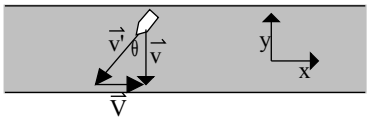
Chapter 3 Problem 29 [†]



Given
$V = 0.57\ m/s$ (speed of river)
$v' = 1.3\ m/s$ (speed of boat relative to the water)
$v =$? (speed of the boat relative to the shore)
$d = 63\ m$ (width of the river)

Solution
a) In what direction should you head your boat?

Since you want to travel straight across the river, you want the x-component of your boats velocity to cancel the velocity of the current. Since the desired direction of travel is perpendicular to the current, the vectors form a right triangle. The angle for the direction of travel is then

$$\sin\theta = \frac{V}{v'} = \frac{0.57\ m/s}{1.3\ m/s}$$

$$\theta = 26^\circ\ upstream$$

b) How long will it take to get across the river?

The velocity of the boat with respect to the shore is found using the right triangle in the diagram.

$$\cos\theta = \frac{v}{v'}$$

$$v = v'\cos\theta = (1.3\ m/s)\cos(26.0^\circ)$$

$$v = 1.17\ m/s$$

Since the velocity is constant, the time is calculated from the formula $d = v \cdot t$

$$t = \frac{d}{v} = \frac{63\ m}{1.17\ m/s} = 54\ s$$

[†]Problem from Essential University Physics, Wolfson