27c

| T | R |
|---|---|
| 7.6 | 5.8 |
| 30 | 15 |
| 380 | 78 |
| 930 | 143 |

$7.6 \xrightarrow{\times 3.947} 30$ $\qquad$ $5.8 \xrightarrow{\times 2.586} 15$

$2^x = 8$

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

$T^2 \propto R^3$

$2.586^x = 3.947$

$\log 2.586^x = \log 3.947$

$x \log 2.586 = \log 3.947$

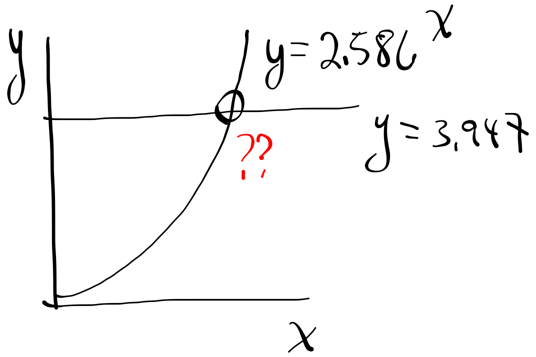
$$x = \frac{\log 3.947}{\log 2.586}$$

$x = 1.445\ldots$

$x \approx 1.5$ or $\frac{3}{2}$

Solve by graphing:

$$\underbrace{2.586^x}_{y_1} = \underbrace{3.947}_{y_2}$$



# §1-8 Using Proportioning Techniques in Physics

## Determine an equation from a proportionality

Consider the proportionality:

$$I \propto \frac{1}{d^2}$$ (proportionality)

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

$$k = Id^2$$
$$k = (10\,lx)(3.0\,cm)^2$$
$$k = 90\ lx \cdot cm^2$$
solving for k

$$I = \frac{90\,lx \cdot cm^2}{d^2}$$ specific equation

## Find the proportionalities from the equation

Consider the equation:

$$a = \frac{4\pi^2 r}{T^2}$$

$a \propto r$

$a \propto \frac{1}{T^2}$

Solving Problems using the proportioning technique

SP1 $F \propto v^2$

$F = kv^2$

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

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

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

$\boxed{F' = 9F}$ ← The new force will be 9x the original!

SP2 $V = \pi r^2 h$

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

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

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

$V' = 8V$

$V' = 8(1.0\times10^3 L)$

$\boxed{V' = 8.0\times10^3 L}$

One more example:

By what factor will a change if r is tripled and T is halved.

$a = \frac{4\pi^2 r}{T^2}$

$a' = \frac{4\pi^2(3r)}{\left(\frac{T}{2}\right)^2}$

$a' = \frac{3}{\frac{1}{4}}\left(\frac{4\pi^2 r}{T^2}\right)$ a

$a' = 12a$

TO DO

1. PP/30 – FOP
2. Assignment – due Fri.
3. Quiz – Thurs (proportioning technique)

## Log-Log Plots

What if you need to find $n$ in: $y \propto x^n$

$$y = kx^n$$

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

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

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

$$y = b + m\,x$$

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