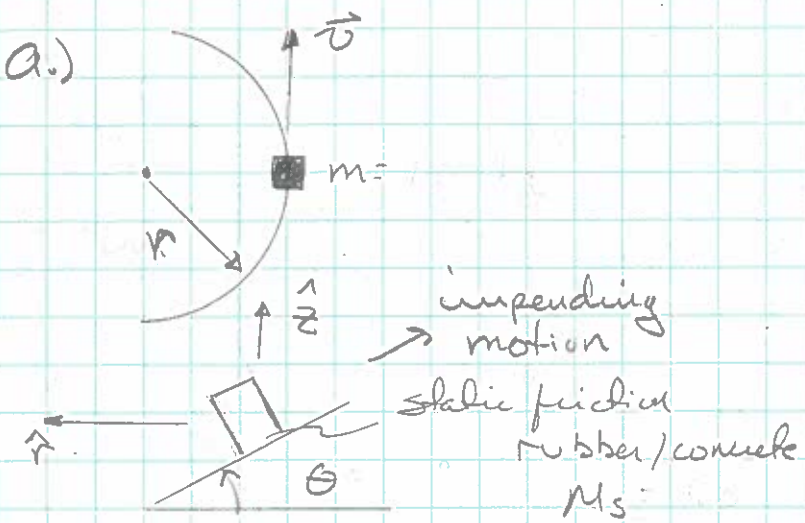
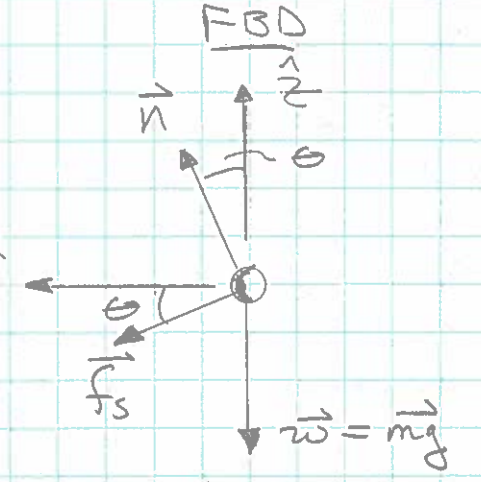
a.)





a.) Centripetal force is the $\hat{r}$ components of $\vec{f}_s$ & $\vec{n}$.

b.) find: maximum speed to not skid.

$$\Sigma F_r = ma_r$$

$$f_s \cos\theta + n \sin\theta = \frac{mv^2}{r} \qquad \text{(for UCM)}$$

and

$v = v_{max}$ when $f_s = f_{s\,max} = \mu_s n$

So: $\mu_s n \cos\theta + n \sin\theta = \frac{mv^2}{r}$ (1)

Now: $\Sigma F_z = 0$

$$n\cos\theta - f_s \sin\theta - w = 0$$

Or, $n\cos\theta - \mu_s n \sin\theta - mg = 0$

So: $$n = \frac{mg}{\cos\theta - \mu_s \sin\theta}$$

Now, eqn (1) is: $n(\mu_s \cos\theta + \sin\theta) = \frac{mv^2}{r}$

So: $$mg\left(\frac{\mu_s \cos\theta + \sin\theta}{\cos\theta - \mu_s \sin\theta}\right) = \frac{mv^2}{r}$$

$$\therefore \quad v = \left\{ rg\left(\frac{\mu_s \cos\theta + \sin\theta}{\cos\theta - \mu_s \sin\theta}\right)\right\}^{1/2}$$

NOTE: For $\theta \to 0$, same as WB 8-3