Graham's Law of Effusion

Course on States of Matter for Class XI

akhilesh • Lesson 7 • July 23, 2021

S-1

(1) $NaN_3 \longrightarrow Na(s) + \frac{3}{2} N_2$

(4) 0.2 lit × 60 per hour

= $\frac{1}{2}$ mol per hr.

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

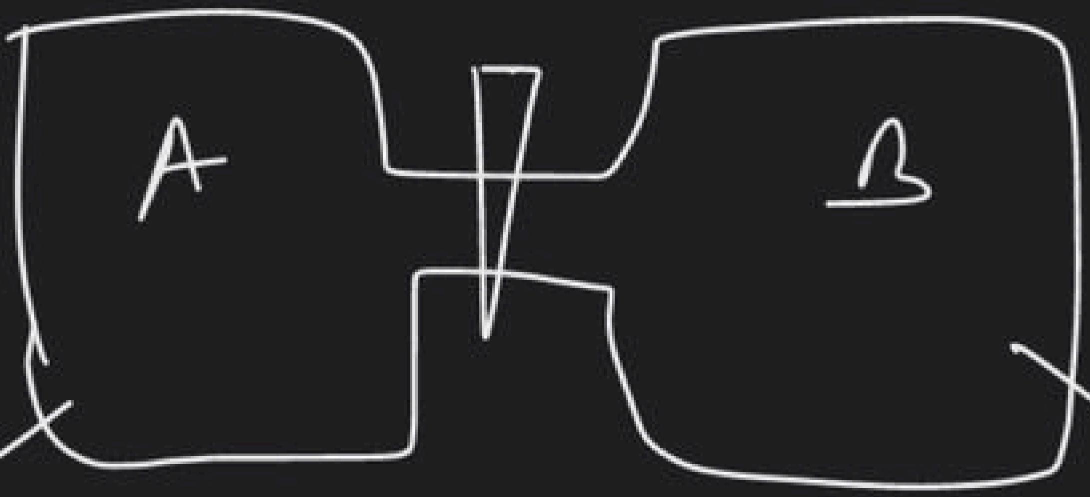
$\frac{1}{6} \times \frac{1}{12}$ $\qquad$ $\frac{1}{2}$

5

$$PV = nRT$$

$$n^2 = \frac{P^2}{(RT)^2} V^2$$

$$\left(\frac{P}{RT}\right)^2 = \left(\frac{\cancel{8.21} \, 100}{\cancel{0.0}821 \times 200}\right)^2 = \frac{1}{4} = 0.25$$



100 ml

P

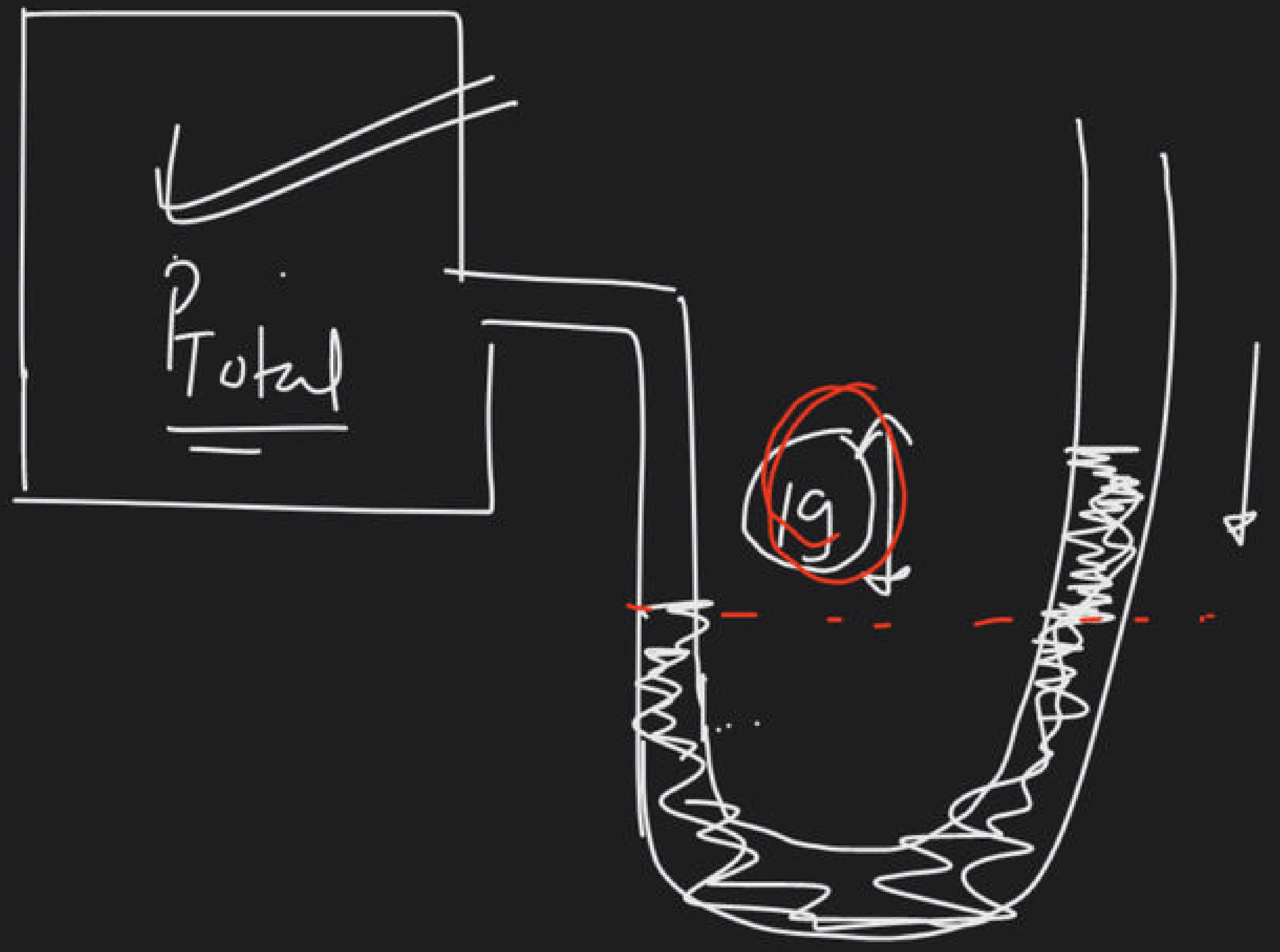
V ml

0.4 P

$$\cancel{P} \times 100 = 0.4\cancel{P}\,(100 + V)$$

$$V = 150$$

11



$$P_{Total} = 76 + 19$$
$$= 95\ \text{cm}$$
$$= 1.25\ \text{atm}$$

$$2NH_3 \longrightarrow N_2 + 3H_2$$

$$1 - x \qquad \frac{x}{2} \qquad \frac{3x}{2}$$

$$1 + x = 1.25 \qquad x = 0.25$$

$$\frac{P_1}{n_1 T_2}$$

$$\frac{P_1 V = n_1 R T_1}{P_2 V = n_2 R T_2} = \frac{W_1 R T_1}{W_2 R T_2}$$

Question

from ARITRA AMB...

Volume(V) (dm^3) →

Fig. 5.5(a) Graph of pressure, p vs. Volume, V of a gas at different temperatures.

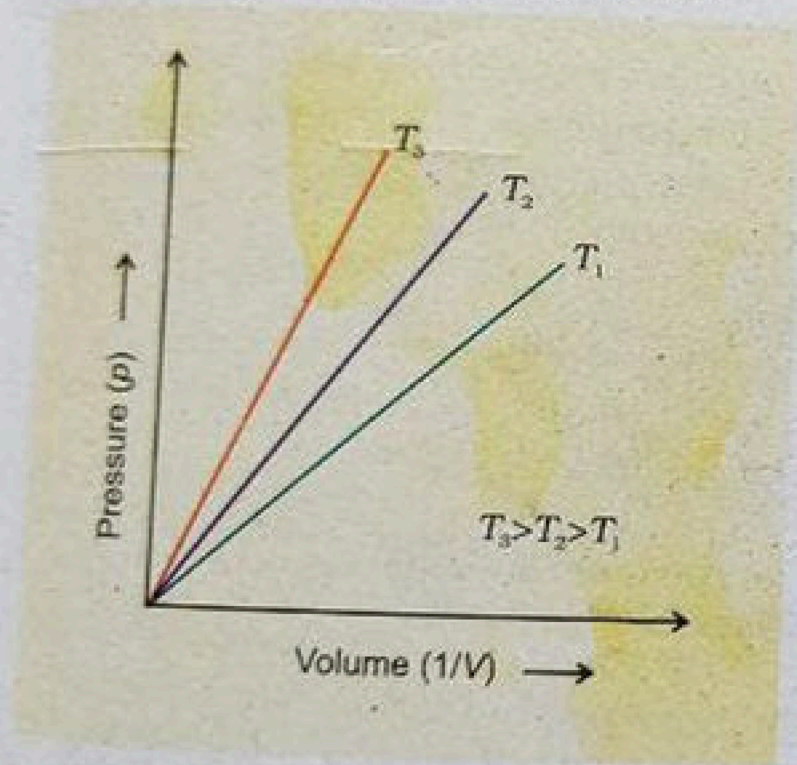


Fig. 5.5 (b) Graph of pressure of a gas, p vs. $\frac{1}{V}$

Fig 5.5 (b) represents the graph between p and $\frac{1}{V}$. It is a straight line passing through origin. However at $\boxed{\text{high pressures,}}$ gases deviate from Boyle's law and under such conditions a straight line is not obtained in the graph. ?

Experiments of Boyle, in a quantitative manner prove that gases are highly compressible because when a given mass of a gas is compressed, the same number of molecules occupy a smaller space. This means that gases become denser at high pressure. A relationship can be obtained between density and pressure of a gas by using Boyle's law:

By definition, density 'd' is related to the mass 'm' and the volume 'V' by the relation $d = \frac{m}{V}$. If we put value of V in this equation from Boyle's law equation, we obtain the relationship.

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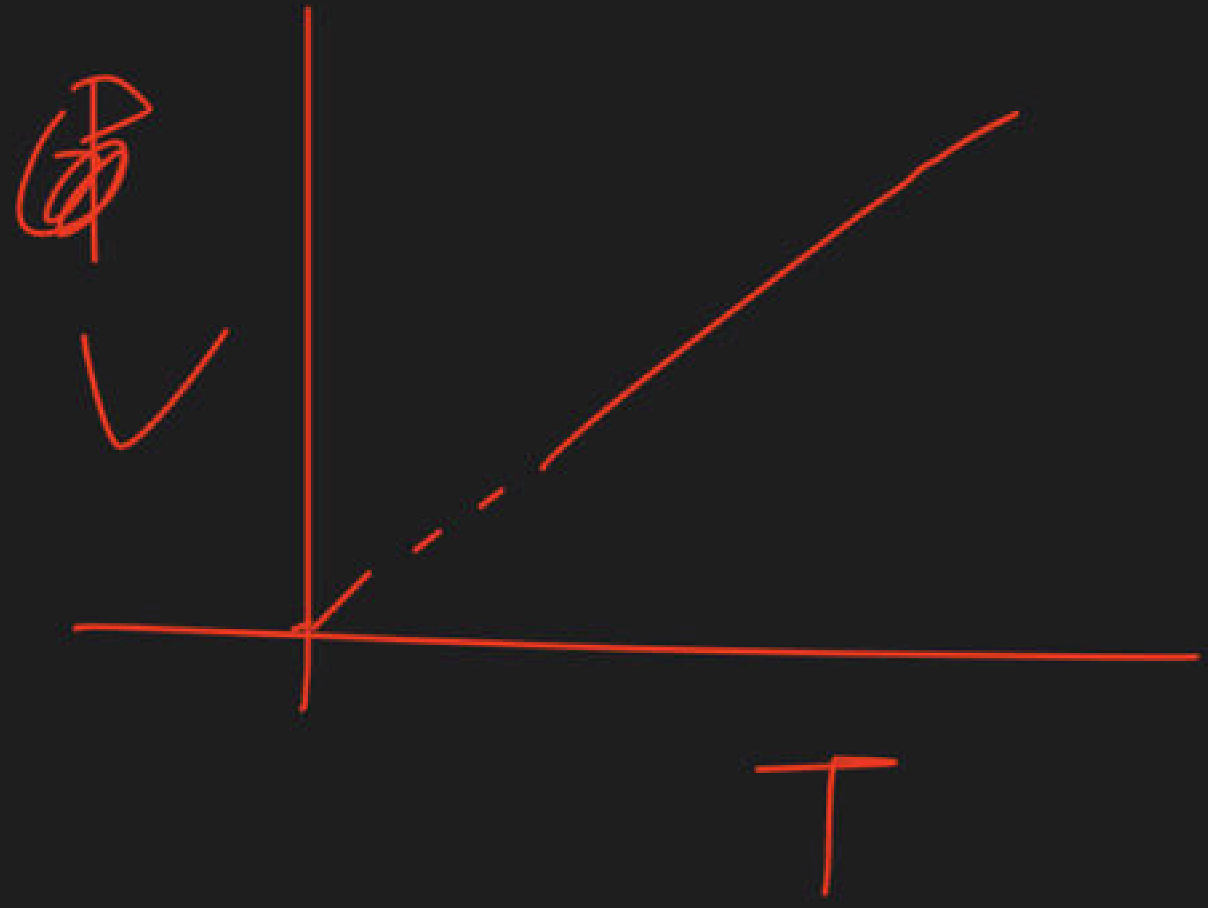
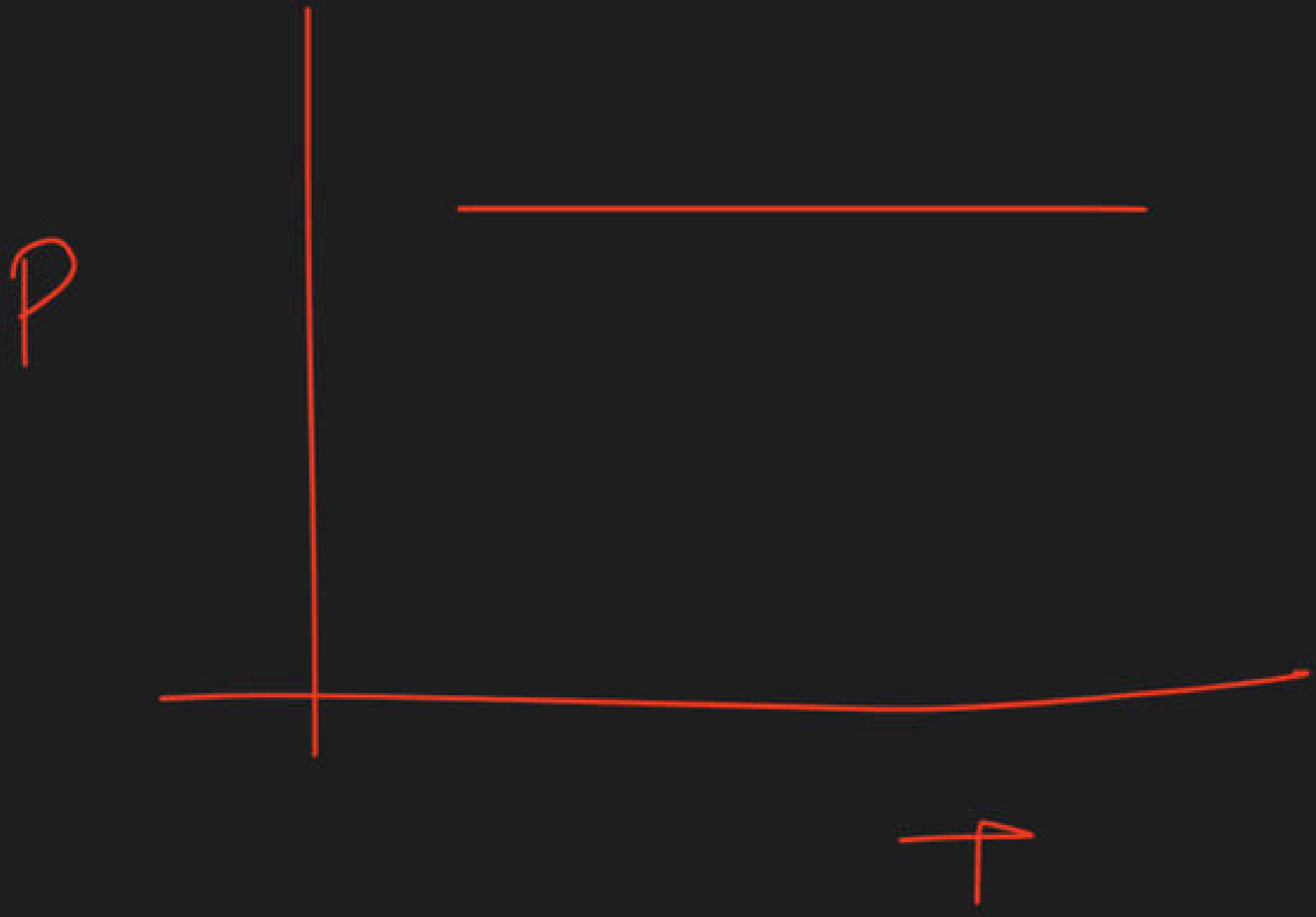


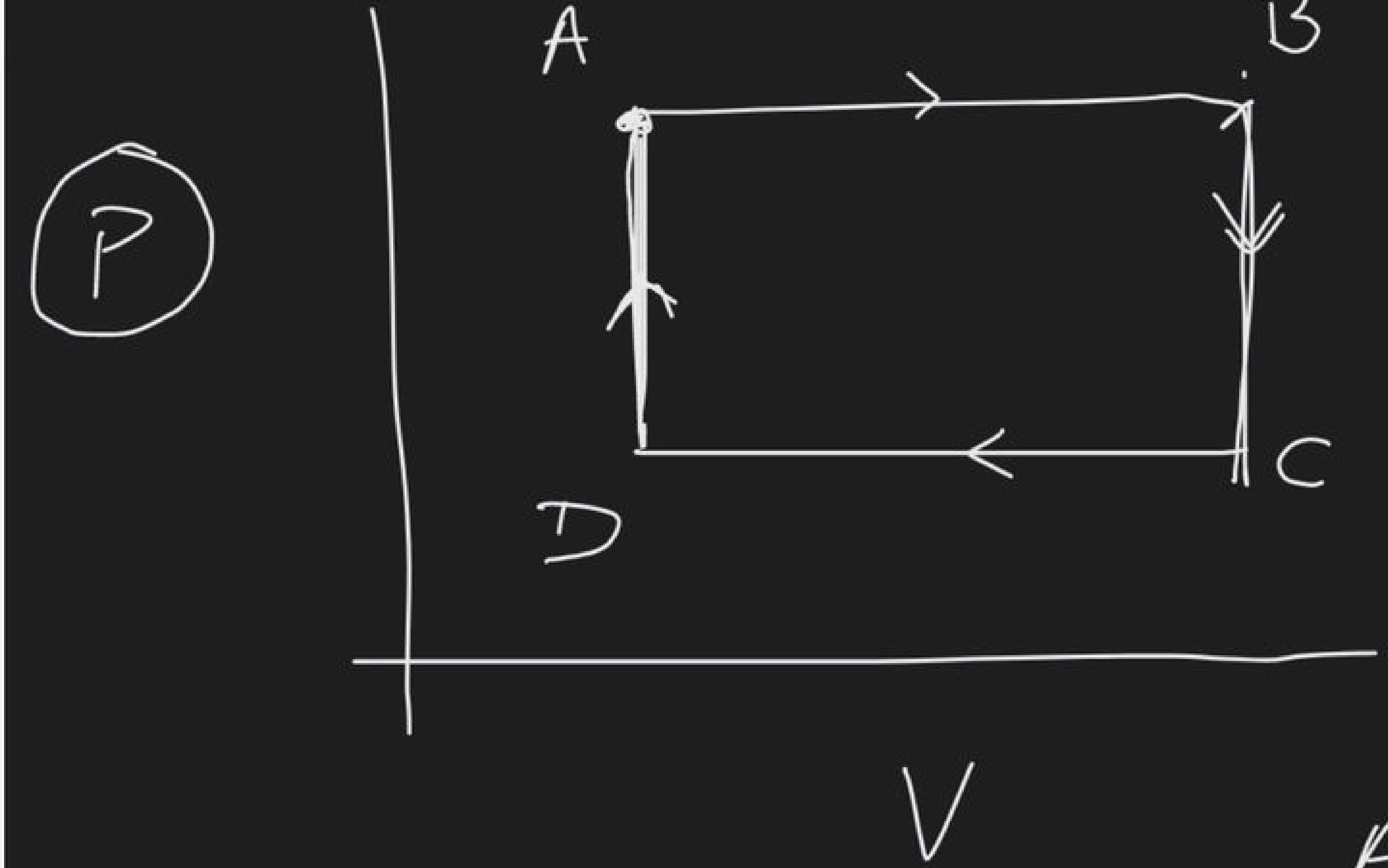
P = Const

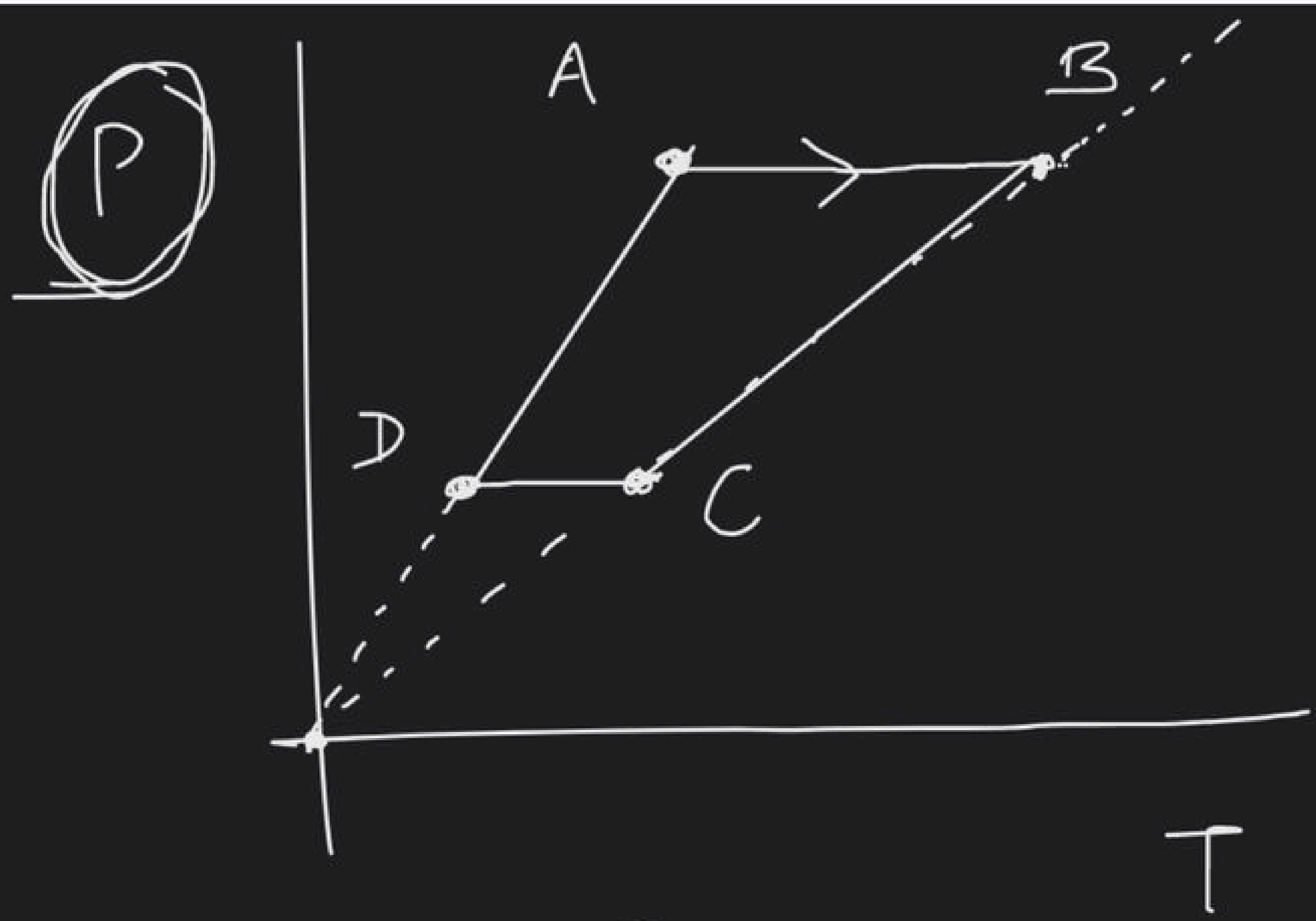
→ isobar

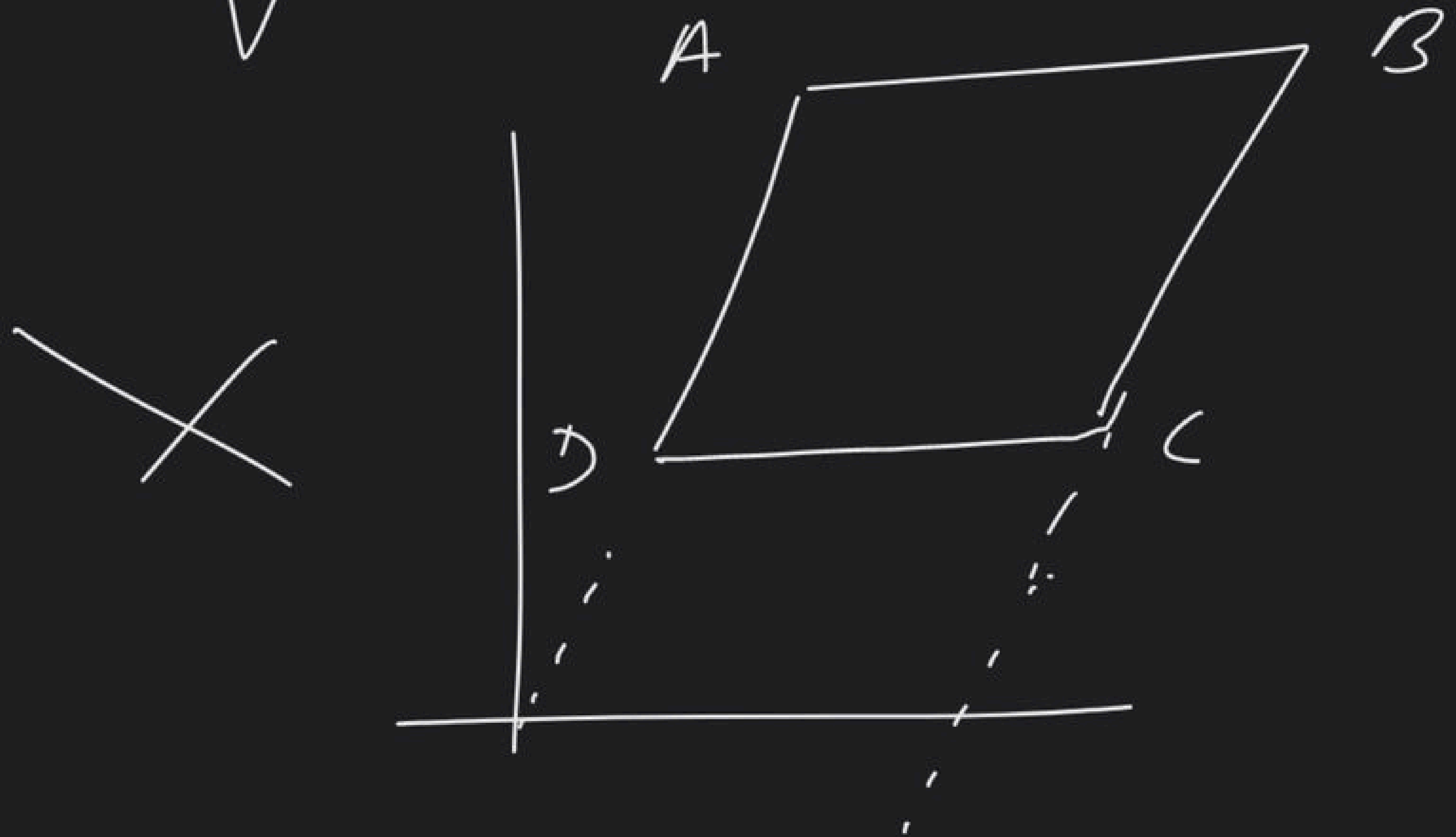
→ isochore

→ isothermal

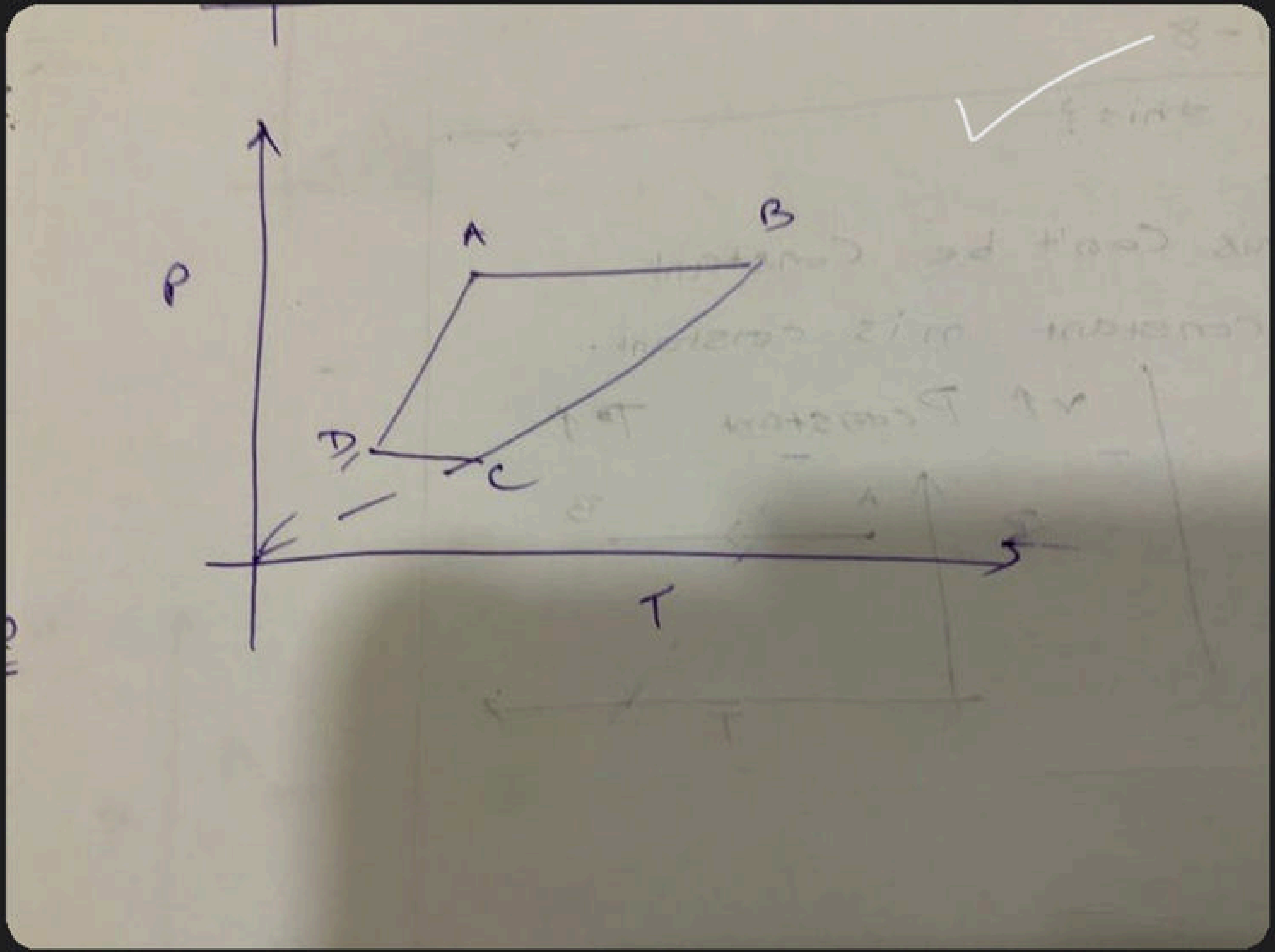



P
A
B
C
D
V


P
A
B
C
D
T

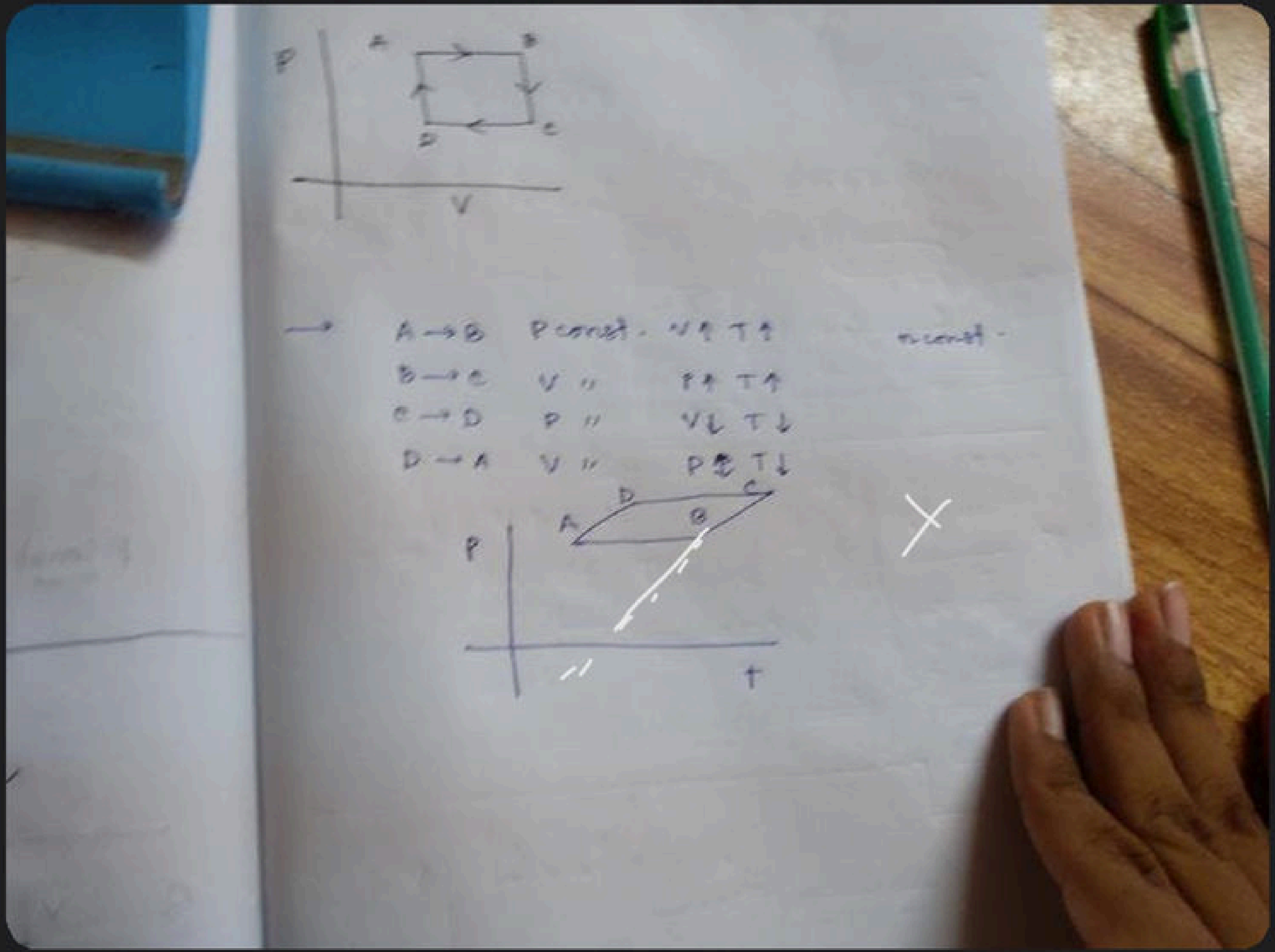

A
B
C
D

Question
from Ridham



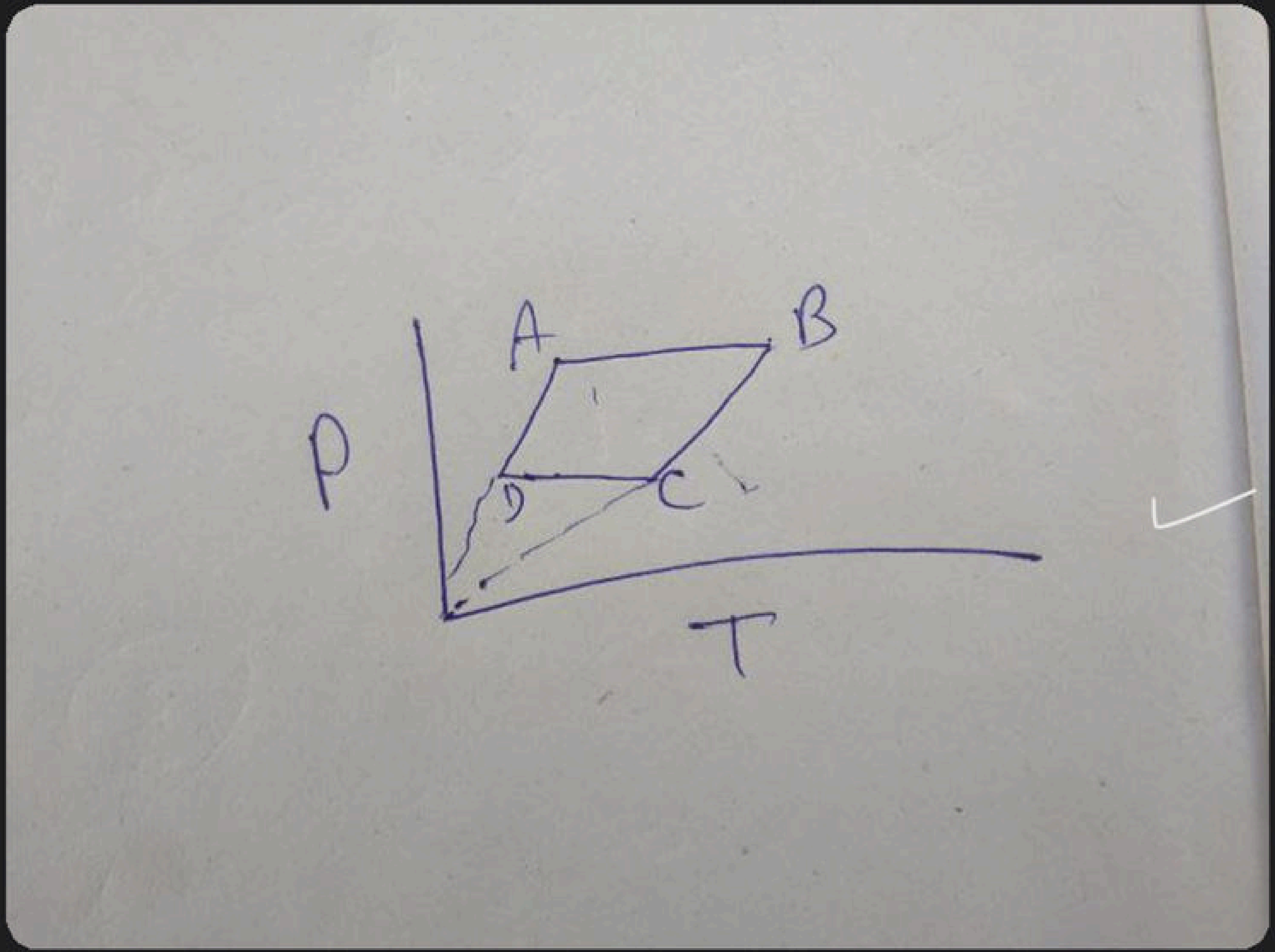
Question

from ARITRA AMB...



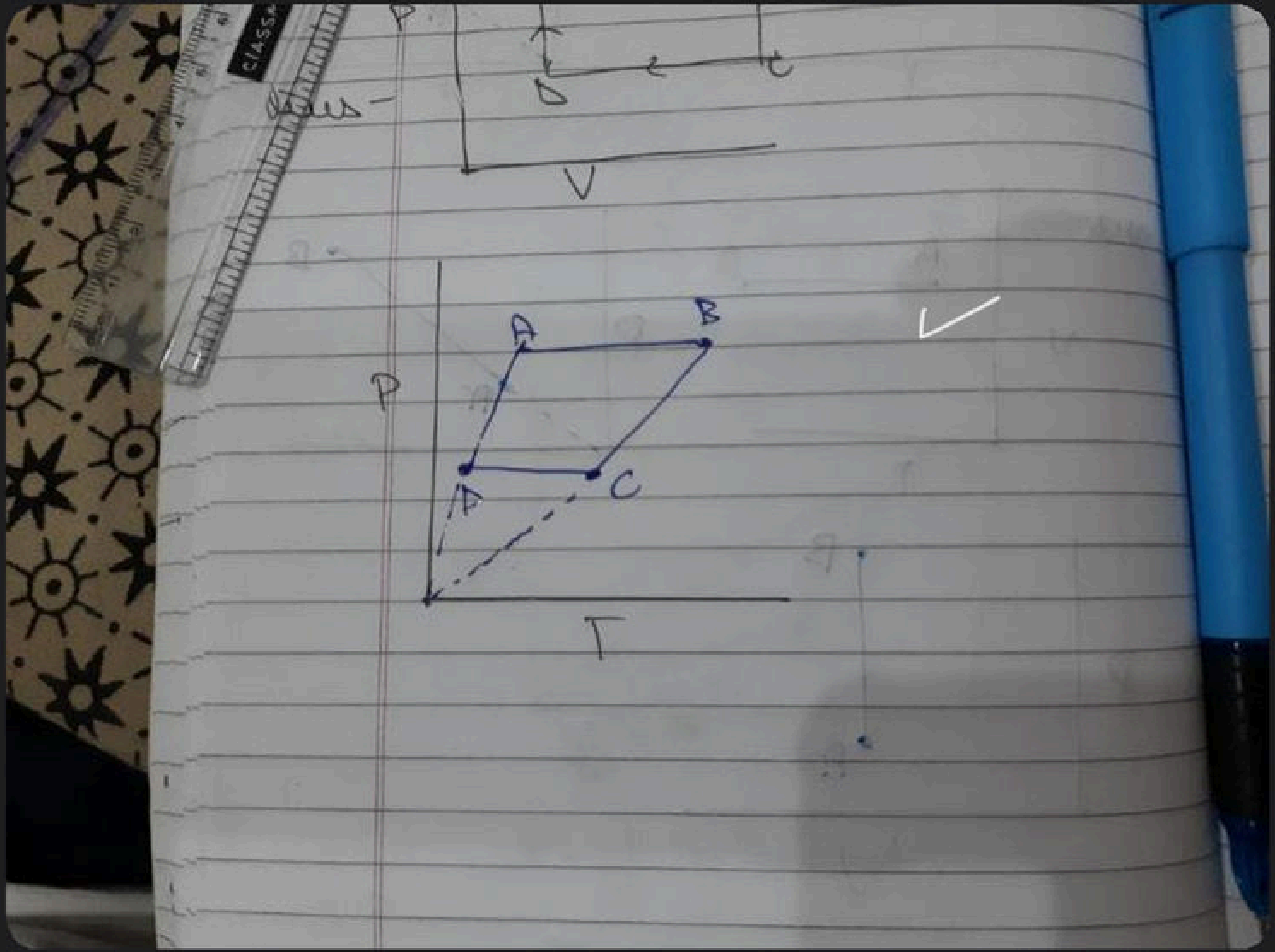
Question

from Abhinav



Question

from Aaditya



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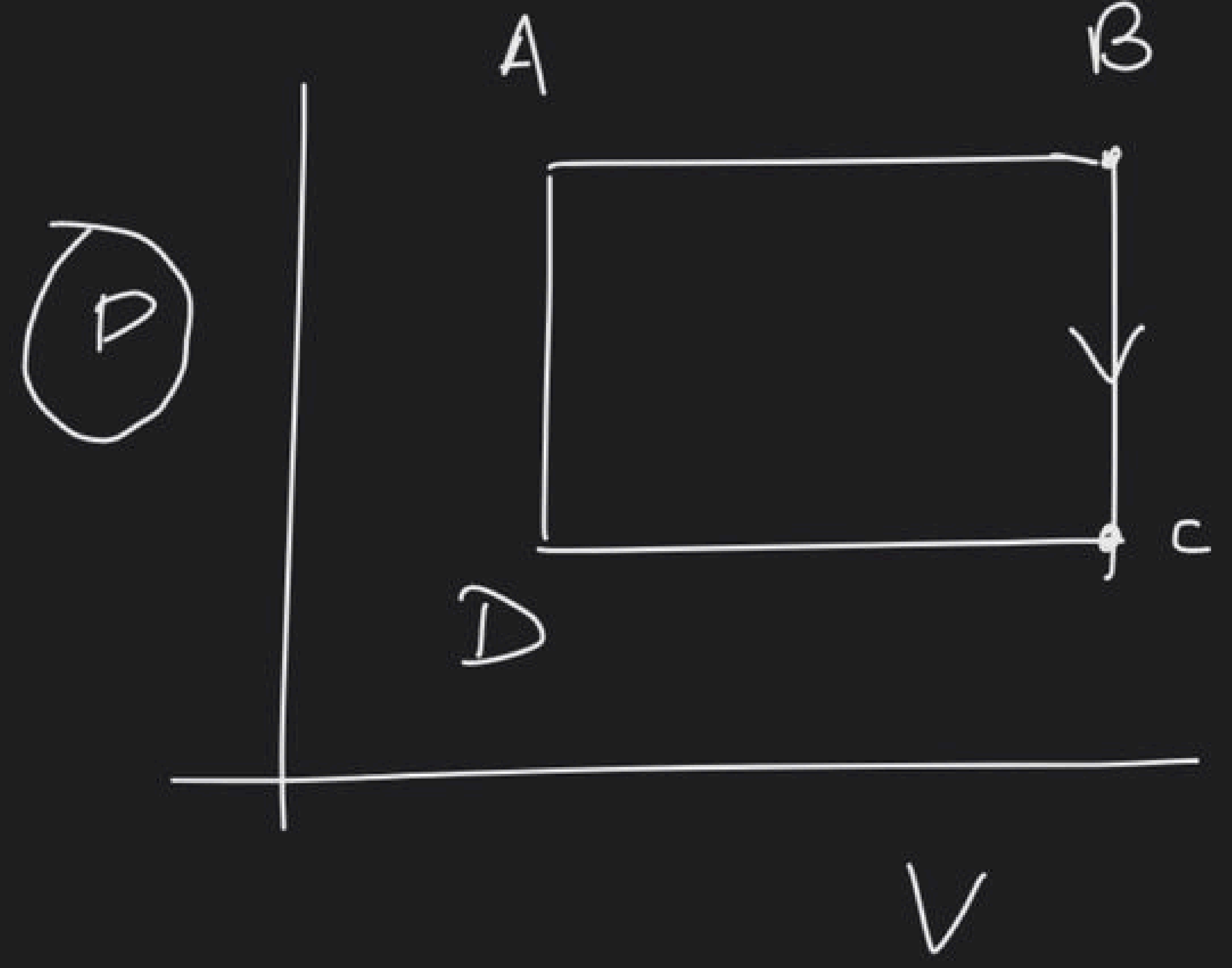
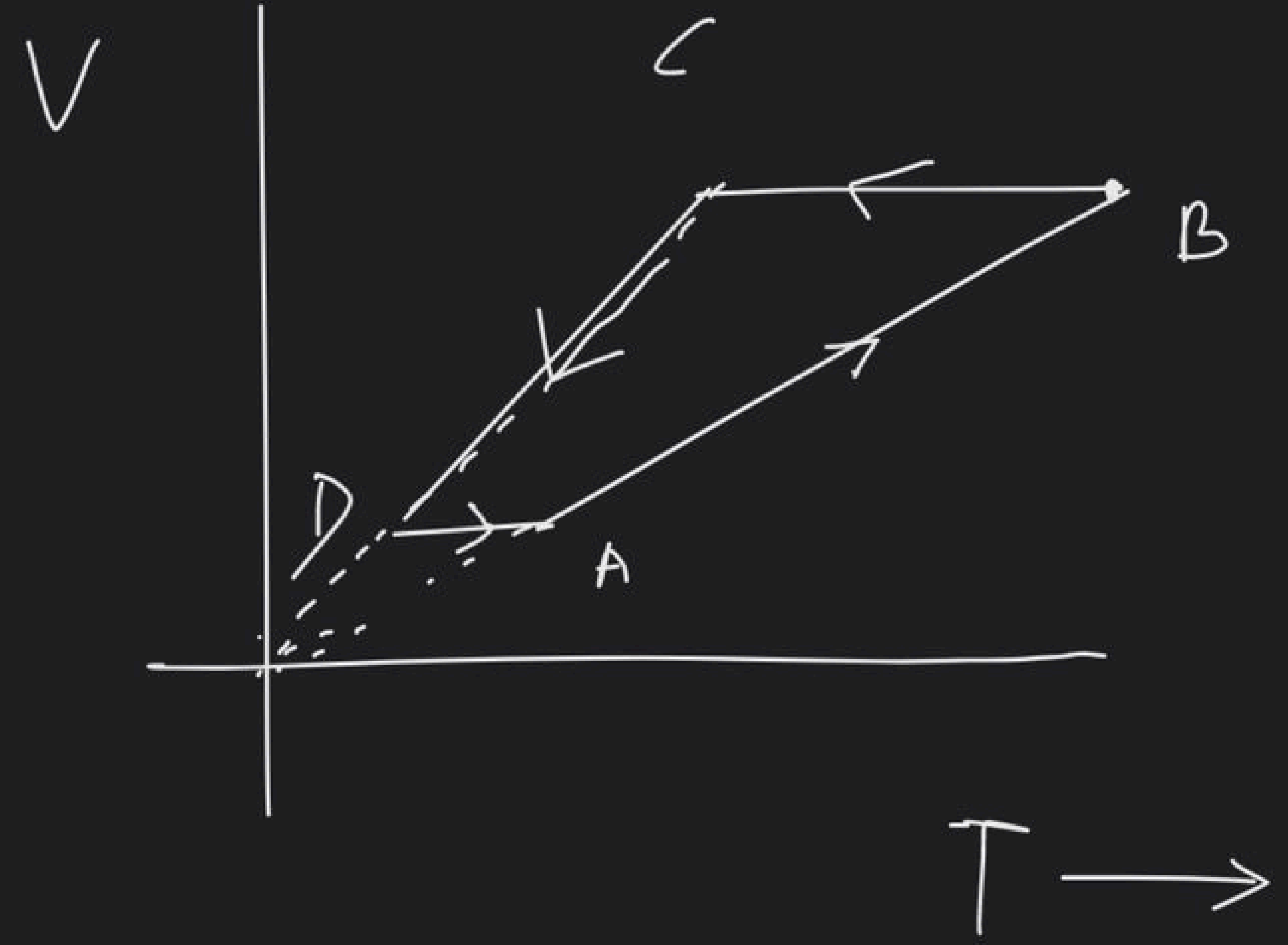
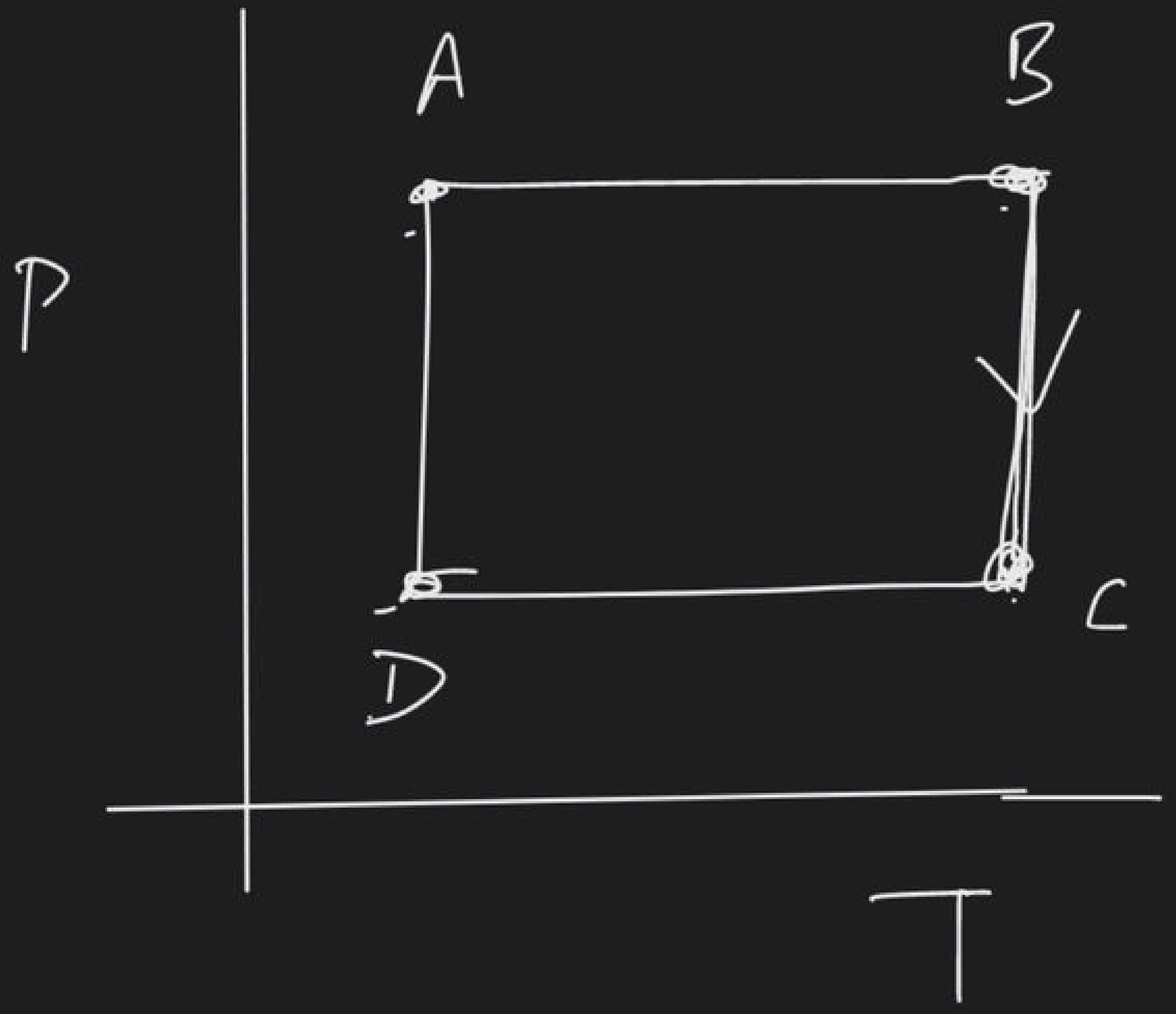
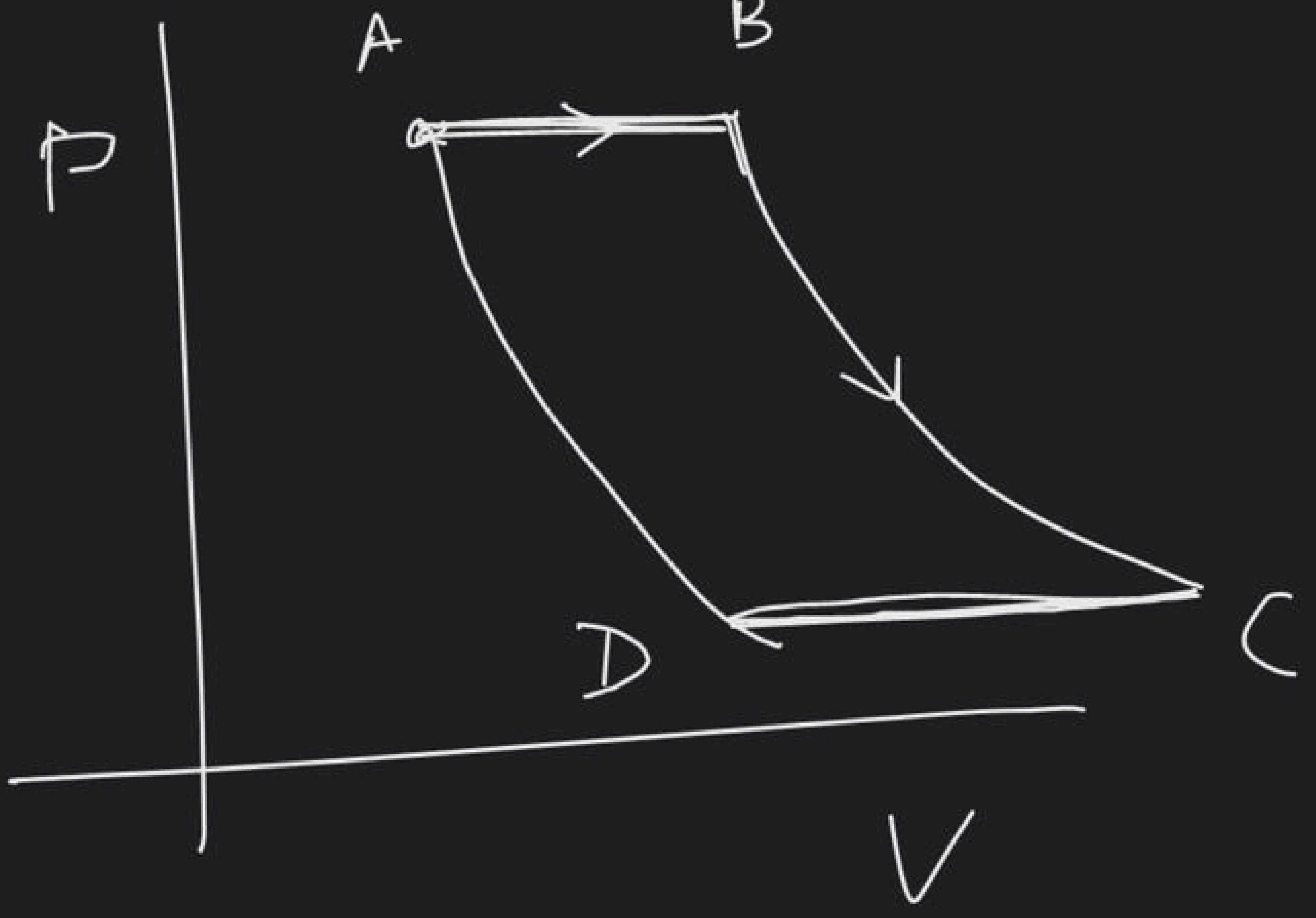

A
B
P
C
D
V


V
C
B
D
A
T





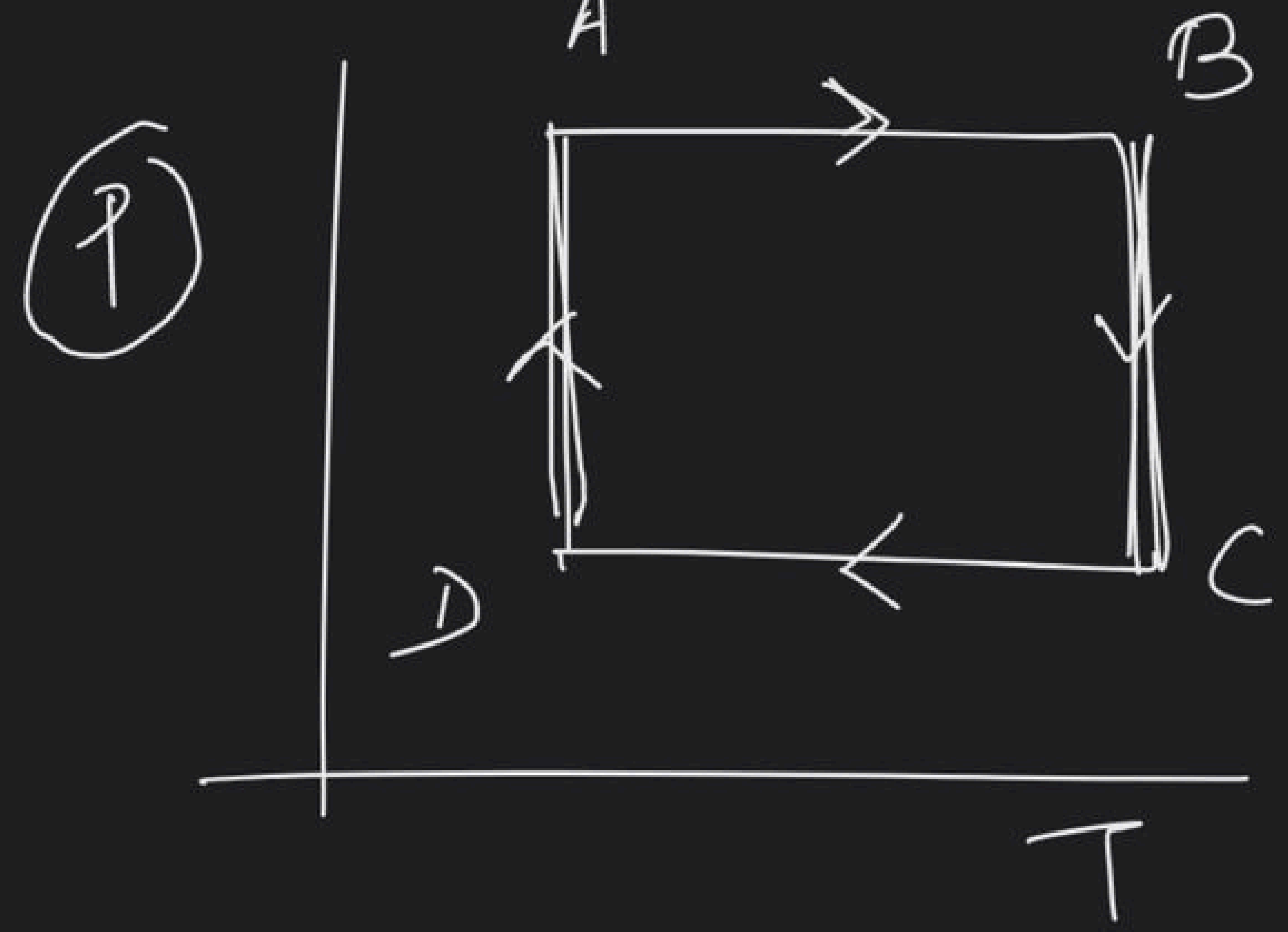
$$PV = nRT$$

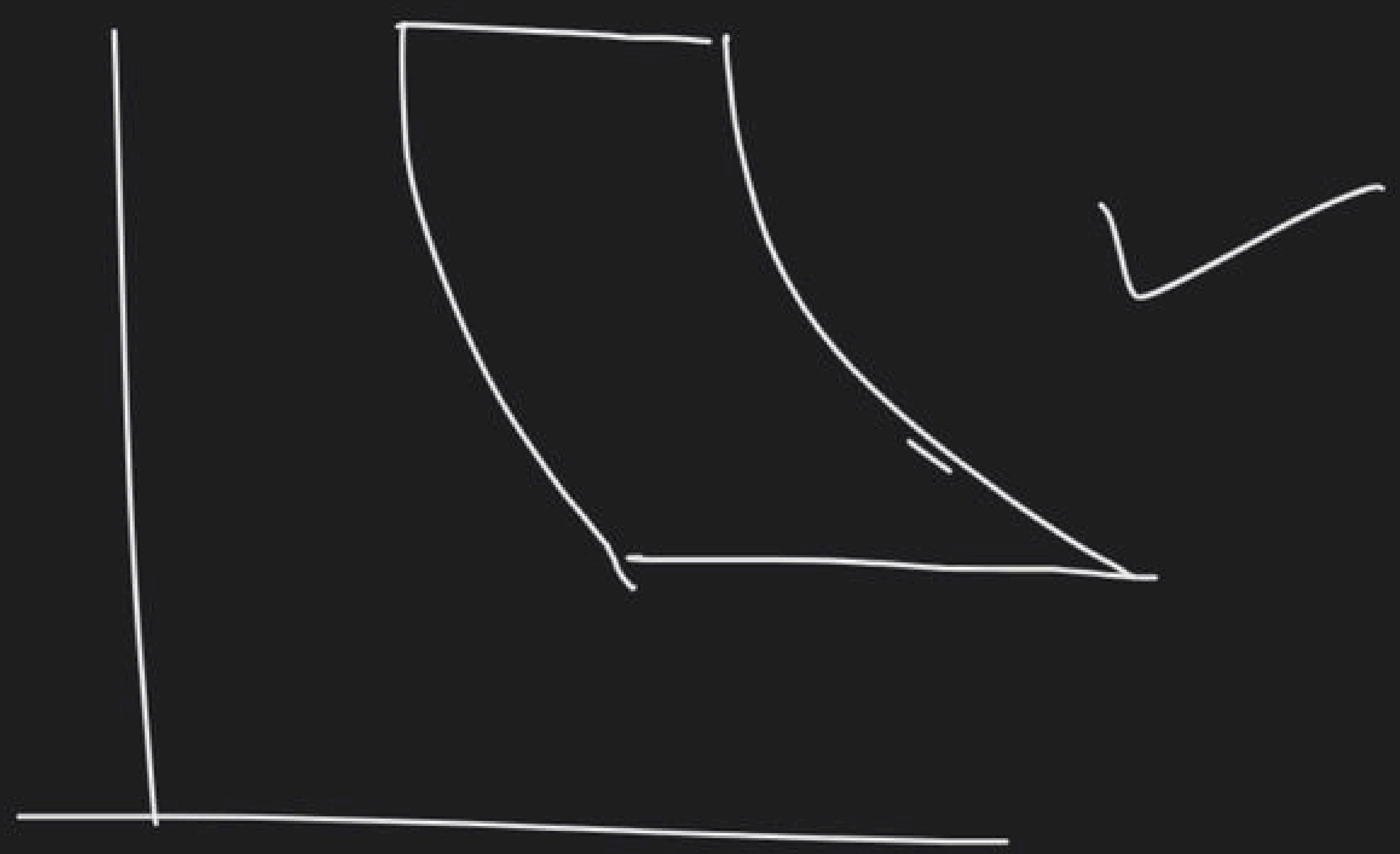
$$\cancel{P}\,\Delta V = nR\,\Delta T$$

P

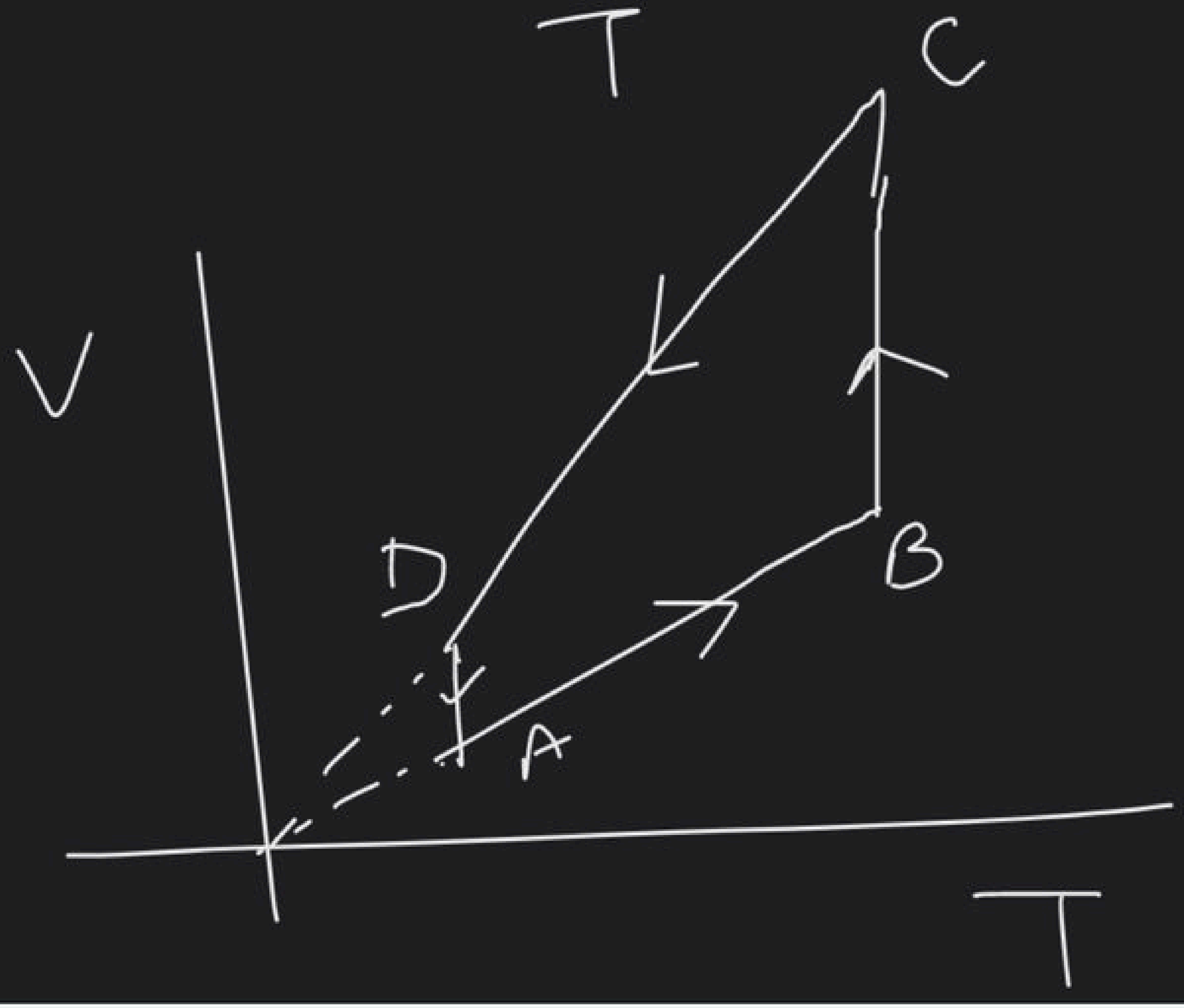
$$\Delta T_{AB} = \Delta T_{CD}$$

$$\Delta V_{AB} \quad \Delta V_{CD}$$





$\Delta V_{BC} > \Delta V_{DA}$



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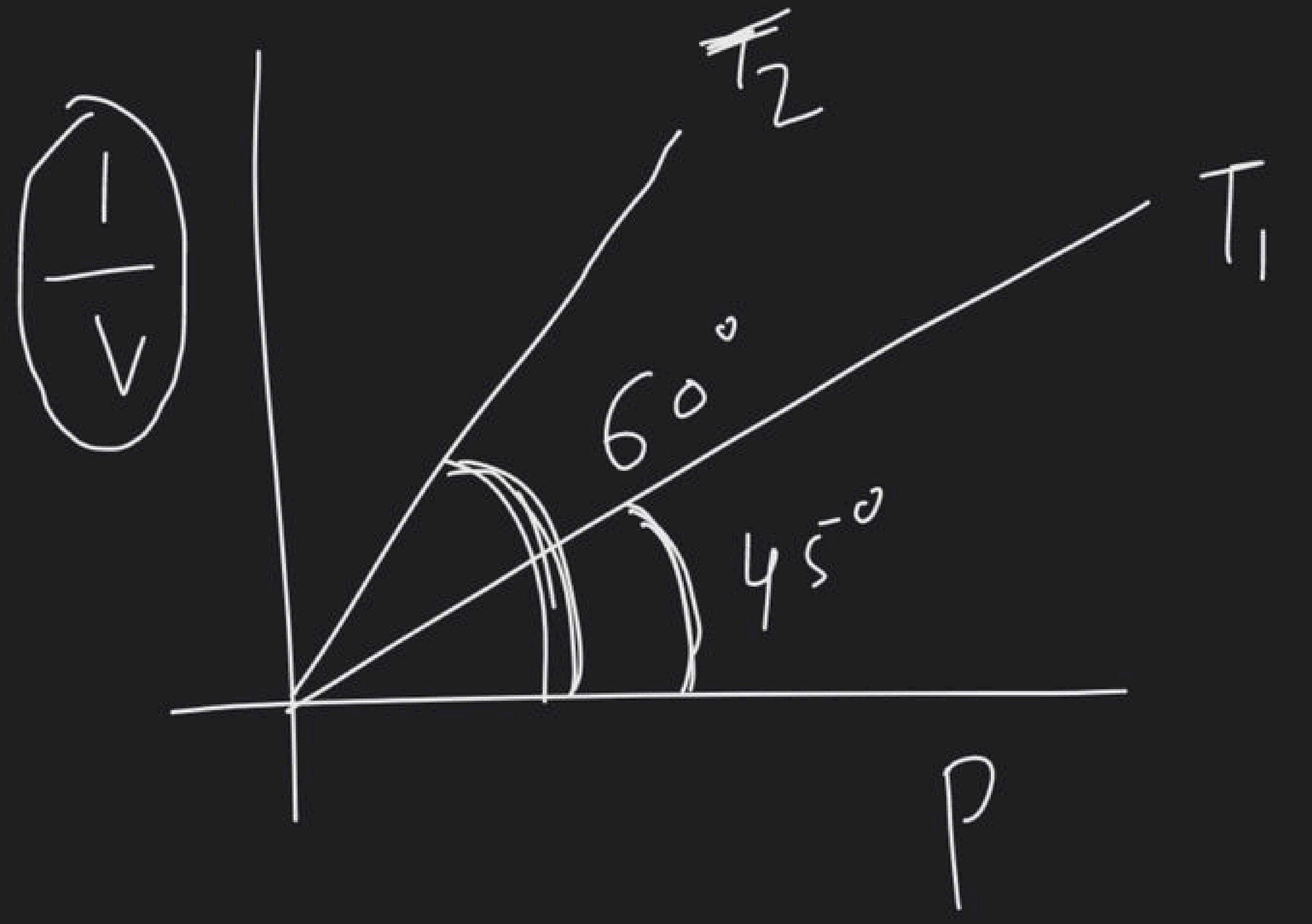


$$\frac{T_2}{T_1} = ?$$

$$P = nRT\frac{1}{V}$$

$$\frac{1}{V} = \frac{1}{nRT} P$$

(A) $1/\sqrt{3}$

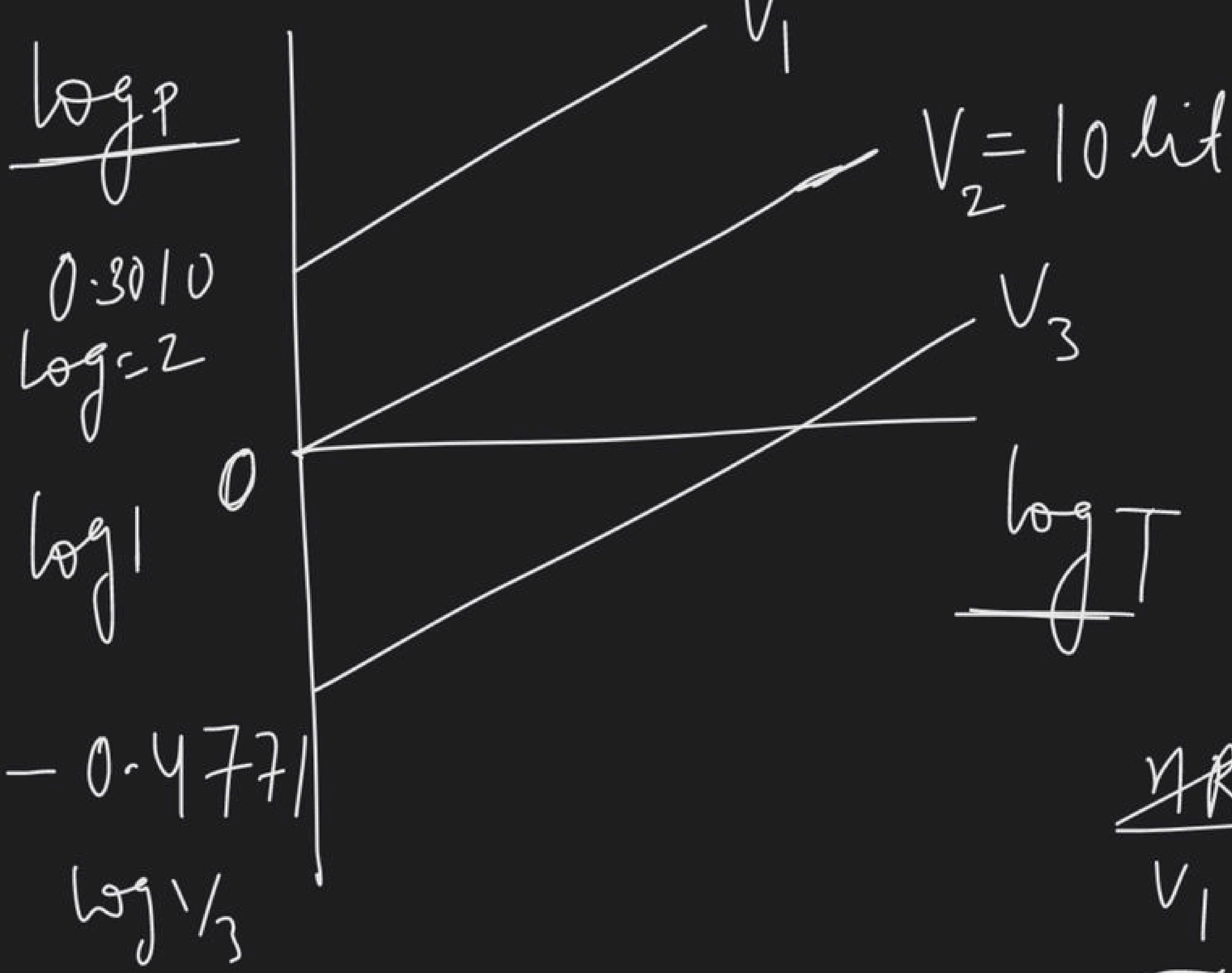
(B) $\sqrt{3}$

(C) 1

(D) None

$$\tan\theta = \frac{1}{nRT_2} = \sqrt{3}$$

$$\frac{1}{nRT_1} = 1$$



$V_1, V_3 = ?$

$$P = \frac{nR}{V} T$$

$$\log P = \log \frac{nR}{V} + \log T$$

$$\frac{nR}{V_1} = 2$$

$$\frac{nR}{V_2} = 1$$

$$\frac{nR}{V_3} = \frac{1}{3}$$

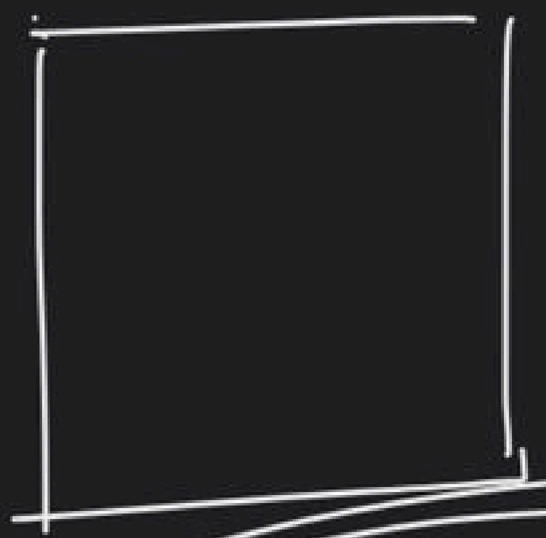
$\log 2 = 0.3010$

$\log 3 = 0.4771$

Problems related with containers :→

- Closed
  - Rigid
  - Non-rigid
- Open

Rigid



P
T
n
V

V = Const

Non-rigid

T, n, V

Balloon

$P_{in} = P_{ext} = \text{const}$

Closed container

(1) **Rigid** : A gas cylinder has been filled at 10 atm pressure at 300K

This cylinder can bear 20 atm pressure.

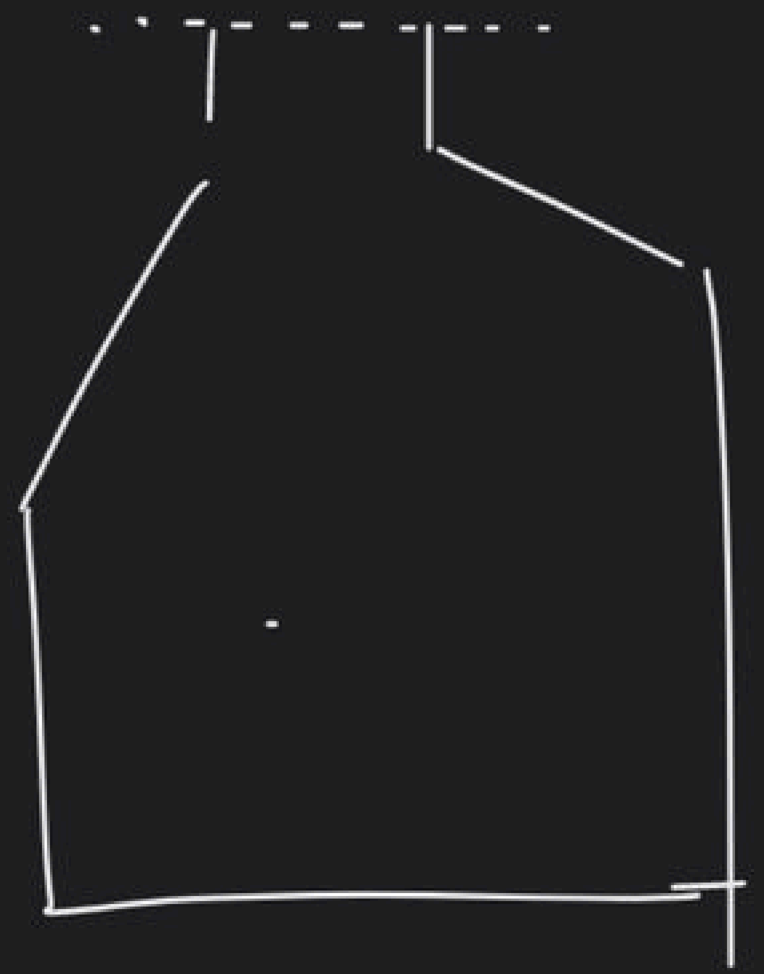
Due to sudden fire in the building temp starts rising. find Temp at which cylinder will burst.

Q. A balloon is inflated to $7/8^{th}$ of its max volume at 300K. find the temp at which it ~~will~~ will burst.

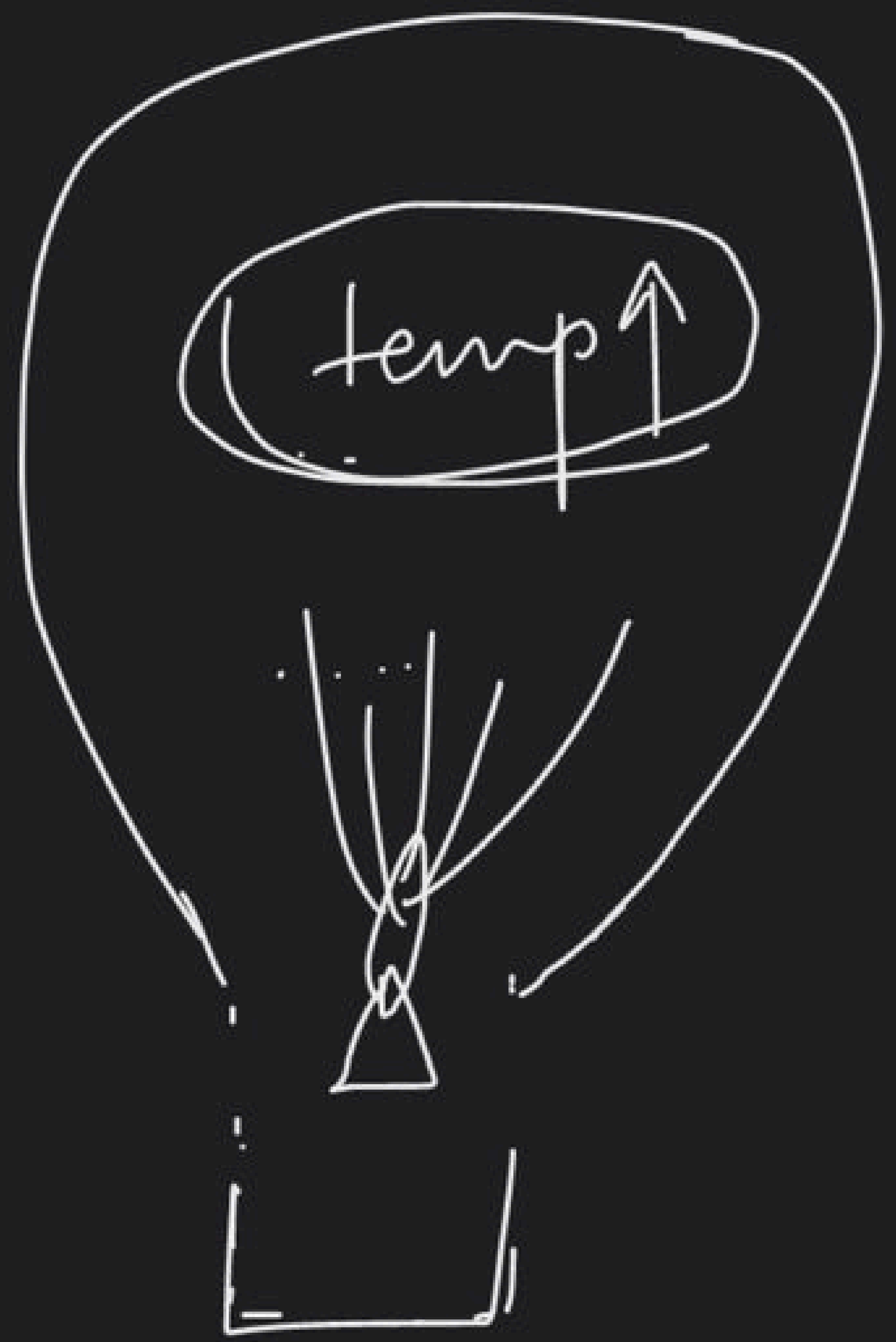
$$\frac{T_2}{V_2} = \frac{T_1}{V_1}$$

$$T_2 = \frac{V}{7/8\,V} \times 300$$

Open container



$P = \text{const}$

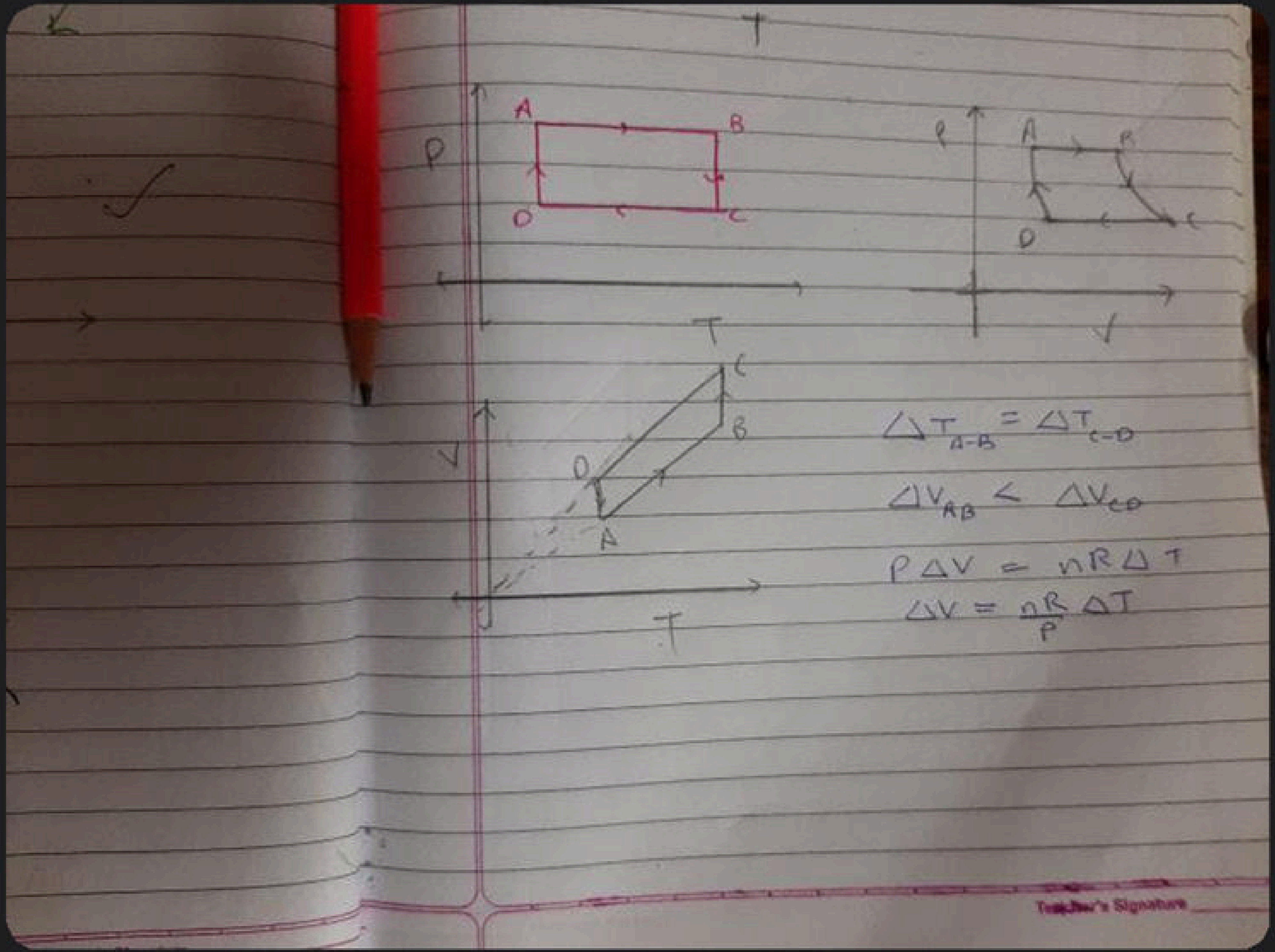


$$n_1 T_1 = n_2 T_2$$

Question

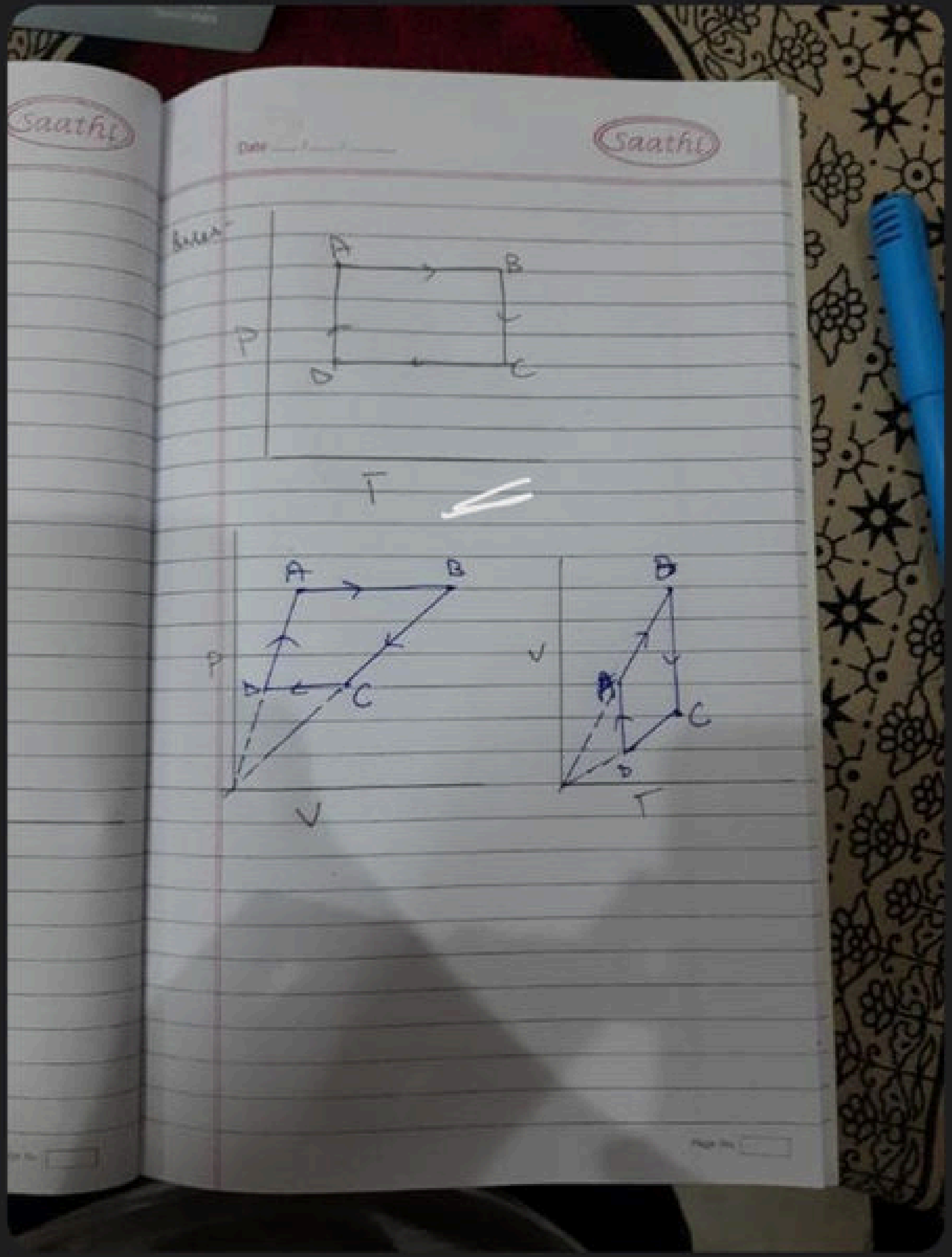
from Raghav

Vt curve new



Question
from Aaditya

New graph



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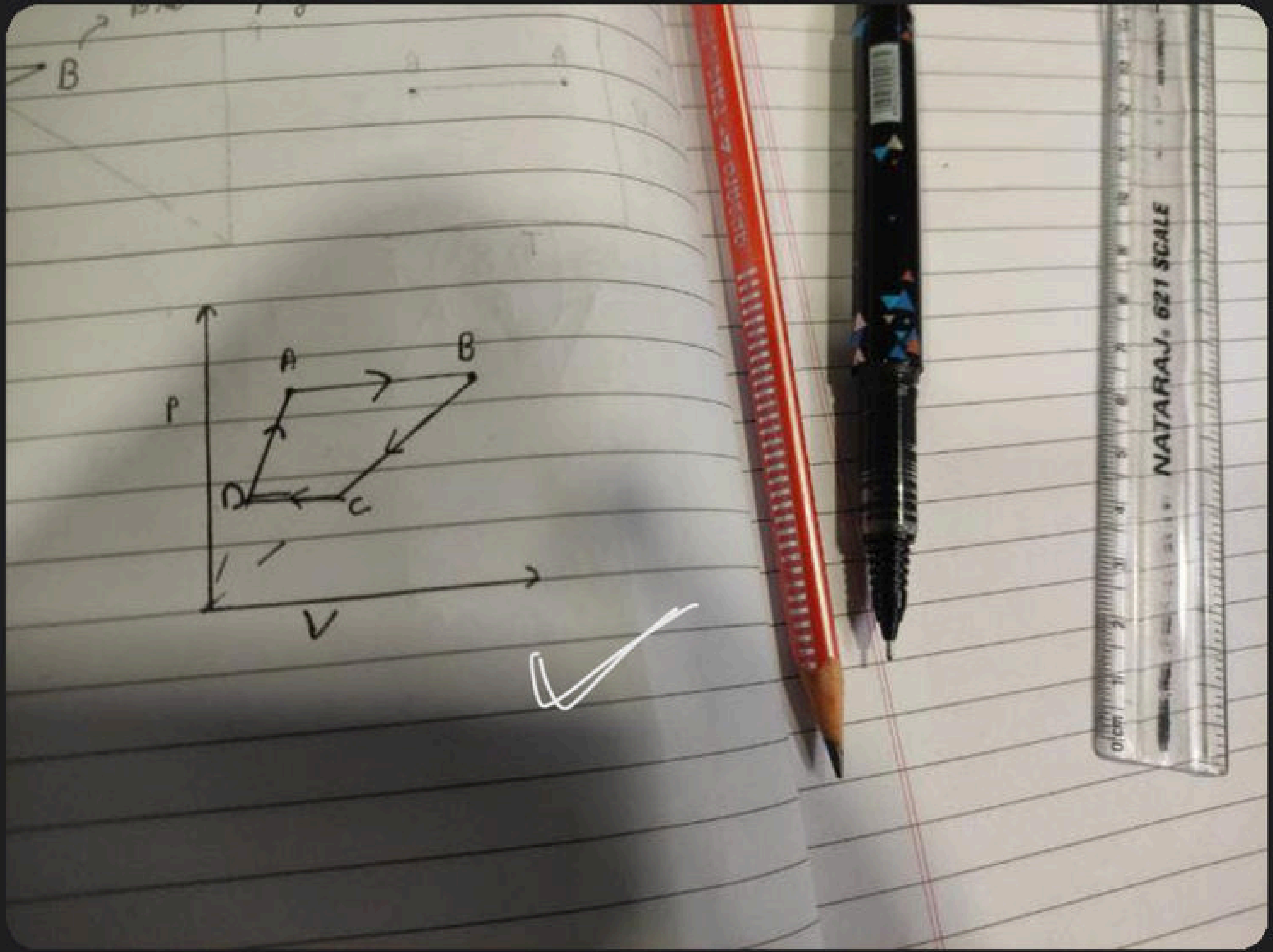
Question

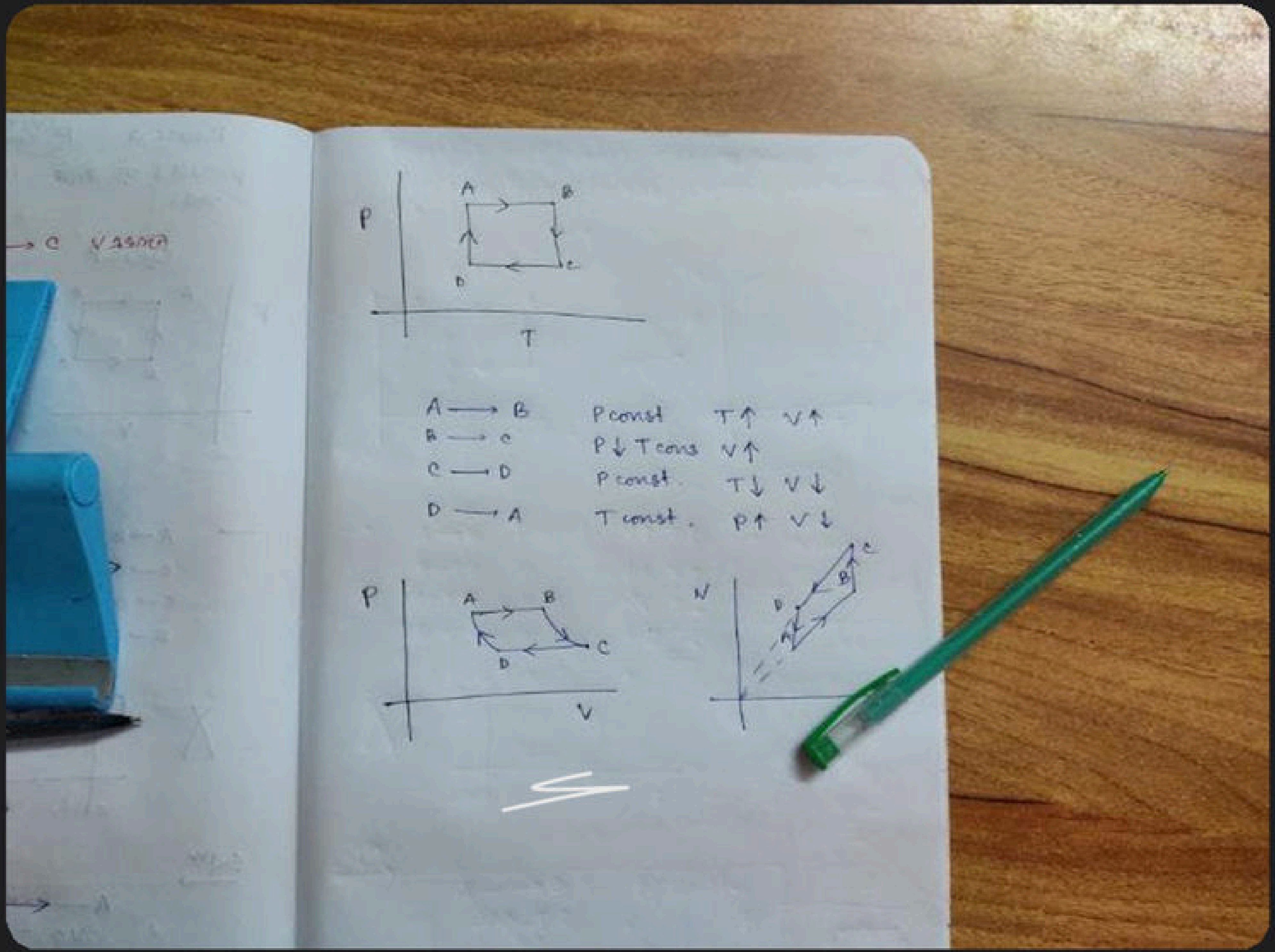
from Edum Shiva...

p-v



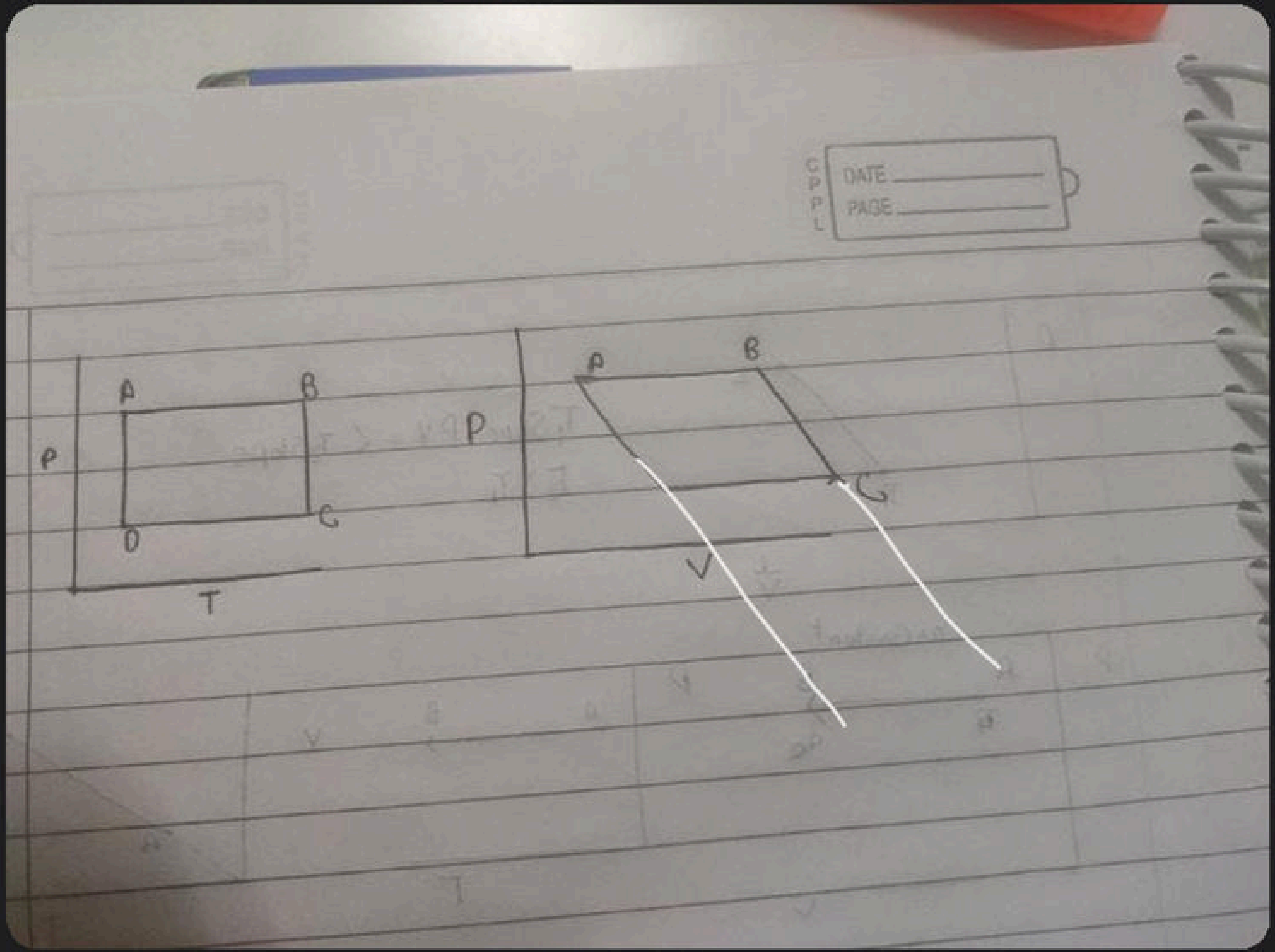
Question

from ARITRA AMB...



Question

from ANSH



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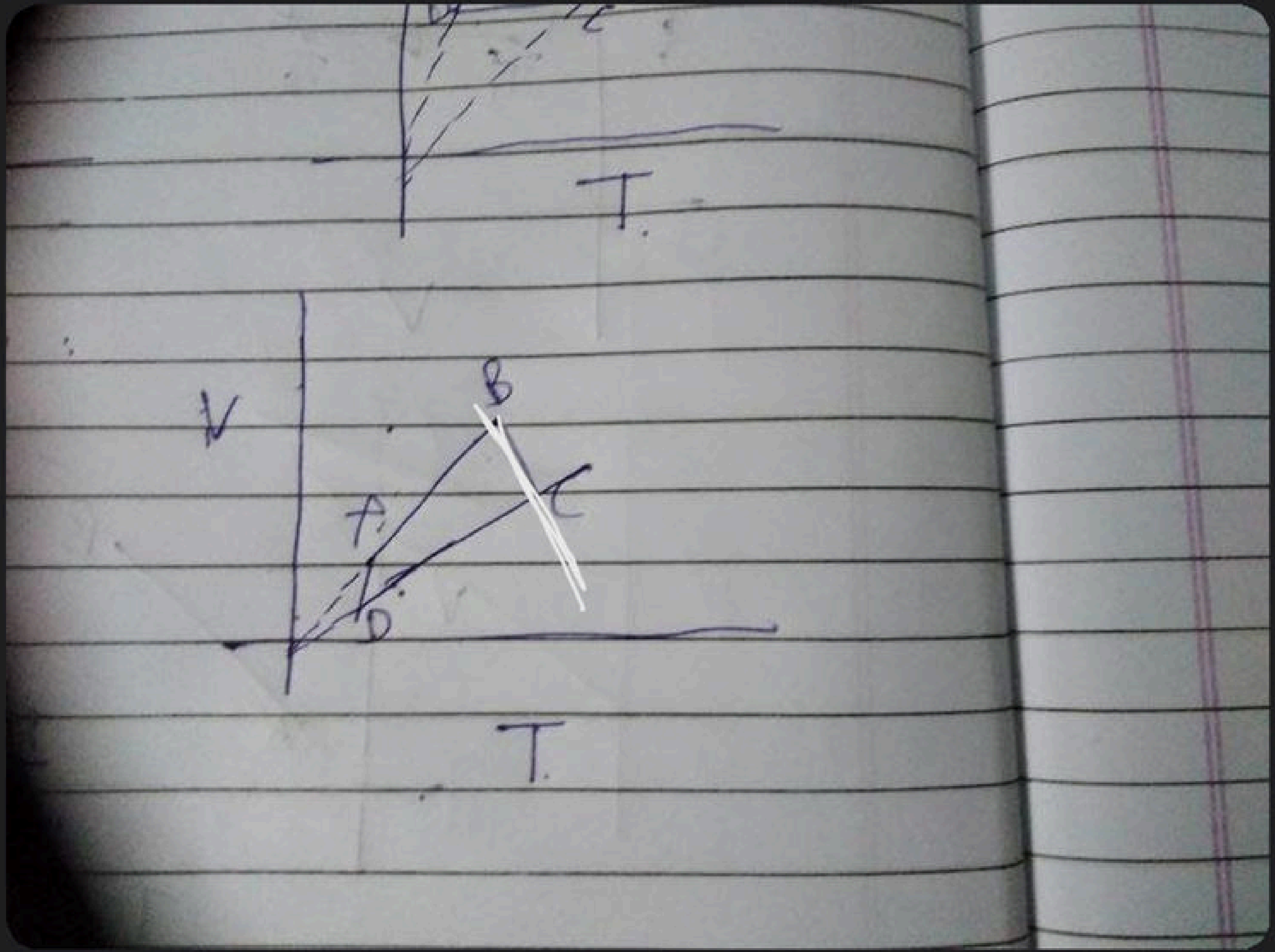
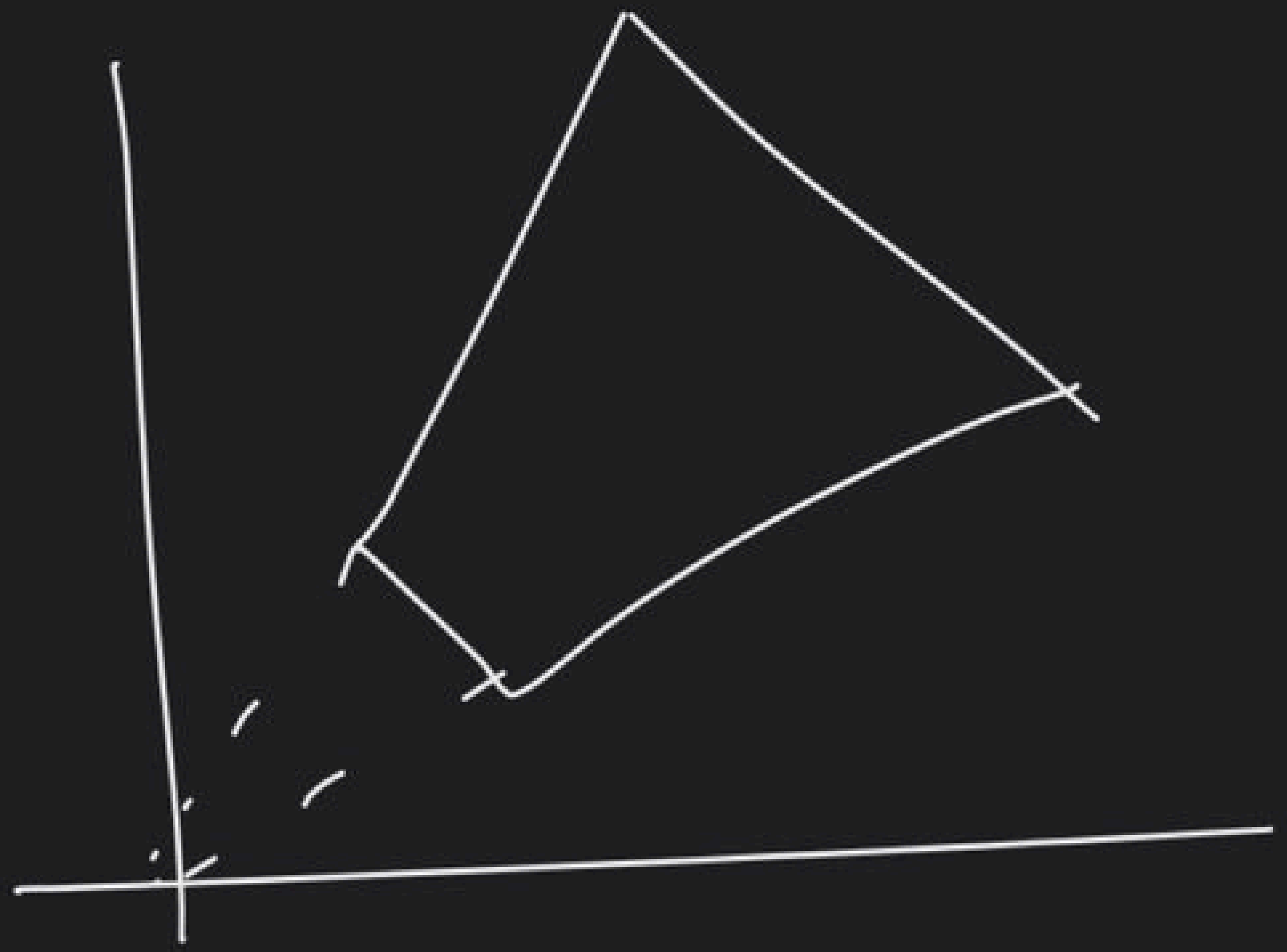
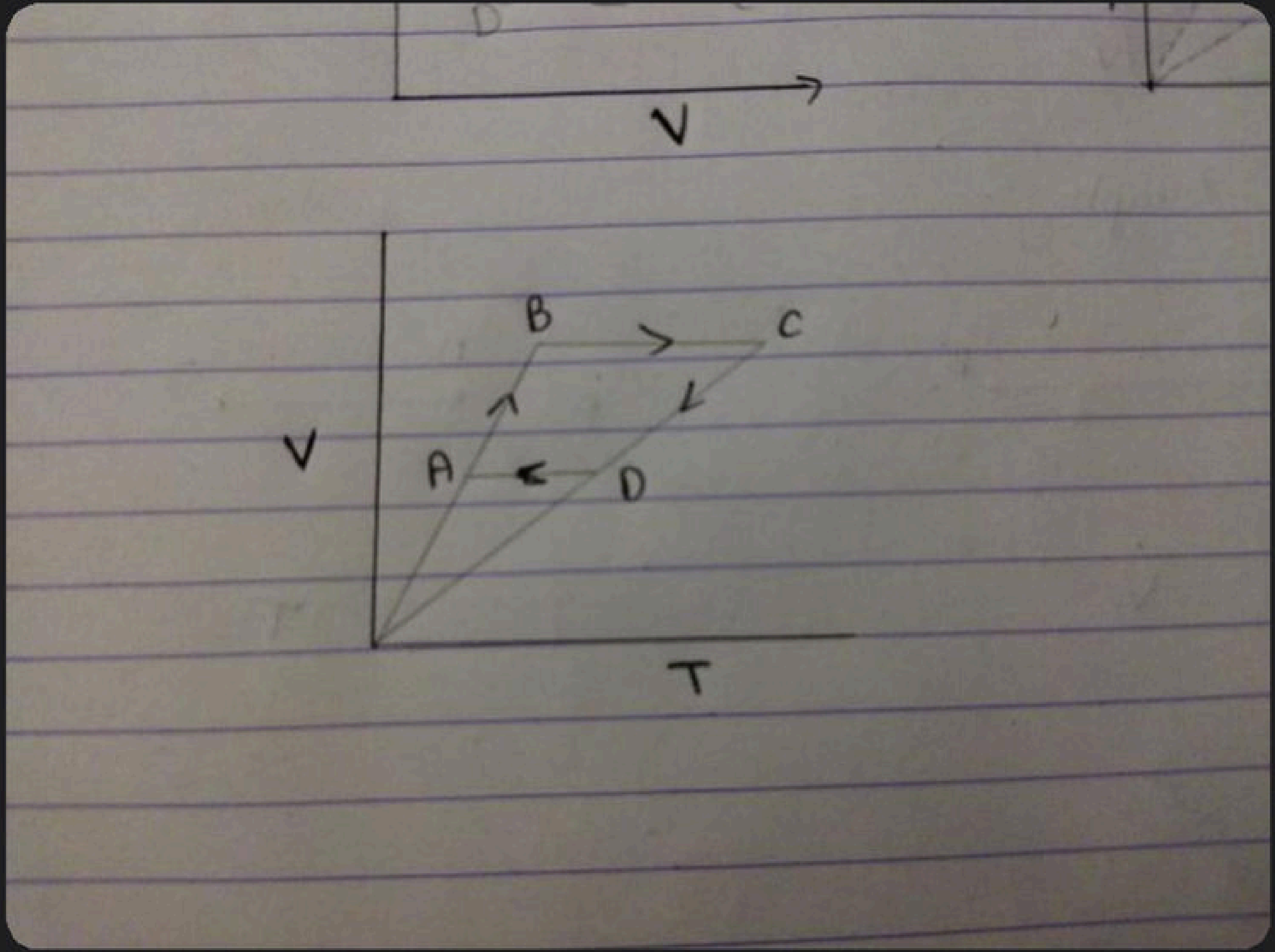
Question
from Jeet Raj





Question

from Tanmay



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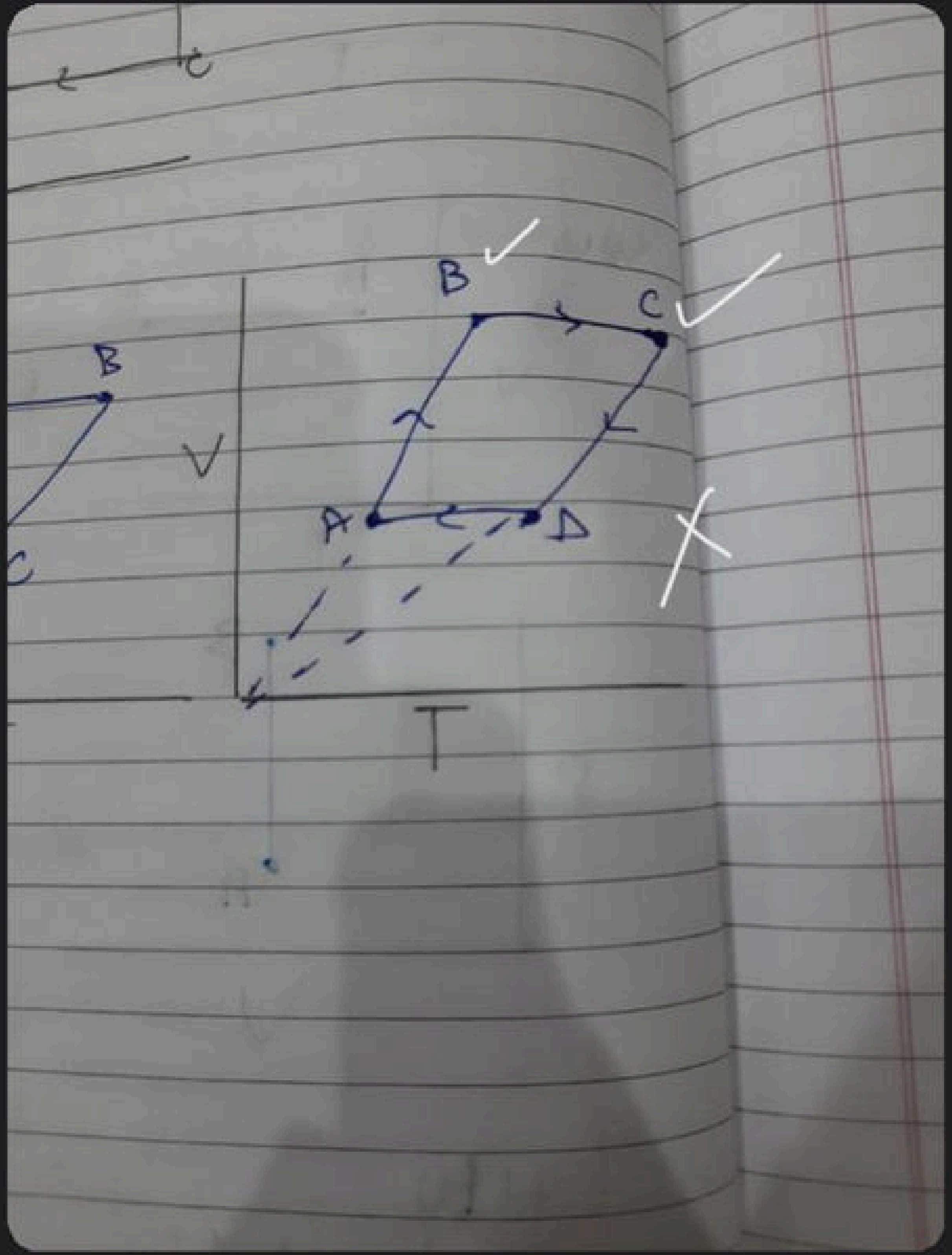
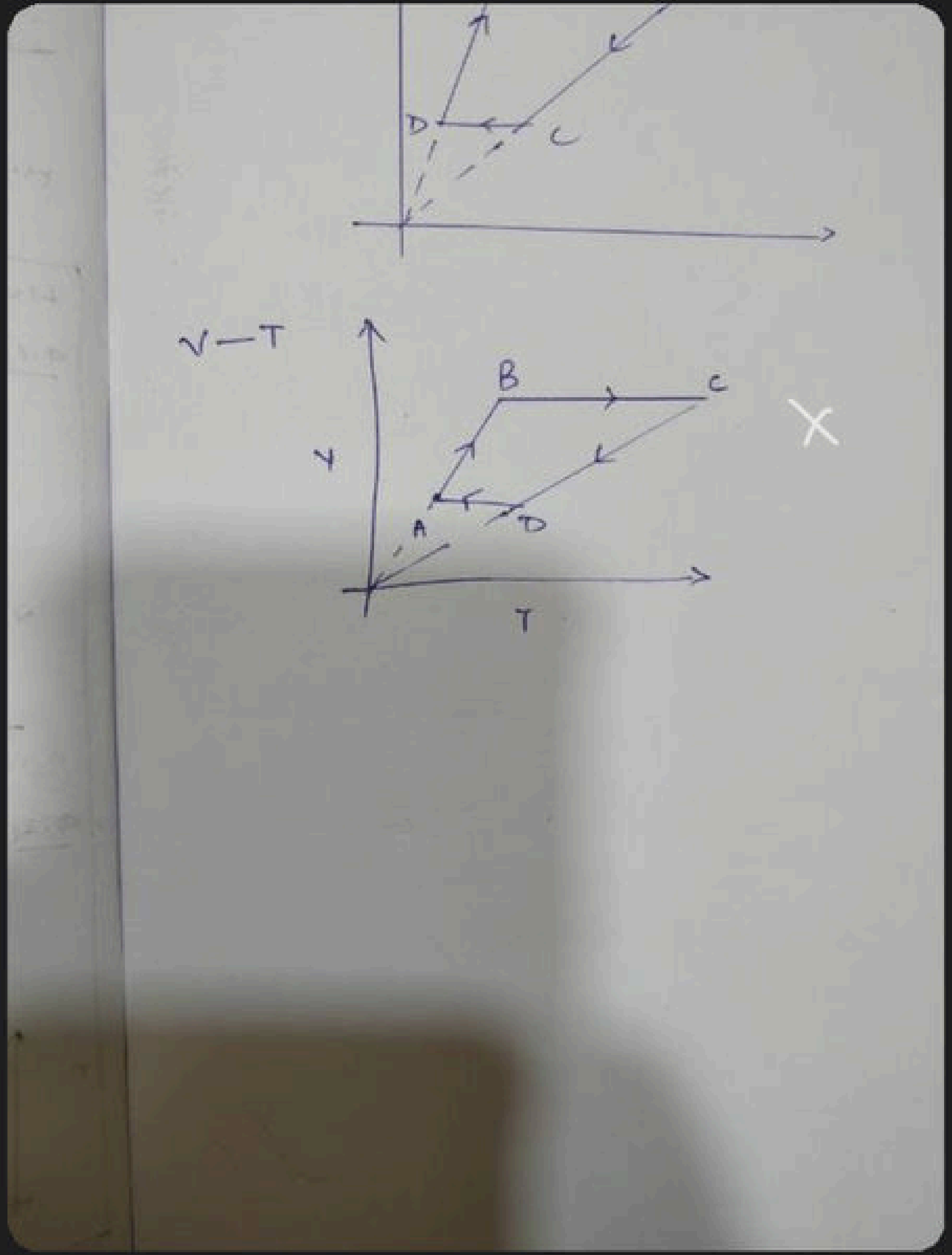
Question
from Aaditya

VT curve



Question

from Ridham



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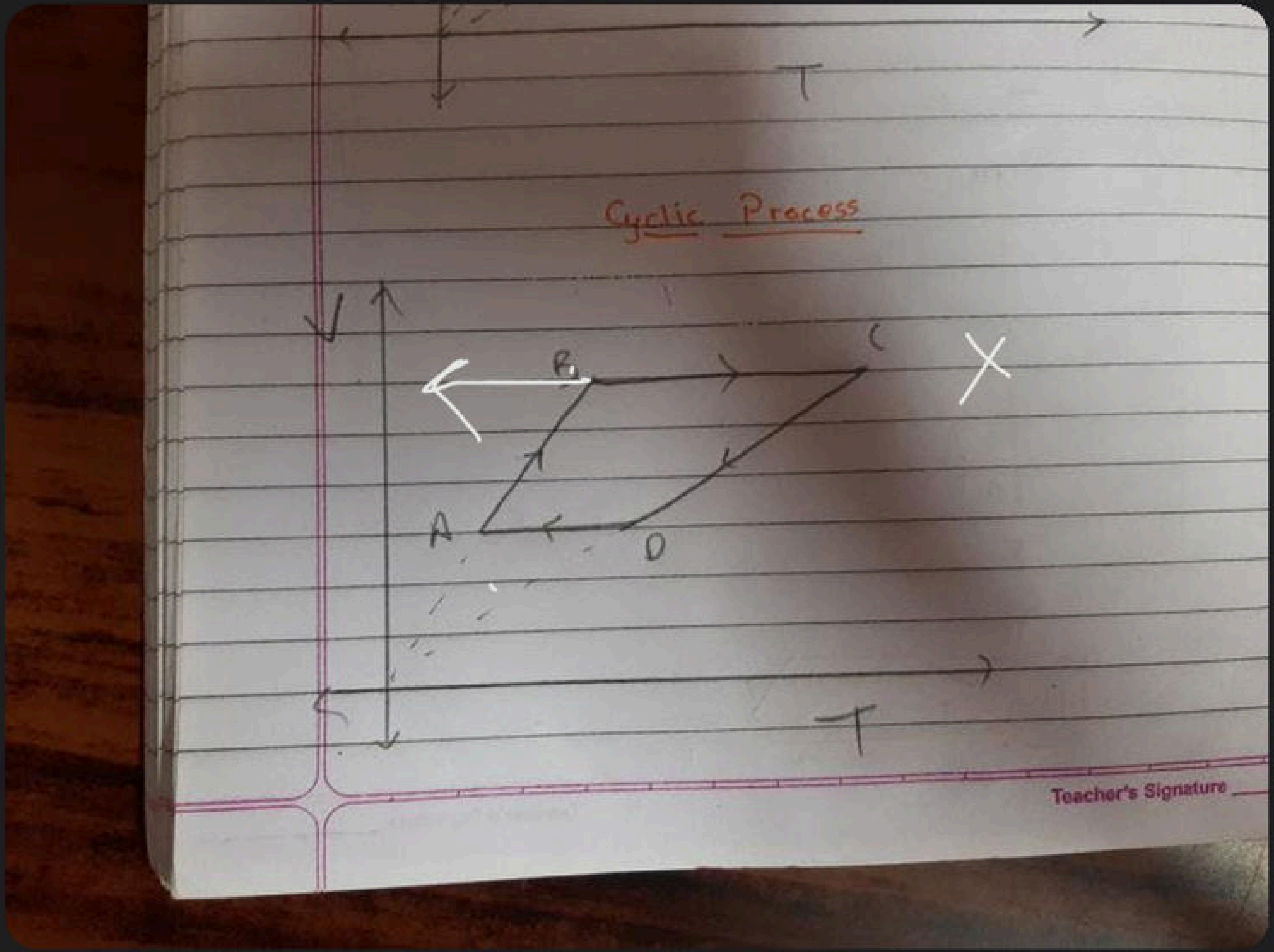
Question

from Raghav



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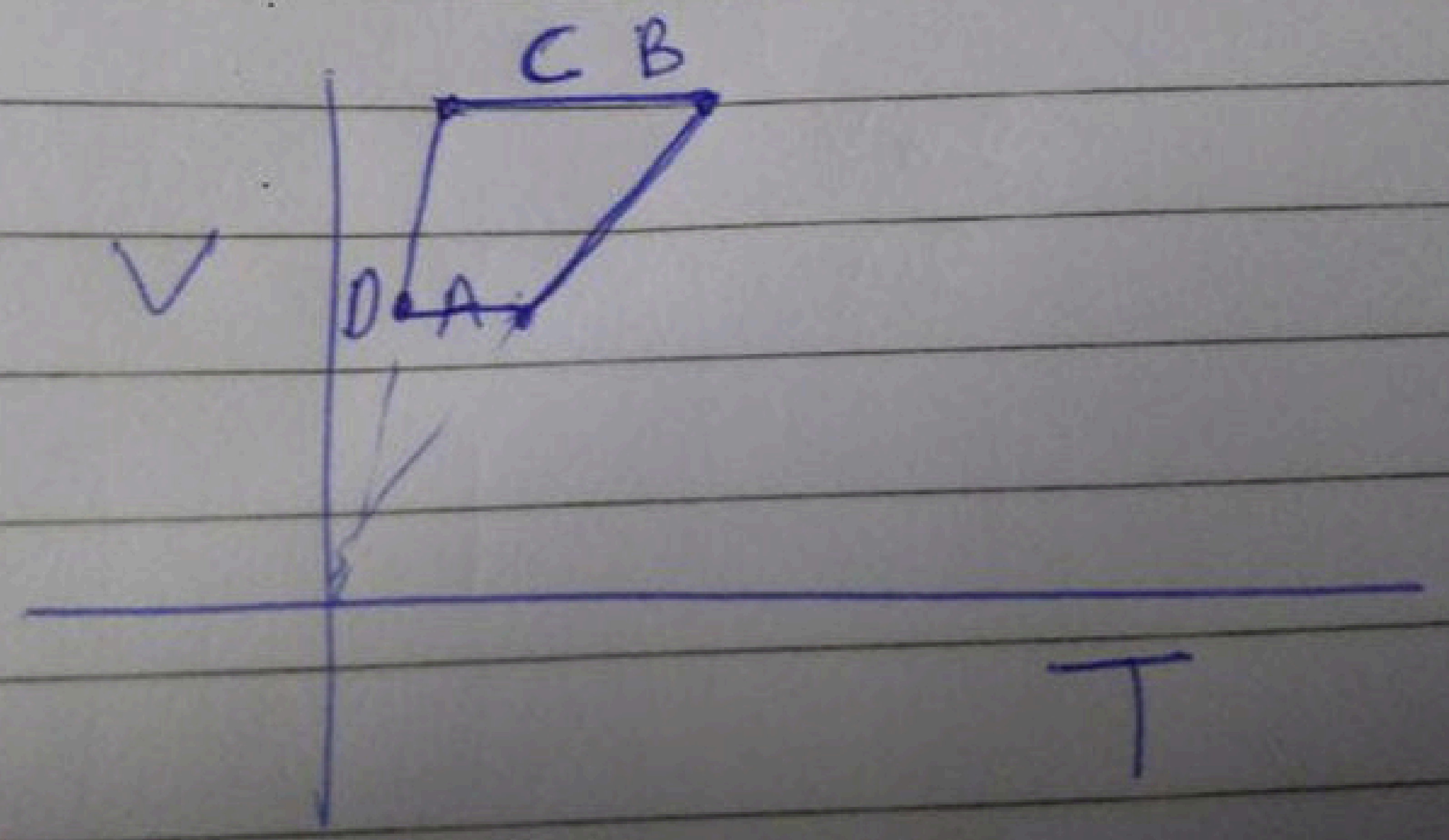
Question

from Raghav

→ ⇒ vol const xx h

→ galal

now VT curve.



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