1a) (50 pts) Two canoeists start paddling at the same time and head toward a small island in a lake, as shown in the figure.

Canoeist 1 paddles with a speed of \( v_1 = 1.19 \text{ m/s} \) at an angle of \( \theta = 45.0^\circ \) north of east. Canoeist 2 starts on the opposite shore of the lake, a distance of \( D = 1.72 \text{ km} \) due east of canoeist 1. As shown, \( L = 1.09 \text{ km} \). In what direction relative to north must canoeist 2 paddle to reach the island? Give the angle counterclockwise relative to the north. (in deg)

6) geometry problem, 2 triangles, find \( \theta_2 \) estimate \( \theta_2 > 45^\circ \)

\[ \alpha = \tan^{-1} \frac{x}{L} \]

\[ x = D - L \]

Isosceles \( \Delta \) \( Y \) agrees with estimate correct unit

\[ \alpha = \tan^{-1} \left( \frac{1.72 - 1.09}{1.09} \right) = 30^\circ \]

1b) (50 pts) What speed must canoeist 2 have if the two canoes are to arrive at the island at the same time? (in m/s)

6) Simple kinematics estimate \( v_1 = 1.19 \text{ m/s} \)

\[ v_2 < 1.19 \text{ m/s} = 90 \text{ m/s} \]

constraint \( t_1 = t_2 \)

\[ \begin{align*}
  &d_1 = \frac{L}{\cos \alpha} ; \\
  &d_2 = \frac{L}{\cos \alpha_2} \\
  &\text{can say} \quad \frac{d_1}{v_1} = \frac{d_2}{v_2}
\end{align*} \]

\[ \alpha = \frac{L}{v_1 \cos \alpha} = \frac{L}{v_2 \cos \alpha_2} \]

\[ v_1 \cos \alpha_1 = v_2 \cos \alpha_2 \] y component of \( v_1, v_2 \) must be equal \( \Rightarrow \) case

\[ v_2 = \frac{v_1 \cos \alpha_1}{\cos \alpha_2} = 1.19 \text{ m/s} \cos 45^\circ = 0.972 \text{ m/s} \]

\[ L \] correct units estimate 2 ways to solve