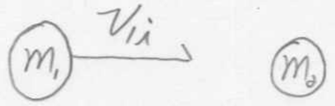
Ch9, #61



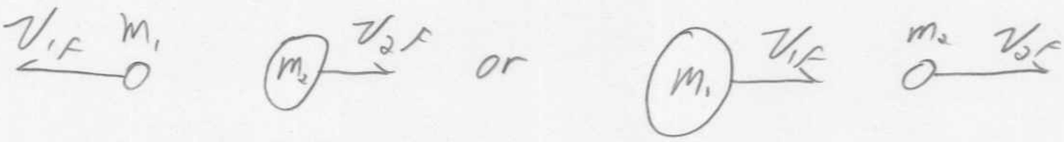
After the collision, m_2 has half of the initial kinetic energy. Since energy is conserved, m_1 must have the other half.

$K_{1i} = 2K_{1f}$ or $\frac{1}{2}\cancel{m_1}v_{1i}^2 = \cancel{m_1}v_{1f}^2$

$$v_{1i}^2 = 2v_{1f}^2$$

K is independant of direction, so v_{1f} could be positive or negative:

$$v_{1i} = \pm\sqrt{2}\, v_{1f}$$



1D elastic collision

$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2}v_{1i} + \cancelto{0}{\frac{2m_2}{m_1+m_2}v_{2i}}$$

$$\cancel{v_{1f}} = \frac{m_1 - m_2}{m_1 + m_2}\pm\sqrt{2}\,\cancel{v_{1f}}$$

$$m_1 + m_2 = \pm\sqrt{2}\,m_1 - \pm\sqrt{2}\,m_2 \Rightarrow m_1(1 - \pm\sqrt{2}) = -m_2(1 + \pm\sqrt{2})$$

$$\frac{m_1}{m_2} = -\frac{1 + \pm\sqrt{2}}{1 - \pm\sqrt{2}} = \boxed{\frac{\pm\sqrt{2} + 1}{\pm\sqrt{2} - 1}}$$

Ch 9, #61 continued

Then, if $\dfrac{m_1}{m_2} = \dfrac{\pm\sqrt{2}+1}{\pm\sqrt{2}-1}$, we can multiply both sides by 1

and we have $\dfrac{(\pm\sqrt{2}+1)}{(\pm\sqrt{2}-1)} \cdot \dfrac{(\pm\sqrt{2}+1)}{(\pm\sqrt{2}+1)}$ this equals 1

$$\Rightarrow \frac{2+2\pm\sqrt{2}+1}{2-1} = \frac{3+2\pm\sqrt{2}}{1}$$

$$\Rightarrow \boxed{\frac{m_1}{m_2} = 3 \pm \sqrt{8}}$$