Exam 4, Physics 200B, fall 2008

1. a) $\omega = \frac{2\pi \text{ rad}}{27 \text{ day}} = 2.7\times10^{-6} \text{ rad/s}$

b) $L_i = L_f \rightarrow \frac{2}{5}MR^2\omega_i = \frac{2}{5}M(100R)^2\omega_f \rightarrow \omega_f = 2.7\times10^{-10} \text{ rad/s}$

2. a) $\sum \tau_{\text{pivot at hip}} = mg(50) - T\sin 30(75) = 0 \rightarrow T = 327 \text{ N}$

b) $F_y + T\sin 30 - mg = 0 \rightarrow F_y = 82 \text{ N}$

$-F_x + T\cos 30 = 0 \rightarrow F_x = 283 \text{ N}$

3. $\frac{1}{2}mv^2 - \frac{GmM_E}{R_E} = -\frac{GmM_E}{(R_E+h)} \rightarrow$ ~~R_E~~ $\rightarrow 3.5\times10^7 \text{ m}$ $v = 10\times10^3 \text{ m/s}$

4. a) $T = 2.5 \text{ s}$; $\omega = \frac{2\pi}{T} = \sqrt{\frac{k}{m}} \rightarrow k = 1580 \text{ N/m}$

b) $a_{max} = \omega^2 A \rightarrow A = 7.8 \text{ m}$

c) $\vec{F} = m\vec{a} = -k\vec{x}$ so $\vec{F}$ largest + ⊕ when $\vec{x}$ most negative (greatest − disp.)

d) $x = \frac{A}{2} \rightarrow \frac{1}{2}kA^2 = \frac{1}{2}mv^2 + \frac{1}{2}k\left(\frac{A}{2}\right)^2 \rightarrow v = 17 \text{ m/s}$

5. a) 2 m

b) $\omega = 2 \text{ rad/s} \rightarrow f = \frac{\omega}{2\pi} = \frac{1}{\pi} \text{ Hz}$

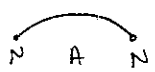
c) $k = 3 \text{ m}^{-1} \rightarrow \lambda = \frac{2\pi}{k} = \frac{2\pi}{3} \text{ m}$

d) amplitude: magnitude of greatest displacement
frequency: # cycles/s
wavelength: distance traveled in $t = T$ or distance between adjacent points of same phase

e) $v = \lambda f \left(= \frac{\omega}{k}\right) = \frac{2}{3} \text{ m/s}$ in $-\hat{\imath}$ direction

6. A. a) $-6\hat{k}$ b) 0

B. a) A + B b) same (same $r\sin\phi = d$)

C. 

$\frac{\lambda}{2} = L \rightarrow \lambda = 2L = 6 \text{ m}$

D. a) no (no dependence on A) b) no (no dependence on f) c) yes, $T\uparrow + \mu\downarrow$

E. yes, if the waves are out of phase 

(crest meets trough)

F. a) iii
b) ii
c) c