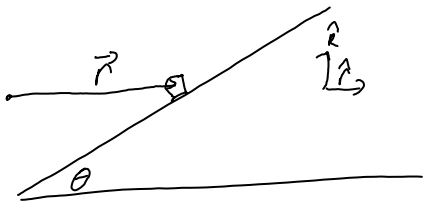
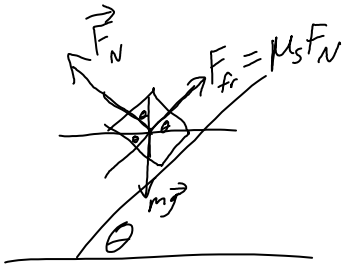
PSet 3 - Problem 28: (Circular motion: banked turn)

Wednesday, September 30, 2009
1:52 PM

a)





$$\hat{r}: F_N \sin\theta - \mu_s F_N \cos\theta = \frac{mv^2}{r}$$

$$\hat{k}: F_N \cos\theta - mg + \mu_s F_N \sin\theta = 0$$

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

$$\frac{\sin\theta - \mu_s\cos\theta}{\cos\theta + \mu_s\sin\theta} = \frac{v^2}{gr}$$

$$\boxed{v_{max} = \sqrt{gr\,\frac{\sin\theta - \mu_s\cos\theta}{\cos\theta + \mu_s\sin\theta}}}$$

b) $v_{min} = \sqrt{gr\,\frac{\sin\theta + \mu_s\cos\theta}{\cos\theta - \mu_s\sin\theta}}$

c) $v = \sqrt{gr\tan\theta}$