6.75

6.75 Two fixed, horizontal, parallel plates are spaced 0.4 in. apart. A viscous liquid ($\mu = 8 \times 10^{-3}$ lb · s/ft^2, $SG = 0.9$) flows between the plates with a mean velocity of 0.5 ft/s. The flow is laminar. Determine the pressure drop per unit length in the direction of flow. What is the maximum velocity in the channel?

$$V = \frac{h^2}{3\mu}\frac{\Delta p}{\ell} \qquad \text{(Eq. 6.137)}$$

Thus,

$$\frac{\Delta p}{\ell} = \frac{3\mu V}{h^2} = \frac{3\left(8\times10^{-3}\ \frac{lb\cdot s}{ft^2}\right)\left(0.5\ \frac{ft}{s}\right)}{\left(\frac{0.2\ in.}{12\ \frac{in.}{ft}}\right)^2} = \underline{\underline{43.2\ \frac{lb}{ft^2}\ \text{per ft}}}$$

$$u_{max} = \frac{3}{2}V \qquad \text{(Eq. 6.138)}$$

$$= \frac{3}{2}\left(0.5\ \frac{ft}{s}\right) = \underline{\underline{0.75\ \frac{ft}{s}}}$$