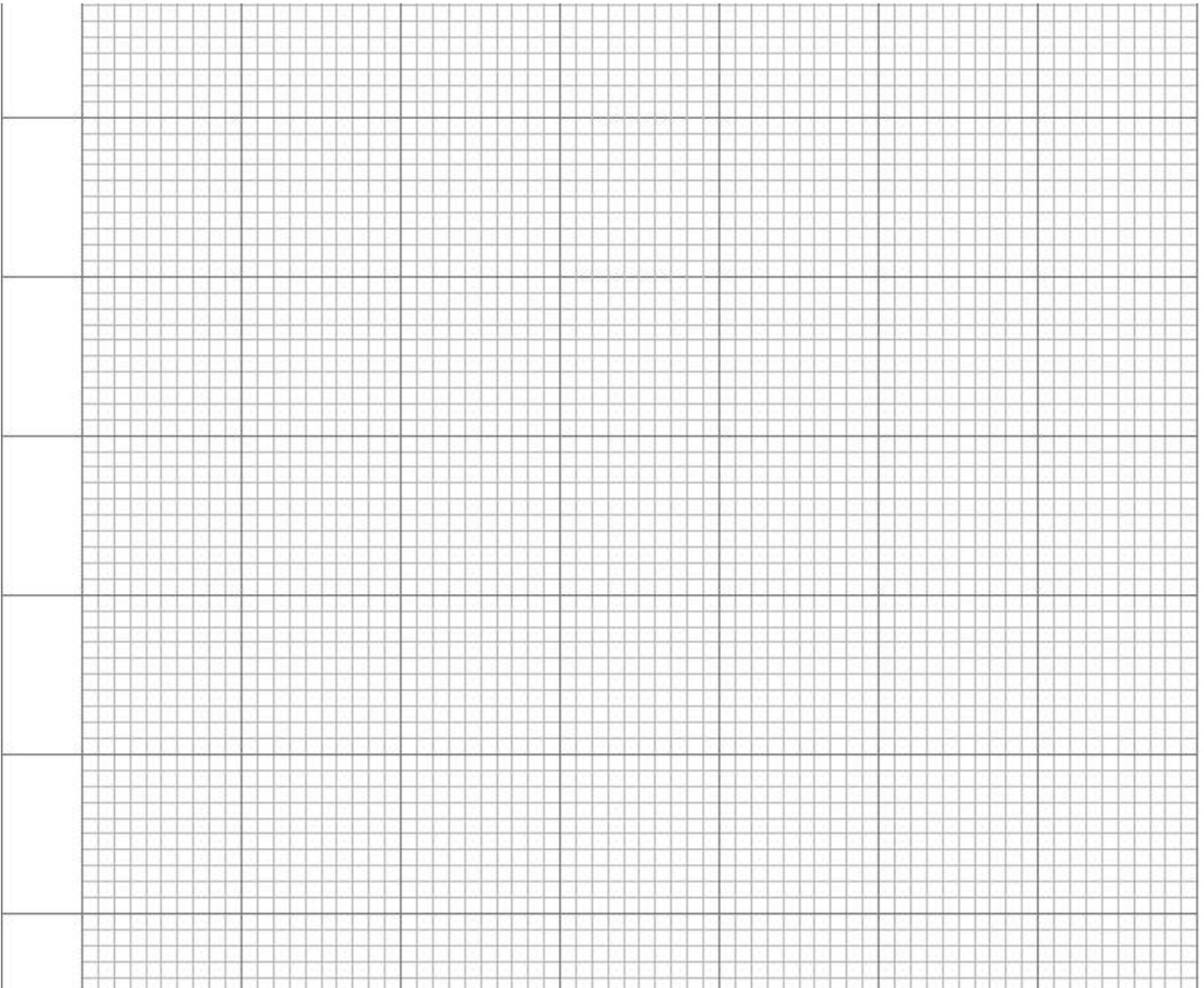
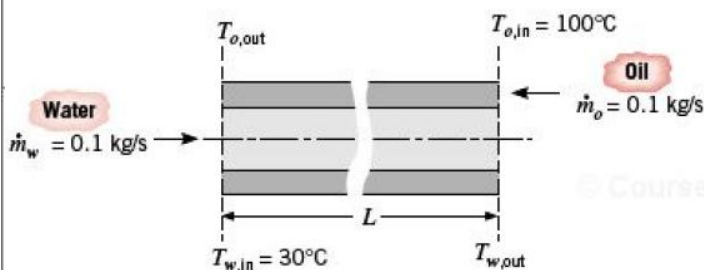


HW# 11.9, 11.16, 11.20, 11.25, 11.59

11.20 A concentric tube heat exchanger for cooling lubricating oil is comprised of a thin-walled inner tube of 25-mm diameter carrying water and an outer tube of 45-mm diameter carrying the oil. The exchanger operates in counterflow with an overall heat transfer coefficient of $60 \text{ W/m}^2 \cdot \text{K}$ and the tabulated average properties.

- (a) If the outlet temperature of the oil is 60°C , determine the total heat transfer and the outlet temperature of the water.
- (b) Determine the length required for the heat exchanger.

Properties	Water	Oil
ρ (kg/m ³)	1000	800
c_p (J/kg · K)	4200	1900
ν (m ² /s)	7×10^{-7}	1×10^{-5}
k (W/m · K)	0.64	0.134
Pr	4.7	140

