

3.13

3.13 Air flows along a horizontal, curved streamline with a 20 ft radius with a speed of 100 ft/s. Determine the pressure gradient normal to the streamline.

$$-\gamma \frac{dz}{dn} - \frac{\partial p}{\partial n} = \frac{\rho V^2}{R}, \text{ where } \frac{dz}{dn} = 0 \text{ since the streamline is horizontal.}$$

Thus,

$$\begin{aligned} \frac{\partial p}{\partial n} &= -\frac{\rho V^2}{R} = \frac{-(0.00238 \frac{\text{slug}}{\text{ft}^3})(100 \frac{\text{ft}}{\text{s}})^2}{20 \text{ ft}} \\ &= -1.19 \frac{\text{slug}}{\text{ft}^2 \cdot \text{s}^2} \left( 1 \frac{\text{lb}}{\text{slug} \cdot \text{ft}} \right) = \underline{\underline{-1.19 \frac{\text{lb}}{\text{ft}^3}}} \end{aligned}$$

