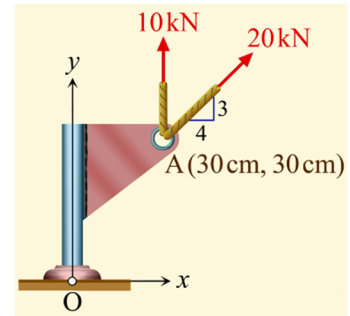


STATICS
Equilibrium of the Particle
Dr. Umit N. ARIBAS

Question : The specified forces act on a point A of a bracket welded to a post. Determine the equivalent force-couple system at point O.



Solution:

The force vectors are written in Cartesian coordinates;

$$\mathbf{F}_1 = (10\mathbf{j})\text{kN}$$

$$\mathbf{F}_2 = 20\left(\frac{4}{5}\mathbf{i} + \frac{3}{5}\mathbf{j}\right)\text{kN} = (16\mathbf{i} + 12\mathbf{j})\text{kN}$$

The resultant vector is obtained by the summation of the components having the same unit vectors;

$$\mathbf{R} = \sum \mathbf{F}_i = 10\mathbf{j} + (16\mathbf{i} + 12\mathbf{j}) = 16\mathbf{i} + 22\mathbf{j}$$

The position vector in Cartesian coordinates;

$$\mathbf{r}_A = (30\mathbf{i} + 30\mathbf{j})\text{ cm}$$

The resultant couple is determined applying the cross product;

$$\mathbf{M}_O = \mathbf{r}_A \times \mathbf{R} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 30 & 30 & 0 \\ 16 & 22 & 0 \end{vmatrix} = (30 \times 22 - 30 \times 16)\mathbf{k} = (180\mathbf{k})\text{kNcm}$$