Angular Momentum

The angular momentum $\boldsymbol{l}$ of a point mass m relative to an origin is defined as

$$\boldsymbol{l} = \boldsymbol{r} \times \boldsymbol{p},$$

where $\boldsymbol{r}$ is the position vector of the mass and $\boldsymbol{p} = m\dot{\boldsymbol{r}}$ is the momentum of the mass. Show that

$$|\boldsymbol{l}| = mr^2|\dot{\theta}|.$$