

**37.54** A pressurized tank contains air at  $300\text{psia}$ . What is the Mach number of air exiting to the atmosphere through a hole in the tank?

- A. 0.8
- B. 2.6
- C. 4.2
- D. 5.5

Determine the ratio of the pressure downstream of the opening to the pressure inside the tank.

$$\frac{P}{P_0} = \frac{14.7\text{psia}}{300\text{psia}} = 0.049$$

Use the **One-Dimensional Isentropic Compressible-Flow Functions** table to look up the pressure ratio and obtain the corresponding **Mach Number**,  $M$ .

$$M \approx 2.6$$

Alternatively, use the equation from **Isentropic Flow Relationships**. Solve for  $M$ . Assume the ratio of specific heats  $k = 1.4$ .

$$\begin{aligned}\frac{P_0}{P} &= \left(1 + \frac{k-1}{2}M^2\right)^{\frac{k}{k-1}} \\ M &= \sqrt{\left(\frac{2}{k-1}\right) \left[\left(\frac{P_0}{P}\right)^{\frac{k-1}{k}} - 1\right]} \\ M &= \sqrt{\left(\frac{2}{1.4-1}\right) \left[\left(\frac{300\text{psia}}{14.7\text{psia}}\right)^{\frac{1.4-1}{1.4}} - 1\right]} = 2.61\end{aligned}$$

**Answer B**