1.12 For low-speed (laminar) flow in a tube of radius r_o, the velocity u takes the form

$$u = B\frac{\Delta p}{\mu}\left(r_o^2 - r^2\right)$$

where μ is viscosity and Δp the pressure drop. What are the dimensions of B?

$$u = B\,\frac{\Delta p}{\mu}\,(r_0^2 - r^2)$$

$$\frac{L}{T} = (B?)\,\frac{M/LT^2}{M/LT}\,L^2 \qquad B = L^{-1}$$

$$\Delta p = \frac{F}{L^2} = \frac{mL/T^2}{L^2} = \frac{M}{LT^2}$$

$$\mu = \frac{\tau}{\frac{\partial u}{\partial y}} = \frac{\frac{M}{LT^2}}{\frac{L}{TL}} = \frac{M}{LT}$$

$$u(r) = \frac{1}{4\mu}\left(-\frac{dp}{dx}\right)(r_0^2 - r^2) = c\,\frac{\Delta p}{\mu 2}\,(r_0^2 - r^2)$$

$$\left.\begin{aligned} \Delta p &= -dp = p_1 - p_2 \\ \Delta x &= L \\ c &= 1/4 \end{aligned}\right\} \quad B = \frac{c}{L} = \frac{1}{4L}$$