \text{initial value}}{\Delta t}$

$= \frac{12 - 0}{11 - 10} = \boxed{12 km/h}$

(ii) time = ?

time = $\frac{\text{displacement}}{\text{velocity}}$

$= \frac{0 - 12}{-32/3} = (+12)\left(\frac{3}{32}\right) \Rightarrow \boxed{1.125 hr}$

velocity for BC

$V = \frac{\text{displacement}}{\text{time}} = \frac{-4 - 12}{1.5} = \frac{-16}{1.5}$

$\boxed{V = -10.667 km/h}$ or $\left(-\frac{32}{3}\right)$

: time for BC
11:30 → 13:00
= 1.5 hr

time = 1.125 hr ⟶ minuite, sec.

time = 1 hr + 0.125 hr

time = (1 hr + 0.125) hr

time = 1 hr + $\left(\frac{0.125}{1000} \times 60\right)$ min

time = 1 hr + 7.5 min

time = 1 hr + 7 min + 0.5 min

= 1 hr 7 min + $\left(\frac{0.5}{10} \times 60\right)$ sec

time = 1 hr, 7 min, 30 second.

time = 12:37:30

(iii) Velocity for BC.

$$V = \frac{-4-12}{1.5} = \frac{-16}{1.5} = \boxed{-\frac{32}{3}\ Km/hr}$$

velocity for CD

$$V = 0-(-4) = \boxed{4\ Km/hr}$$

(iv) speed = $\frac{\text{total distance}}{\text{total time}}$

$$s = \frac{12+16+4}{4} = \boxed{8\ Km/hr}$$

Q4) Solution:- $V_i = 0 ms^{-1}$

Stage 1 accelerates

$a = 0.4 ms^{-2}$ $V_f = 16 ms^{-1}$

$\boxed{t = ?}$

$V_f = V_i + at$

$\frac{16}{0.4} = t$

$\boxed{t = 40s}$

Stage 2 Constant speed

$V = 16 ms^{-1}$, $s = 2000m$

$t = ?$ $V = \frac{S}{t}$

$\boxed{t = \frac{S}{V}}$

$t = \frac{2000}{16} = \boxed{125 second.}$

1 hr

Stage 3: retards

$t = 20s$, $v_f = 0$

$v_i = 16ms^{-1}$

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

$2as = v_f^2 - v_i^2$

$v_f = v_i + at$

$0 = 16 + a(20)$

$a = \frac{-16}{20}$

$a = -0.8$

$2(-0.8)s = 0 - (16)^2$

$s(-1.6) = -256$

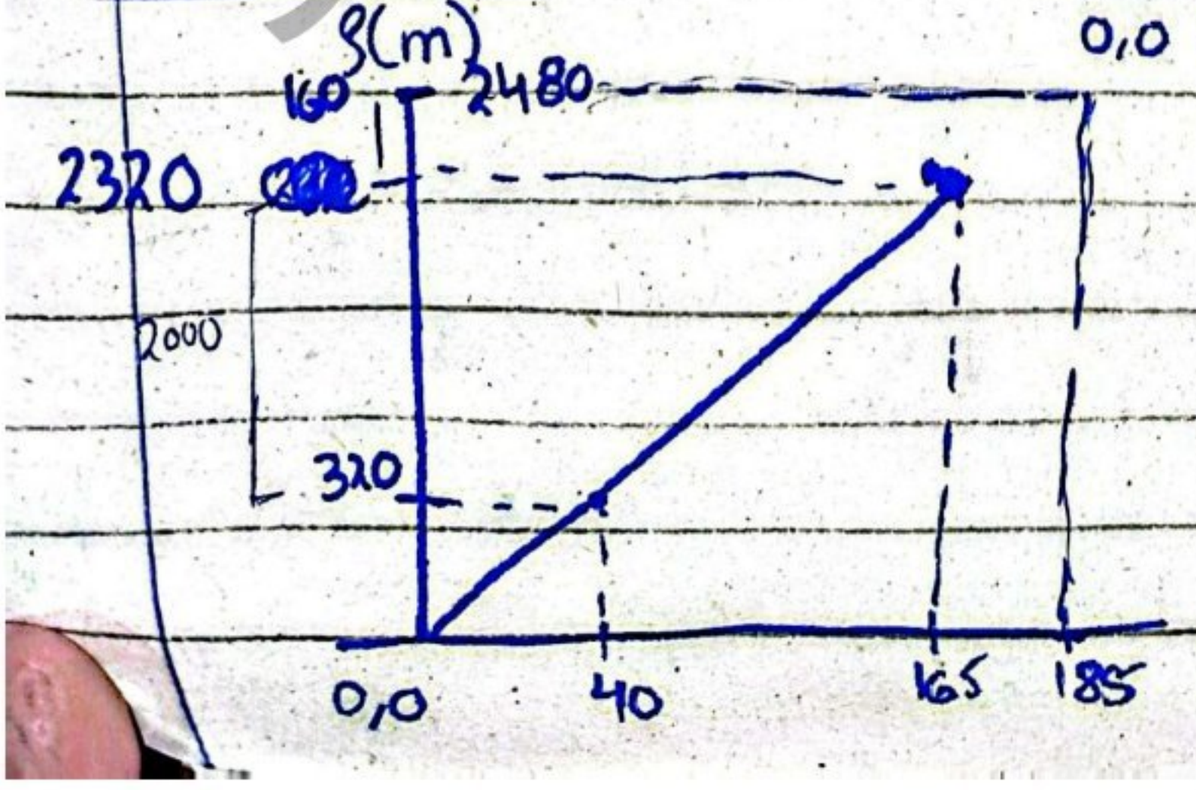
$s = 160m$

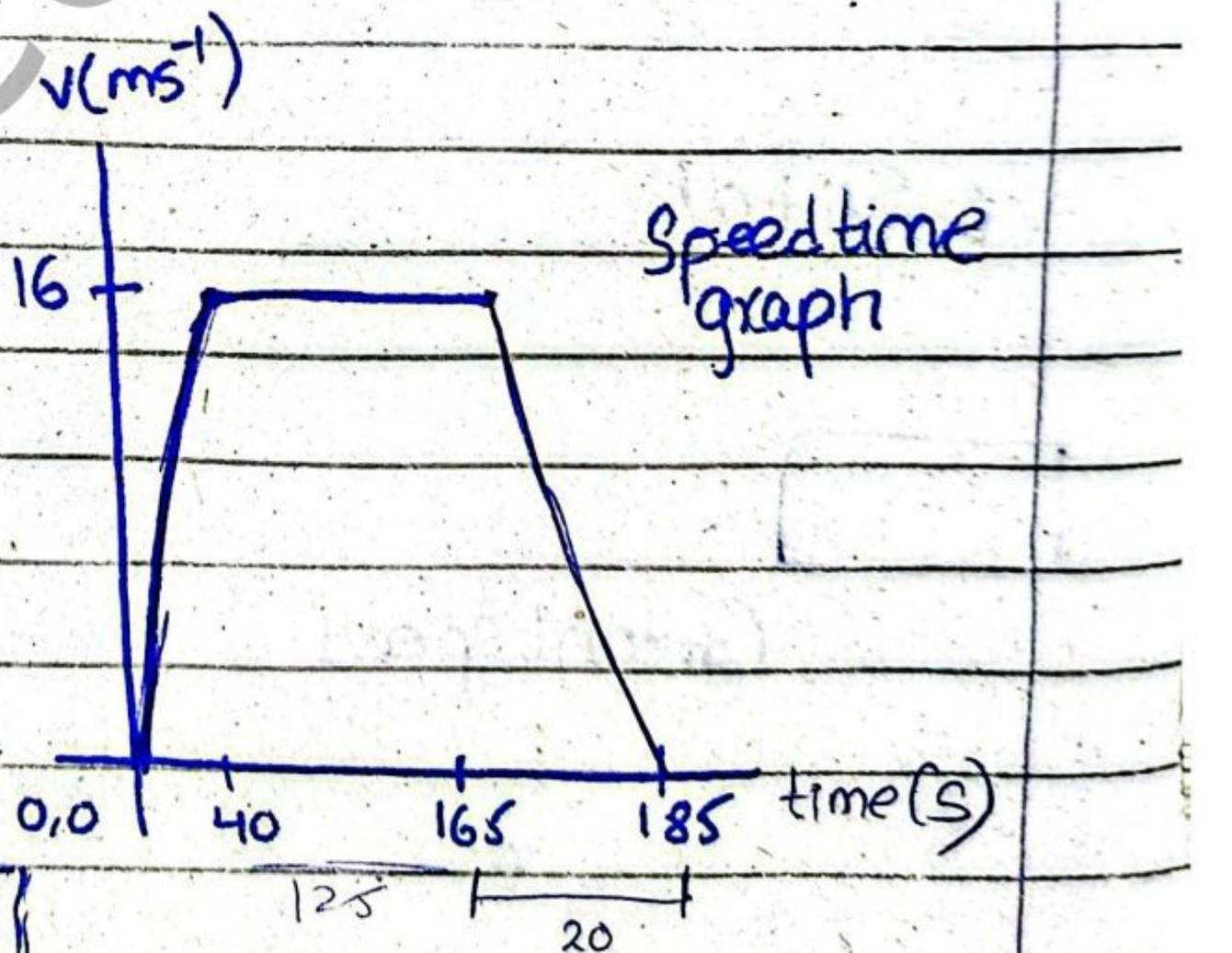
$2as = v_f^2 - v_i^2$

$2(0.4)s = 256 - 0$

$s = \frac{256}{0.8}$

$s = 320m$





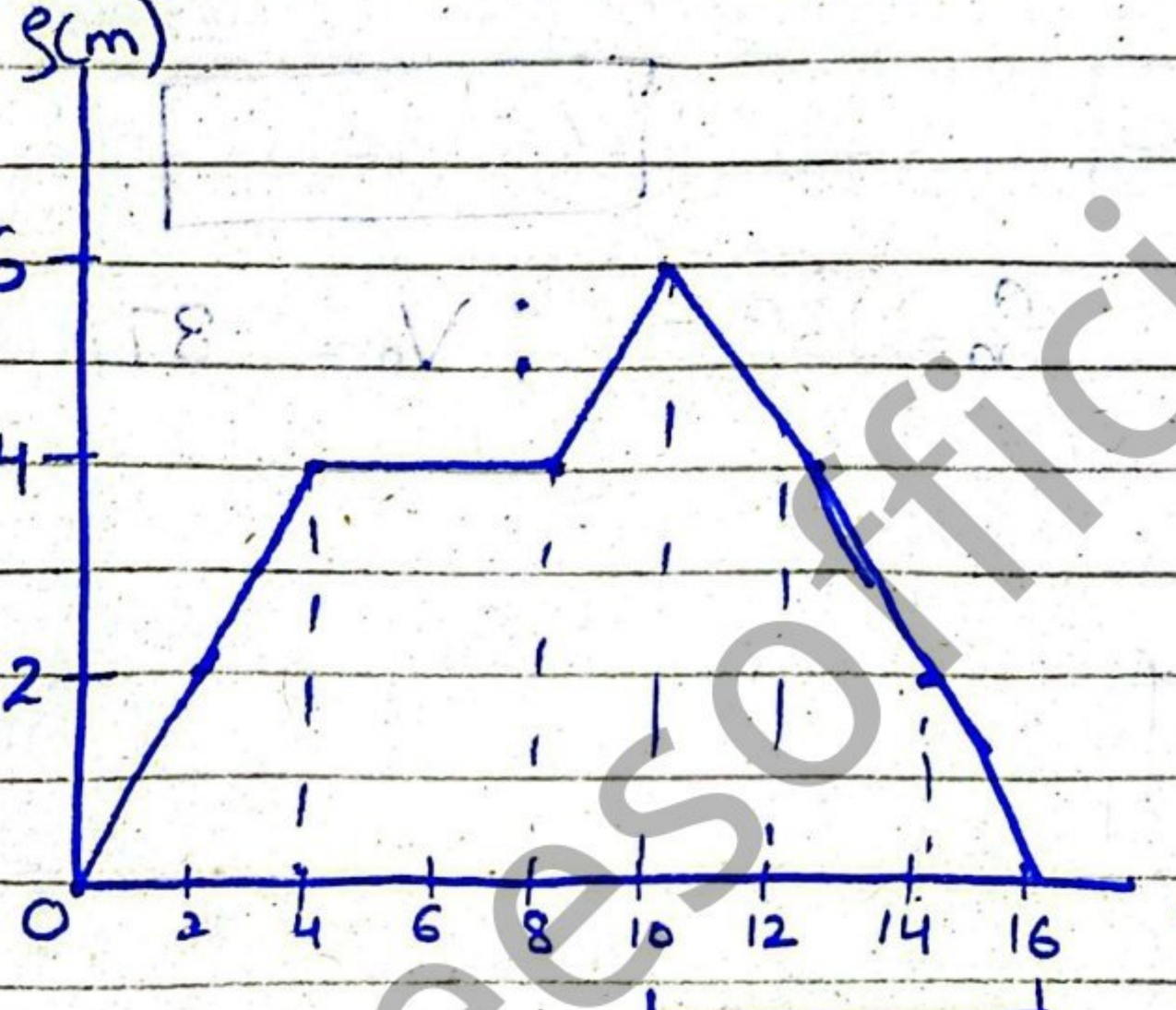
(i) Total time = 185s

(ii) Total displacement = 2480m

Answer.

(Os) Solution:-

Time (s)	0	2	4	6	8	10	12	14	16
Displacement (m)	0	2	4	4	4	6	4	2	0



for 4s

$V = \frac{\Delta S}{\Delta t} = \frac{4-0}{4-0} = 1 ms^{-1}$

Next 4s (4s - 8s)

$V = \frac{\Delta S}{\Delta t} = \frac{4-4}{8-4} = \frac{0}{4} = 0 ms^{-1}$

last 6s (10s - 16s)

$V = \frac{\Delta S}{\Delta t} = \frac{0-6}{16-10} = \frac{-6}{6} = -1 ms^{-1}$

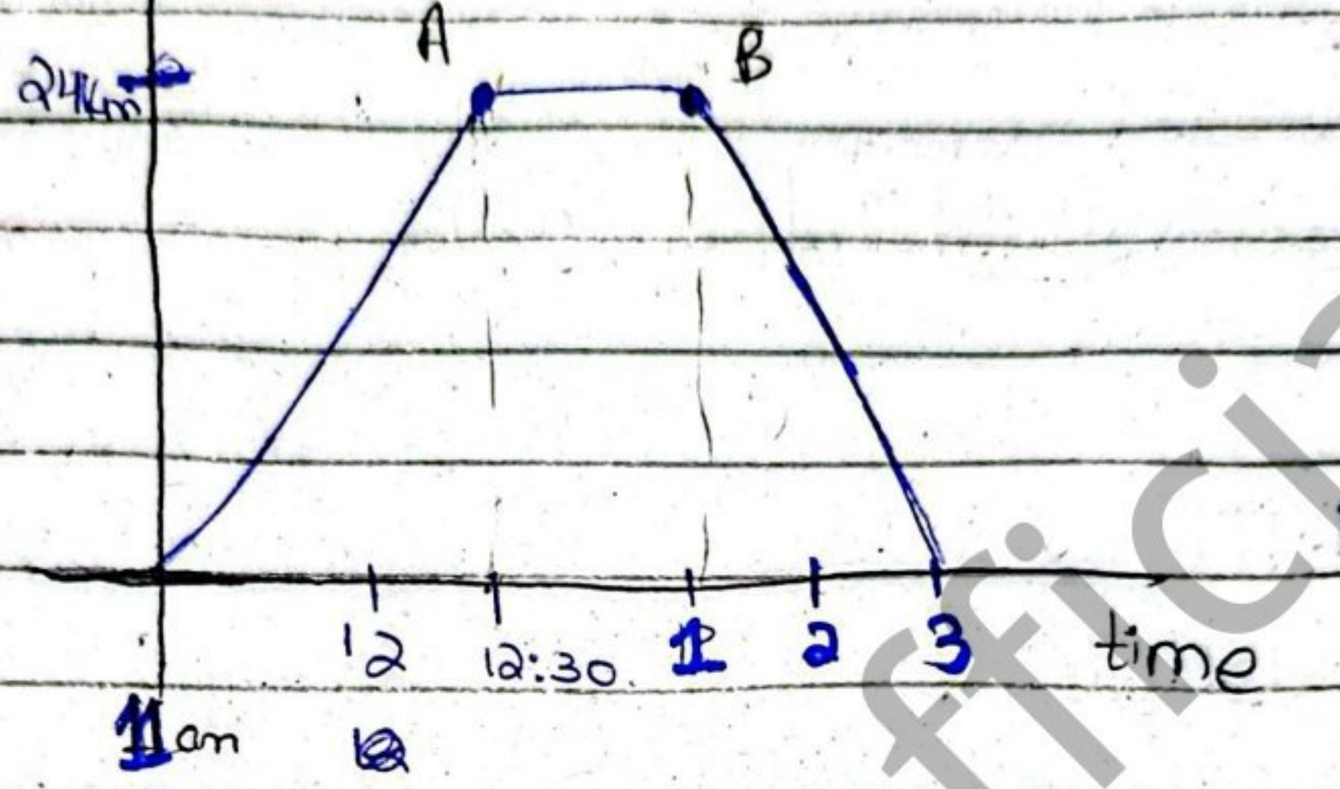
Total displacement

$S_{total} = 0m$

Exercise 5.1

Q6) Solution:-

(i)



Stage 1:- time = 90min = $\frac{90}{60}$ = 1.5hrs

V = 16Km/hr

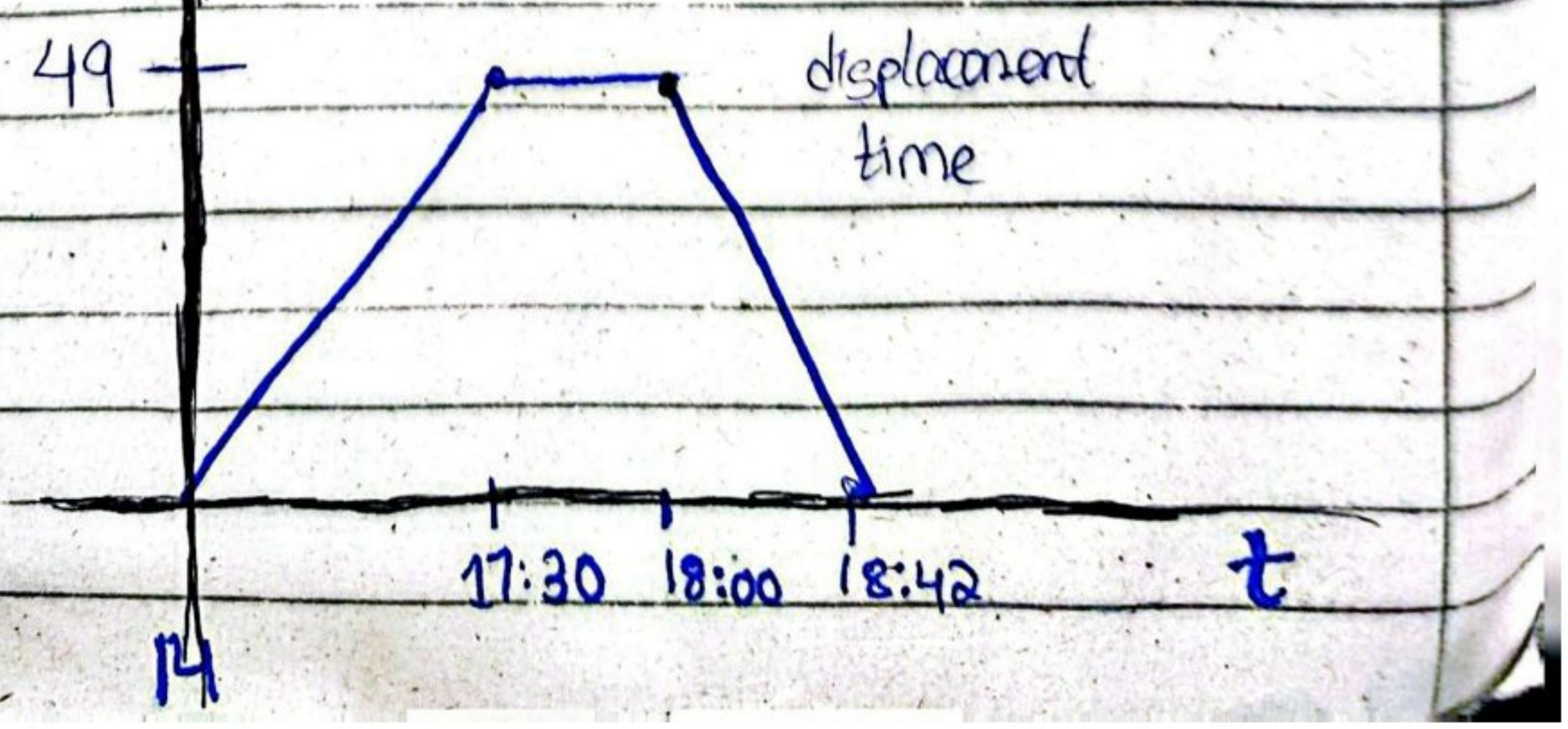
Displacement = ?

$V = \frac{\text{distance}}{\text{time}}$ ⇒ distance = 16 × 1.5 = 24km

(ii) $V_{Avg\ speed}$ return past = ?

$V = \frac{S}{t} \Rightarrow \frac{24}{3-1}$ = 12km/hr Ans

Q7) Solution:-



time = 3.5hour ; V = 14km/h ; S = ?

$V = \frac{S}{t} \Rightarrow S = vt \Rightarrow S = 3.5 \times 14 \Rightarrow S = 49km$

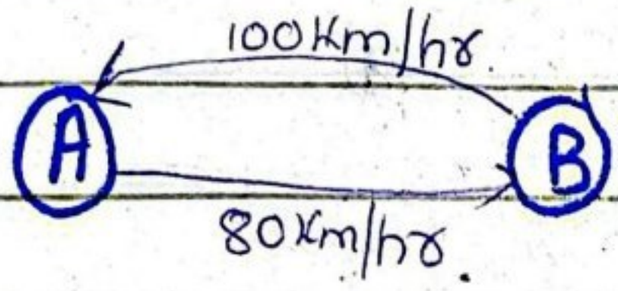
V = 70km/hr

t = ? , S = 49

$t = \frac{S}{V} \Rightarrow \frac{49}{70} \Rightarrow (0.7)hr$ or $\frac{0.7 \times 60}{10}$

= 42minute

Q) Sol:-



time = 45min

$= \frac{45}{60} = \boxed{0.75hr}$

$\boxed{V = 80km/hr}$

$V = \frac{d}{t} \Rightarrow d = (80)(0.75)$

$\boxed{d = 60km}$

Return:-

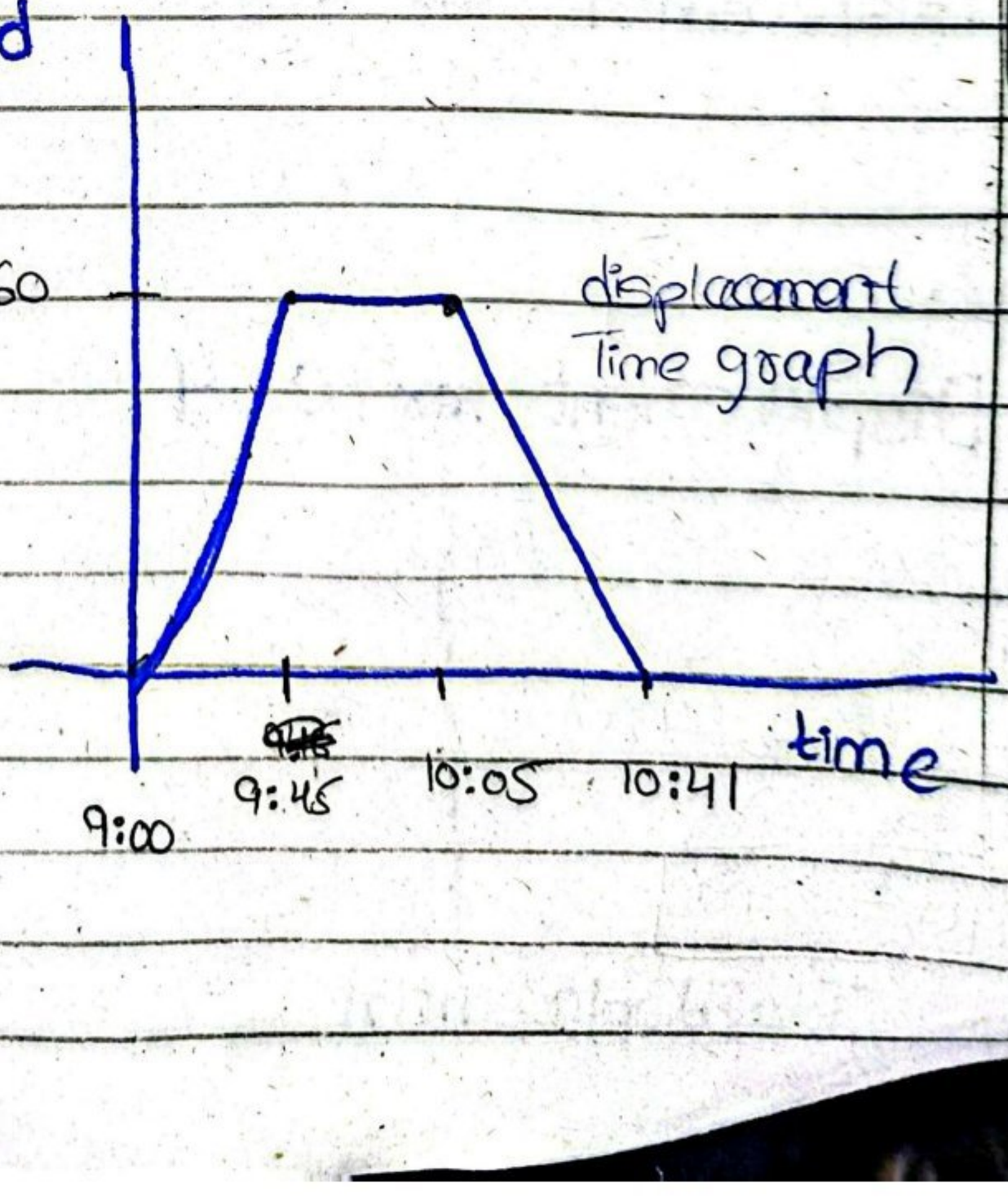
V = 100km/hr

t = ? d = 60km

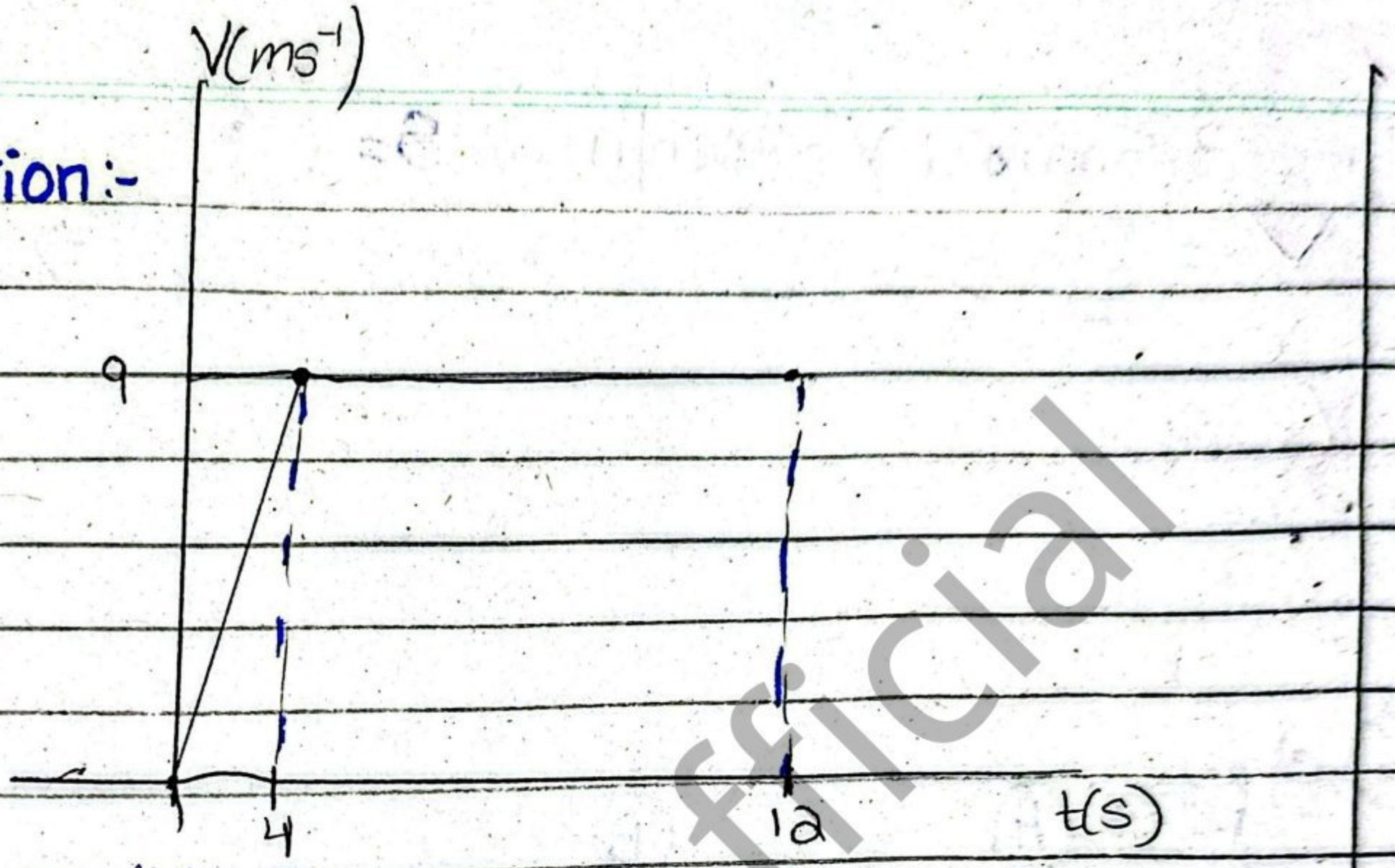
$t = \frac{60}{100} = \boxed{0.6hr}$

or

36mins



Q9) Solution :-



Sol :- (i) $a = \frac{\Delta V}{\Delta t}$

$a = \frac{9-0}{4-0} = \boxed{2.25 ms^{-1}}$

(ii) $v = \frac{d}{t} \Longrightarrow$ for constant velocity so cant use in part (i).

Displacement for 4-12 sec

(V)(t) = d

d = (9)(8) or $d = l \times w = 8 \times 9$

$= \boxed{72}$

$\boxed{d = 72m}$

Displacement for (0-4) sec

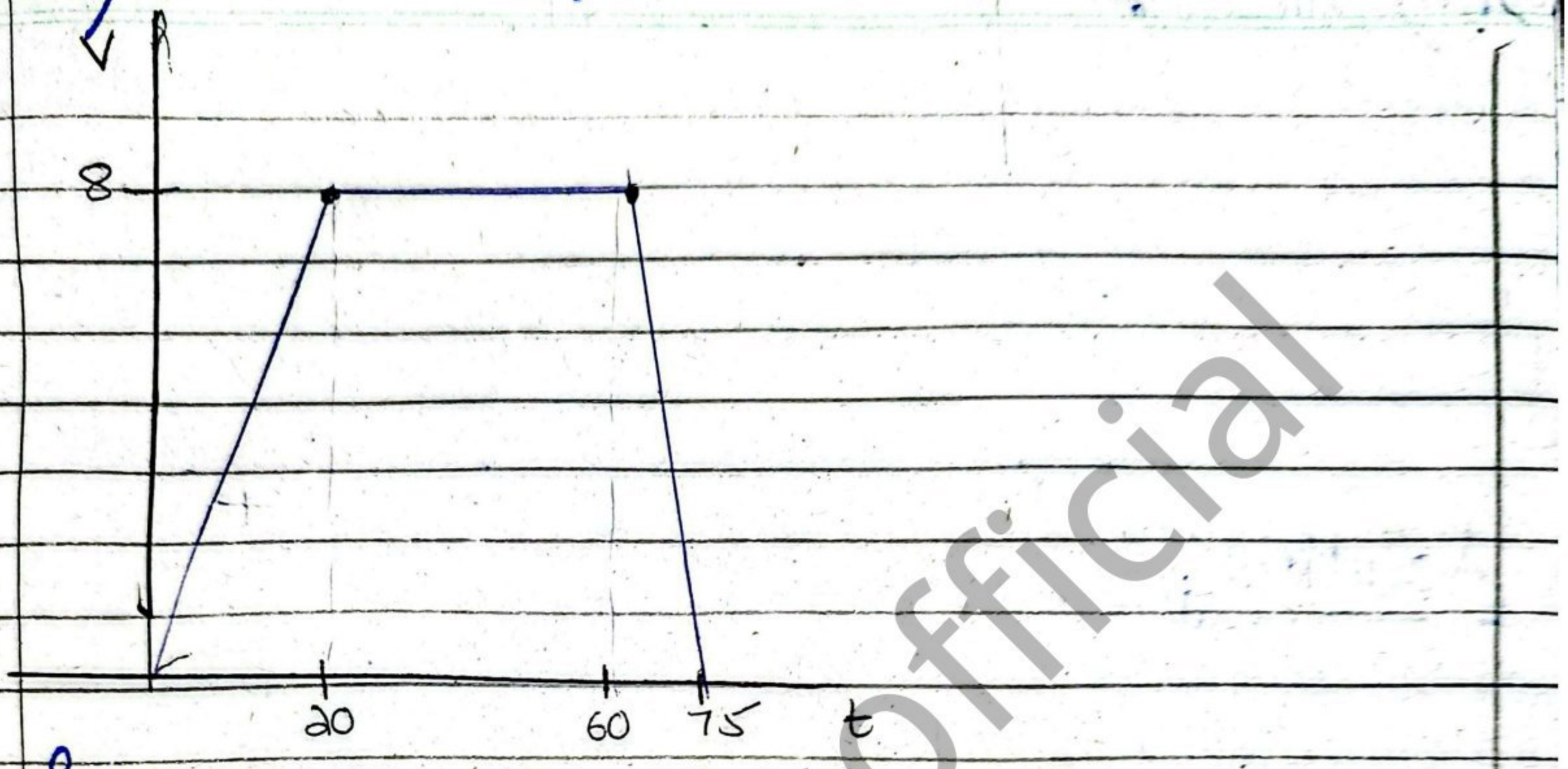
Area of $\Delta = \frac{1}{2}(\text{length})(\text{width})$

$= \frac{1}{2}(4)(9)$

$\boxed{d = 18m}$

Total displacement $\rightarrow 72 + 18 = \boxed{90m}$

(10) Sol



Solution:- acceleration from (0—20)

(i) $a = \frac{\Delta V}{\Delta t} = \frac{8-0}{20-0} = \frac{8}{20} =$ 0.4 ms⁻²

(ii) de acceleration for (60-75)

$a = \frac{0-8}{75-60} =$ -0.534

(iii) for (0-20) time

$S_1 = \frac{1}{2} l \times w$

$= \frac{1}{2}(20)(8) = 80m$

for 20-60 time

$S_2 = l \times w$

$= (40)(8) =$ 320m

for (60-75) time

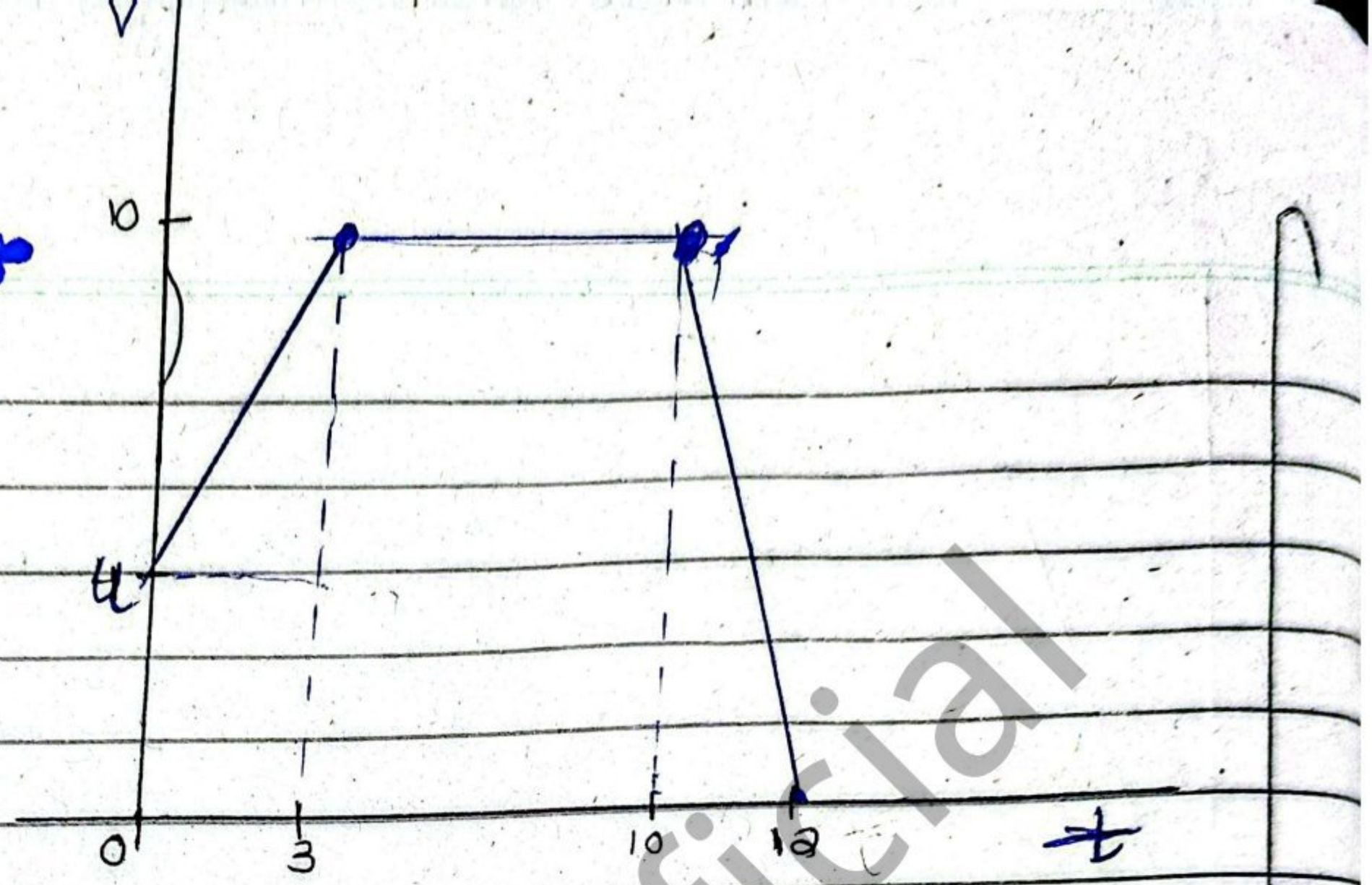
$S_3 = \frac{1}{2}(15)(8) = 60m$

Total displacement = 80+320+60 = 460m

Ans.

IMPORTANT.

Q11) Solution:



Solution:- (i) Distance (0–3)

d_1 = (Rectangle + triangle)

$d_1 = (3)(4) + \frac{1}{2}(10-4)(3)$

$d_1 = 3u + \frac{3}{2}(10-u)$.

$d_1 = 3u + \frac{30}{2} - \frac{3}{2}u$

$d_1 = u(3-\frac{3}{2}) + \frac{30}{2}$

$\boxed{d_1 = \frac{3}{2}u + 15}$

distance (3–10)

$d_2 = (7)(10) = 70m$

distance (10–12)

$d_3 = \frac{1}{2}(2)(10)$

$\boxed{d_3 = 10m}$

Total distance $= d_1 + d_2 + d_3$

$100 = \frac{3}{2}u + 15 + 70 + 10$

$\frac{(5)(2)}{3} = u$

$\boxed{u = \frac{10}{3} ms^{-1}}$

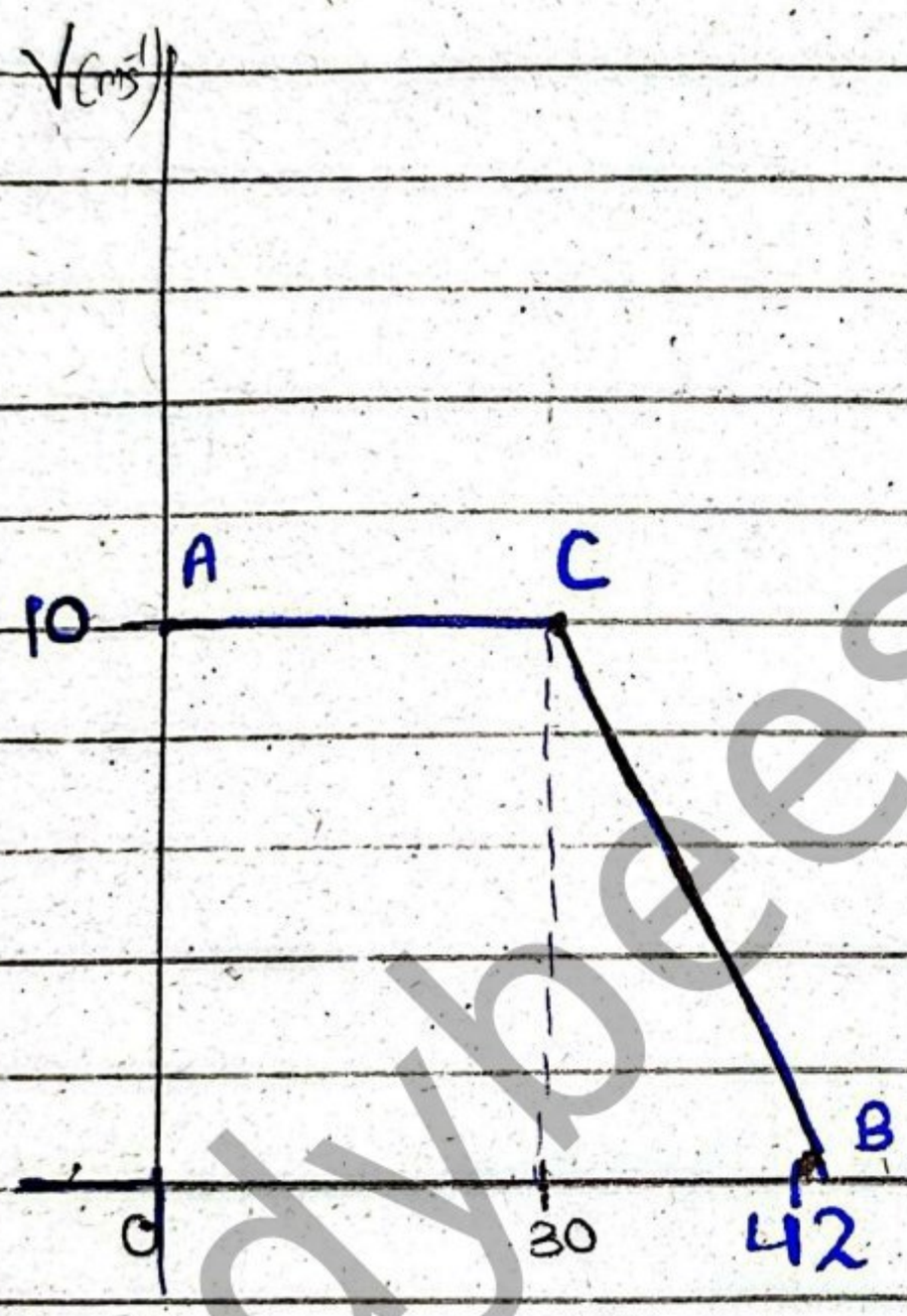
(ii) $a = \frac{\Delta V}{\Delta t}$

$a = \frac{10-U}{3}$

$a = \frac{10-\frac{10}{3}}{3} \Rightarrow \boxed{a = \frac{20}{9}\ ms^{-2}}$ Answer.

(Q12.)

(i)



(ii) distance (0 — 30)

$d_1 = l \times w$

$d_1 = (30)(10)$

$\boxed{d_1 = 300}$

distance for (30 — 42)

$d_2 = \frac{1}{2} l \times h$

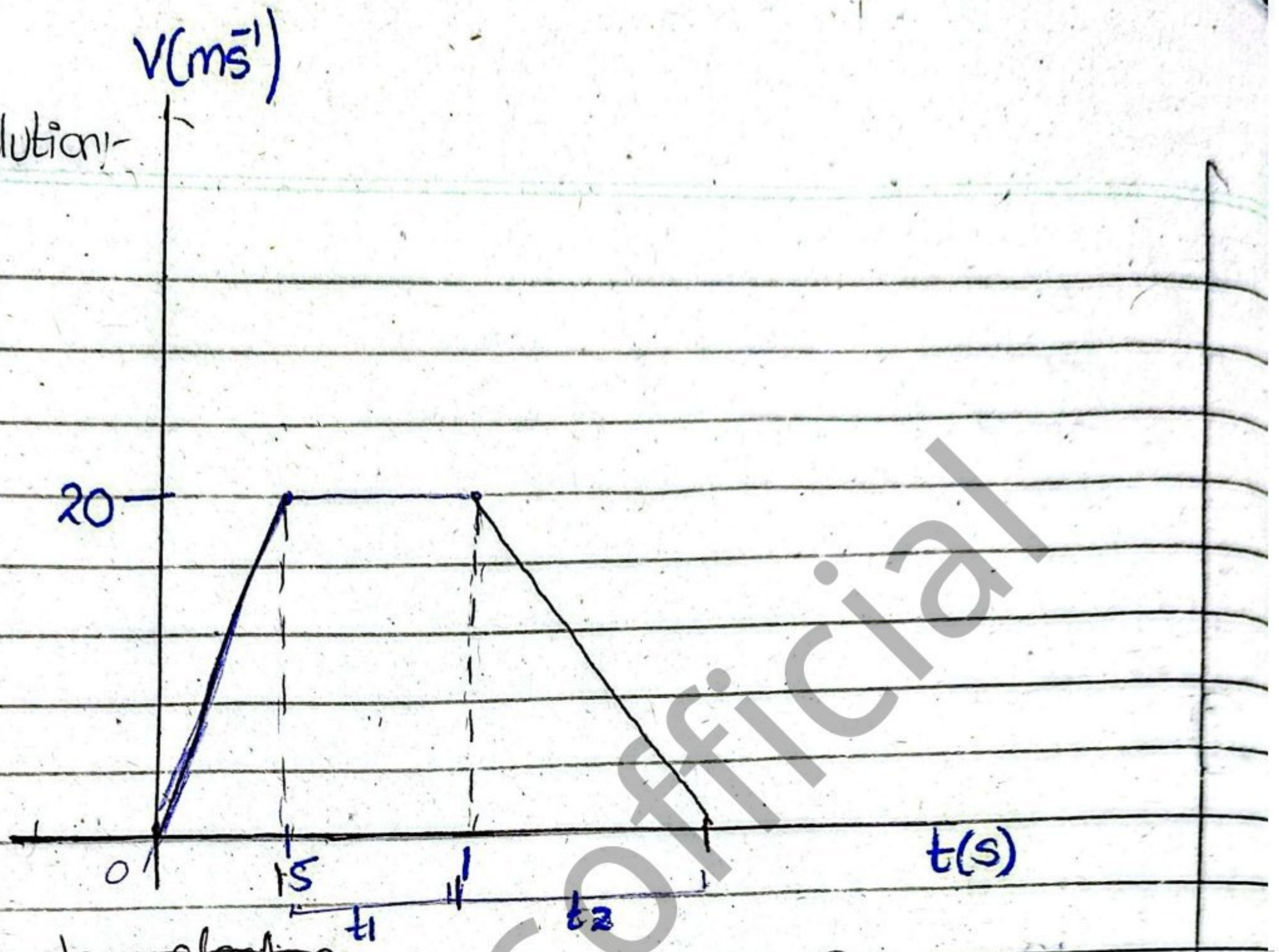
$= \frac{1}{2}(12 \times 10) \Rightarrow \boxed{60m}$

Total distance

$= 300 + 60$

$\therefore \boxed{d = 360m}$

Q13) Solution:-



Let ~~Time decelerating~~

Time decelerating = t_2

Time const velocity = $t_1 = 4t_2$

Total displacement = 480m.

$$\left[\left(\frac{1}{2}\right)(15)(20)\right] + \left[t_1 \times 20\right] + \left[\frac{1}{2} t_2 \times 20\right] = 480$$

$$150 + 4t_2 \times 20 + 10t_2 = 480$$

$$150 + 80t_2 + 10t_2 = 480$$

$$150 + 90t_2 = 480$$

$$90t_2 = 480 - 150$$

$$90t_2 = 330$$

$$\boxed{t_2 = \frac{11}{3}} \Rightarrow \boxed{t_2 \approx 3.67}$$

$t_1 = 4t_2$

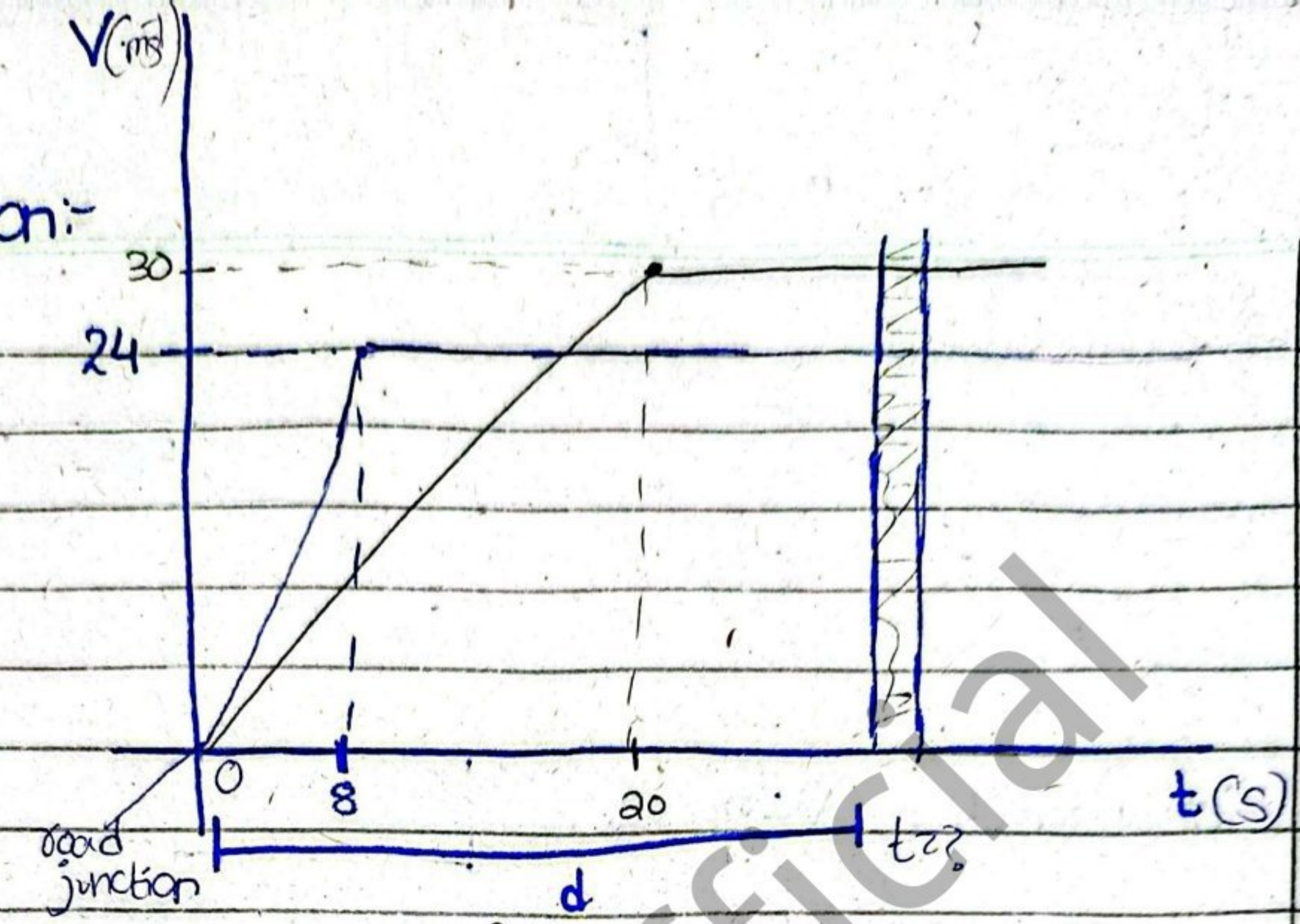
$t_1 = 4(3.67) \approx \boxed{14.67}$

(ii) Total time $= 15 + \frac{44}{3} + \frac{11}{3}$

$\boxed{t = 33.34 \text{ second}}$

Q14) Solution:-

(i)



Solution:- for M(motorcyclist)

$a = 3ms^{-2}$, $t = 8s$, $V = ?$

$a = \frac{\Delta V}{\Delta t} \Rightarrow V = at \Rightarrow V = (3)(8)$

$\boxed{V = 24ms^{-1}}$

Car.

$V = 30ms^{-1}$; $t = 20s$

(ii) $d_M = d_C$.

$$\left[\left(\frac{1}{2}\right)(8)(24)\right] + \left[(t-8)\times(24)\right] = \left[\frac{1}{2}(20)(30\right] + \left[(t-20)(30)\right]$$

$96 + 24t - 192 = 300 + 30t - 600$

$-96 + 300 = 30t - 24t$

$t = \frac{204}{6}$

$\boxed{t = 34s}$

distance $= \left[\frac{1}{2} \times 20 \times 30\right] + \left[(34-20)(30)\right]$

distance $= 300 + (14)(30)$

distance $= 720m$ Answer.