

11장 각운동량

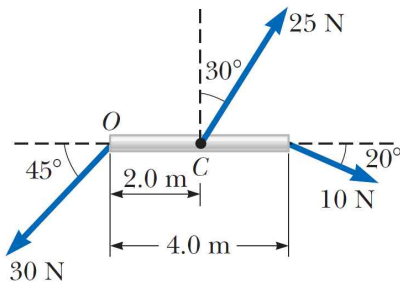
3. $\vec{A} = \hat{i} + 2\hat{j}$, $\vec{B} = -2\hat{i} + 3\hat{j}$ 에서

(a) $\vec{A} \times \vec{B} = 2\hat{i} \times \hat{i} + 3\hat{i} \times \hat{j} - 4\hat{j} \times \hat{i} + 6\hat{j} \times \hat{j} = 0 + 3\hat{k} - 4(-\hat{k}) + 0 = 7.00\hat{k}$

(b) $|\vec{A} \times \vec{B}| = AB \sin \theta$ 에서,

$$\theta = \sin^{-1}\left(\frac{|\vec{A} \times \vec{B}|}{AB}\right) = \sin^{-1}\left(\frac{7}{\sqrt{1^2+2^2}\sqrt{2^2+3^2}}\right) = 60.3^\circ$$

4.



$$\vec{f}_1 = -30(\cos 45^\circ \hat{i} + \sin 45^\circ \hat{j})$$

$$\vec{f}_2 = 25(\sin 30^\circ \hat{i} + \cos 30^\circ \hat{j})$$

$$\vec{f}_3 = 10(\cos 20^\circ \hat{i} - \sin 20^\circ \hat{j})$$

(a) $\vec{r}_1 = 0, \vec{r}_2 = 2.0\hat{i}, \vec{r}_3 = 4.0\hat{i}$

$$\sum \vec{\tau} = \vec{r}_1 \times \vec{f}_1 + \vec{r}_2 \times \vec{f}_2 + \vec{r}_3 \times \vec{f}_3$$

$$= 0 + (2.0\hat{i}) \times \{25(\sin 30^\circ \hat{i} + \cos 30^\circ \hat{j})\} + (4.0\hat{i}) \times \{10(\cos 20^\circ \hat{i} - \sin 20^\circ \hat{j})\}$$

$$= 50 \cos 30^\circ \hat{k} - 40 \sin 20^\circ \hat{k} = 30 \hat{k} \text{ N} \cdot \text{m}$$

돌림힘의 크기는 30 N · m 이고 방향은 반시계 방향

(b) $\vec{r}_1 = -2.0\hat{i}, \vec{r}_2 = 0, \vec{r}_3 = 2.0\hat{i}$

$$\sum \vec{\tau} = 60 \sin 45^\circ \hat{k} - 20 \sin 20^\circ \hat{k} = 36 \hat{k} \text{ N} \cdot \text{m}$$

돌림힘의 크기는 36 N · m 이고 방향은 반시계 방향

8. 각운동량 $\vec{L} = \vec{r} \times \vec{p} = m\vec{r} \times \vec{v}$

$$= (1.50)(1.50\hat{i} + 2.20\hat{j}) \times (4.20\hat{i} - 3.60\hat{j}) = (1.50)(-1.50 \times 3.60 - 2.20 \times 4.20)\hat{k} = -22.0 \hat{k} \text{ kg} \cdot \text{m}^2/\text{s}$$

11. $\vec{r}(t) = 6.00\hat{i} + 5.00t\hat{j}$, $\vec{v}(t) = \frac{d}{dt}\vec{r}(t) = 5.00\hat{j}$

$$\vec{L}(t) = \vec{r} \times \vec{p} = m\vec{r} \times \vec{v} = m(6.00\hat{i} + 5.00t\hat{j}) \times (5.00\hat{j}) = (2.00)(30.0)\hat{k} = 60.0 \hat{k} \text{ kg} \cdot \text{m}^2/\text{s}$$