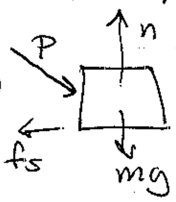
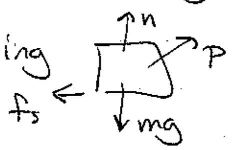
Exam 2, Physics 200B, fall 2008

1. a) 

b) $P\cos\theta - f_s = 0$ $\quad f_s = \mu_s n \rightarrow \mu_s = \frac{f_s}{n} = \frac{P\cos\theta}{P\sin\theta + mg} = 0.271$

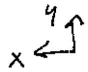
$n - P\sin\theta - mg = 0$

c) pulling  now $n + P\sin\theta - mg = 0 \rightarrow n$ smaller, so f_s less and P needed is less

d) push: $\oplus$ $(\theta = 35°)$; f_s: $\ominus$ $(\theta = 180)$; n: zero $(\theta = 90°)$; mg: zero $(\theta = 90°)$

$W = F\Delta r\cos\theta$

2. a) 

b)  $T\cos 20 + F\sin 20 = \frac{mv^2}{r}$

$F\cos 20 - T\sin 20 - mg = 0$ $\Big\}$ $T = 11.9$ N

3. a) $|F_s| = kx \rightarrow k = \frac{|F_s|}{x} = 240$ N/m

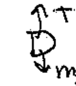
b) $W_s = \frac{1}{2}kx_i^2 - \frac{1}{2}kx_f^2 = +0.30$ J

c) $W_s = \Delta K = \frac{1}{2}mv_f^2 - 0 \rightarrow v_f = 3.5$ m/s

d) $W = \Delta K$; $W = \int F\,dx$ = area under curve = -0.165 J

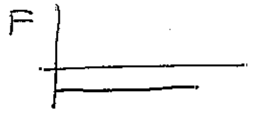
so $-0.165 = \frac{1}{2}mv_f^2 - \frac{1}{2}m(3.5)^2 \rightarrow v_f = 2.3$ m/s

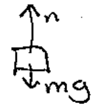
4. A. constant $\vec{v} \rightarrow \vec{a} = 0$ so $\vec{F} - \vec{f}_k = 0 \rightarrow$ same force since f_k constant

B. a) same  $(\vec{a} = 0)$ b) $\vec{a}$ down, so $mg > T$

C. $a = F/m = GM/r^2$ so since $8M/(2r)^2 = 2M/r^2$, a = twice as large $= 2(2) = 4$ m/s²

D. $K = \frac{1}{2}mv^2$: since v is squared, $\frac{1}{2}mv^2 = K$ vs $\frac{1}{2}(2m)(\frac{v}{2})^2 = \frac{1}{2}K$ ← first one does more damage

E. a)  b) F = constant + to left

F.  $n > mg$ for net force toward center

extra credit: $F = G\frac{mM}{(R+h)^2}$ so at $h = R$ $F = G\frac{mM}{(2R)^2} = \frac{1}{4}\left(G\frac{mM}{R^2}\right)$