Boat Problems /Acmes Problems
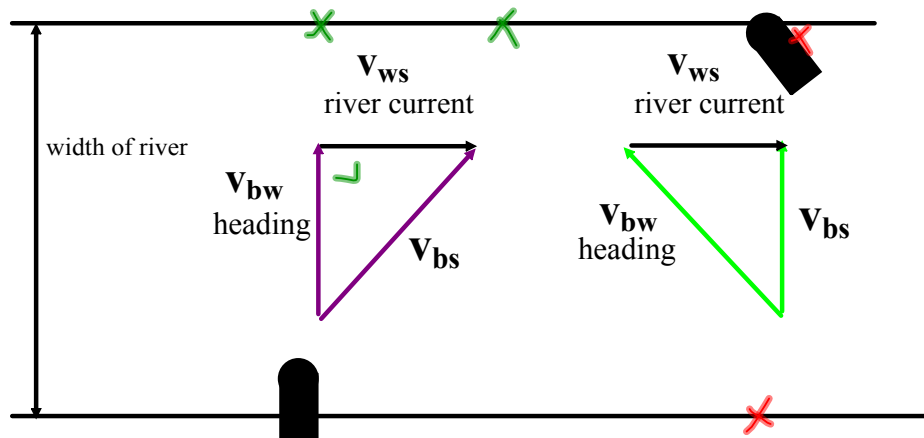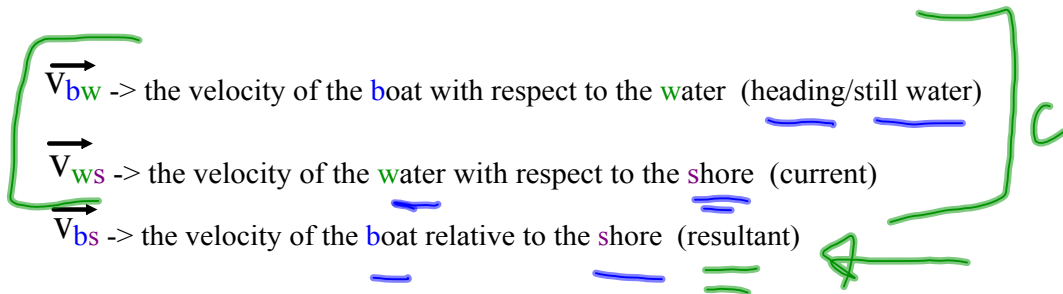
Boat Simulation

Vectors Not Along The Same Line ✓

If the velocities are not along the same line, <u>vector addition</u> must be used.

I. BOAT PROBLEMS ✓ / Plane Problems

<u>Example</u>: Imagine a boat crossing a river. Consider the following velocities:

$\overrightarrow{V_{bw}}$ -> the velocity of the boat with respect to the water (heading/still water)

$\overrightarrow{V_{ws}}$ -> the velocity of the water with respect to the shore (current)

$\overrightarrow{V_{bs}}$ -> the velocity of the boat relative to the shore (resultant)

width of river

V_{ws}
river current

V_{ws}
river current

V_{bw}
heading

V_{bs}

V_{bw}
heading

V_{bs}

$\overrightarrow{V_{bs}} = \overrightarrow{V_{bw}} + \overrightarrow{V_{ws}}$
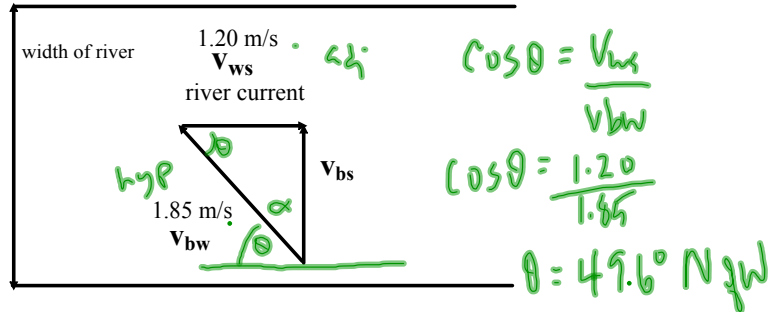
first   last

Do <u>NOT</u> just add the terms on the right. You need to find the resultant of the two vectors.
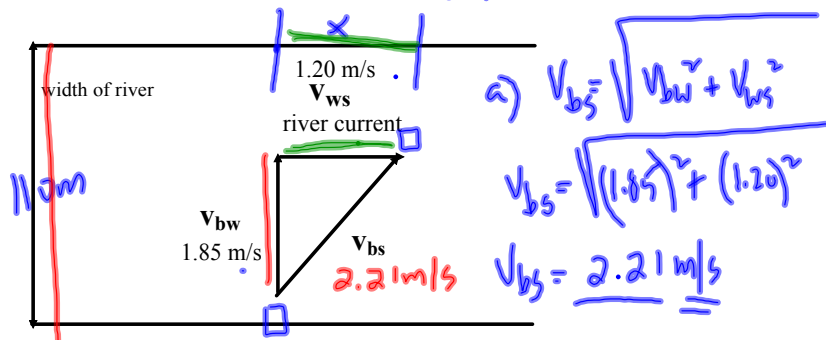
Law of Pythagoras.

TRY

1. A boat's speed in still water is 1.85 m/s. If the boat is to travel directly across a river whose current has a speed of 1.20 m/s, at what angle must the boat head relative to the shore? ($49.6°$ N of W)

width of river

1.20 m/s
V_{ws}
river current

hyp

V_{bs}

1.85 m/s
V_{bw}

θ

α

$$\cos\theta = \frac{V_{ws}}{V_{bw}}$$

$$\cos\theta = \frac{1.20}{1.85}$$

$$\theta = 49.6° \text{ N } \text{of} \text{ W}$$

2. The same boat now heads directly across the river.
  a) What is the magnitude of **v_{bs}**? (2.21 m/s)
  b) If the river is 110 m wide, how long will it take to cross the river and how far downstream will the boat be then? (59.5 s, 71.4 m)

$t = ?$

width of river

1.20 m/s
V_{ws}
river current

110m

V_{bw}
1.85 m/s

V_{bs}
2.21 m/s

a) $V_{bs} = \sqrt{V_{bw}^2 + V_{ws}^2}$

$V_{bs} = \sqrt{(1.85)^2 + (1.20)^2}$

$V_{bs} = \underline{2.21 \text{ m/s}}$

b) $\vec{V} = \frac{\vec{d}}{t}$

$V_{bw} = \frac{d}{t}$

$t = \frac{d}{V_{bw}}$

$t = \frac{110m}{1.85 m/s}$

$t = 59.5 s$

$V = \frac{d}{t} = \frac{x}{t}$

$x = V_{ws} t$

$x = (1.20 m/s)(59.5 s)$

$x = 71.4 m$

Attachments

Physics 122 - Review Exercise.doc

Physics 121 - Type II Force Problems.doc