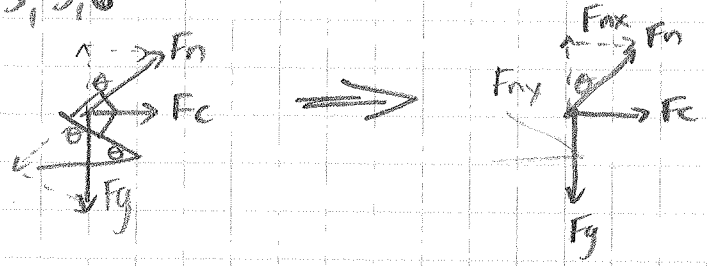
p. 123 # 2, 5; p. 124 # 3, 5, 6

2. $r = 450\,m$
$v = 97\,km/h = 26.94\,m/s$
$\theta = ?$



$$\sum F_y = 0N = F_{ny} - F_g$$

$$F_g = F_{ny}$$

$$mg = F_n \cos\theta$$

$$F_n = \frac{mg}{\cos\theta}$$

$$\sum F_x = F_c = F_{nx}$$

$$\frac{mv^2}{r} = F_n \sin\theta$$

$$\frac{mv^2}{r} = \frac{mg}{\cos\theta}\sin\theta \qquad \frac{\sin\theta}{\cos\theta} = \tan\theta$$

$$\frac{v^2}{r} = g\tan\theta$$

$$\tan\theta = \frac{v^2}{gr}$$

$$\theta = \tan^{-1}\left(\frac{(26.94\,m/s)^2}{(9.8\,m/s^2)(450\,m)}\right)$$

$$\theta = 9.3°$$

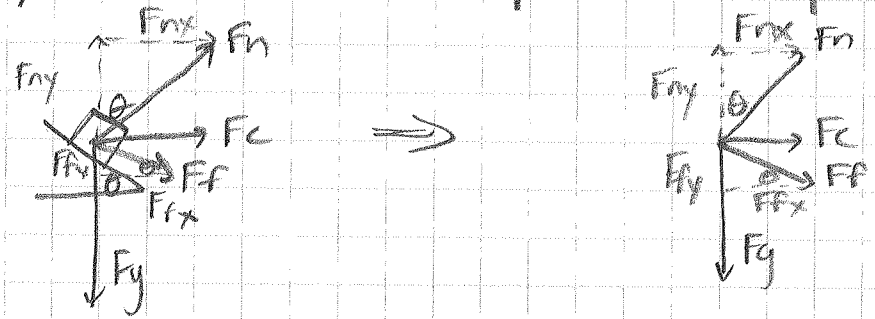
p. 123 # 2, 5; p. 124 # 3, 5, 6

5. Refer to Sample Problem 3 for Given

$r = 2.0 \times 10^2 m$
$\theta = 20.0°$
$\mu = 0.25$

Speed on dry pavement = 49 m/s

Speed on wet pavement should be less



$$\sum F_y = 0 \quad N = F_{ny} - F_g - F_{fy}$$

$$F_g + F_{fy} = F_{ny}$$

$$mg + F_f \sin\theta = F_n \cos\theta$$

$$mg + \mu F_n \sin\theta = F_n \cos\theta$$

$$mg = F_n \cos\theta - \mu F_n \sin\theta$$

$$mg = F_n (\cos\theta - \mu \sin\theta)$$

$$F_n = \frac{mg}{\cos\theta - \mu \sin\theta}$$

$$\sum F_x = F_c = F_{nx} + F_{fx}$$

$$\frac{mv^2}{r} = F_n \sin\theta + F_f \cos\theta$$

$$\frac{mv^2}{r} = F_n \sin\theta + \mu F_n \cos\theta$$

$$\frac{mv^2}{r} = F_n (\sin\theta + \mu \cos\theta)$$

p. 123 # 2.5, p. 124 # 3, 5, 6

$$\frac{mv^2}{r} = \frac{mg}{\cos\theta - \mu\sin\theta}(\sin\theta + \mu\cos\theta)$$

$$\frac{v^2}{r} = \frac{g(\sin\theta + \mu\cos\theta)}{\cos\theta - \mu\sin\theta}$$

$$v^2 = \frac{gr(\sin\theta + \mu\cos\theta)}{\cos\theta - \mu\sin\theta}$$

$$v = \sqrt{\frac{(9.8\ m/s^2)(2.0\times10^2\ m)(\sin 20.0 + (0.25)\cos 20.0)}{\cos 20.0 - (0.25)\sin 20.0}}$$

$$v = 36\ m/s$$

p. 124 # 3

3a) θ increases → greater speed possible

b) μ increases → greater speed possible

c) mass increases → no effect

5.a) θ gives F_{nx}; F_{nx} contributes to F_c, which means greater v possible

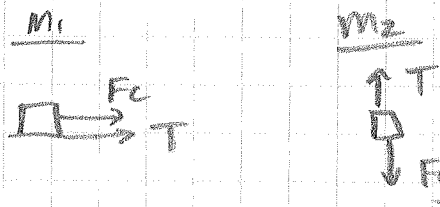
b) μ is decreased, which means F_{fx} is decreased, which means F_c is decreased which means lower v

c) greater θ - problems: cost more to construct, too much θ and F_{fy} becomes a problem, ...

p. 123 # 2, 5; p. 124 # 3, 5, 6

#6 CHALLENGE

$m_1 = 0.26\ kg$
$r = 1.2\ m$
$m_2 = 0.68\ kg$
$v = ?$



For mass 2 $\Sigma F_y = 0N$ $\therefore$ $F_g = T$, $T = m_2 g$

For mass 1:

$\Sigma F_y = 0N$

$\Sigma F_x = F_c = T$

$F_c = m_2 g$

$\frac{m_1 v^2}{r} = m_2 g$

$v = \sqrt{\frac{m_2 g r}{m_1}}$

$v = \sqrt{\frac{(0.68\ kg)(9.8\ m/s^2)(1.2\ m)}{0.26\ kg}}$

$v = 5.5\ m/s$