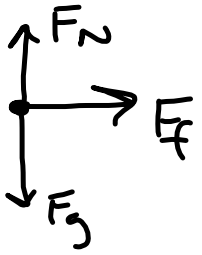
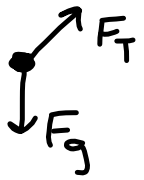
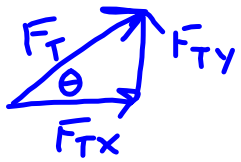
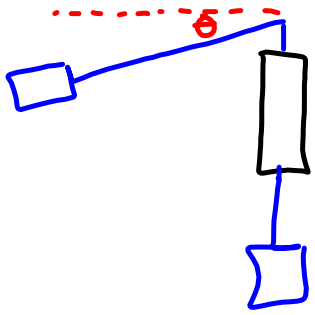
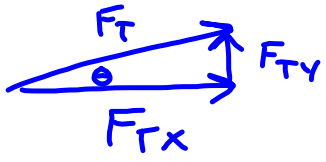
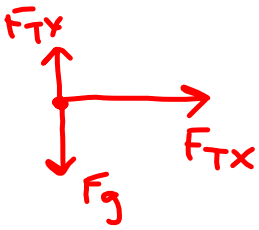
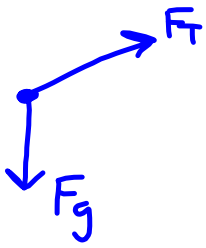
	Friction	Gravitation	Tension
FBD			 
Net force equation	$F_c = \frac{mv^2}{r}$	$F_c = \frac{mv^2}{r}$	$F_c = \frac{mv^2}{r}$
Substitute for centripetal force	$F_f = \frac{mv^2}{r}$	$\frac{Gm_1m_2}{r^2} = \frac{m_2v^2}{r}$	$F_{TX} = \frac{mv^2}{r}$
Solve for v	$v = \sqrt{\frac{F_f r}{m}}$	$v = \sqrt{\frac{Gm_1}{r}}$	$v = \sqrt{\frac{F_{TX} r}{m}}$
Solve for	$\boxed{\mu_s}$	$\boxed{m_1}$	$\boxed{F_T}$
	$F_f = \mu F_N$	$m_1 = \frac{rv^2}{G}$	$\cos\theta = \frac{F_{TX}}{F_T}$
	$\mu = \frac{F_f}{F_N}$		$F_T = \frac{F_{TX}}{\cos\theta}$
	$= \frac{\frac{mv^2}{r}}{mg}$		$= \frac{\frac{mv^2}{r}}{\cos\theta}$
	$= \frac{mv^2}{mgr}$		$F_T = \frac{mv^2}{r\cos\theta}$
	$\mu = \frac{v^2}{gr}$		

2)









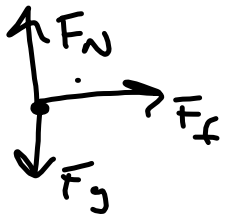
$$F_{TY} = F_g$$
$$= ma_g$$
$$= (0.02\,kg)(9.8\,m/s^2)$$
$$= 0.196\,N$$

$$F_{TX} = \frac{mv^2}{r}$$
$$= \frac{(0.02\,kg)(6.9\,m/s)^2}{0.45\,m}$$
$$= 2.1\,N$$

$$v = \frac{2\pi r}{T}$$
$$= \frac{2\pi(0.45\,m)}{0.41\,s}$$
$$= 6.9\,m/s$$

$$\tan\theta = \frac{F_{TY}}{F_{TX}}$$
$$\theta = \tan^{-1}\left(\frac{F_{TY}}{F_{TX}}\right)$$
$$= \tan^{-1}\left(\frac{0.196\,N}{2.1\,N}\right)$$
$$= 5.3^\circ$$

3)



$$F_N = F_g$$
$$= m a_g$$

$$F_f = \frac{m v^2}{r}$$

$$F_f = \mu F_N$$

$$\frac{m v^2}{r} = \mu m a_g$$

$$\mu = \frac{v^2}{r a_g}$$

$$= \frac{(8.3\ m/s)^2}{(42\ m)(9.8\ m/s^2)}$$

$$= 0.17$$