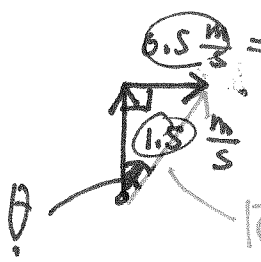
IB Math 2: Vector Application

Name: Key period: ____

1. In still water, Jacques, can swim at 1.5 m/s. Jacques is at point A on the edge of a canal, and considers point B directly opposite. A current is flowing from the left at a constant speed of 0.5 m/s.

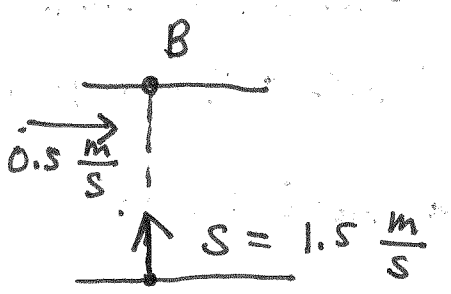
   a. If Jacques dives in straight towards B, and swims without allowing for the current, what will his actual speed and direction be?



θ: direction.

$\theta = \tan^{-1}\left(\frac{0.5}{1.5}\right) \approx 18.4°$

|a|: speed influenced by current

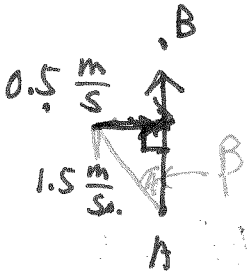


$a^2 = (1.5)^2 + (0.5)^2$

$\Rightarrow a = \sqrt{(1.5)^2+(0.5)^2} \approx 1.58 \frac{m}{s}$

   b. Jacques wants to swim directly across the canal to point B.

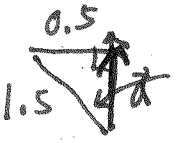
   (i) At what angle should Jacques aim to swim in order that the current will correct his direction?



$\sin\beta = \frac{0.5}{1.5}$

$\beta = \sin^{-1}\left(\frac{0.5}{1.5}\right) \approx 19.5°$

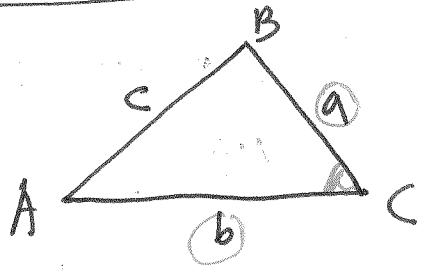
   (ii) What will Jacques' actual speed influenced by the current toward to B be?



$\vec{a}$: actual speed

$(1.5)^2 = (0.5)^2 + a^2$

$a = \sqrt{(1.5)^2 - (0.5)^2} = 1.41 \frac{m}{s}$

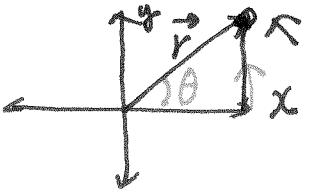


$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$c^2 = a^2 + b^2 - 2 \cdot ab \cdot \cos C$ (SAS)

Vector in $xi + yj$ form.

$= |r|\cos\theta\, i + |r|\sin\theta\, j$



$(|r|\cos\theta, |r|\sin\theta)$

2. Sam walks 6 miles on a bearing of 50° ($\overrightarrow{AB}$), then another 4 miles on a bearing of 170° ($\overrightarrow{BC}$).

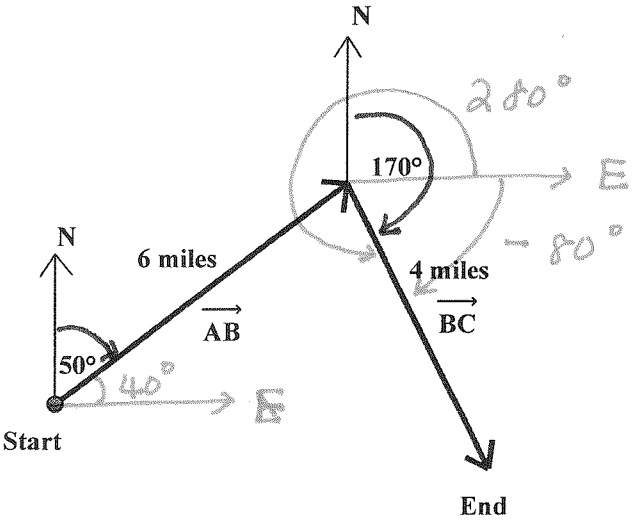
a. Write the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$ in $xi + yj$ form.

$\overrightarrow{AB} = (6\cos 40°)i + (6\sin 40°)j$

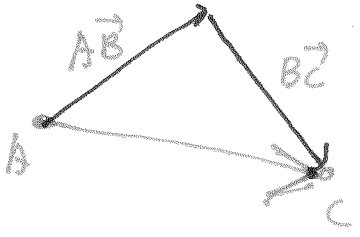
$\approx 4.60i + 3.86j$

$\overrightarrow{BC} = (4\cos(-80°))i + (4\sin -80°)j$

$\approx .695i + (-3.94)j$



b. Hence, write the resulting distance, displacement, as a sum of two vectors. Show the diagram of the resulting vector and calculate the displacement.



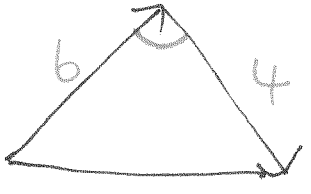
resultant vector : $\overrightarrow{AC}$

$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

$\overrightarrow{AC} = [(4.60)i + (3.86j)] + [.695i - 3.94j]$

$= 5.30i - 0.08j$

$|\overrightarrow{AC}| = \sqrt{(5.30)^2 + (0.08)^2} =$ 5.30 miles



AC ?