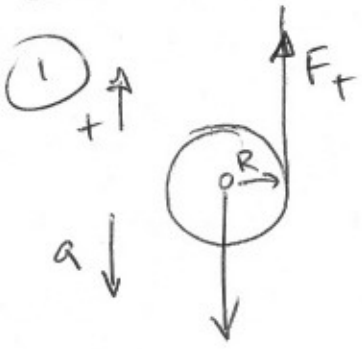
Exam 4

NOTE minus sign

(1)



$\sum F = ma$ $\quad \sum \tau = I\alpha$ $\quad$ NOTE $a = r\alpha$

$(+\uparrow) F_T - F_w = ma$ $\quad \circlearrowleft \; rF_T = I\alpha = I\frac{a}{r}$

Use $I = \frac{1}{2}mR^2$ $\Rightarrow$ $a = \frac{2}{3}g$

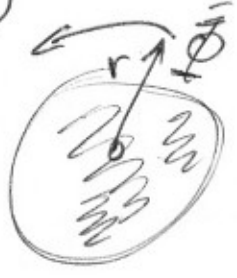
$F_T = \frac{1}{3}mg$

(2) Use $\sum \tau = \frac{dL}{dt} = 0$ so $L_f = L_i$

$L_i = m_i v_i r_i = m_f v_f r_f$

$v_f = v_i\left(\frac{r_i}{r_f}\right)$ $\quad r_f = \frac{r_i}{10}$ $\quad v_f = 10 v_i$

(3)



$v = \left(\frac{GM_\oplus}{r}\right)^{1/2}$ $\quad M_\oplus$ = mass of Earth, r = radius of orbit

$L = mvr = m\left(GM_\oplus r\right)^{1/2} = \left(GM_\oplus m^2 r\right)^{1/2}$

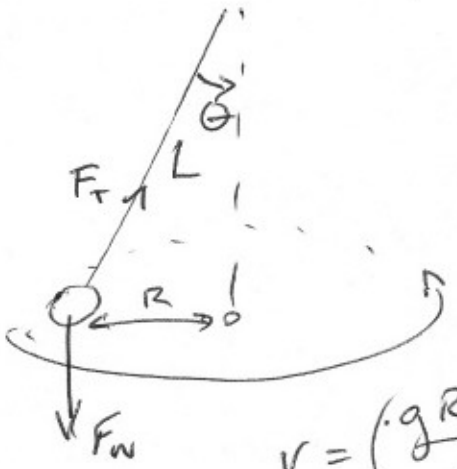
as $r \uparrow$ $L \uparrow$

(5) $y(x,t) = 0.02 \sin(6.28x - 15t)$

$v_y(x,t) = \left.\frac{\partial y}{\partial t}\right|_x = (0.02)(-15)\cos(6.28x - 15t)$ $\quad x = 0$, $t = 1.2\,s$

$v_y(x,t) =$

(9)



$$+\uparrow \sum F_y = F_T \cos\theta - F_W = 0$$

$$\rightarrow \sum F_x = F_T \sin\theta = ma_c = m\frac{v^2}{R}$$

$$v = \left(\frac{gR\sin\theta}{\cos\theta}\right)^{1/2}$$

$$v = \frac{2\pi R}{T} \quad \text{so} \quad T = \frac{2\pi R}{v} \quad \text{use } R = L\cos\theta$$

$$\therefore \quad T = 2\pi\left(\frac{L\cos\theta}{g}\right)^{1/2}$$