Given a copper object of length 1m for which a one-dimensional heat model is appropriate and has cross sectional area and temperature profiles defined by

$$\begin{aligned} A(x) &= \frac{1}{1000}\left(5 + 15.5x - 19.5x^2\right), \\ T(x) &= 100(1 - \sinh(x)), \end{aligned}$$

determine the positions along the x-axis at which the energy in the rod reaches 17%, 46% and 83% of its total value.

To do this, define

$$Q(x) = \int_0^x \rho c A(t) T(t)\, dt.$$

Subdivide the x-axis, then use this to generate a table of $Q(x)$ vs x. Use inverse interpolation as needed to obtain the requested x-coordinates.

Use your results to create a plot similar to the one in Figure 2 from the course notes. You don't need to have the horizontal lines.