54. The problem involves the completely inelastic collision of the two children followed by their completely inelastic collision with the (already moving) man. Speeds are given but no angles, so we are free to orient our $-x$ axis along the direction of motion of the man before his collision with the children (so his angle is 180°). The magnitude of the man's momentum before that collision is $(75\,\text{kg})(2.0\,\text{m/s}) = 150$ kg·m/s. Thus, with SI units understood, the second collision is described by momentum conservation:

$$\vec{p} + (150 \angle 180^\circ) = 0$$

which yields the momentum of the stuck-together children $\vec{p} = (150 \angle 0^\circ)$ in magnitude-angle notation. We now describe the first collision (of the two children) using momentum conservation:

$$\vec{p}_1 + \vec{p}_2 = (150 \angle 0^\circ) \quad \text{or} \quad 150\,\hat{\text{i}}$$

where the unit-vector notation has also been used, in case the magnitude-angle notation is less familiar. Now, since $m_1 = m_2 = 30$ kg and $|\vec{p}_1| = |\vec{p}_2| = 120$ kg·m/s, we see that the y components of the children's initial velocities must be equal and opposite. Therefore, if child 1 has an initial velocity angle θ then child 2 has an initial velocity angle $-\theta$. The previous equation becomes

$$120\cos(\theta) + 120\cos(-\theta) = 150$$

which has the solution $\theta = 51^\circ$. The angle between the children (initially) is therefore $2\theta \approx 103^\circ$.