

## Answer on Question #76259, Physics Mechanics Relativity

Two automobiles of equal mass approach an intersection. One vehicle is traveling with velocity 14.0 m/s toward the east and the other is traveling north with speed  $v_{2i}$ . Neither driver sees the other. The vehicles collide in the intersection and stick together, leaving parallel skid marks at an angle of  $60.0^\circ$  north of east. Determine the initial speed  $v_{2i}$  of the northward-moving vehicle.

### Solution.

Write the law of conservation of momentum in x and y projections

$$mv_{1x} + mv_{2x} = Mv_{total\ x} \cdot \cos 60^\circ$$

$$mv_{1y} + mv_{2y} = Mv_{total\ y} \cdot \sin 60^\circ$$

Where  $M = 2m$

Receive  $v_{1x} = 2v_{total\ x} \cdot \cos 60^\circ$ , because  $mv_{2x} = 0$

$mv_{2y} = 2v_{total\ y} \cdot \sin 60^\circ$ , because  $mv_{1y} = 0$

Here  $14 = 2v_{total\ x} \cdot \frac{1}{2}$

$$v_{total\ x} = 14$$

From basic trigonometry

$$v_{total\ y} = v_{total\ x} \cdot \tan 60 = 14 \cdot \sqrt{3}$$

$$mv_{2y} = 2v_{total\ y} \cdot \sin 60^\circ = 2 \cdot 14 \cdot \sqrt{3} \cdot \frac{\sqrt{3}}{2} = 42 \frac{m}{s}$$

**Answer:**  $mv_{2y} = 42 \frac{m}{s}$

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