Instructions: You are expected to finish this quiz in 15 minutes. Discussion within pairs is allowed. Bonus credits could be counted till your overall score is 10.

As in the figure below, $OD = 1, \varphi = \pi/4, \theta = \pi/6$.

1). Write out the position vector of $P$ in spherical representation (Don’t use $\hat{x}, \hat{y}$ etc). (3’)

2). Obtain the expression of $\hat{r}$ in terms of $\hat{x}, \hat{y}, \hat{z}$ (7’)

3). (Bonus) Find the components of $\overrightarrow{OD}$ with respect to $\{\overrightarrow{OP}, \hat{z}\}$ (4’)

As in the figure below, $OD = 1, \varphi = \pi/4, \theta = \pi/6$.