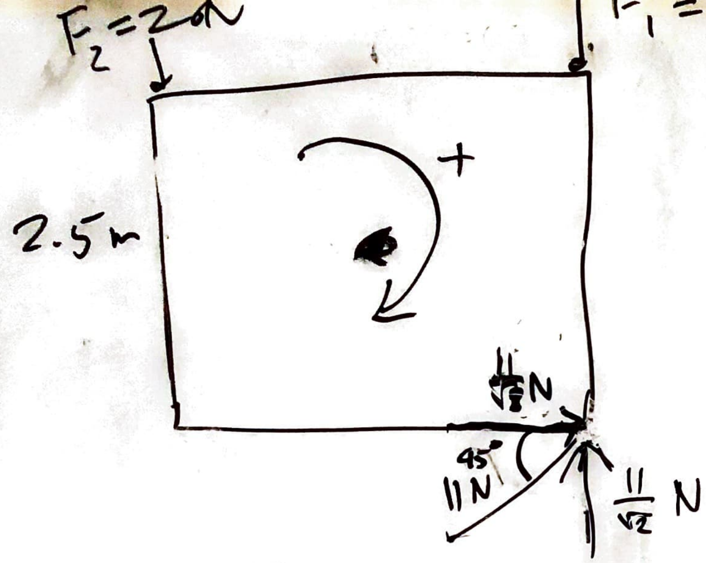
8
3
2 m/prob



$$\tau_m = \sum \tau_i = -20 \cdot 1.25 + 18 \times 1.25 - \frac{11}{\sqrt{2}} \cdot 1.25 - \frac{11}{\sqrt{2}} \cdot 1.25$$

$$= -2 \cdot 1.25 - \frac{22}{\sqrt{2}} \cdot 1.25$$

$$= -\left(\frac{2\sqrt{2}+22}{\sqrt{2}} \cdot 1.25\right)$$

$$= -(2+11\sqrt{2})(1.25)$$

$$\boxed{\approx -21.95 \ N \cdot m}$$

2.

$\frac{1}{2}mra = (T_v - T_h)r$

$\frac{1}{2}ma = 80 - 8a - 14a$

$1.5a = 80 - 22a$

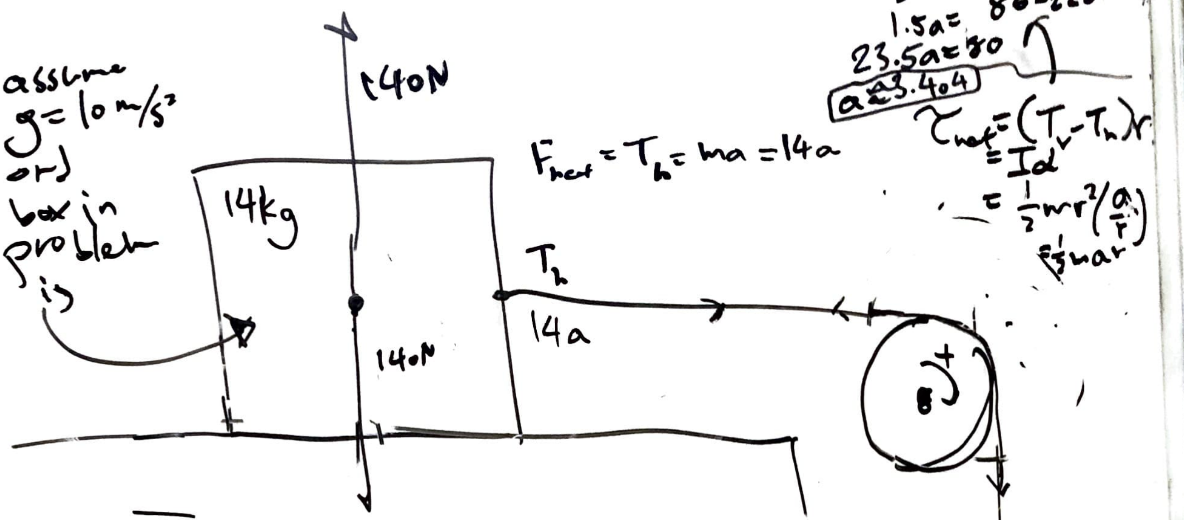
$23.5a = 80$

$\boxed{a \approx 3.404}$

$\tau_{net} = (T_v - T_h)r = I\alpha = \frac{1}{2}mr^2\left(\frac{a}{r}\right) = \frac{1}{2}mar$

assume $g = 10\ m/s^2$ and box in problem is

$F_{net} = T_h = ma = 14a$



a) T_h, T_v, a

$T_h = 14a \approx 14 \cdot 3.404 \approx \boxed{47.656\ N}$

$T_v = 80-8a \approx 80 - 8(3.404) \approx \boxed{52.768\ N}$

$F_{net} = F_g - T_v$

$8a = 80 - T_v$

$T_v = 80 - 8a$

b) $\boxed{a \approx 3.404\ m/s^2}$

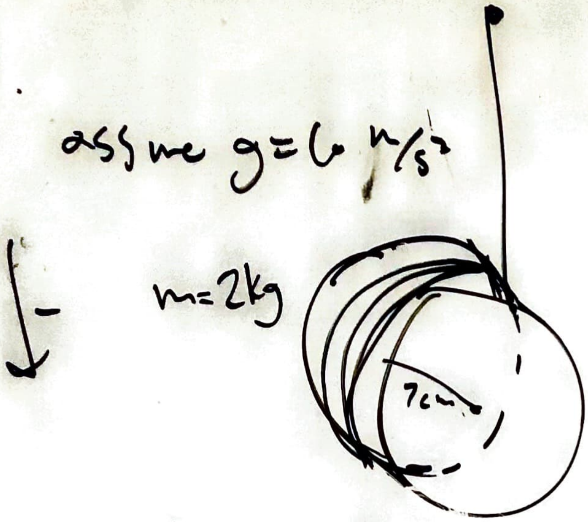
c) Horizontal component $= T_h = \boxed{47.656\ N}$

Vertical $= T_v = \boxed{52.768\ N}$

3.

assume $g = 10\ m/s^2$

$m = 2kg$



hoop $I = mr^2$

$\tau = T \cdot r$

$T = mg - ma$

$\frac{a}{r} = \alpha$

$\tau = (mg - m\alpha r)r$

$= m(gr - \alpha r^2)$

$\tau = I\alpha = mr^2\alpha$

$r^2\alpha = gr - \alpha r^2$

$r\alpha = g - \alpha r$

$2\alpha r = g$

$\alpha = \frac{g}{2r} = \frac{10}{.14} = \frac{1000}{14}$ rad/s^2

$a = \alpha r = \frac{1000}{14} \cdot .07$

$= 5$

b). $v = \sqrt{2ah}$

$= \sqrt{2 \cdot 5 \cdot .8}$

$\boxed{= \sqrt{8}\ m/s}$

a) $\omega = \frac{v}{r}$

$\boxed{= \frac{\sqrt{8}}{.07}\ rad/s}$

4

Rod

$I=$

Hollow cylinder

No net force, therefore

$I = mr^2$

$L_i = I\omega = I_f \omega_f = L_f$

$\omega_i = .4 \cdot 2\pi = \frac{4}{5}\pi$

$I = .5 + m_{hands} r^2$

$I\omega = I_f \omega_f$

$(.5 + 1 \cdot 1^2)\frac{4}{5}\pi = 9 \cdot .25^2 \omega_f$

$\frac{16}{9} \cdot \frac{4}{16}\pi = \omega_f$

$\boxed{\frac{4}{9}\pi = \omega_f}$

$.5 = m_{body} \cdot r^2$

$.5 = m_b \cdot .25^2$

$\frac{1}{2} \cdot 16 = m_b$

$8 = m_b$

$m_h = 9 - 8 = 1$

5

$I = \frac{1}{2}M(a^2 + b^2)$ for hollow disk $a = .3$ $b = .6$

a) $E_i = E_f$ $KE_f = \frac{1}{2}I\omega^2 + \frac{1}{2}mv^2$

$PE_i = KE_f$

$mgh = \frac{1}{4}m(.3^2 + .6^2)\left(\frac{v}{.6}\right)^2 + \frac{1}{2}mv^2$

$20 = \frac{1}{4}\left(\left(\frac{.3}{.6}\right)^2 + 1\right)v^2 + \frac{1}{2}v^2$

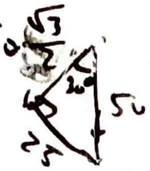
$20 = \left(\frac{1}{4} \cdot \frac{5}{4} + \frac{1}{2}\right)v^2$

$20 = \frac{13}{16}v^2$

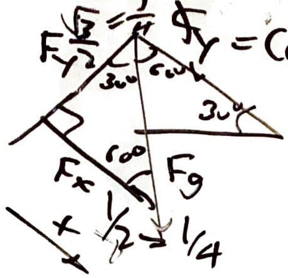
$4.96\ m/s \approx v$

$\sin 30 = \frac{1}{2}$
$\cos 30 = \frac{\sqrt{3}}{2}$

6 assume $g = 10\ m/s^2$

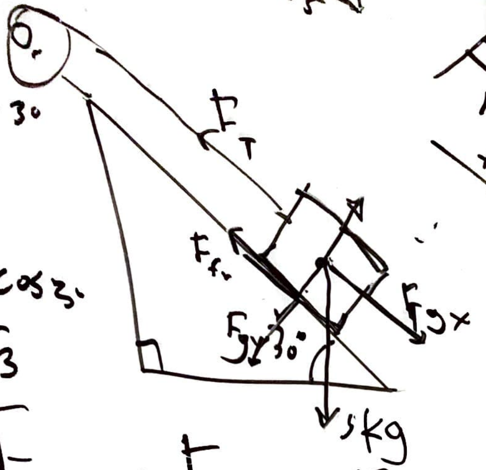


$F_x = \sin 30 \cdot F_g$
$F_y = \cos 30 \cdot F_g$



$F_{gx} = mg \sin 30$
$F_{gx} = 25$

$F_{fr} = \mu\, mg \cos 30$
$= .3 \cdot 25\sqrt{3}$



$\frac{3}{10}$

$F_{net} = F_{gx} - F_{fr} - F_T$

$ma = 25 - 7.5\sqrt{3} - F_T$

$a = 5 - 1.5\sqrt{3} - F_T/5$

$a = 5 - 1.5\sqrt{3} - \frac{.909}{5}$

$\boxed{a \approx 2.22\ m/s^2}$

b) $\boxed{F_T \approx .909\ N}$

$\alpha = \frac{a}{r}$

$\tau = I \cdot \alpha$

$= \frac{1}{4} \cdot \frac{a}{.4}$

$= \frac{5}{8} a$

$\tau = F_T r$

$\frac{5}{8} a = F_T r$

$\frac{5}{8}(5 - 1.5\sqrt{3}) - \frac{F_T}{8} = F_T \cdot \frac{2}{5}$

$.909 = F_T$

7

$E_d = E$ [illegible] at drop at cliff   assume $g = 10\ m/s^2$

$E_i = E_d$

$E_i = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$ $I_{sphere} = \frac{2}{5}mr^2$

$\omega = \frac{v}{r}$ $= \frac{1}{2}m\,24^2 + \frac{1}{2}\cdot\frac{2}{5}m\cancel{r^2}\frac{24^2}{\cancel{r^2}}$

$= \frac{7}{10}m\,24^2$

$K = \frac{7}{10}mv_i^2$ for any velocity v

$E_d = \frac{7}{10}mv_d^2 + mgh$

$= \frac{7}{10}mv_d^2 + m\cdot 300$

Time to fall is

$0 = y_i - 5t^2$

$5t^2 = 30$

$t^2 = 6$

$t = \sqrt{6}$

$\frac{7}{10}24^2 = \frac{7}{10}v_d^2 + 300$

$\frac{7}{10}24^2 - 300 = \frac{7}{10}v_d^2$

$12.14 \approx v_d$

a) $x_f = v\cdot t$

$= 12.14\cdot\sqrt{6}$

$\boxed{\approx 29.74\ m}$

$v_f = \sqrt{2gh}$

$= \sqrt{600} = 24.4$

b) $v_f = |\vec{v}| = \sqrt{12.14^2 + 600}$

$\boxed{\approx 27.338\ m/s}$

8

$\tau = Fr = I\alpha$

$I = \frac{1}{3}md^2$ for plate

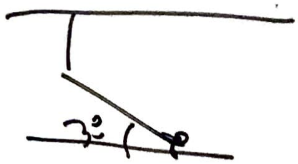
$Fr = (mg)\cos\theta \cdot d/2$

$I\alpha = \frac{1}{3}m\,d^2 \cdot \alpha$

$\frac{15}{9}$
$\overline{135}$

$10m\cos 30 \cdot \frac{9}{2} = \frac{1}{3}m\,9^2 \cdot \alpha$

$\frac{135}{81} \cdot \frac{\sqrt{3}}{2} = \alpha$



$\boxed{a)\ \alpha \approx .257\ rad/s^2}$

$E_i = E_f$

height $= 9\sin 30$ c.m.
$= \frac{9}{2}$

$PE_i = KE_f$

$45m = \frac{1}{2}I\omega^2$

$45m = \frac{1}{6}md^2\omega^2$

240

$\frac{270}{81} = \omega^2$

$3\sqrt{3}$

$\boxed{\sqrt{30}/3\ rad/s = \omega}$