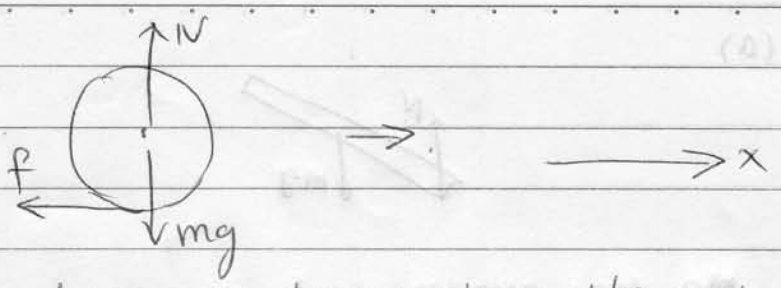
Date
NO

5. (a)



only f gives rise to nonzero torque about the center of mass.

(b) $\begin{cases} f = \mu_k N \\ N = mg \\ f = ma \end{cases}$ $a = +\mu_k g = 1.47\ m/s^2$ in the $-x$ direction

(c) $\tau = I\alpha$, $I = \frac{m}{2}r^2$, $\tau = fr$ $\Rightarrow \alpha = \frac{\tau}{I} = \frac{2\mu_k mgr}{mr^2} = \frac{2\mu_k g}{r} = 24.5\ s^{-2}$

(d) when it rolls without sliding

$$\alpha t \cdot r = v_0 - at$$
$$t(\alpha r + a) = v_0$$
$$t = \frac{v_0}{3\mu_k g} = 0.147\ s$$

(e) $\Delta E_K = \frac{1}{2}mv^2 + \frac{I}{2}\left(\frac{v}{r}\right)^2 - \frac{1}{2}mv_0^2$

$v = v_0 - at$

$\Delta E_K = \frac{3}{4}mv^2 - \frac{1}{2}mv_0^2 = \frac{3}{4}m\frac{4}{9}v_0^2 - \frac{1}{2}mv_0^2$

$= \frac{1}{3}mv_0^2 - \frac{1}{2}mv_0^2$

$= -\frac{1}{6}mv_0^2$

$= -0.0845\ J$

(f) $W = -fs = -f\left(v_0 t - \frac{a}{2}t^2\right) = -0.0845\ J$

Yes, it does.