

Answer on Question #73297-Physics-Mechanics-Relativity

Cow 1: 400 kg and going 3 m/s. Cow 2: 500 kg and going 2 m/s Two cows collide with different masses and velocities and jet off 40 degrees to the right of original direction and 50 degrees to the left of original direction. Find the velocity of each cow.

Solution

From the conservation of momentum in x-direction:

$$m_1 v_1 + m_2 v_2 = m_1 v'_1 \cos 40 + m_2 v'_2 \cos 50$$

From the conservation of momentum in y-direction:

$$0 = m_1 v'_1 \sin 40 - m_2 v'_2 \sin 50$$

$$v'_2 = v'_1 \frac{m_1 \sin 40}{m_2 \sin 50}$$

So,

$$m_1 v_1 + m_2 v_2 = m_1 v'_1 \cos 40 + m_2 v'_1 \frac{m_1 \sin 40}{m_2 \sin 50} \cos 50$$

$$v'_1 = \frac{m_1 v_1 + m_2 v_2}{m_1 \cos 40 + m_1 \cot 50 \sin 40}$$

$$v'_1 = \frac{v_1 + \frac{m_2}{m_1} v_2}{\cos 40 + \cot 50 \sin 40}$$

$$v'_1 = \frac{3 + \frac{5}{4} 2}{\cos 40 + \cot 50 \sin 40} = 4.2 \frac{m}{s}$$

$$v'_2 = \frac{3 + \frac{5}{4} 2}{\cos 40 + \cot 50 \sin 40} \frac{4 \sin 40}{5 \sin 50} = 2.8 \frac{m}{s}$$

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