1.3

1.3 下列因次 V：速度；ℓ 長度，ν：流體性質 (L^2T^{-1})

(a). $V\ell\nu \Rightarrow \frac{L}{T} \times L \times (L^2 \times \frac{1}{T}) = \frac{L^4}{T^2}$

(b). $V\ell/\nu \Rightarrow \frac{L}{T} \times L \times \frac{T}{L^2}$ = 無因次 #

(c). $V^2\nu \Rightarrow (\frac{L}{T})^2 \times (\frac{L^2}{T}) = \frac{L^4}{T^3}$

(d). $V/\ell\nu \Rightarrow \frac{L}{T} \times \frac{1}{L} \times \frac{T}{L^2} = \frac{1}{L^2}$

1.5

1.5 管內流動液体之体積流率 Q 為 $\frac{\pi R^4 \Delta P}{8 \mu \ell}$；$R$ 半徑、ΔP 沿管壓差、μ 流体黏度、ℓ 管長

求單位均勻。

$$Q = \frac{\pi}{8}\left(\frac{L^4 \times F \times L^{-2}}{F \times L^{-2} T \times L}\right) = \frac{\pi}{8}\left(\frac{L^3}{T}\right) \#$$

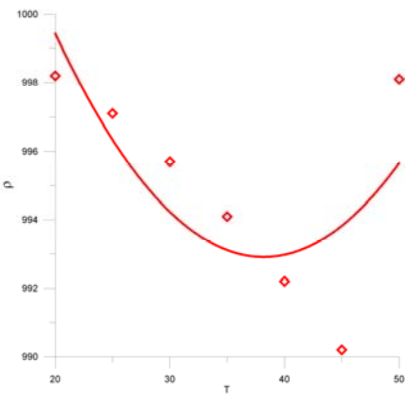
相同得証.

Q 之一般常用方程式 $= 0.61A\sqrt{2gh}$

$$= 0.61L^2\left(2 \times \frac{L}{T^2} \times L\right)^{\frac{1}{2}}$$

$$= 0.61 \times \sqrt{2}\left(L^2 \times \frac{L}{T}\right) = \left(\frac{L^3}{T}\right)$$

1.17



使用迴歸或最小平方法

+5.0000E+01 +9.8810E+02 +9.8805E+02

Thus, $\rho = 1001 - 0.05333\,T - 0.004095\,T^2$

Note that ρ (predicted) is in good agreement with ρ (given).

At $T = 42.1\,°C$,

$$\rho = 1001 - 0.05333\,(42.1\,°C) - 0.004095\,(42.1\,°C)^2 = 991.5\ \frac{kg}{m^3}$$

1.28

剪應力(shear strss)的定義，若速度爲 y 方向之函數， $\tau = \mu \dfrac{du}{dy}$

$$\tau_{\substack{surface \\ (y=0)}} = \mu \left(\frac{du}{dy}\right)_{y=0}$$

$$\frac{du}{dy} = U \left(\frac{3}{2\delta} - \frac{3}{2}\frac{y^2}{\delta^3}\right)$$

@ $y=0$, $\dfrac{du}{dy} = \dfrac{3}{2}\dfrac{U}{\delta}$

Since, $\mu = \nu\rho$

$$\tau_{surface} = \nu\rho \left(\frac{3}{2}\frac{U}{\delta}\right)$$

$$= \left(4 \times 10^{-4} \frac{m^2}{s}\right)\left(0.92 \times 10^3 \frac{kg}{m^3}\right)\left(\frac{3}{2}\right)\frac{U}{\delta}$$

$$= \underline{\underline{0.552 \frac{U}{\delta} \ N/m^2 \text{ acting to left on plate}}}$$