

Question

A 4 kg ball having velocity $(7\mathbf{i} + 6\mathbf{j})$ m/s collides and bounces off a wall with a velocity of $(-3\mathbf{i} + 6\mathbf{j})$ m/s. The ball is in contact with the wall for 0.01 s. In unit-vector notation, what are a) the impulse and b) the average force on the ball from the wall.

Answer

$$m = 4 \text{ kg}; \vec{v}_1 = 7\vec{i} + 6\vec{j} \frac{m}{s}; \vec{v}_2 = -3\vec{i} + 6\vec{j} \frac{m}{s}; \Delta t = 0.01 \text{ s}$$

a) For the impulse we obtain

$$\vec{I} = \Delta \vec{p} = \vec{p}_2 - \vec{p}_1 = m(\vec{v}_2 - \vec{v}_1) = 4((-3 - 7)\vec{i} + (6 - 6)\vec{j}) \frac{\text{kg} * \text{m}}{\text{s}} = -40 * \vec{i} \frac{\text{kg} * \text{m}}{\text{s}}$$

b)

$$\vec{F} \Delta t = \vec{I} \rightarrow \vec{F} = \frac{\vec{I}}{\Delta t} = -4000 * \vec{i} \text{ N}$$