

27c)

	$\times 10^6$	$\times 10^{10}$
T	R	
7.6	5.8	
30	15	
380	78	
930	143	

$\times 3.947$ (red arrow pointing to the first row)

$\times 2.586$ (red arrow pointing to the first row)

$$2.586^x = 3.947$$

$$\log 2.586^x = \log 3.947$$

$$x \log 2.586 = \log 3.947$$

$$x = \frac{\log 3.947}{\log 2.586}$$

$$x = 1.44\dots$$

$$\approx \frac{3}{2}$$

$$T \propto R^{\frac{3}{2}}$$

$$T^2 \propto R^3$$

Using Proportioning Techniques in Physics

* Form an equation from the proportionality

Proportionality $I \propto \frac{1}{d^2}$ If $d = 3.0 \text{ cm}$ and $I = 10 \text{ lx}$
find the specific equation.

$$I = k \left(\frac{1}{d^2} \right)$$

general equation $I = \frac{k}{d^2}$

find k. $\left\{ \begin{array}{l} k = Id^2 \\ k = (10 \text{ lx})(3.0 \text{ cm})^2 \\ k = 90 \text{ lx cm}^2 \end{array} \right.$

specific equation

$$I = \frac{90 \text{ lx cm}^2}{d^2}$$

* Forming Proportionalities from an equation

Recall that you can combine 2 or more proportionalities:

$$\left. \begin{array}{l} R \propto \frac{1}{d^2} \\ R \propto l \end{array} \right\} R \propto \frac{l}{d^2} \Rightarrow R = \frac{kl}{d^2}$$

You can "unwrap" an equation to find the proportionalities:

$$a = \frac{k}{T^2} r \quad \begin{array}{l} \rightarrow a \propto r \\ \rightarrow a \propto \frac{1}{T^2} \end{array}$$

* Solving Problems using Proportionality technique:

SP1

If we triple v ,
what happens to F ?

$$F \propto v^2$$

$$F = kv^2$$

$$F' = k(3v)^2$$

$$F' = k(9v^2)$$

$$F' = 9(kv^2)$$

$$F' = 9F$$

new: F' (force)
 $3v$ (speed)

SP2

$$V = 1.0 \times 10^5 L$$

double dimensions

$$V' = ??$$

$$V = \pi r^2 h$$

$$V' = \pi (2r)^2 (2h)$$

$$V' = \pi (4r^2) (2h)$$

$$V' = 8\pi r^2 h$$

$$V' = 8V$$

$$V' = 8(1.0 \times 10^5 L)$$

$$V' = 8.0 \times 10^5 L$$

new: V'
 $2r$
 $2h$

Example

What happens to F if m_1 is doubled
 m_2 is decreased by a factor of 3
and r is 4 times larger.

$$F = \frac{Gm_1 m_2}{r^2}$$

$$F' = \frac{G(2m_1)(\frac{m_2}{3})}{(4r)^2}$$

$$F' = \frac{G(\frac{2}{3}m_1 m_2)}{16r^2}$$

$$F' = \frac{2}{48} \left(\frac{Gm_1 m_2}{r^2} \right) \leftarrow F$$

$$F' = \frac{1}{24} F$$

Suppose you are trying to find the proportionality given experimental data:

Consider the proportionality: *how do we find n?
(another way)*

$$y \propto x^n$$

$$y = kx^n$$

$$\log y = \log kx^n$$

$$\log y = \log k + \log x^n$$

$$\log y = \log k + n \log x$$

$$(y = b + m x) \leftarrow \text{a linear equation in disguise.}$$

A graph of $\log y$ vs $\log x$ will be linear with a slope of n and a y -intercept of $\log k$.

TO DO

① PP/30

② Assignment: p38 | 28-34, ^{ADV} (35+36)

(DUE TUES)

③ QUIZ - WED (like the Practice from HW from last night)