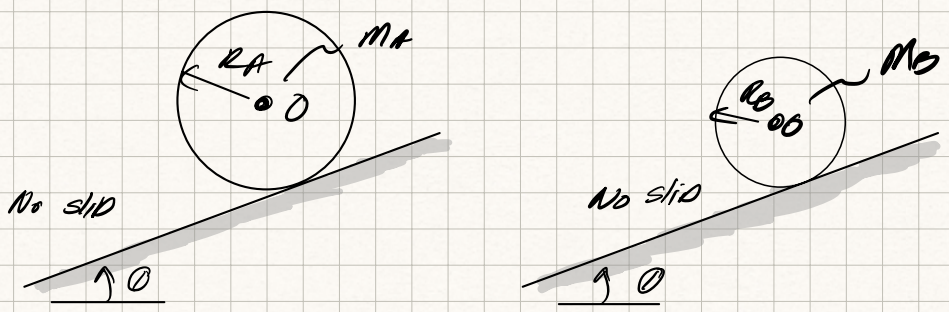
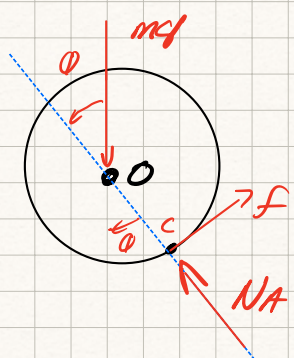
1) Consider the homogeneous of disks A and B with $m_A > m_B$ and $R_A > R_B$. The disks are released from rest. Circle the answer below that most accurately describes the relative size of the angular acceleration of the centers of the two disk, α_A and α_B on release.



Let's just look at disk A



$$\curvearrowleft \Sigma m_C : (m_A g \sin\theta) R_A = I_C \alpha_A$$

$$I_C = \tfrac{1}{2} m_A R_A^2 + m_A R_A^2$$

$$\alpha_A = \frac{m_A g \sin\theta R_A}{\tfrac{3}{2} m_A R_A^2}$$

$$\alpha_A = \frac{2}{3} g / R_A$$

if we do the same for B

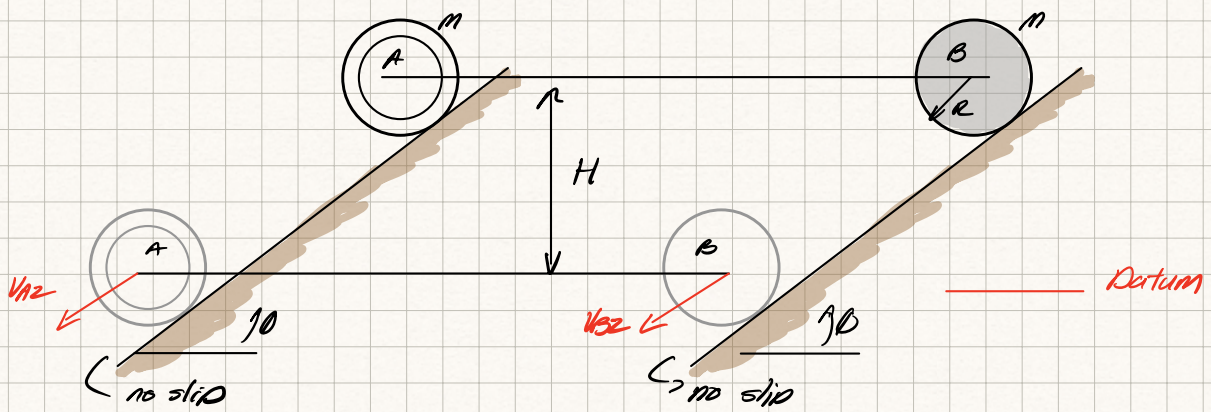
$$\alpha_B = \tfrac{2}{3} g / R_B$$

The α is a function of radius and not of mass

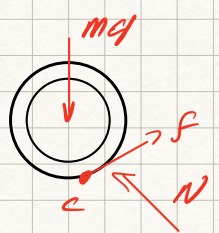
$\alpha_A = \tfrac{2}{3} g / R_A$ $\alpha_B = \tfrac{2}{3} g / R_B$ $R_A > R_B$

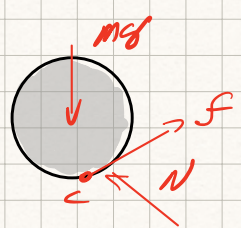
then $\alpha_A < \alpha_B$ Ans

2) The homogeneous ring and disk are released from rest at the same height. Let v_{A2} and v_{B2} represent the speed of the ring and disk after they have dropped through the same vertical distance H. What answer below that most accurately describes the relative sizes of v_{A2} and v_{B2}.



$I_A = mR^2$ $\quad I_B = \frac{1}{2}mR^2$





$v = \omega R$

$$T_1 + V_1 + \Sigma U_{1\to 2}^{NC} = T_2 + V_2$$

$T_1 = 0$

$V_1 = mgH$

$V_2 = 0$

$T_2 = \frac{1}{2}mv_{A2}^2 + \frac{1}{2}I_A\omega_2^2$

$= \frac{1}{2}\left(mv_{A2}^2 + mR^2\frac{v_{A2}^2}{R^2}\right)$

$= \frac{1}{2}(2m)v_{A2}^2$

$T_2 = 0$

$V_1 = mgH$

$V_2 = 0$

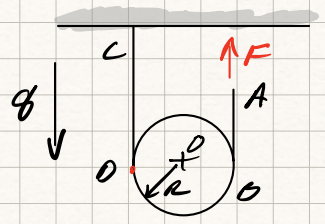
$T_2 = \frac{1}{2}mv_{B2}^2 + \frac{1}{2}I_B\omega_2^2$

$= \frac{1}{2}mv_{B2}^2 + \frac{1}{2}\left(\frac{1}{2}mR^2\right)\frac{v_{B2}^2}{R^2}$

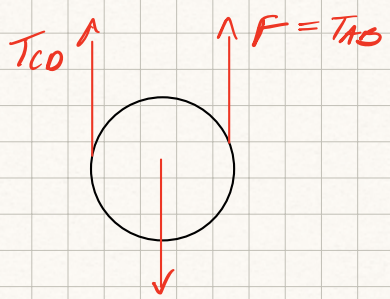
$= \frac{1}{2}\left(\frac{3}{2}m\right)v_{B2}^2$

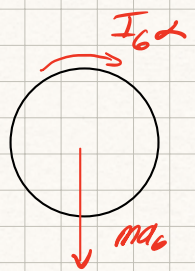
Since $V_2 - V_1$ is the same for both systems and $T_2 = -(V_2 - V_1)$ T_2 is the same for both systems but "A" has an effective mass of $2m$ and "B" has an effective mass of $\frac{3}{2}m \rightarrow v_{B2} > v_{A2}$

3) The center of the disk shown below is known to have a downward acceleration. Assume the cable does not slip on the homogeneous disk. Circle the answer below that most accurately describes the tension in sections AB and CD of the cable.



realize that disk is going to either accelerate up or down based on rolling without slip on cable CD





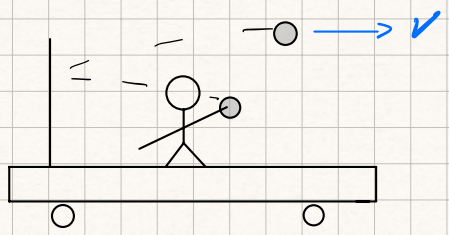
α is clockwise

$\curvearrowleft \Sigma M_G: \quad FR - T_{CD}R = I_G\alpha < 0$

$FR - T_{CD}R < 0$

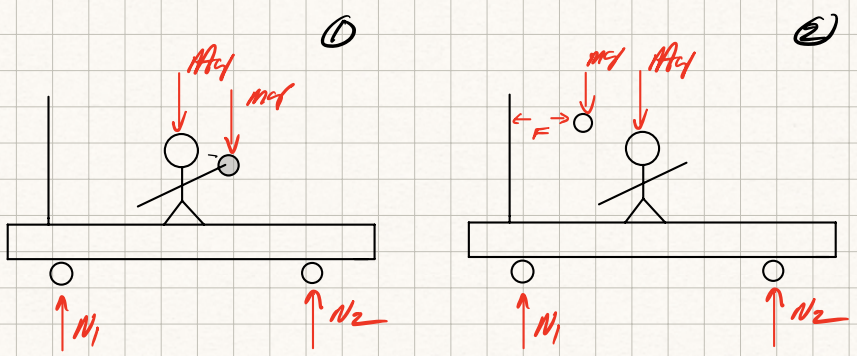
$F - T_{CD} < 0 \quad \rightarrow \quad F < T_{CD}$ or $\boxed{T_{AB} < T_{CD}}$

4) "You are on a cart that is initially at rests on a smooth track. You throw a ball at a partition that is rigidly mounted on the cart. If the ball bounces off the partition as shown in the figure, then at the instant shown in the figure



m = mass of ball

M = mass of man + cart



FBD initially FBD @ impact

Momentum is conserved for system in "x" direction

$\rightarrow$

$$M v_{cart,1x} + m v_{ball,1x} = M v_{cart,2x} + m v_{ball,2x}$$

$$v_{cart,2x} = -\frac{M v_{ball,2x}}{m}$$