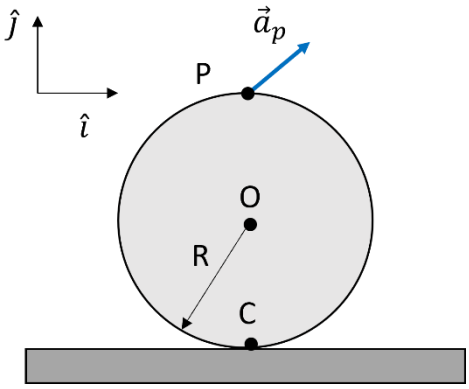
ME 274 – 12:30 section – Quiz 3 Name_____

Given: A disk of radius R is rolling without slipping on a rough stationary surface. The acceleration of point P is $\vec{a}_p = a_x\,\hat{\imath} + a_y\,\hat{\jmath}$. At the time of analysis points P, O, and C are all on the same vertical line. Point O is the center of the disk. Point C is in contact with the stationary surface.

Find: The angular acceleration of the disk. Report your answer in terms of at most a_x, a_y, and R.

Solution:



$$\vec{a}_P = \vec{a}_C + \vec{\alpha} \times \vec{r}_{P/C} - \omega^2 \vec{r}_{P/C}$$

$$\vec{a}_C = a_C \hat{\jmath}$$

$$\vec{r}_{P/C} = 2R\hat{\jmath}$$

$$a_x\hat{\imath} + a_y\hat{\jmath} = a_C\hat{\jmath} + \alpha\hat{k} \times 2R\hat{\jmath} - \omega^2 2R\hat{\jmath}$$

$$\alpha\hat{k} \times 2R\hat{\jmath} = -2\alpha R\hat{\imath}$$

$\hat{\imath}$: $\quad a_x = -2\alpha R$

$\Rightarrow$ $\quad \boxed{\vec{\alpha} = -\frac{a_x}{2R}\hat{k}}$