

56. We denote the velocity of the player with \vec{v}_1 and the relative velocity between the player and the ball be \vec{v}_2 . Then the velocity \vec{v} of the ball relative to the field is given by $\vec{v} = \vec{v}_1 + \vec{v}_2$. The smallest angle θ_{\min} corresponds to the case when $\vec{v} \perp \vec{v}_1$. Hence,

$$\begin{aligned}\theta_{\min} &= 180^\circ - \cos^{-1} \left(\frac{|\vec{v}_1|}{|\vec{v}_2|} \right) \\ &= 180^\circ - \cos^{-1} \left(\frac{4.0 \text{ m/s}}{6.0 \text{ m/s}} \right) \\ &\approx 130^\circ .\end{aligned}$$

