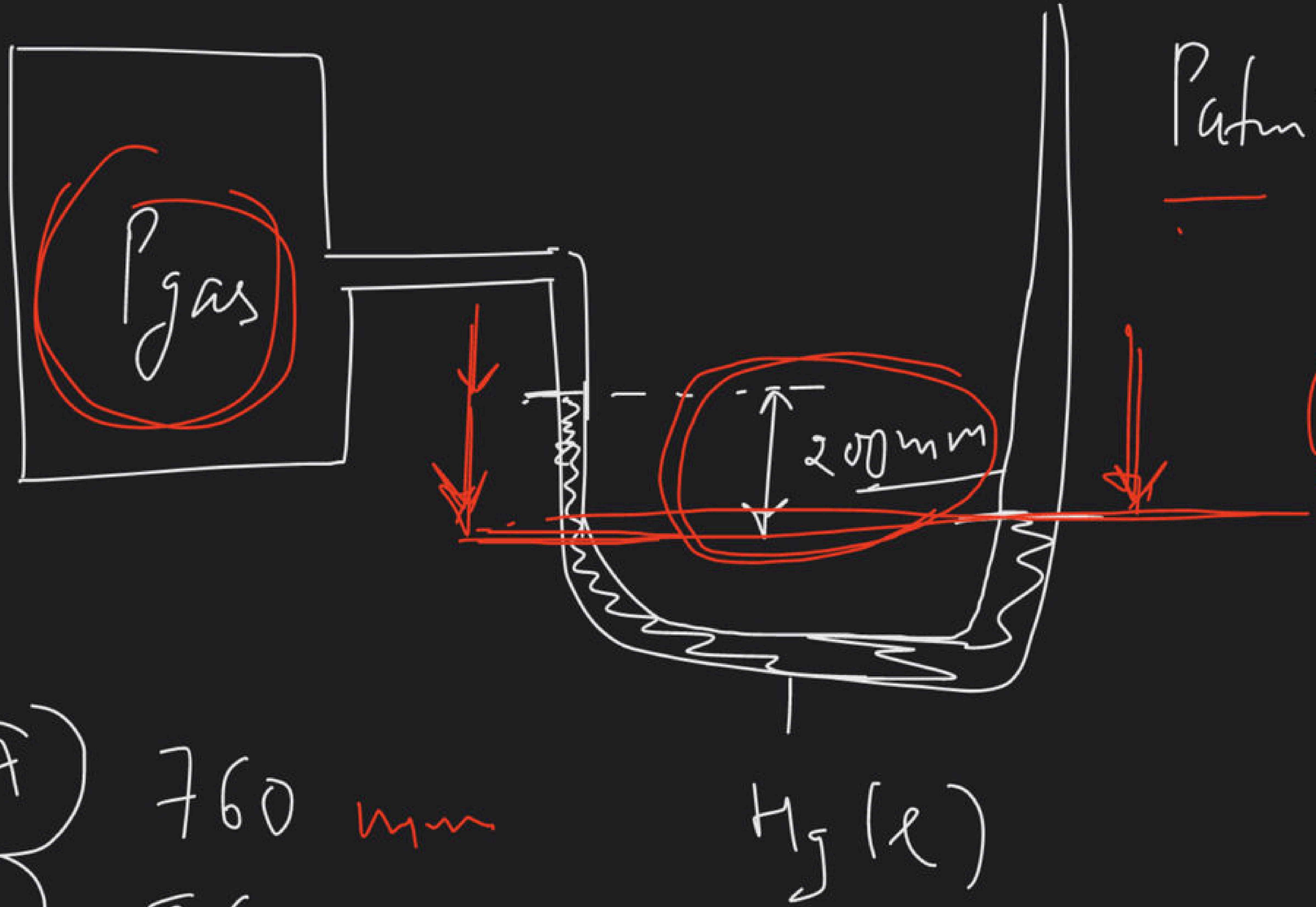
Graphical Representation of pV = nRT

Course on States of Matter for Class XI

akhilesh • Lesson 2 • July 9, 2021



$P_{atm} = 760$ mm of Hg

$P_{gas} + 200 = 760$

$P_{gas} = 560$

(A) 760 mm

(B) 560

(C) 560

(D) None.

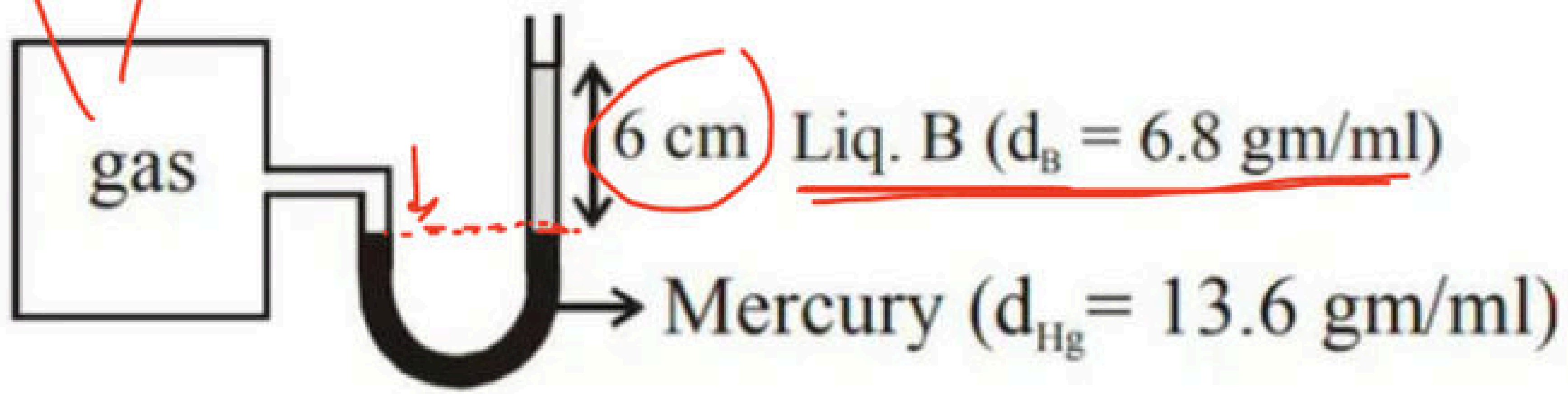
88. At constant volume of 2 litre container containing H_2 gas at 300 K as shown. The pressure of H_2 in the container is –[P_{atm} = 76 cm of Hg] (in mm of Hg)

$P_{gas} = P_{air} + P_{liq\,B}$

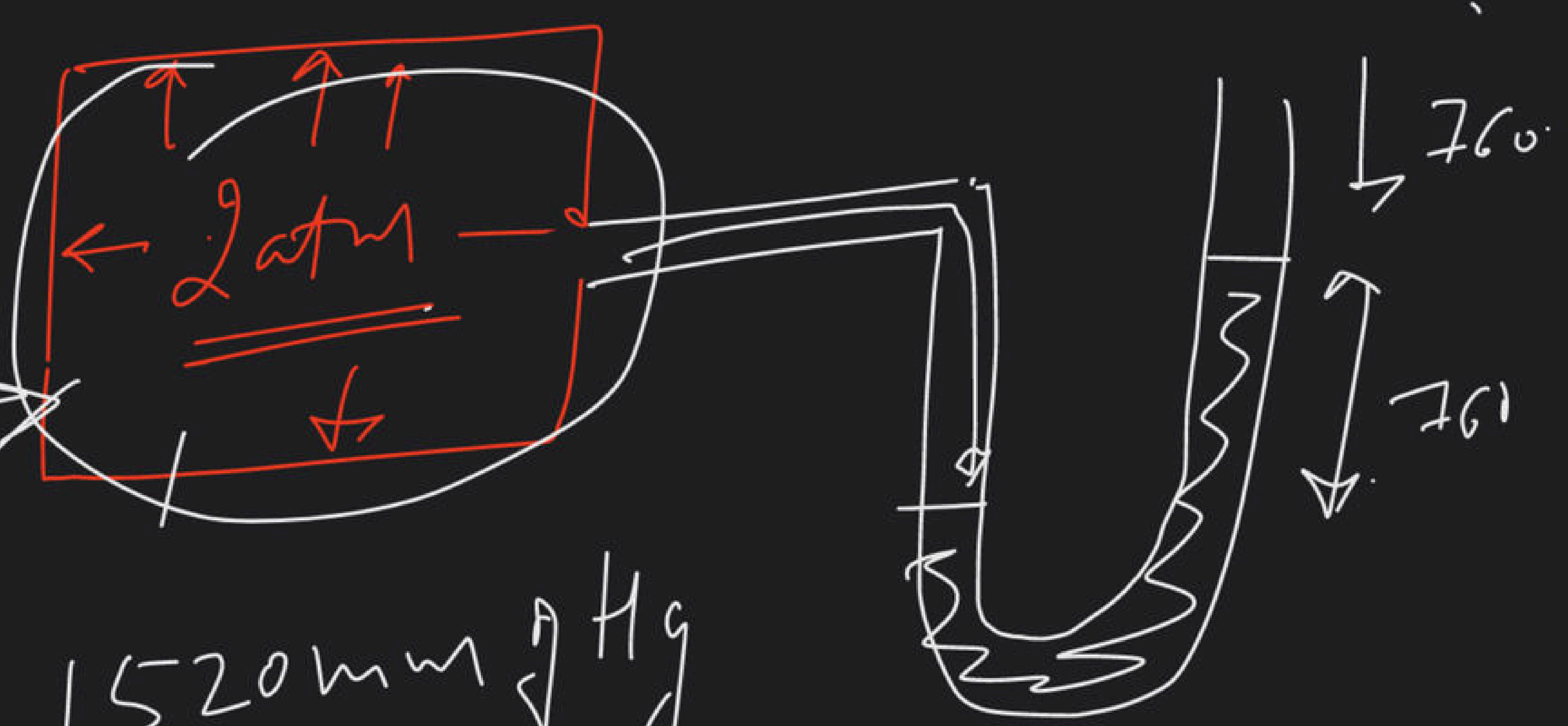
$= 76\text{cm} + 3\text{cm}$

$6 \times 6.8 = h \times 13.6$

$H_2(g)$



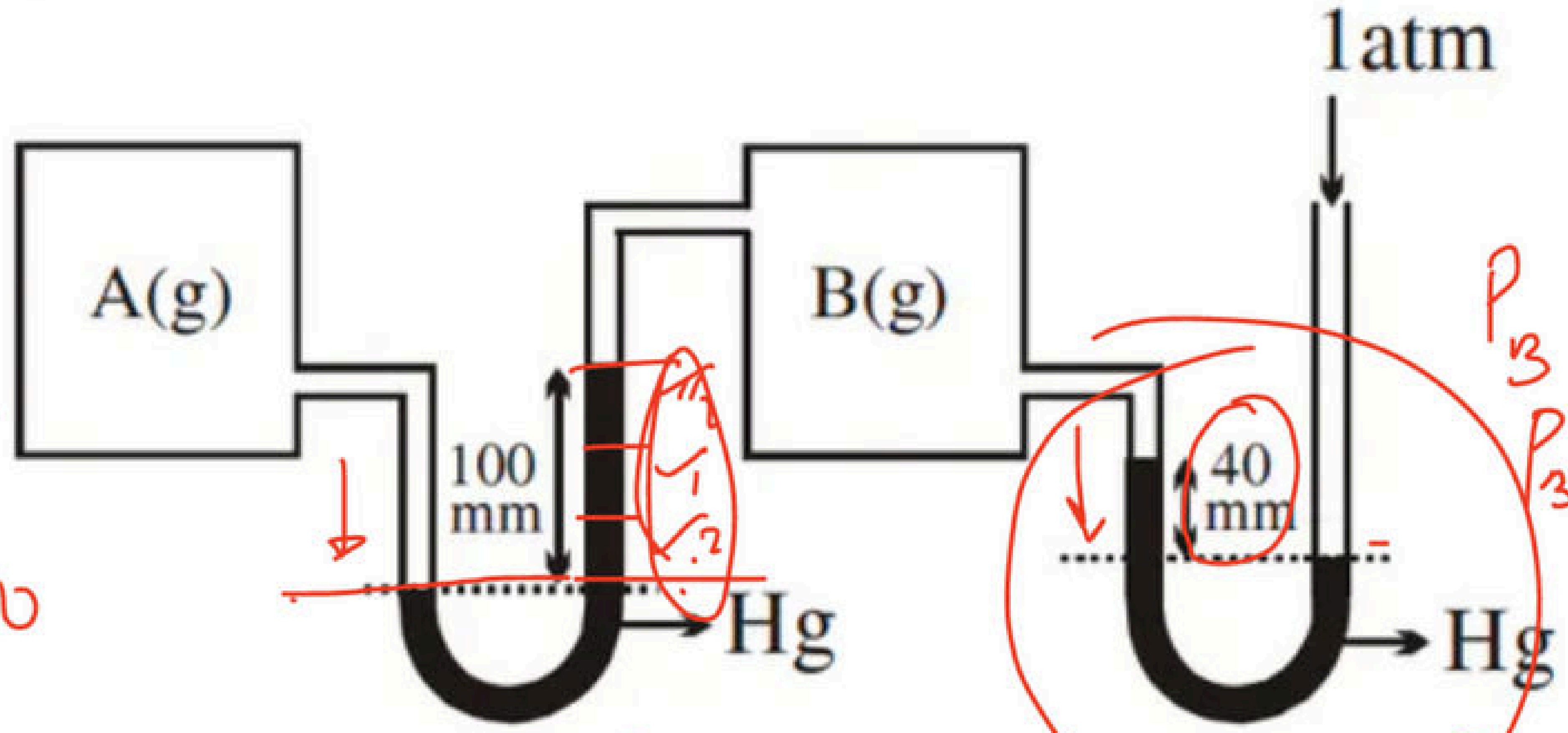
(A) 82 cm
(B) 85 cm
(C) 79 cm
(D) 81 cm



1520 mm Hg

2 atm = 760 x 2 mm Hg

91. At 300 K, two gases are filled in two equal sized containers as given



$P_A = P_B + 100$ mm

$P_B + 40$ mm $= 760$ mm

$P_B = 720$ mm of Hg

$P_A = 720 + 100$

$= 820$

What will be the pressure of A(g) (in mm of Hg)

(A) 400

(B) 820

(C) 600

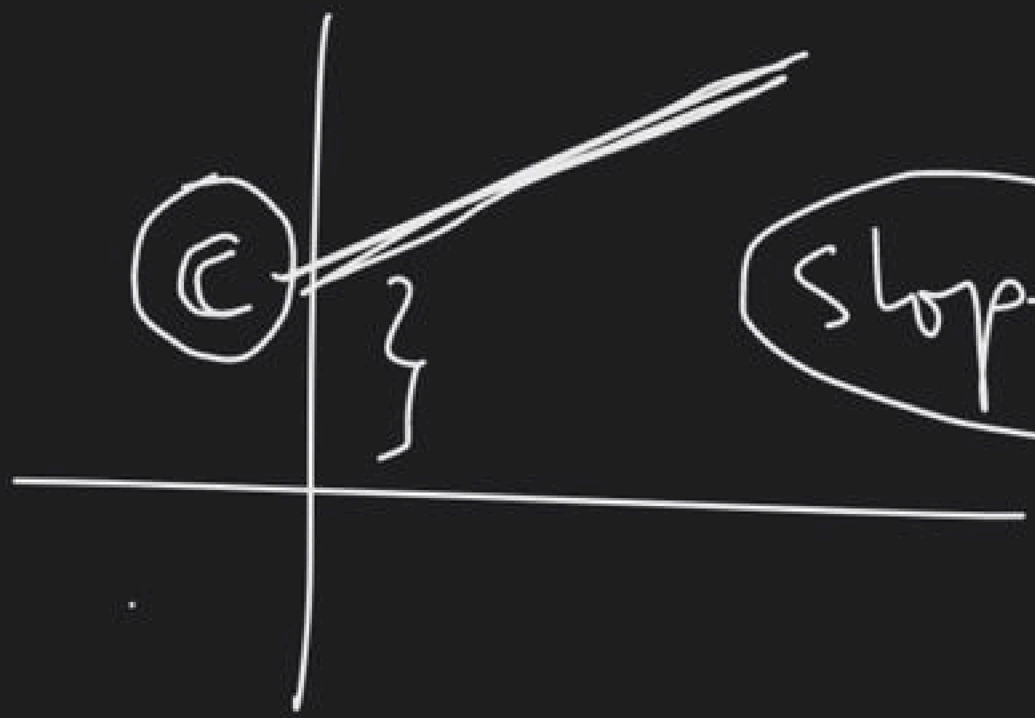
(D) 720

$h_1 d_1 + h_2 d_2 + h_3 d_3 = h_f d_f$

Standard Graph

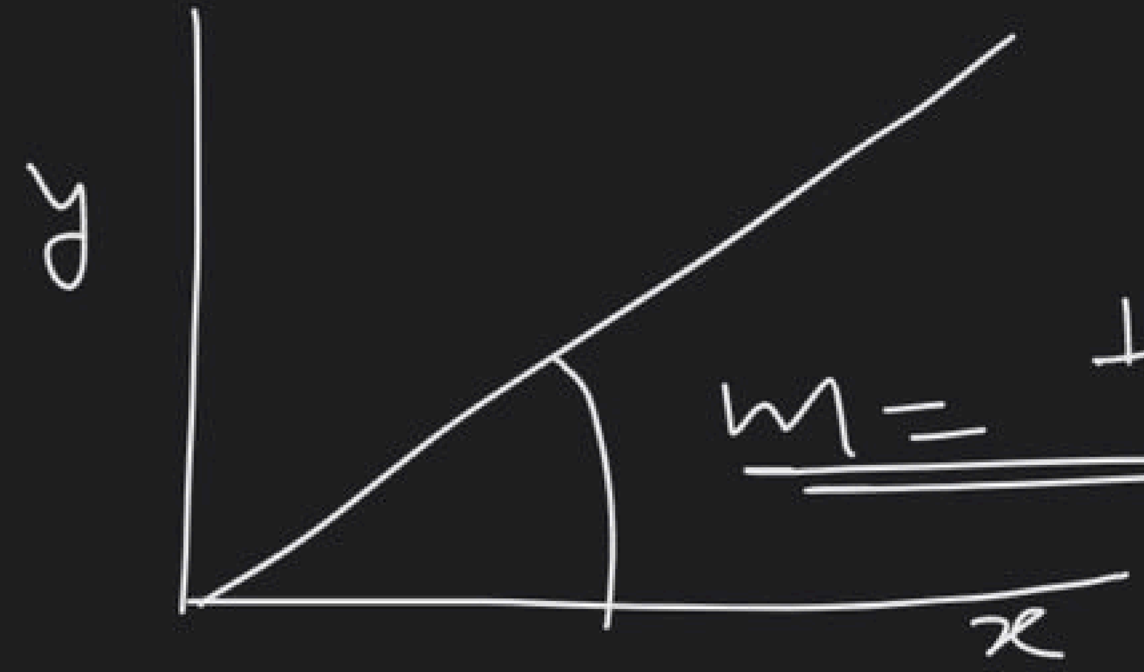
1. St. Line

$$y = \underset{\text{Slope}}{\overset{\text{Const}}{m}}x + \underset{\text{Intercept}}{\overset{\text{Const}}{c}}$$



Slope = m

$$y = mx$$



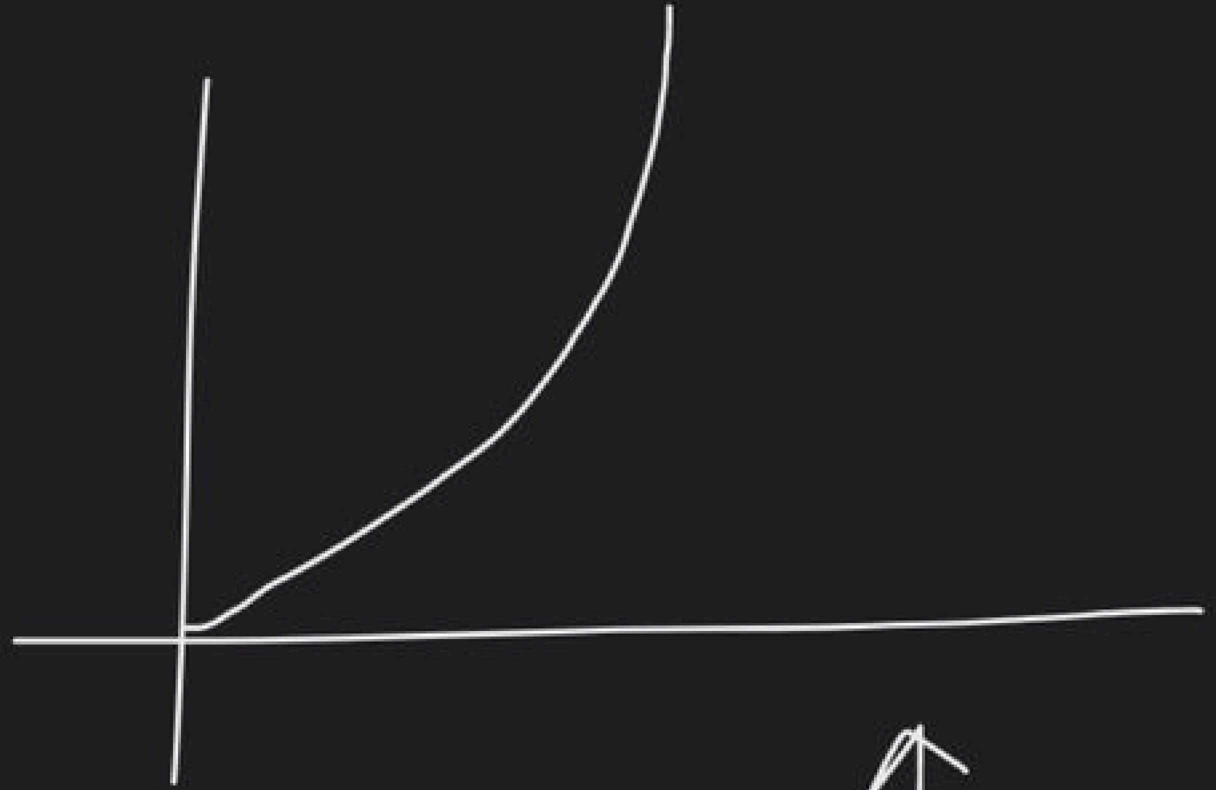
$$m = \tan\theta$$

$\underline{(x_1 \quad y_1)}$ $\quad$ $\underline{(x_2 \; , \; y_2)}$

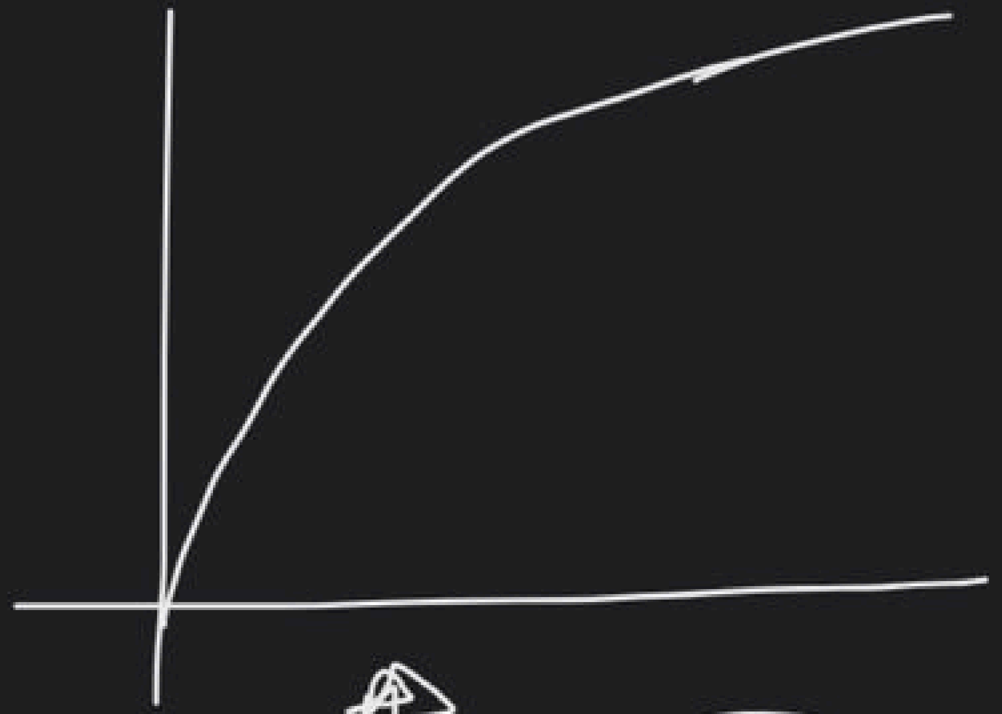
$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

② Parabola

$y = x^2$



$y^2 = x$

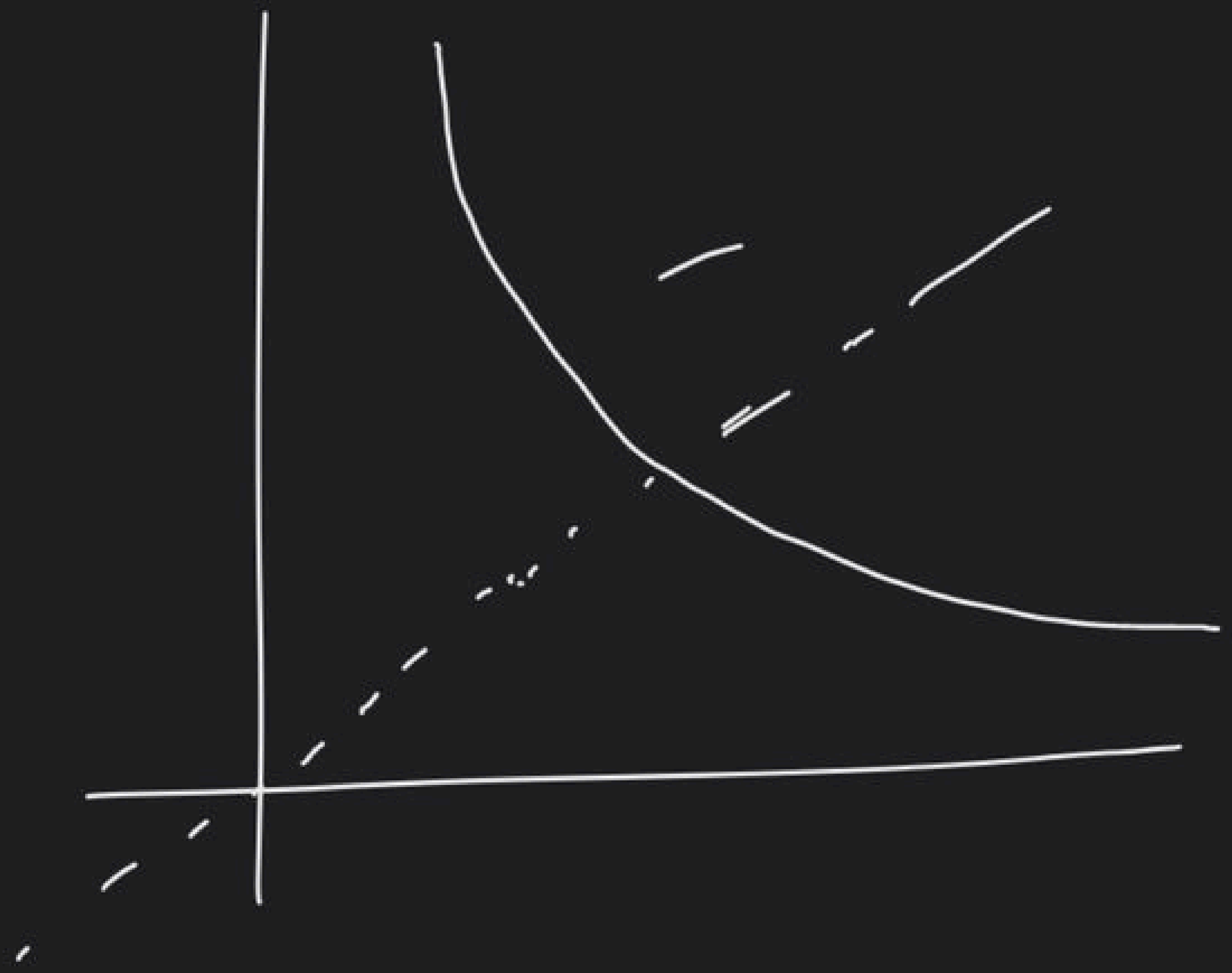


$y = x^n$ if $n > 1$

if $0 < n < 1$

(3) hyperbola

$$y = \frac{c}{x}$$

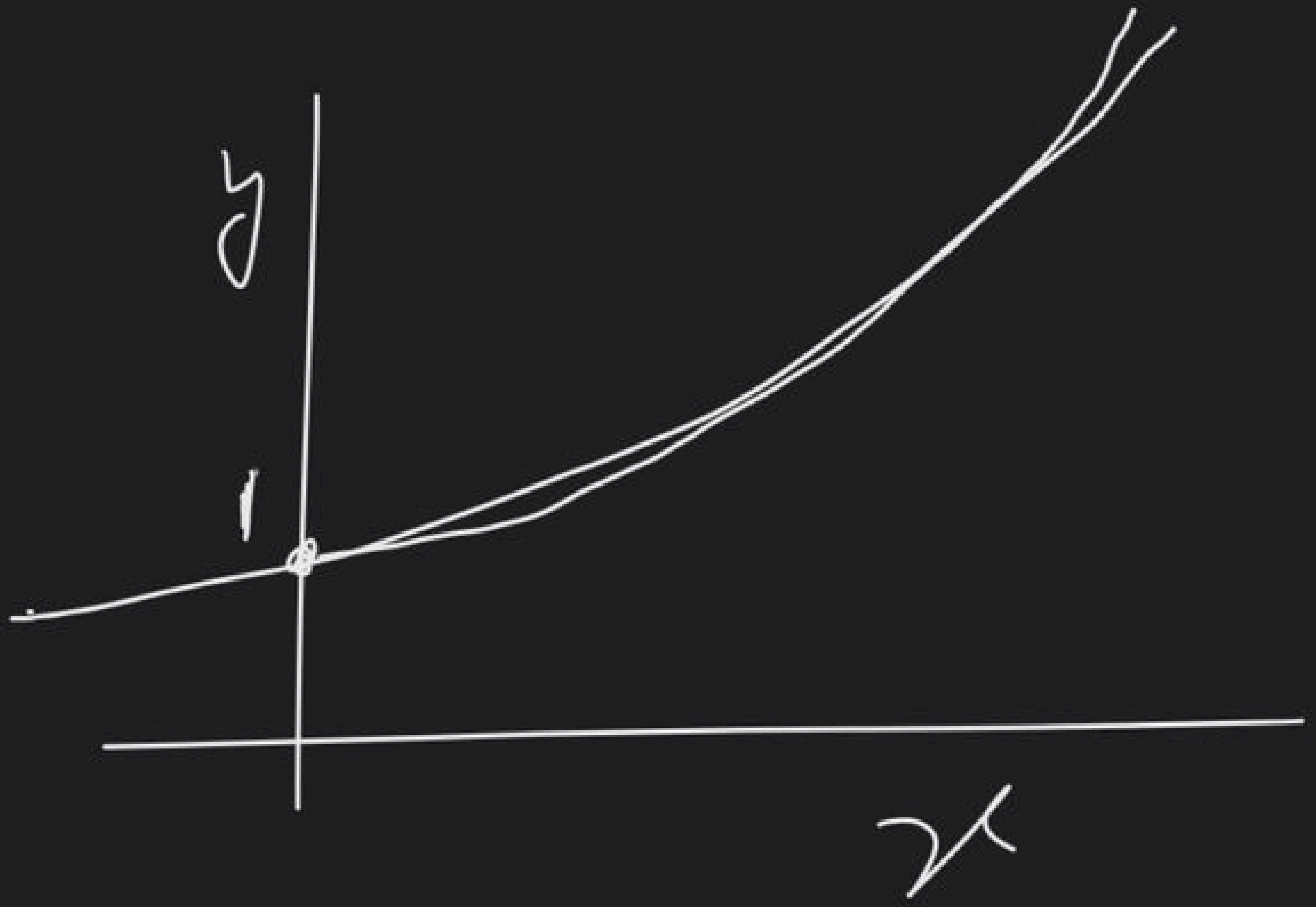


Rectangular hyperbola

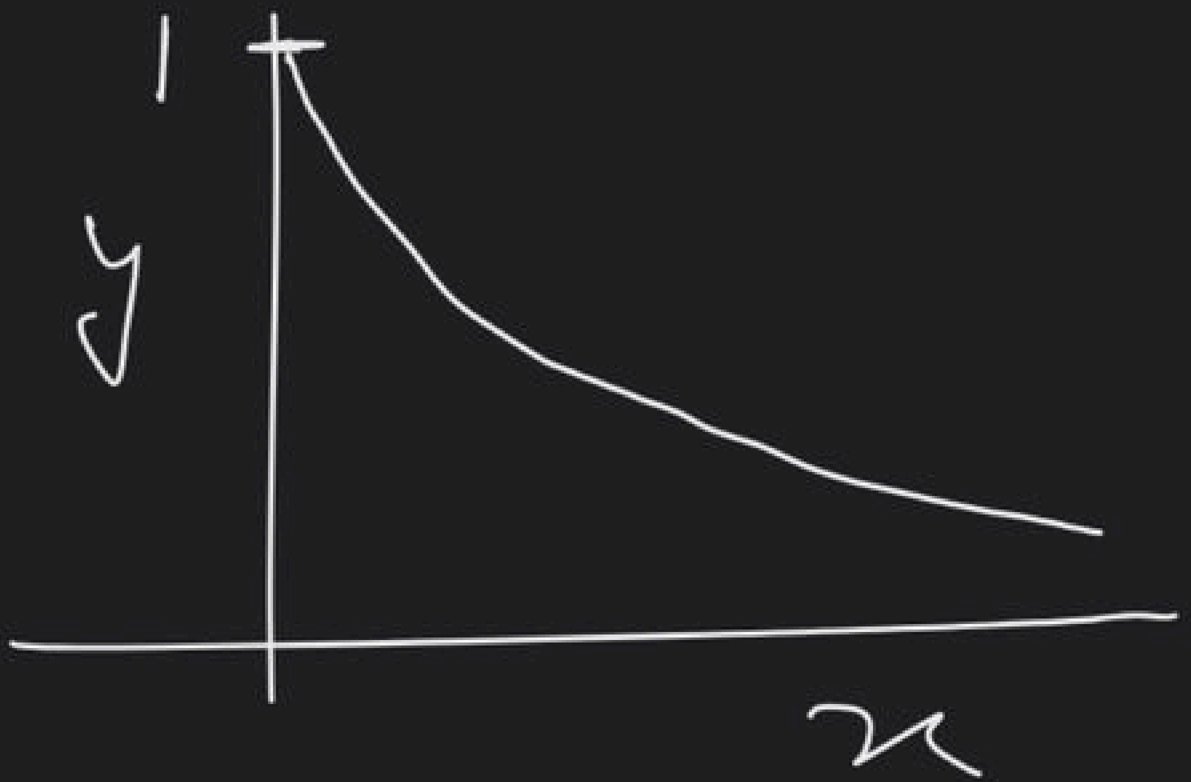
$$y = \frac{c}{x^2}$$

(4) Exponential

$y = e^{x}$



$y = e^{-x}$



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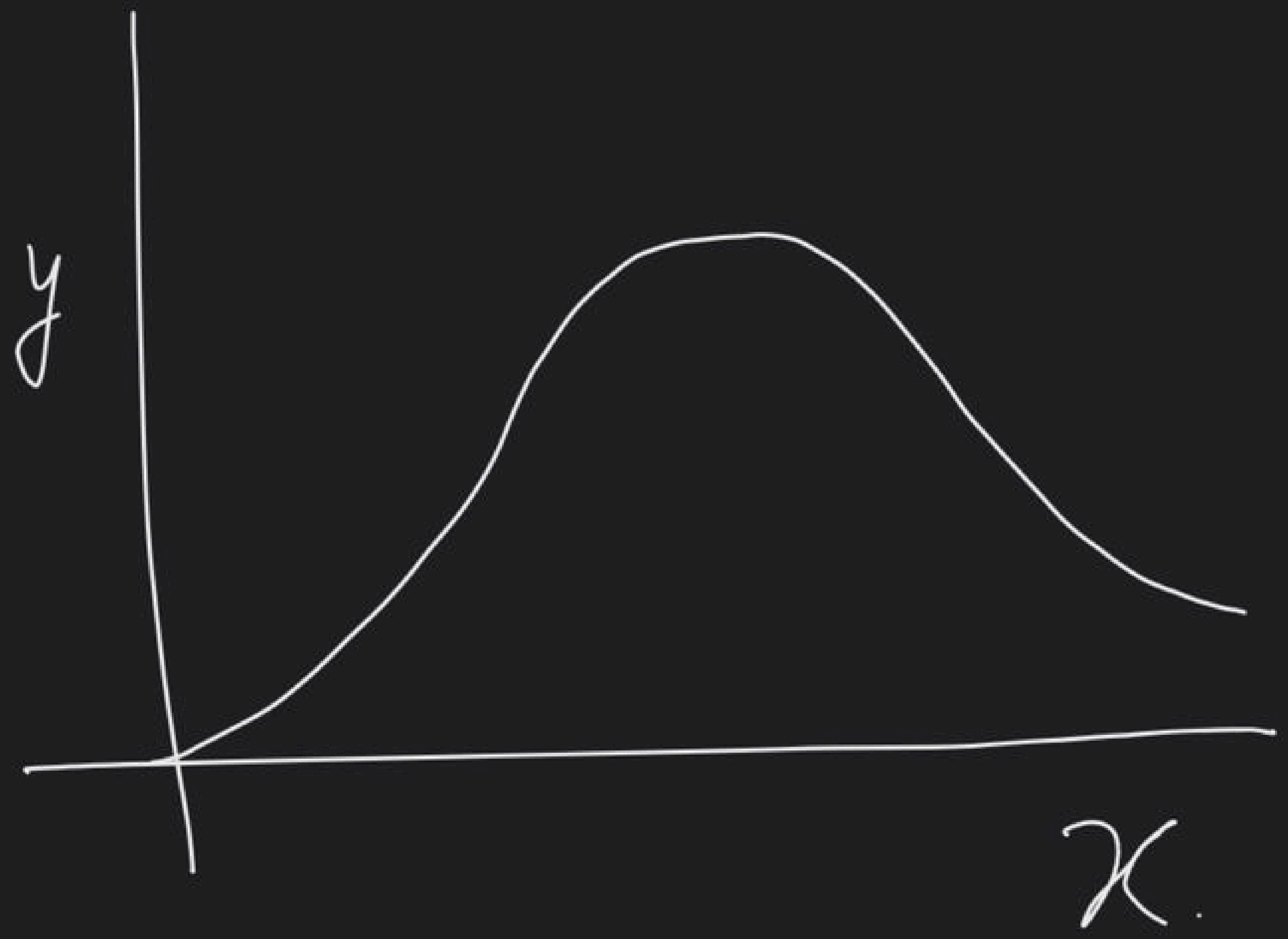
$$y = x e^{-x}$$



Gas Laws

(1) **Boyle's law** :→ At a constant temperature Pressure of a given amount of ideal gas is inversely proportional to its volume.

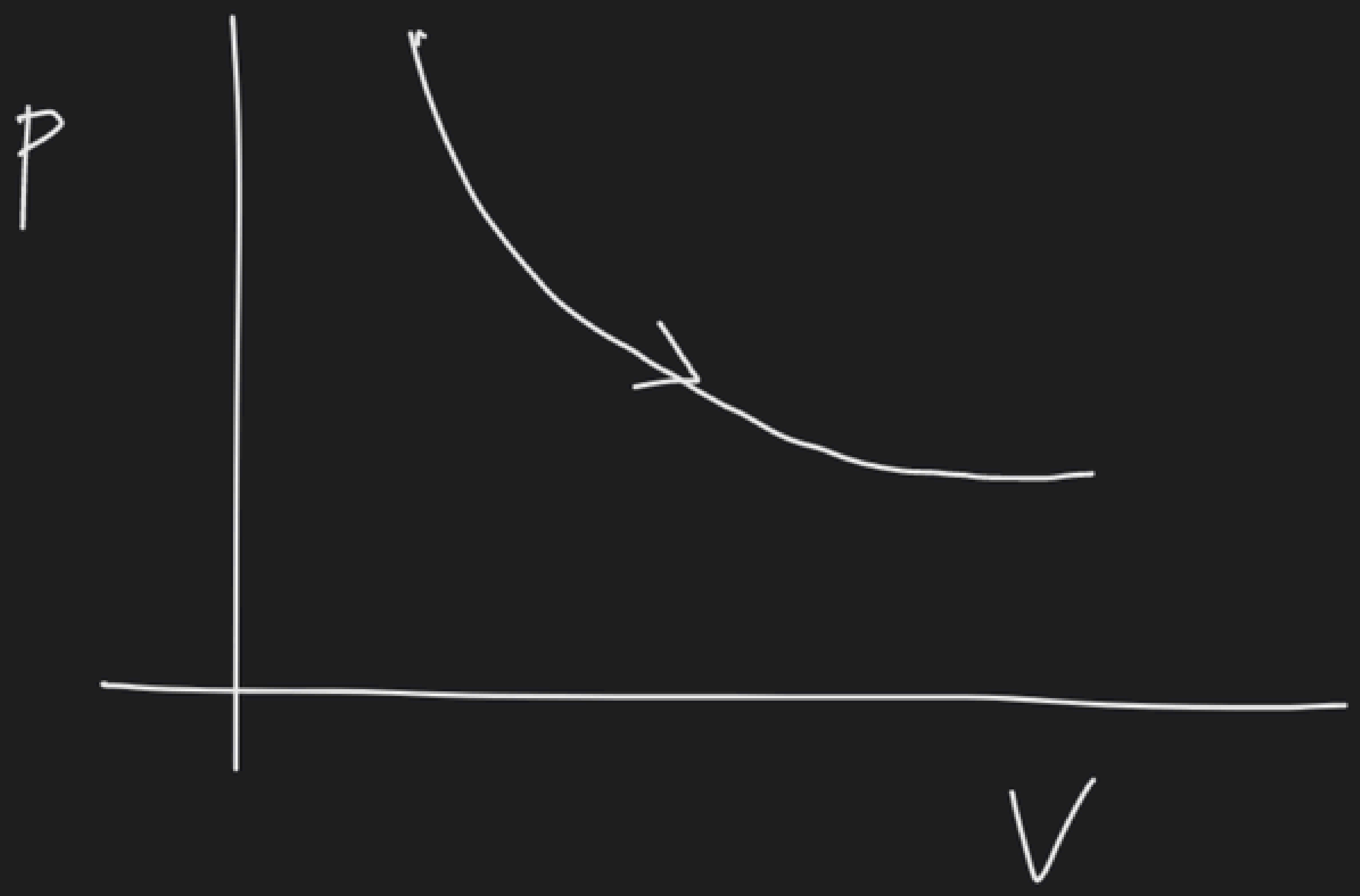
$$P \propto \frac{1}{V}$$

(n & T are const)

$$P = \frac{C}{V}$$

$$PV = \text{Const}$$

$$P_1V_1 = P_2V_2$$



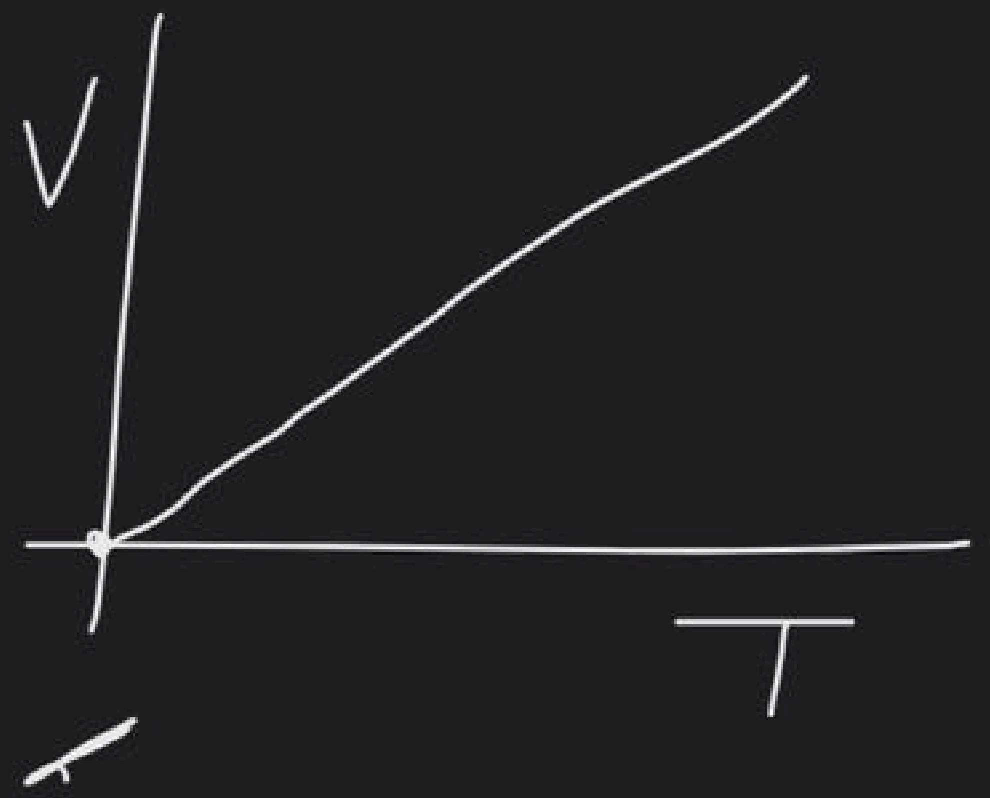
$$P = \frac{C}{V}$$

② Charle's law: At const P, volume of a fixed amount of gas is directly proportional to its absolute temp (in Kelvin)

$V \propto T$ (n & P are const)

$$\boxed{V = cT}$$

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



At const pressure, Volume of a fixed amount of gas increases by $\frac{1}{273}$ by its volume at 0°C per degree increase in in temperature.

$$\frac{1}{273} V_0 \times t + V_0 = V_f$$

$$V_0 \left(\frac{t + 273}{273} \right) = V_f$$

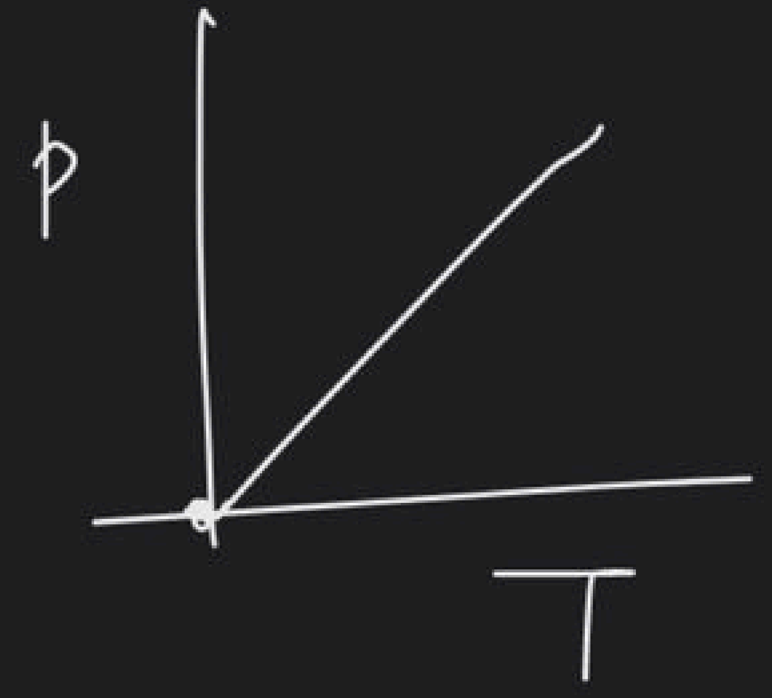
$$\frac{V_0}{273}(T) = V$$

$$\boxed{V \propto T \text{ (in Kelvin)}}$$

(3) Gay Lussac's law (Pressure temp Relationship)

At const volume, pressure of a given amount of gas is directly proportional to its absolute temperature.

$$P \propto T$$



$$P = C\,T$$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}.$$

(4) Avogadro's law :→ It state that equal volume of all gases under the same condition of T & P contains equal no of molecules.

$$V \propto n \quad (\text{at const } T, P)$$

$$V \propto \frac{1}{P}$$

$$V \propto T$$

$$V \propto n$$

Combined Gas law

$$V \propto \frac{nT}{P}$$

$$PV \propto nT$$

ideal gas const

$$\boxed{PV = nRT}$$

Ideal gas eqn

Graphical Representation of $PV = nRT$: →

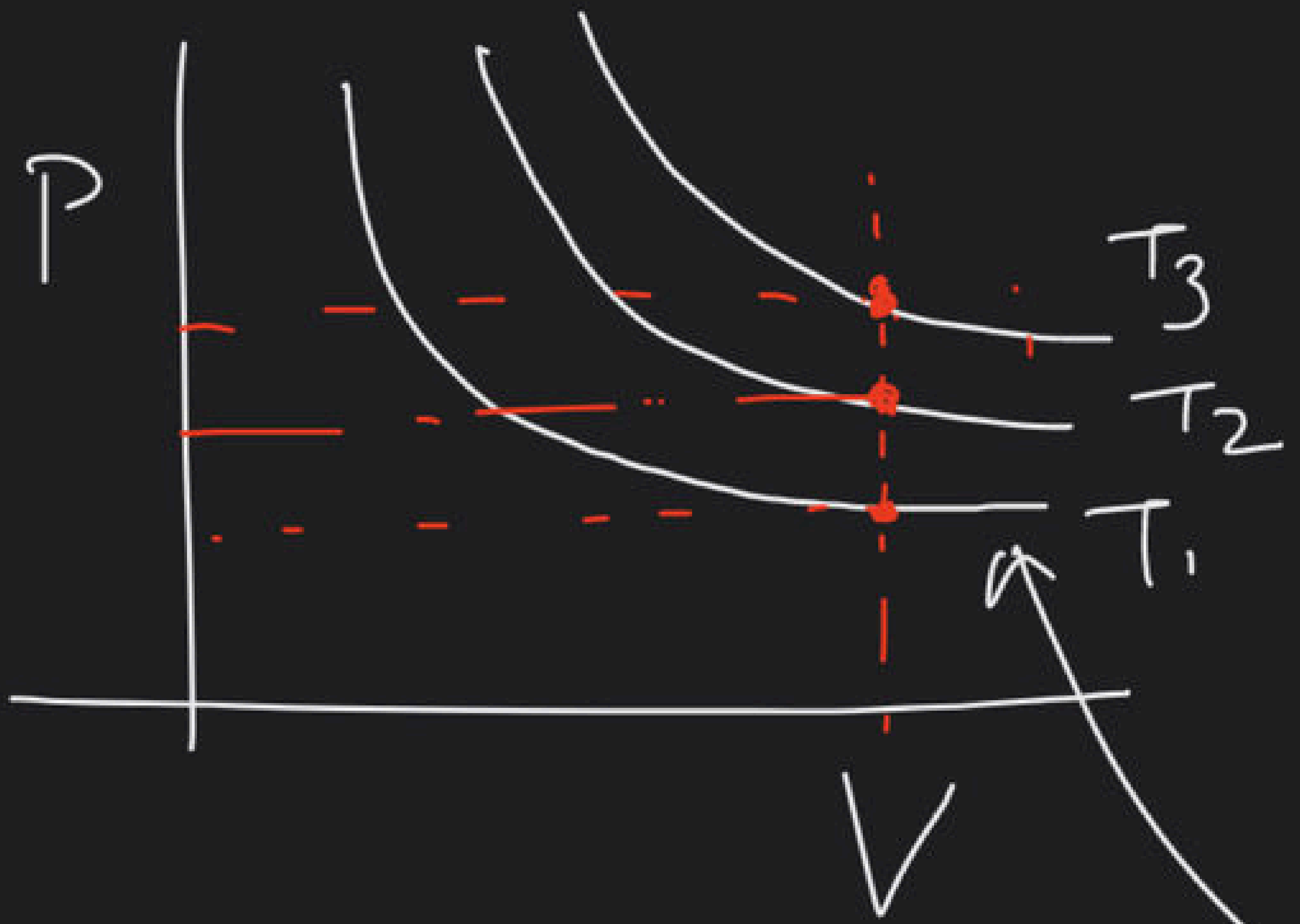
① P vs V

$$PV = nRT$$

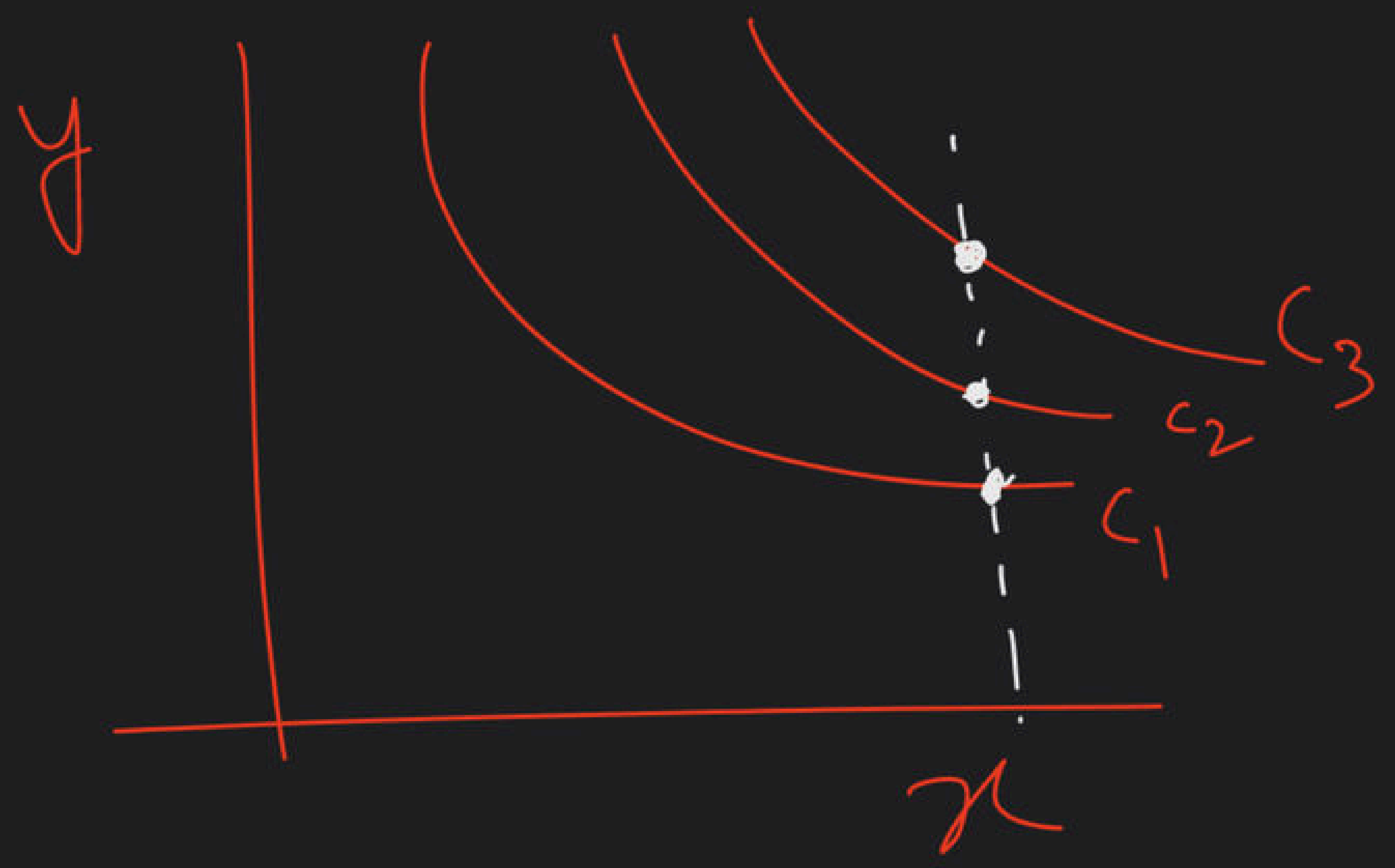
$n, T = $ Const

$PV = $ Const

$T_3 > T_2 > T_1$



(T = const) Isotherm



$$y = \frac{c}{x}$$

2 $\underline{V \text{ vs } T}$ (n & P = const)

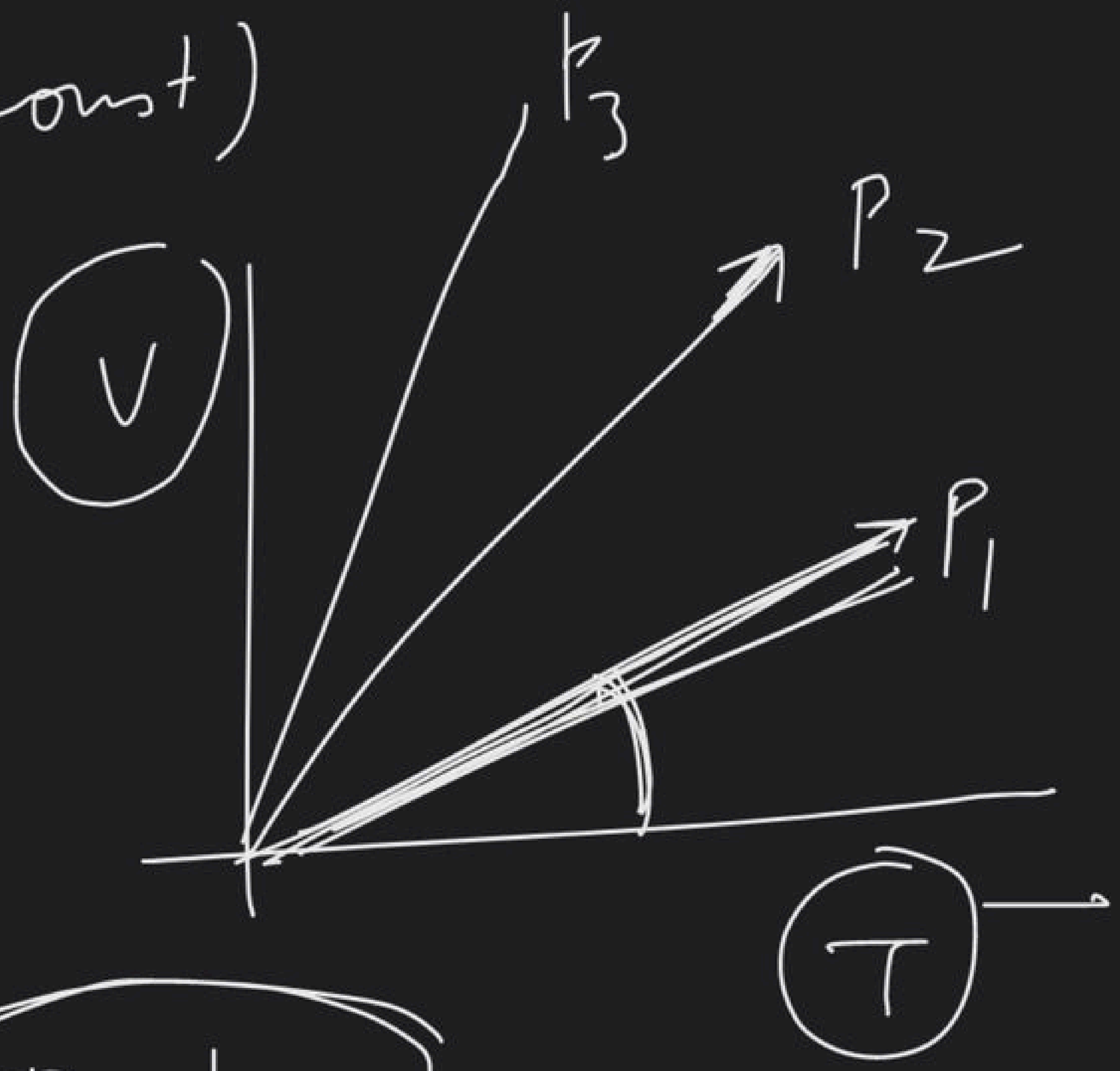
$$PV = nRT$$

$$V = \left(\frac{nR}{P}\right) T$$

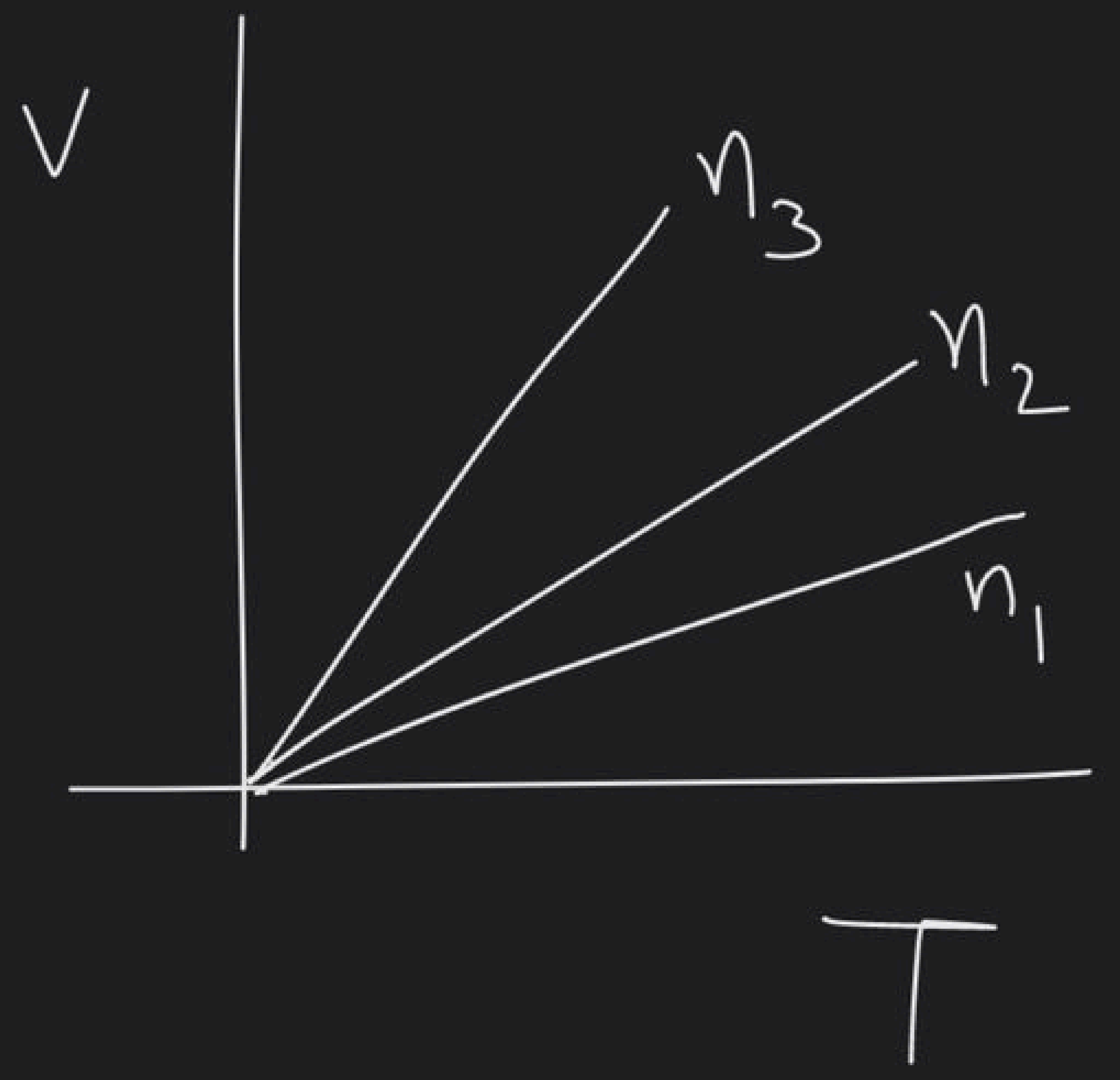
$$\text{slope} = \frac{nR}{P}$$

more 'P' less slope

$$P_1 > P_2 > P_3$$



Isobar

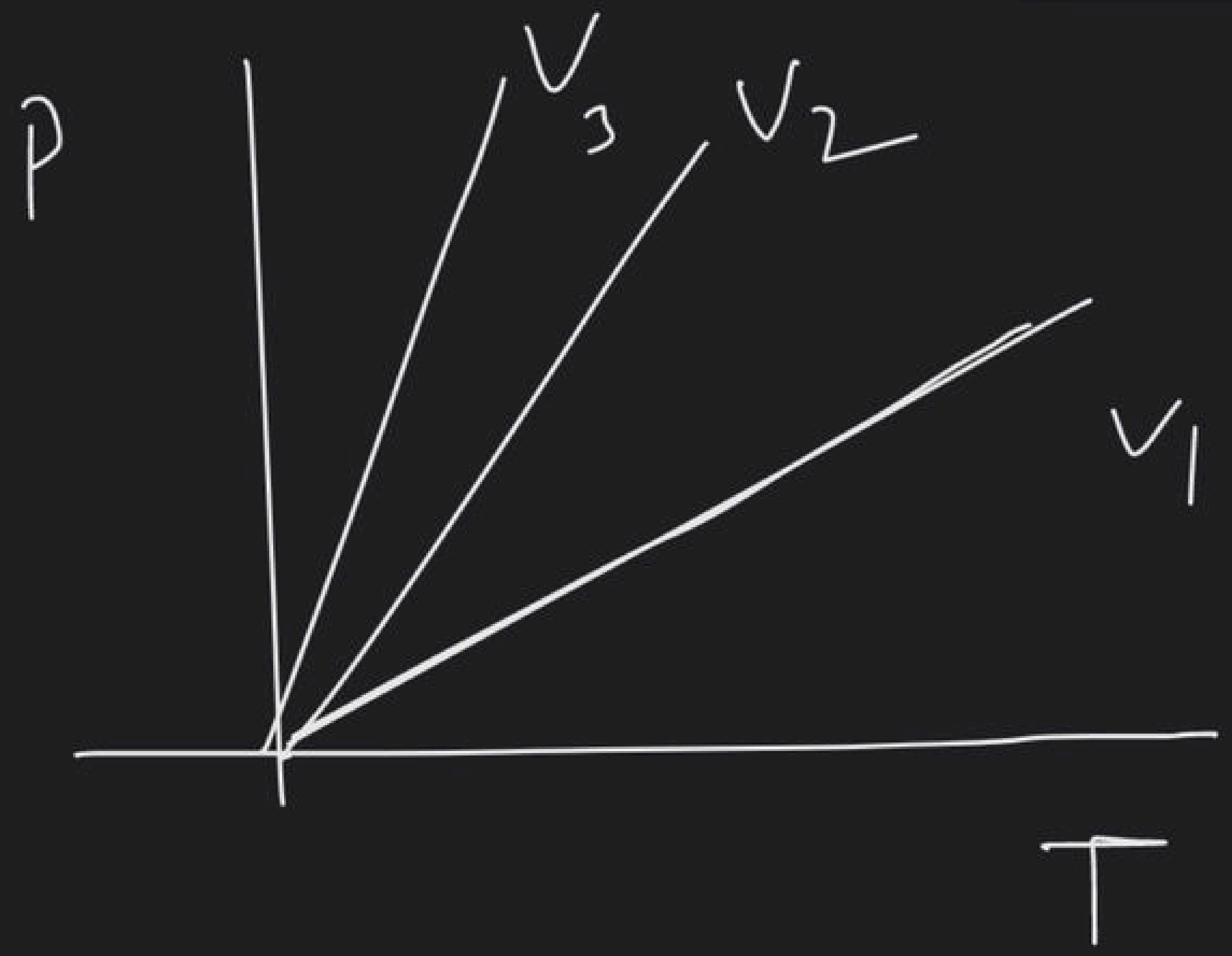


$$V = \frac{nR}{P} T$$

$$n_3 > n_2 > n_1$$

③ P vs T

"Isochore"



$$P = \frac{nR}{V_1} T$$

$$V_1 > V_2 > V_3$$

$\Rightarrow$ $PV = nRT$.

$\boxed{\text{DPP-1}}$

atm lit 0.0821 atm/lit/mol/K

Pa m^3 8.314 J/mol/K