Given:
Air is compressed from an initial state of 100 kPa and 17°C to a final state of 600 kPa and 57°C.

$P_1 := 100\ \text{kPa}$ $\quad T_1 := 17\ °\text{C}$ $\quad P_2 := 600\ \text{kPa}$ $\quad T_2 := 57\ °\text{C}$

Required:
Determine the entropy change of air during this compression process
(a) by using the property tables and
(b) by using an average specific heat.

Solution:
Going to Table A-2(a) @ air shows

$$R_{air} := 0.287\ \frac{\text{kJ}}{\text{kg K}}$$

Going to Table A-17 @ $T_1 = 290.2\ \text{K}$ shows that interpolation is needed. This is shown below.

$T_a := 290\ \text{K}$ $\quad T_b := 295\ \text{K}$

$s°_a := 1.66802\ \frac{\text{kJ}}{\text{kg K}}$ $\quad s°_b := 1.68515\ \frac{\text{kJ}}{\text{kg K}}$

$$s°_1 := \frac{T_1 - T_a}{T_b - T_a} \cdot \left(s°_b - s°_a\right) + s°_a = 1.669\ \frac{\text{kJ}}{\text{kg K}}$$

Going to Table A-17 @ $T_2 = 330.2\ \text{K}$ shows that interpolation is needed. This is shown below.

$T_a := 330\ \text{K}$ $\quad T_b := 340\ \text{K}$

$s°_a := 1.79783\ \frac{\text{kJ}}{\text{kg K}}$ $\quad s°_b := 1.82790\ \frac{\text{kJ}}{\text{kg K}}$

$$s°_2 := \frac{T_2 - T_a}{T_b - T_a} \cdot \left(s°_b - s°_a\right) + s°_a = 1.798\ \frac{\text{kJ}}{\text{kg K}}$$

The change in entropy is then found by

$$\boxed{\Delta s_{table} := s°_2 - s°_1 - R_{air} \cdot \ln\left(\frac{P_2}{P_1}\right) = -0.3845\ \frac{\text{kJ}}{\text{kg K}}} \quad \text{(a)}$$

The average temperature is found by

$$T_{avg} := \frac{T_1 + T_2}{2} = 310.15\ \text{K}$$

Going to Table A-2(b) @ $T_{avg} = 310.2\ \text{K}$ and air shows that interpolation is needed. This is shown below.

$T_a := 300\ \text{K}$ $\quad T_b := 350\ \text{K}$

$c_a := 1.005\ \frac{\text{kJ}}{\text{kg K}}$ $\quad c_b := 1.008\ \frac{\text{kJ}}{\text{kg K}}$

$$c_{p,avg} := \frac{T_{avg} - T_a}{T_b - T_a} \cdot \left(c_b - c_a\right) + c_a = 1.006\ \frac{\text{kJ}}{\text{kg K}}$$

The change in entropy when using an average specific heat value is then found by

$$\boxed{\Delta s_{avg,cp} := c_{p,avg} \cdot \ln\left(\frac{T_2}{T_1}\right) - R_{air} \cdot \ln\left(\frac{P_2}{P_1}\right) = -0.3844\ \frac{\text{kJ}}{\text{kg K}}} \quad \text{(b)}$$

$$\%diff := \left|\frac{\Delta s_{table} - \Delta s_{avg,cp}}{\Delta s_{table}}\right| = 0.03285\ \%$$