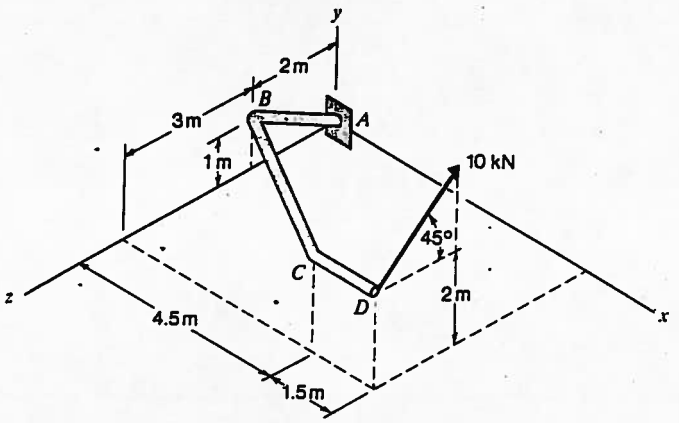
EXAMPLE

A 10 kN force is applied as shown to the free end, point D, of the bent rod. Compute the moment of this force about point B.



Solution

This is a three-dimensional problem. Therefore, we compute the moment about point B by constructing the position vector from this point to point D on the line of action of the force and then applying eq. (10). The diagram indicates that the force is parallel to the yz plane at an angle of 45° above the negative z direction. Thus

$$\bar{r}_{D/B} = 3\bar{k} + 6\bar{i} + \bar{j} \text{ m}$$

$$\bar{F} = 10(-\cos 45°\,\bar{k} + \sin 45°\,\bar{j}) = 7.071(\bar{j} - \bar{k}) \text{ kN}$$

$$\bar{M}_B = \bar{r}_{D/B} \times \bar{F} = (3\bar{k} + 6\bar{i} + \bar{j}) \times 7.071(\bar{j} - \bar{k})$$

$$= 3(7.071)\bar{k} \times \bar{j} + 6(7.071)\bar{i} \times \bar{j} - 6(7.071)\bar{i} \times \bar{k} - (7.071)\bar{j} \times \bar{k}$$

$$= -28.3\bar{i} + 42.4\bar{j} + 42.4\bar{k} \text{ kN-m}$$