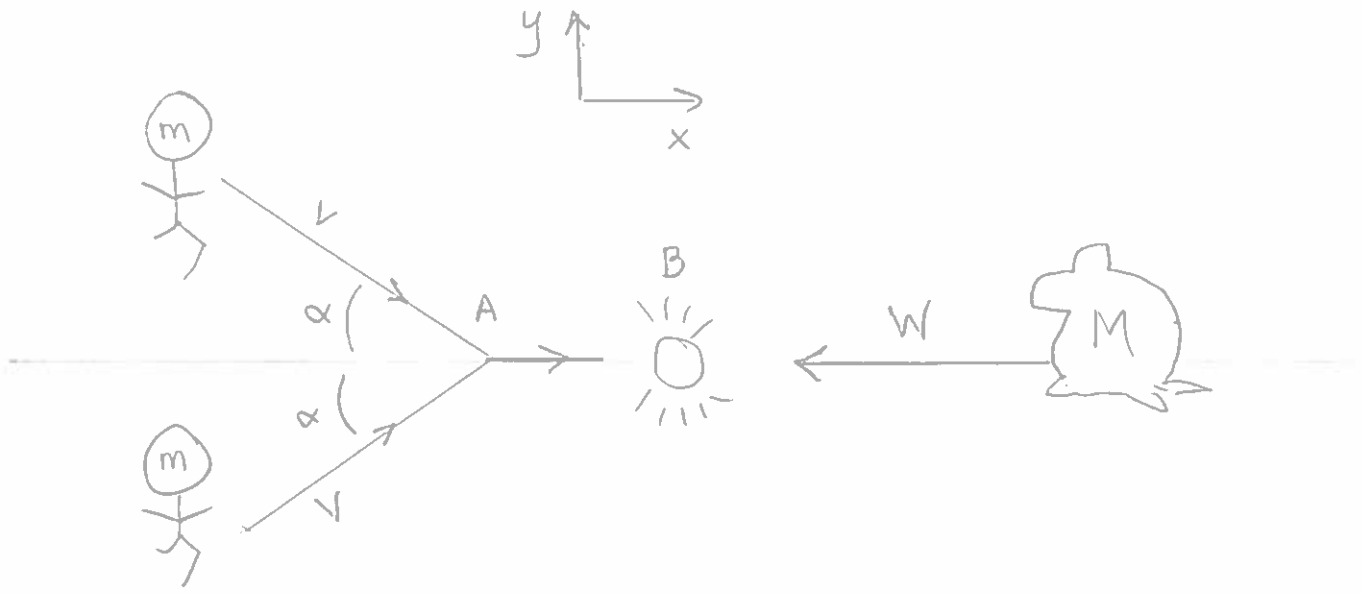


Two children of mass $m = 35$ kg, each sliding with speed $v = 6 \frac{m}{s}$, collide and stick together at point A. Together, they continue to slide to the right. At point B, they run into a polar bear of mass $M = 76$ kg, who was sliding to the left at $w = 1$ m/s. They all stick togther, and are motionless.

What was the angle between initial velocities of the children?

Use momentum.

Before			After		
object	x	y	object	x	y
top child	$+mv\cos\alpha$	$-mv\sin\alpha$	top child	0	0
bottom child	$+mv\cos\alpha$	$+mv\sin\alpha$	bottom child	0	0
bear	$-Mw$	0	bear	0	0
total	$2mv\cos\alpha - Mw$	0		0	0

From the X-direction, we see

$$\underset{\text{before}}{2mv\cos\alpha} - \underset{\text{after}}{Mw} = 0$$

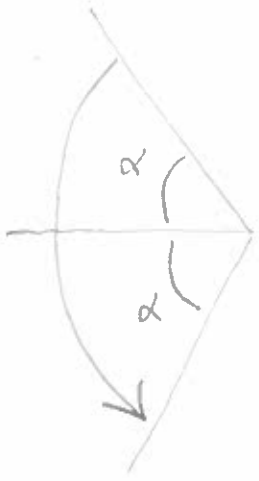
So we can solve for the angle α:

$$\cos\alpha = \frac{Mw}{2mv}$$

$$= \frac{(76\,kg)(1\,m/s)}{2(35\,kg)(6\,m/s)}$$

$$\cos\alpha = 0.181$$

$$\rightarrow \quad \alpha = \cos^{-1}(0.181) = 79.6^\circ$$



The angle between the two initial velocities of the children is $\boxed{\alpha + \alpha = 159.1^\circ}$