55. Let $m_n = 1.0$ u be the mass of the neutron and $m_d = 2.0$ u be the mass of the deuteron. In our manipulations we treat these masses as "exact", so, for instance, we write $m_n/m_d = \frac{1}{2}$ in our simplifying steps. We assume the neutron enters with a velocity $\vec{v}_\mathrm{o}$ pointing in the $+x$ direction and leaves along the positive y axis with speed v_n. The deuteron goes into the fourth quadrant with velocity components $v_{dx} > 0$ and $v_{dy} < 0$. Conservation of the x component of momentum leads to

$$m_n v_\mathrm{o} = m_d v_{dx} \implies v_{dx} = \frac{1}{2} v_\mathrm{o}$$

and conservation of the y component leads to

$$0 = m_n v_n + m_d v_{fy} \implies v_{dy} = -\frac{1}{2} v_\mathrm{n} \ .$$

Also, the collision is elastic, so kinetic energy "conservation" leads to

$$\frac{1}{2} m_n v_\mathrm{o}^2 = \frac{1}{2} m_n v_n^2 + \frac{1}{2} m_d v_d^2$$

which we simplify by multiplying through with $2/m_n$ and using $v_d^2 = v_{dx}^2 + v_{dy}^2$

$$v_\mathrm{o}^2 = v_n^2 + \frac{m_d}{m_n}\left(v_{dx}^2 + v_{dy}^2\right) \ .$$

Now we substitute in the relations found from the momentum conditions:

$$v_\mathrm{o}^2 = v_n^2 + 2\left(\frac{v_\mathrm{o}^2}{4} + \frac{v_n^2}{4}\right) \implies v_n = v_\mathrm{o}\sqrt{\frac{1}{3}} \ .$$

Finally, we set up a ratio expressing the (relative) loss of kinetic energy (by the neutron).

$$\frac{K_\mathrm{o} - K_n}{K_\mathrm{o}} = 1 - \frac{v_n^2}{v_\mathrm{o}^2} = 1 - \frac{1}{3} = \frac{2}{3} \ .$$