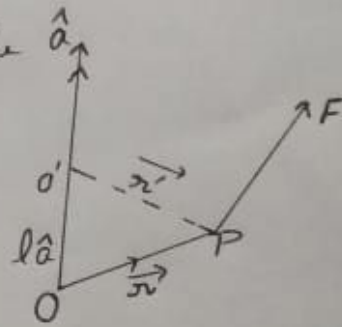


Q. ⑤ show that the scalar moment of a vector about a (directed) line is independent of the point chosen on the line.

We know that the moment of a vector \vec{F} about the (directed) line along the unit vector \hat{a} is

$$S = [\hat{a} \vec{r} \vec{F}]$$



Where \vec{r} is the position vector of any point P on the line of action of the vector \vec{F} w.r.t. a point O on the line \hat{a} .

Suppose, instead of point O on the line \hat{a} we choose another point O' on line \hat{a} such that

$$\vec{OO'} = l\hat{a}$$

Then w.r.t. O' the position vector of P is

$$\vec{r}' = \vec{r} - l\hat{a}$$

Then the moment of \vec{F} about the line \hat{a}

$$\begin{aligned} &= [\hat{a} \vec{r}' \vec{F}] \\ &= [\hat{a} \vec{r} - l\hat{a} \vec{F}] \\ &= [\hat{a} \vec{r} \vec{F}] - [\hat{a} l\hat{a} \vec{F}] \\ &= [\hat{a} \vec{r} \vec{F}] - 0 \\ &= S \end{aligned}$$

(2)

This shows that the moment of a
vector of the about a line is independent
of the point chosen on the line.