Problem Set 1

1. $I \propto$ Amount

$I = kA$

$\updownarrow$

P

$A = 3250$

$I = 113.75$

$\frac{113.75}{3250} = \frac{3250k}{3250}$

$.035 = k$

$I = .035A$

$I = .035P$

2. $l \propto g$

$l = kg$

$14 \text{ gal} = 53 l$

$53 = k\,14$

$\frac{53}{14} = k$

$3.79 = K$

$l = 3.79g$

5 gal

$l = 3.79(5)$

$l = 18.99 l$

25 gal

$l = 3.79(25)$

$l = 94.64 l.$

3. $d \propto f$

$d = kf$

$f = 265 N$

$d = .15 m$

$.15 = k(265)$

$\frac{.15}{265} = k$

$0.000566 = k$

$0.000566 = K$

$d = .000566f$

(a) $d = .1 m$

$\frac{.1}{.000566} = \frac{.000566f}{.000566}$

$176.66 = f$

$176.66 N = f$

(b) $f = 90 N$

$d = .000566(90)$

$d = .0509\ldots$

$d \approx .051 m$

4. $d \propto f$

$d = kf$

$d = 1 ft \quad f = 15 lb$

$1 = k \cdot 15$

$\frac{1}{15} = k$

$d = \frac{1}{15} f$

door moves 8 ft

Springs move 4 ft

$4 = \frac{1}{15} f$

$4(15) = f$

$60 = f$

60 lbs of force by each spring

120 lbs of force applied to door by the springs.

Problem Set 2

1. $d \propto v^2$

$d = kv^2$

$v = .25$ mph

$d = .02$ in

$.02 = k(.25)^2$

$\frac{.02}{(.25)^2} = k$

$.32 = k$

$d = .32v^2$

$d = .12$

$.12 = .32v^2$

$\frac{.12}{.32} = v^2$

$.375 = v^2$

$.612 = v$ mph

$.612$ mph $= v$

2. $f \propto \frac{\sqrt{t}}{l}$

$f = k\frac{\sqrt{t}}{l}$

middle A string

t_A, l_A

$f = 440 \frac{vib}{sec}$

$440 = k\frac{\sqrt{t_A}}{l_A}$

new string

$t = 1.25\, t_A$

$l = 1.2\, l_A$

$f = \frac{k\sqrt{t}}{l}$

$= \frac{k\sqrt{1.25\, t_A}}{1.2 l_A}$

$f = \frac{k\sqrt{t_A}}{l_A} \cdot \frac{\sqrt{1.25}}{1.2}$

$f = 440 \frac{\sqrt{1.25}}{1.2}$

$f = 409.946$

3. $W \propto mh$

$W = kmh$

$m = 120$ kg

$h = 1.8$ m

$W = 2116.8$ joules

$2116.8 = k(120)(1.8)$

$\frac{2116.8}{120(1.8)} = k$

$9.8 = k$

$W = 9.8\, mh$

$m = 100$ kg

$h = 1.5$ m

$W = 9.8(100)(1.5)$

$W = 1470$ joules

Problem Set #3

1. max load $\propto w \cdot d^2 \cdot \frac{1}{l}$

$L = k\frac{wd^2}{l}$ gives max safe load L_{max}

$L_{max} = k\frac{wd^2}{l}$

@ w, d, l are safe

double w & l

$L_{double} = \frac{k(2w)d^2}{(2l)}$

$= \frac{kwd^2}{l}$

$= L_{max}$

Load is the same

(b) double w, d

$L_{new} = k\frac{(2w)(2d)^2}{l}$

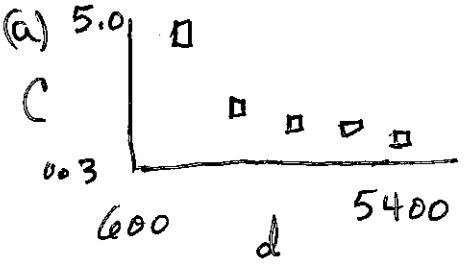
$= k\frac{2w \cdot 4d^2}{l}$

$= 8 \cdot k\frac{wd^2}{l}$

$= 8 L_{max}$

new load limit is 8 times L_{max}

2. (a)



(b) Power model/Reg (c)

$C = \frac{K}{d^P}$

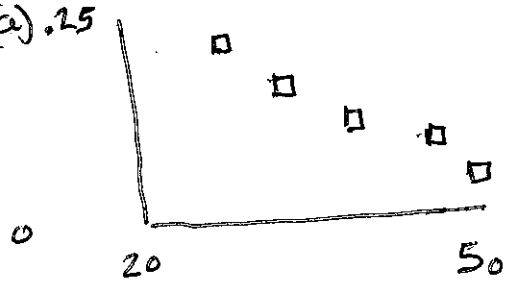
$C = \frac{22291.04}{d^{.9203}}$

$d = 1356.5965$

set $y_2 = 3$

find intersection

3. (a)



(b) Power model/Reg

$I = \frac{678.0670}{x^{-2.3895}}$

(c) ~~set~~

Calc Value

$x = 25$

$I = .3097$

set window

$20 \le x \le 50$

$0 \le y \le .25$