

21-P-FA-AG-013

An adventurer, still running from a scary monster, has come across a fast-flowing river. Their only option to escape is to cross the river. The river is D_1 meters across and the water flows at $V_1 \frac{m}{s}$. The adventurer can row at $V_2 \frac{m}{s}$ in still water. They can also hear the roar of a raging waterfall only D_2 meters downstream. Determine the angle that the adventurer must angle their boat into the current to get straight across the river. Also determine the speed of the boat from the perspective of the monster, who got to the river just after the adventurer started their crossing.

ANSWER:

For the boat to get straight across the river, the speed of the current must match the component of the speed of the boat in the upstream direction.

$$V_1 - V_2 \sin(\theta) = 0 \rightarrow \theta = \sin^{-1}\left(\frac{V_1}{V_2}\right)$$

From the perspective of the monster, the boat is crossing straight across the river, so

$$v_{from\ the\ monster's\ perspective} = V_2 \cos(\theta)$$