

**Learning Goal:** I will be able to use vectors to model and solve real-world problems involving velocity.

**Minds On:** The trouble with wind...groups

**Action:** 1. Example - boating!  
2. Practice on page 369

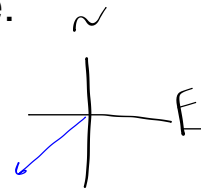
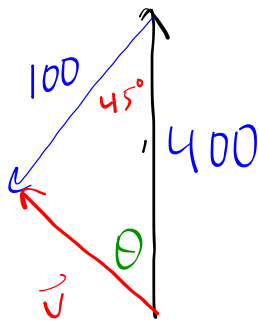
**Consolidation:** Exit Question

**Minds On**

# Finishing Yesterday

### Minds On

A plane is heading due north with an air speed of 400 km/h when it is blown off course by a wind of 100 km/h from the northeast. Determine the resultant ground velocity of the airplane.



$$|\vec{v}| = \sqrt{100^2 + 400^2 - 2(100)(400)\cos 45^\circ}$$

$$|\vec{v}| = 336.4 \text{ km/h}$$

$$\frac{\sin \theta}{100} = \frac{\sin 45^\circ}{336.4}$$

$$\theta = 12.1^\circ$$

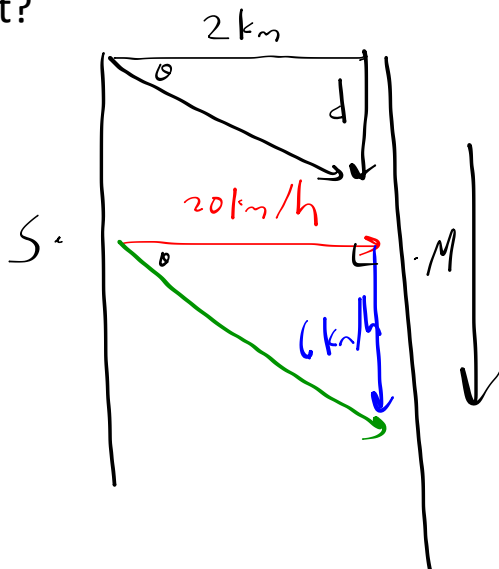
$\therefore$  ground velocity

$$\therefore 336.4 \text{ km/h } [N 12.1^\circ W]$$

## Action

**Example 1:** A river is 2 km wide and flows at 6 km/h. Anna is driving a motorboat, which has a speed of 20 km/h in still water and she heads out from one bank in a direction perpendicular to the current. A marina lies directly across the river from the starting point on the opposite bank.

a) How far downstream from the marina will the current push the boat?

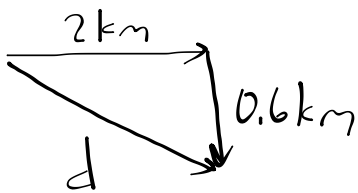


$$\frac{6 \times 2}{20} = \frac{d}{6}$$

$$d = 0.6 \text{ km}$$

## Action

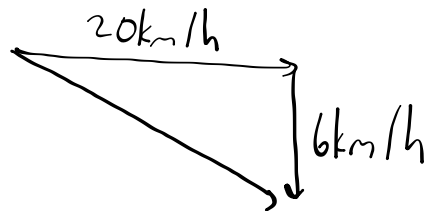
b) How long will it take for the boat to cross the river?



$$d = \sqrt{2^2 + 0.6^2}$$

$$d = 2.09 \text{ km}$$

$$s = \frac{d}{t}$$



$$s = \sqrt{20^2 + 6^2}$$

$$s = 20.9 \text{ km/h}$$

$$t = \frac{d}{s}$$

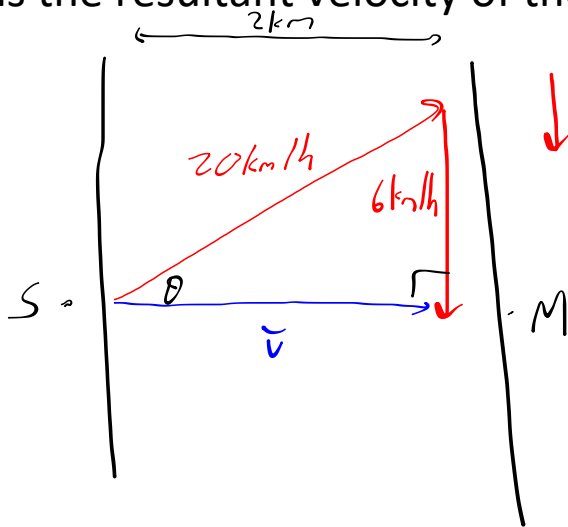
$$= \frac{2.09}{20.9}$$

$$= 0.1 \text{ h}$$

or 6 minutes

## Action

c) If Anna decides that she wants to end up directly across the river at the marina, in what direction should she head? What is the resultant velocity of the boat?



$$|\vec{v}| = \sqrt{20^2 - 6^2}$$

$$|\vec{v}| = 19.1 \text{ km/h}$$

$$\sin \theta = \frac{6}{20}$$

$$\theta = 17.5^\circ$$

She heads out at an angle of  $17.5^\circ$  upstream. Her resultant velocity is  $19.1 \text{ km/h}$  perpendicular to the shore.

## **Consolidation**

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