Given:

Air is compressed in a car engine from 22°C and 95 kPa in a reversible and adiabatic manner.

$T_1 := 22\ °C = 295.15\ K$ $P_1 := 95\ kPa$

Required:

If the compression ratio (v_1 / v_2) of the engine is 8, determine the final temperature of the air.

Solution:

The compression ratio is defined as

$r_c := 8$

Going to Table A-17 @ $T_1 = 295.2\ K$ shows that interpolation is needed. This is shown below.

$T_a := 295\ K$ $T_b := 298\ K$

$v_{ra} := 647.9$ $v_{rb} := 631.9$

$$v_{r1} := \frac{T_1 - T_a}{T_b - T_a} \cdot \left(v_{rb} - v_{ra} \right) + v_{ra} = 647.1$$

The relative specific volume at state 2 may then be found by

$$v_{r2} = \frac{v_2}{v_1} \cdot v_{r1} \quad \text{or} \quad v_{r2} := \frac{v_{r1}}{r_c} = 80.89$$

Going to Table A-17 @ $v_{r2} = 80.89$ shows that interpolation is need.

$v_{ra} := 85.34$ $v_{rb} := 81.89$

$T_a := 650\ K$ $T_b := 660\ K$

$$T_2 := \frac{v_{r2} - v_{ra}}{v_{rb} - v_{ra}} \cdot \left(T_b - T_a \right) + T_a = 662.9\ K \qquad T_2 = 389.8\ °C$$