

Physics 101Rec
Quiz#7-8-Sect 06
Chapter 9-10

Name:

Key

Id:

1. An object of mass 2.0 kg has an initial velocity $\vec{v}_i = 2.4\hat{i} - 3.6\hat{j}$ (m/s). During a time of 0.16 s, it receives an impulse $\vec{J} = 3.2\hat{i} + 4.8\hat{j}$ (N.s). Calculate the final speed of the object.

$$\begin{aligned}\text{Impulse } \vec{J} &= \Delta\vec{p} = m(\vec{v}_f - \vec{v}_i) \\ \vec{v}_f &= \frac{\vec{J}}{m} + \vec{v}_i = (1.6\hat{i} + 2.4\hat{j}) + (2.4\hat{i} - 3.6\hat{j}) \\ \vec{v}_f &= (4.0\hat{i} - 1.2\hat{j}) \text{ m/s} \\ \text{Speed } |\vec{v}_f| &= \sqrt{(4)^2 + (-1.2)^2} = \boxed{4.17 \text{ m/s}}\end{aligned}$$

2. A wheel with rotational inertia of 80 kg.m² is rotating with an initial angular velocity of 30 rad/s. If a torque of magnitude 160 N.m is applied to decelerate the wheel for 5.0 sec, what is the final angular speed of the wheel?

$$\tau_{\text{net}} = I\alpha \Rightarrow \alpha = \frac{\tau_{\text{net}}}{I} = -\frac{160}{80}$$

$$\alpha = -2 \text{ rad/s}^2.$$

$$\omega = \omega_0 + \alpha t = 30 - 2 \times 5 = \boxed{20 \text{ rad/s}}$$