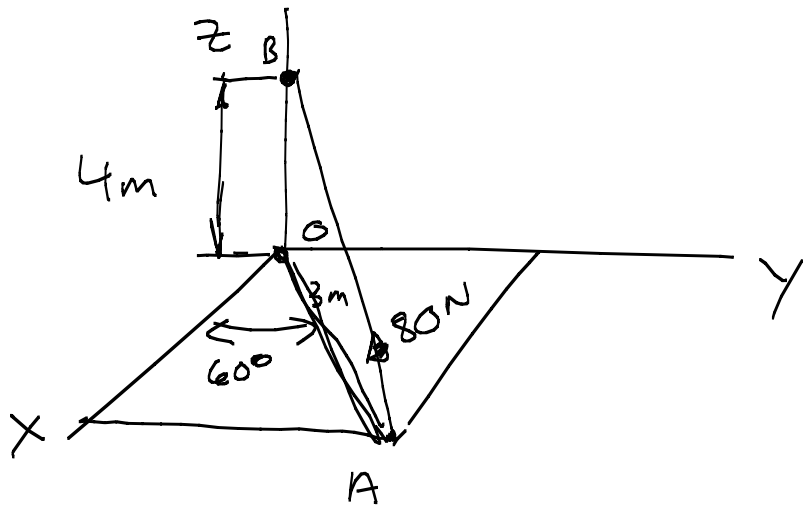
Problem 3

Given:



Determine: The magnitude of the projection of the 80 N force along OA

$O(0,0,0)$ m

$A(3\cos 60°, 3\sin 60°, 0)$ m

$B(0, 0, 4\text{ m})$

$$\vec{r}_{OA} = \{1.5\,\hat{i} + 2.6\,\hat{j} + 0\,\hat{k}\}\text{ m}$$

$$r_{OA} = 3\text{ m}$$

$$\vec{u}_{OA} = \left\{\frac{1.5}{3}\hat{i} + \frac{2.6}{3}\hat{j} + 0\hat{k}\right\} = \{0.5\,\hat{i} + 0.87\,\hat{j} + 0\hat{k}\}$$

$$\vec{r}_{AB} = \{-1.5\,\hat{i} - 2.6\,\hat{j} + 4\,\hat{k}\}\text{ m}$$

$$r_{AB} = \sqrt{(-1.5)^2 + (-2.6)^2 + (4)^2} = 5\text{ m}$$

$$\vec{u}_{AB} = \frac{\vec{r}_{AB}}{r_{AB}} = \frac{-1.5}{5}\hat{i} - \frac{2.6}{5}\hat{j} + \frac{4}{5}\hat{k}$$

$$= -0.3\hat{i} - 0.52\hat{j} + 0.8\hat{k}$$

$$\vec{F}_{AB} = F_{AB}\,\vec{u}_{AB} = (80\,N)\{-0.3\hat{i} - 0.52\hat{j} + 0.8\hat{k}\}$$

$$\vec{F}_{AB} = \{-24\hat{i} - 41.6\hat{j} + 64\hat{k}\}\,N$$

$$F_{OA} = \vec{F}_{AB} \cdot \vec{u}_{OA}$$

$$= \{-24\hat{i} - 41.6\hat{j} + 64\hat{k}\}\,N \cdot \{0.5\hat{i} + 0.87\hat{j} + 0\hat{k}\}$$

$$= (-24)(0.5) + (-41.6)(0.87) + (64)(0)$$

$$\boxed{F_{OA} = -48\,N}$$