You are given expressions for the polar unit vectors in terms of the Cartesian unit vectors:

\[
\hat{r} = \cos \theta \hat{i} + \sin \theta \hat{j} \\
\hat{\theta} = -\sin \theta \hat{i} + \cos \theta \hat{j}
\]

Start with the position vector \( \vec{r} = r \hat{r} \) and calculate the acceleration vector \( \vec{a} \) expressed in polar coordinates.

You may need the derivatives:

\[
\frac{d}{d\theta} \cos \theta = -\sin \theta \quad \text{and} \quad \frac{d}{d\theta} \sin \theta = \cos \theta .
\]

Show all the steps in the derivation — do not use any other results that have been shown in class.

Don’t forget to be neat.