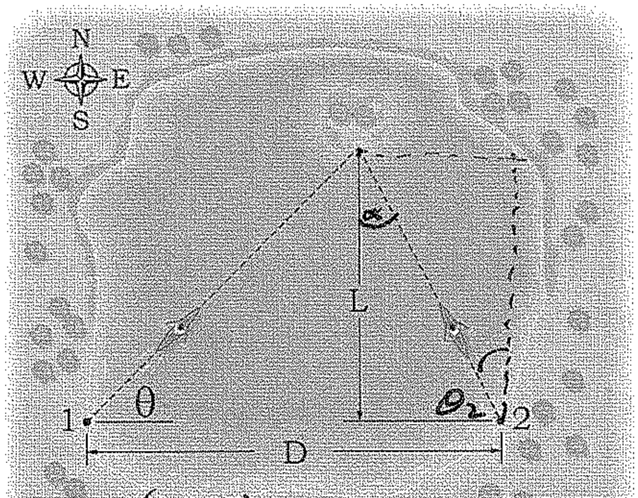
1a) (50 pts) Two canoeists start paddling at the same time and head toward a small island in a lake, as shown in the figure.

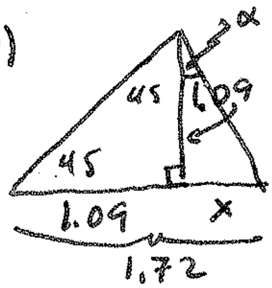
Canoeist 1 paddles with a speed of 1.19 m/s at an angle of $\theta = 45.0°$ north of east. Canoeist 2 starts on the opposite shore of the lake, a distance of $D = 1.72$ km due east of canoeist 1. As shown, $L = 1.09$ km. In what direction relative to north must canoeist 2 paddle to reach the island?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



G) geometry problem, 2 triangles, find θ_2 $(90-\theta_2)$ estimate $\theta_2 > 45$

$90 - \theta_2 < 45$

O)



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

$x = D - L$ b/c isosceles Δ

U) Agrees with estimate ✓ correct units

A) $\alpha = \tan^{-1}\left(\frac{D-L}{L}\right) = \tan^{-1}\left(\frac{1.72-1.09}{1.09}\right) = 30°$

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)*

G) Simple kinematics

estimate $V_1 = 1.19$ m/s

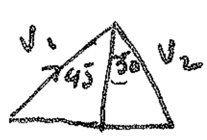
$V_2 < 1.19$ m/s $\approx .90$ m/s

known v_1, d_1, d_2, θ_1

unknown t_1, t_2, v_2

constraint $t_1 = t_2$.

O) $d = vt$



can say

$\frac{d_1}{v_1} = \frac{d_2}{v_2}$

A) $d_1 = \frac{L}{\cos \alpha_1}$; $d_2 = \frac{L}{\cos \alpha_2}$

so

$\frac{L}{v_1 \cos \alpha_1} = \frac{L}{v_2 \cos \alpha_2}$

$v_1 \cos \alpha_1 = v_2 \cos \alpha_2$ ← y-components of v_1, v_2 must be equal → of course!

$v_2 = \frac{v_1 \cos \alpha_1}{\cos \alpha_2} = 1.19\text{ m/s} \frac{\cos 45}{\cos 30} = 0.972$ m/s

U) correct units, estimate ✓; 2 ways to solve