

Momentum 2 Dimensional example 1
 A 20.0 kg cart moving east at 2.0 m/s collides and becomes coupled to a 15.0 kg cart which was initially moving South at a speed of 4.0 m/s. What is the common velocity after collision?

$\vec{p}_1 = m_1 v_1$
 $= (20\text{ kg})(2.0\text{ m/s})$
 $= 40\text{ kg}\cdot\text{m/s East}$
 $\vec{p}_2 = m_2 v_2$
 $= (15\text{ kg})(4.0\text{ m/s})\text{ South}$
 $= 60\text{ kg}\cdot\text{m/s South}$

$\vec{p}_1 = \vec{p}_T$
 $\tan\theta = \frac{60}{40}$
 $\theta = \tan^{-1}\left(\frac{60}{40}\right)$
 $\theta = 56.3^\circ$

$P_T^2 = 40^2 + 60^2$
 $P_T = 72.1\text{ kg}\cdot\text{m/s}$

$P_T = 72.1\text{ kg}\cdot\text{m/s} \text{ @ } 146.3^\circ$

$P = P_T = 72.1\text{ kg}\cdot\text{m/s}$

$\vec{v}' = \frac{P'}{m} = \frac{72.1\text{ kg}\cdot\text{m/s}}{20\text{ kg} + 15\text{ kg}} = 2.06\text{ m/s}$

$v' = 2.06\text{ m/s} \text{ @ } 146.3^\circ$

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