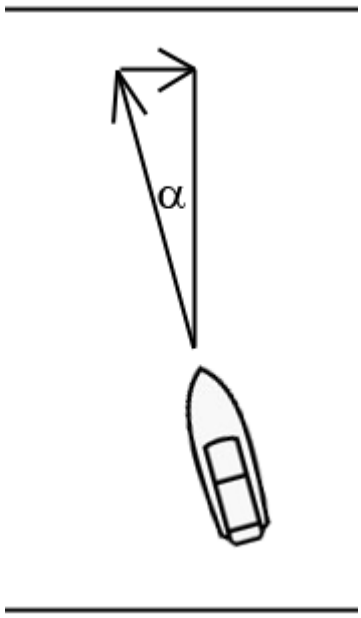
Question #60202, Physics / Mechanics | Relativity

The speed of a boat is 5 km/hr in still water. It crosses a river of width 1.0 km along the shortest possible path in 15 minute. The velocity of the river water (km/h) is
(1) 3
(2) 1
(3) 4
(4) 5

Solution.
To cross the river in the shortest path, the boat must move perpendicular to the shores. Therefore, the boat should move at a specific angle α, so that its own speed will compensate the lateral displacement caused by the flow speed:



The resulting speed of the boat in respect to the shores:

$$v_{boat}^2 = v_{cross}^2 + v_{flow}^2$$

At the same time:

$$v_{cross} = \frac{d}{\Delta t} = \frac{1}{15/60} = 2.5 \text{ km/h}$$

$$v_{flow} = \sqrt{v_{boat}^2 - v_{cross}^2} = \sqrt{5^2 - 2.5^2} = 4.33 \text{ km/h}$$