49. (a) We use Fig. 10-16 of the text (which treats both angles are positive-valued, even though one of them is in the fourth quadrant; this is why there is an explicit minus sign in Eq. 10-43 as opposed to it being implicitly in the angle). We take the cue ball to be body 1 and the other ball to be body 2. Conservation of the x component of the total momentum of the two-ball system leads to $mv_{1i} = mv_{1f}\cos\theta_1 + mv_{2f}\cos\theta_2$ and conservation of the y component leads to $0 = -mv_{1f}\sin\theta_1 + mv_{2f}\sin\theta_2$. The masses are the same and cancel from the equations. We solve the second equation for $\sin\theta_2$:

$$\sin\theta_2 = \frac{v_{1f}}{v_{2f}}\,\sin\theta_1 = \left(\frac{3.50\,\mathrm{m/s}}{2.00\,\mathrm{m/s}}\right)\sin 22.0^\circ = 0.656\ .$$

Consequently, the angle between the second ball and the initial direction of the first is $\theta_2 = 41.0^\circ$.

(b) We solve the first momentum conservation equation for the initial speed of the cue ball.

$$\begin{aligned} v_{1i} &= v_{1f}\cos\theta_1 + v_{2f}\cos\theta_2 \\ &= (3.50\,\mathrm{m/s})\cos 22.0^\circ + (2.00\,\mathrm{m/s})\cos 41.0^\circ \\ &= 4.75\ \mathrm{m/s}\ . \end{aligned}$$

(c) With SI units understood, the initial kinetic energy is

$$K_i = \frac{1}{2}mv_i^2 = \frac{1}{2}m(4.75)^2 = 11.3m$$

and the final kinetic energy is

$$K_f = \frac{1}{2}mv_{1f}^2 + \frac{1}{2}mv_{2f}^2 = \frac{1}{2}m\left((3.50)^2 + (2.00)^2\right) = 8.1m\ .$$

Kinetic energy is not conserved.