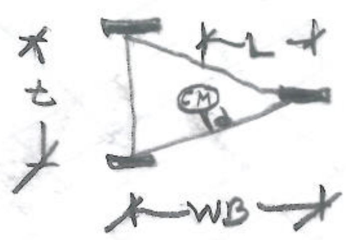
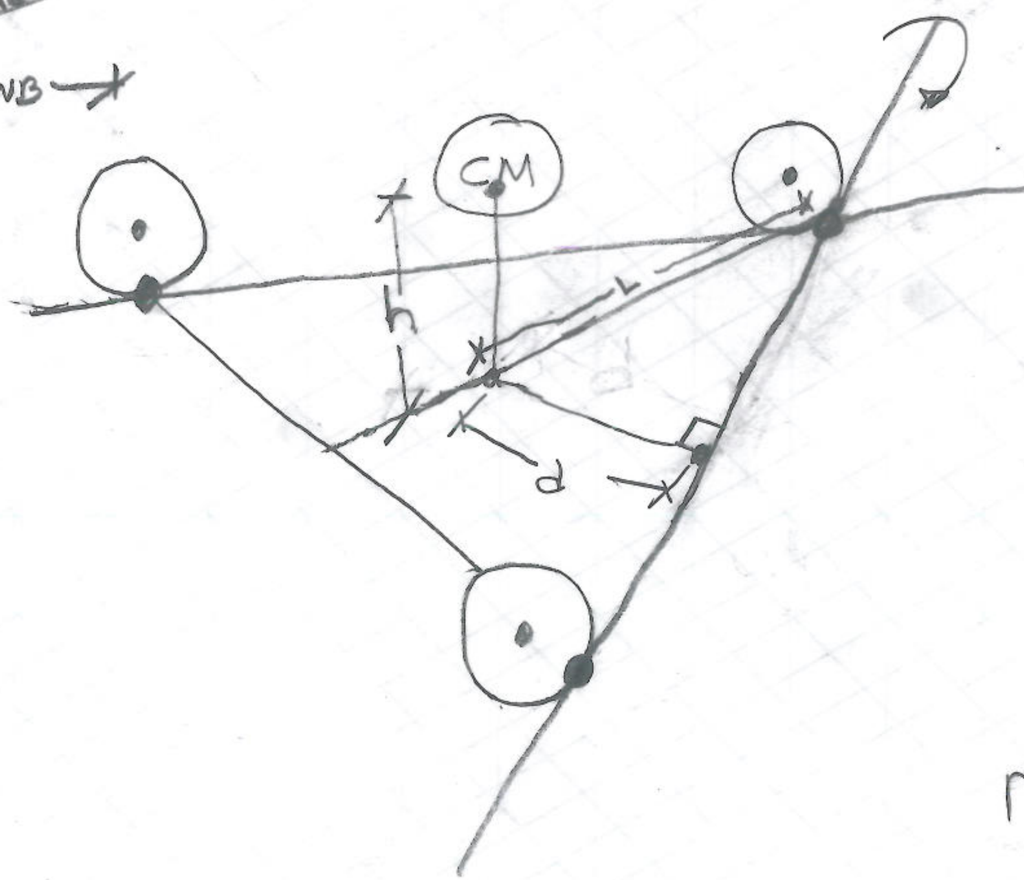
Stability
KAF
3/3/09

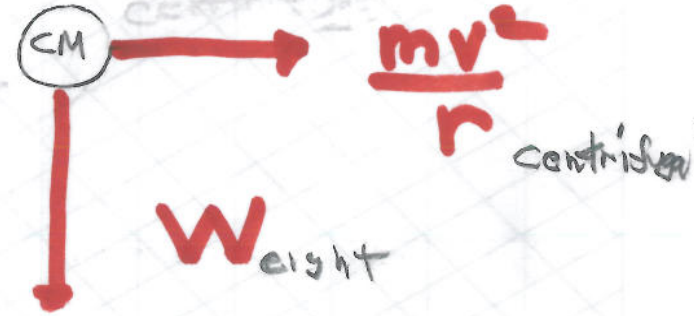
SHEET 1

topview





Forces on Center of Mass in turn



moments on the Center of mass

No Roll over $\Rightarrow (W) \times d \geq \left(\frac{mv^2}{r}\right) \cdot h$

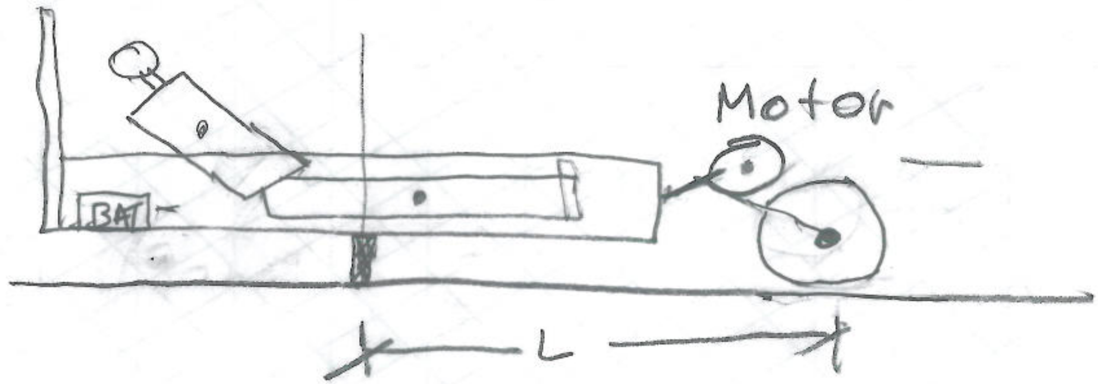
Where r = turn radius
v = speed m/sec
m = mass in Kg

where d is found from STP 605

$$d = L \sin\left(\tan^{-1}(t/2WB)\right)$$

SHEET 2

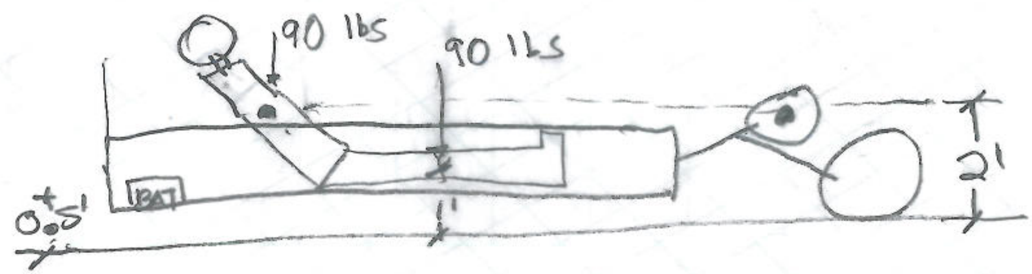
① DETERMINATION OF L



Rear wheels not shown for clarity

CAR & DRIVER BALANCED on 2"×4" to establish L

② Estimation of h



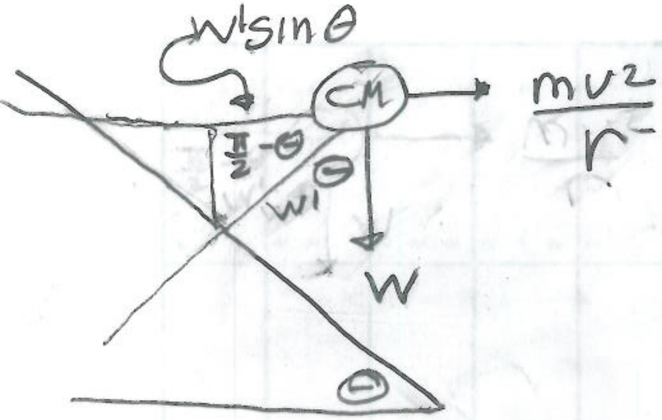
Assume total car weight is 400 lbs

400
-40 motor
-70 BATTERIES
-180 driver

110 lbs remaining

$$h = \frac{0.5(70) + (90)2 + (90)1 + (40)2 + (110)1.5}{400}$$

$$= \frac{(35) + (180) + 90 + 80 + 165}{400} = 1.4'$$



Sheet 3

On angle θ, W has a radial component opposing $\frac{mv^2}{r}$ equal to

#1 $W'(\cos(\frac{\pi}{2}-\theta)) = W'\sin\theta$

and $W' = W\cos\theta$

but for small θ

$\cos\theta \approx 1$ hence

$W' \approx W$ or

radial component #1

becomes $W\sin\theta$

hence

$W \cdot d \geq \left(\frac{mv^2}{r}\right) h$ in the case of a tilt becomes

$$W \cdot d \geq \left(\frac{mv^2}{r} - W\sin\theta\right) h$$

$$\frac{mv^2}{r} \leq \frac{W \cdot d}{h} + W\sin\theta$$

at tip

$$\frac{mv^2}{r} = \frac{W \cdot d}{h} + W\sin\theta$$

or

$$v = \left[\left(\frac{W \cdot d}{h} + W\sin\theta\right)\frac{r}{m}\right]^{-1/2}$$