

## Exercise 1 Hints

$$\begin{aligned} 1) \quad [\text{Wavelength}] &= L & [\rho] &= M/L^3 \\ [g] &= L/T^2 & [v] &= L/T \end{aligned}$$

- $\rho$  cannot be involved in any dimensionless value.
- $v^2$  has to be divided by  $g$  to cancel the  $T$ 's.  
(You have to do more to get a dimensionless constant).

$$\begin{aligned} 2) \quad [g] &= L/T^2 & [u] &= L/T \\ [m] &= M & [t] &= T \end{aligned}$$

$$[F_R] = [k] [u]^\alpha = [k] L^\alpha / T^\alpha$$

Being a force, we must have

$$[F_R] = M \cdot L / T^2$$

$$\text{So } \frac{M \cdot L}{T^2} = [k] \frac{L^\alpha}{T^\alpha} \Rightarrow \text{solve for } [k].$$

There are two dimensionless variables, one involves  $g$ ,  $t$ , and  $u$  and the other involves  $k$ ,  $u$ ,  $m$  and  $g$ .

If we have two dimensionless variables  $\gamma_1, \gamma_2$ , then

$$F(\gamma_1, \gamma_2) = 0$$

or

$$\gamma_1 = G(\gamma_2)$$

for some function  $G$ .