$x = r\cos\phi, \ y = r\sin\phi, \ \phi = \tan^{-1}(y/x), \ \dot{\vec{r}} = \dot{r}\hat{r} + r\dot{\phi}\hat{\phi}, \ \vec{a} = (\ddot{r} - r\dot{\phi}^2)\hat{r} + (r\ddot{\phi} + 2\dot{r}\dot{\phi})p\hat{h}i$