

9.13

9.13 A viscous fluid flows past a flat plate such that the boundary layer thickness at a distance 1.3 m from the leading edge is 12 mm. Determine the boundary layer thickness at distances of 0.20, 2.0, and 20 m from the leading edge. Assume laminar flow.

For laminar flow $\delta = C\sqrt{x}$, where C is a constant.

Thus,

$$C = \frac{\delta}{\sqrt{x}} = \frac{12 \times 10^{-3} \text{ m}}{\sqrt{1.3 \text{ m}}} = 0.0105 \quad \text{or} \quad \delta = 0.0105 \sqrt{x} \quad \text{where } x \sim \text{m}, \delta \sim \text{m}$$

| $x, \text{ m}$ | $\delta, \text{ m}$ | $\delta, \text{ mm}$ |
|----------------|---------------------|----------------------|
| 0.2 | 0.00470 | 4.70 |
| 2.0 | 0.0148 | 14.8 |
| 20.0 | 0.0470 | 47.0 |