Question

A 4 kg ball having velocity (7i + 6j) m/s collides and bounces off a wall with a velocity of (-3i + 6j) 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

$$m = 4 \; kg; \; \vec{v_1} = 7\vec{i} + 6\vec{j} \; \frac{m}{s}; \; \vec{v_2} = -3\vec{i} + 6\vec{j} \; \frac{m}{s}; \quad \Delta t = 0.01 \; s$$

a) For the impulse we obtain

$$\vec{I} = \overrightarrow{\Delta p} = \overrightarrow{p_2} - \overrightarrow{p_1} = m(\overrightarrow{v_2} - \overrightarrow{v_1}) = 4\big((-3-7)\vec{i} + (6-6)\vec{j}\big) \frac{kg * m}{s} = -40 * \vec{i} \; \frac{kg * m}{s}$$

b)

$$\vec{F} \Delta t = \vec{I} \; \rightarrow \; \vec{F} = \frac{\vec{I}}{\Delta t} = -4 \; 000 * \vec{i} \; N$$