12. By the work-kinetic energy theorem,

$$\begin{aligned} W &= \Delta K \\ &= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2 \\ &= \frac{1}{2}(2.0\,\mathrm{kg})\left((6.0\,\mathrm{m/s})^2 - (4.0\,\mathrm{m/s})^2\right) \\ &= 20\ \mathrm{J}\ . \end{aligned}$$

We note that the *directions* of $\vec{v}_f$ and $\vec{v}_i$ play no role in the calculation.