

Physics 101-Rec
Quiz # 9

Instructor: Dr. Mekki

Name: _____

Key

Id#: _____

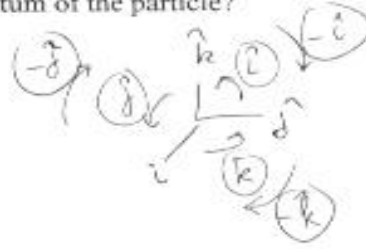
Sect.#: _____

1. At a certain time the position vector of a particle is given by $\vec{r} = 2\hat{i}$ (m). The linear momentum $\vec{p} = 3\hat{j} + 4\hat{k}$ (kg·m/s). What is the angular momentum of the particle?

$$\vec{L} = \vec{r} \times \vec{p}$$

$$= 2\hat{i} \times (3\hat{j} + 4\hat{k})$$

$$\vec{L} = 6\hat{k} - 8\hat{j}$$

$$\boxed{|\vec{L}| = 10} \quad \text{m} \cdot \frac{\text{kg} \cdot \text{m}}{\text{s}} = \frac{\text{kg} \cdot \text{m}^2}{\text{s}}$$


2. A solid sphere of radius 10 cm and mass 2 kg rolls without slipping along a horizontal floor. The kinetic energy of the sphere is 200 J. Calculate the speed of the center of mass of the sphere.

$$I_{\text{sphere}} = \frac{2}{5} mR^2$$

$$K = \frac{1}{2} m v^2 + \frac{1}{2} I \omega^2$$

$$= \frac{1}{2} m v^2 + \frac{1}{2} \left(\frac{2}{5} m R^2 \right) \frac{v^2}{R^2}$$

$$= \frac{1}{2} m v^2 + \frac{1}{5} m v^2 = \frac{7}{10} m v^2$$

$$v = \sqrt{\frac{10K}{7m}} = \boxed{12 \text{ m/s}}$$