Calculate the Cycle Mean Effective Pressure (P_m)

The Mean Effective Pressure is a conceptual average constant pressure that would produce the same net work output across a single stroke displacement. First, evaluate the maximum specific volume using the ideal gas law at the intake state:

$$\frac{V_1}{m} = \frac{RT_1}{P_1} = \frac{\left(0.287\ \frac{kJ}{kg-K}\right)(300\ K)}{150\ kPa} = 0.5740\ \frac{m^3}{kg}$$

$$V_2 = \frac{V_1}{r_k} = \frac{\left(0.5740\ \frac{m^3}{kg}\right)}{4.4164} = 0.1210\ \frac{m^3}{kg}$$

we determine the total volume displacement (V_1 - V_2):

$$P_m = \frac{e_{cycle} Q_A}{V_1 - V_2} = \frac{(0.1916)\left(1868.0765\ \frac{kJ}{kg}\right)}{0.1210\ \frac{m^3}{kg} - 0.5740\ \frac{m^3}{kg}} = 790.1180\ kPa$$

This cycle produces a high Mean Effective Pressure of **790.12kPa**. For an engineer, this metric indicates that the engine can produce a high torque and force output relative to its physical displacement volume. This parameter provides a useful benchmark when designing compact, heavy-duty industrial components where power output per unit space is prioritized over fuel economy.