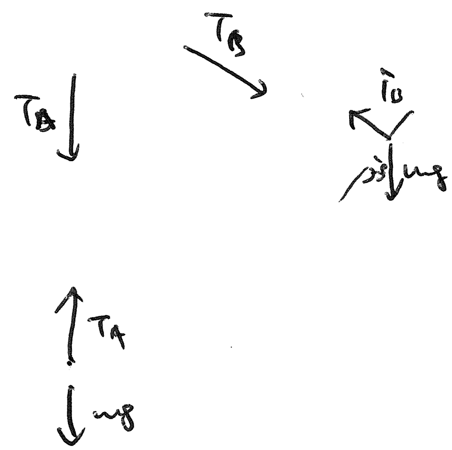
1

a) NO

b)



c) DIRECTION

CW

$$ma = mg - T_A$$

$$ma = T_B - mg\sin 30^\circ$$

$$(T_A - T_B)R = I\alpha$$

$$T_A - T_B = \frac{I\alpha}{R}$$

$$2ma = mg - (T_A - T_B) - mg\sin 30^\circ \qquad \sin 30^\circ = 1/2$$

$$2ma = mg - \frac{I\alpha}{R} - \frac{mg}{2}$$

$$2ma = \frac{mg}{2} - \frac{I\alpha}{R}$$

$$R\alpha = a$$

$$2ma + \frac{I\alpha}{R} = 49\,N \qquad 2ma + \frac{Ia}{R^2} = 49$$

$$a = \frac{49}{\left(2m + \frac{I}{R^2}\right)} = \frac{49}{(20 + 2.5)}$$

$$\frac{I}{R^2} = \frac{1}{2} 5 \cdot \frac{R^2}{R^2} = 2.5$$

$$= \frac{49}{22.5} = 2.18 \, m/s^2$$

d)

$$ma = mg - T_A$$

$$21.8 = 98 - T_A$$

$$T_A = 98 - 21.8 = \underline{76.2 \, N}$$

$$T_B - mg \sin 30° = ma$$

$$T_B - 49 = 21.8$$

$$T_B = 49 + 21.8 = \underline{70.8 \, N}$$

$$T_A - T_B = 5.4 N$$

$$5.4 \times 0.2 = I\alpha$$

$$1.08 = \frac{1}{2} 5 \cdot (0.2)^2 \alpha$$

$$\alpha = 10.8$$

PROBLEM 2

a)

$$Mgh = \frac{1}{2} I\omega^2 + \frac{1}{2} M v^2$$

$$v = R\omega \qquad \omega = \frac{v}{R}$$

$$Mgh = \frac{1}{2} I \frac{v^2}{R^2} + \frac{1}{2} M v^2$$

$$v^2 = \frac{Mgh}{\frac{1}{2}[I/R^2 + M]}$$

$$v = \sqrt{\frac{Mgh}{\frac{1}{2}[I/R^2 + M]}}$$

$$I = \frac{2}{5} MR^2$$

$$v = \sqrt{\frac{2Mgh}{[\frac{7}{5}M]}}$$

$$\boxed{v = \sqrt{\frac{10}{7} gh}}$$

b)

$$Mgh = \frac{1}{2} I\omega^2 + \frac{1}{2} M v^2 + MgD$$

$$Mg(h-D) = \frac{1}{2}\left(\frac{I}{R^2} + M\right) v^2$$

$$v_B = \sqrt{\frac{Mg(h-D)}{\frac{1}{2}\left(\frac{I}{R^2} + M\right)}}$$

$$= \sqrt{\frac{2Mg(h-D)}{\frac{7}{5}M}}$$

$$= \sqrt{\frac{10}{7} g(h-D)}$$

c)

$$N + Mg = \frac{mV^2}{D/2}$$

$$N + Mg = \frac{2mV^2}{D}$$

$$N = \frac{2mV^2}{D} - Mg \qquad N > 0$$

$$\boxed{\frac{2mV^2}{D} - Mg > 0}$$

d)

$$V^2 = \left(\sqrt{\frac{10}{7} g (h - D)}\right)^2$$

$$\frac{2V^2 m}{D} = \frac{m2}{D} \frac{10}{7} g (h - D) > Mg$$

$$\frac{20}{7} \frac{h - D}{D} > 1$$

$$20(h - D) > 7D$$

$$\boxed{h > \frac{27}{20} D}$$

P3

a) ANGULAR MOMENTUM

b) $L_i = 5\,m/s \cdot 1\,kg \cdot 1\,m = 5\,kg\,m^2/s$

$L_f = 1\,kg \; 0.5\,m \cdot V_f = 5\,kg\,m^2/s$

$$\boxed{V_f = 10\,m/s}$$

c) $L_f = 1\,kg \cdot \ell \, V_F = 5$

$$V_F = \frac{5}{\ell}$$

$$\Delta E = \frac{1}{2} m V_F^2 - \frac{1}{2} m V_i^2 = \frac{1}{2} m \left(\frac{25}{\ell^2} - 25 \right)$$

$$\Delta E = 12.5\,m \left(\frac{1}{\ell^2} - 1 \right)$$

d) WORK = FORCE x DISTANCE

$\text{TENSION} = \frac{m V^2}{R}$ $\quad V = \frac{5}{\ell}$

$$= \frac{m\,25}{\ell\,\ell^2} = \frac{25m}{\ell^3} \quad \text{OR} \quad \frac{25m}{r^3}$$

PATH INTEGRAL

WORK = $\frac{25m}{\ell^3}$

$\overrightarrow{d\ell}$

$d\ell \cdot \vec{F} = -F\,dr$

$= -\int_1^{\ell} \frac{2m}{r^3}\, dr$

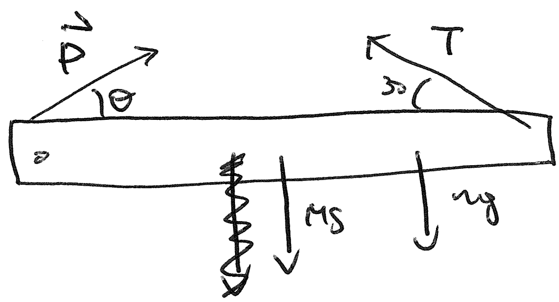
$= + \frac{25}{2} m \frac{1}{\ell^2} \Big]_1^{\ell}$

$$= \frac{25}{2} m \left[-1 + \frac{1}{\ell^2}\right]$$

ΔE = WORK

#4

a)



b) $M = 10\,kg$ $\quad m = 1\,kg$

USE TORQUE ABOUT PIVOT

$$-\frac{Mg\,\cancel{L}}{2} - mg\frac{2\cancel{L}}{3} + T\sin 30^\circ\,\cancel{L} = 0$$

$$-\frac{98}{2} - \frac{9.8\cdot 2}{3} + \frac{T}{2} = 0$$

$$T = 98 + \frac{9.8\cdot 4}{3} = \underline{111\,N}$$

c) ~~Pxn~~ $= P_x$

$F_x = 0 \Rightarrow -111\cos 30^\circ + P\cos\theta = 0$

$F_y = 0 \Rightarrow 111\sin 30^\circ + P\sin\theta = 98 + 9.8$

$P\cos\theta = 111 \sin 30° = 55.5$

$P\sin\theta = -111\cos 30° + 98 + 9.8 = -96 + 98 + 9.8$

$= 11.8$

$P\cos\theta = 111\cos 30° = \underline{96\,N}$

$P\sin\theta = -111\sin 30° + 98 + 9.8 = \underline{52.3\,N}$

$P = \sqrt{96^2 + 52.3^2} = \sqrt{9216 + 2735}$

$P = \underline{109\,N}$