

### Answer on Question #84278 Physics / Other

If a force acting on a is given as  $\mathbf{F} = 2\hat{\mathbf{i}} - \hat{\mathbf{j}}$  and position vector of particle with respect to origin is given as  $\mathbf{r} = \hat{\mathbf{i}} + \hat{\mathbf{j}}$ , calculate torque of this force about origin.

**Solution:**

The torque of the force by definition

$$\begin{aligned}\boldsymbol{\tau} &= \mathbf{r} \times \mathbf{F} \\ &= (\hat{\mathbf{i}} + \hat{\mathbf{j}}) \times (2\hat{\mathbf{i}} - \hat{\mathbf{j}}) \\ &= 2 \underbrace{\hat{\mathbf{i}} \times \hat{\mathbf{i}}}_{0} + 2 \underbrace{\hat{\mathbf{j}} \times \hat{\mathbf{i}}}_{-\hat{\mathbf{k}}} - \underbrace{\hat{\mathbf{i}} \times \hat{\mathbf{j}}}_{\hat{\mathbf{k}}} - \underbrace{\hat{\mathbf{j}} \times \hat{\mathbf{j}}}_{0} \\ &= -3\hat{\mathbf{k}}\end{aligned}$$

**Answer:**  $\boldsymbol{\tau} = -3\hat{\mathbf{k}}$

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