(A2) Problem Statement :

Using false position method, estimate molar volume of ethyl alcohol at given temperature and pressure. and compair result with ideal gas laws.

known ;

$a = 12.02$] empirical constents

$b = 0.08407$]

$t = 400k$ temperature

$p = 2.5$ atm pressure

$R = 0.0821$ univarsal gas constent.

v = molar volume,

equation

$$\left(p + \frac{a}{v^2}\right)(v - b) = Rt$$

Sol^n :

$$\left(p + \frac{a}{v^2}\right)(v - b) = Rt$$

$$v - b = \left(\frac{Rt}{p + a/v^2}\right)$$

$$v = \frac{0.0821 \times 400}{2.5 + 12.02/v^2} + 0.08407$$

$$= \frac{32.84\, v^2}{2.5v^2 + 12.02} + 0.08407$$

$$= \frac{32.84v^2 + 0.210175v^2 + 1.0105214}{2.5v^2 + 12.02}$$

$$v = \frac{33.050175\, v^2 + 1.0105214}{2.5v^2 + 12.02}$$

$$f(v) = -2.5v^3 + 33.050175v^2 - 12.02v + 1.0105214$$

$$2.5v^2 + 12.02$$

so with the help of code we can find that,
$f(v) > 0$ ie $v_u = 12$ and,
$f(v) < 0$ ie $v_l = 13$

according to formula of false - Position method:

$$v_r = v_l - \frac{f(v_l)\,[v_u - v_l]}{f(v_u) - f(v_l)}$$

value of v_r when $f(v_r)$ is closet to zero and point that is intersection of x with fuction is
12.848304885459296

and with ideal gas loco we have,
$13.136\bar{0}$