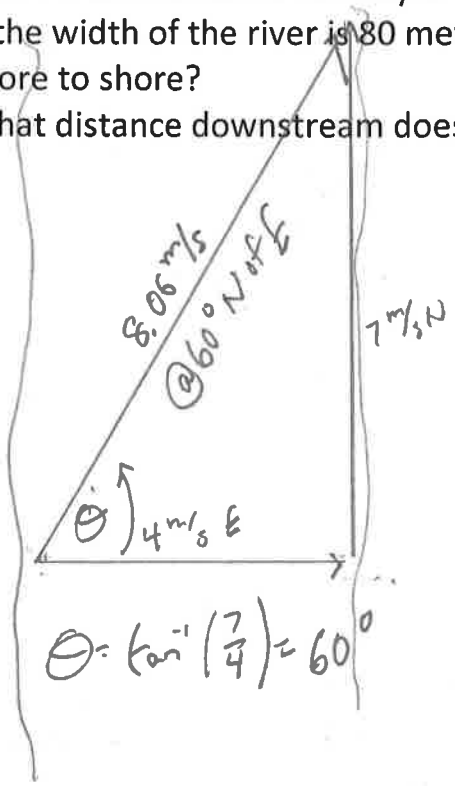
Still More River Problems

1. A motorboat traveling 4 m/s east encounters a current traveling 7.0 m/s north. (from the ıysics Classroom)

a. What is the resultant velocity of the motorboat?

b. If the width of the river is 80 meters wide, then how much time does it take the boat to travel shore to shore?

c. What distance downstream does the boat reach the opposite shore?



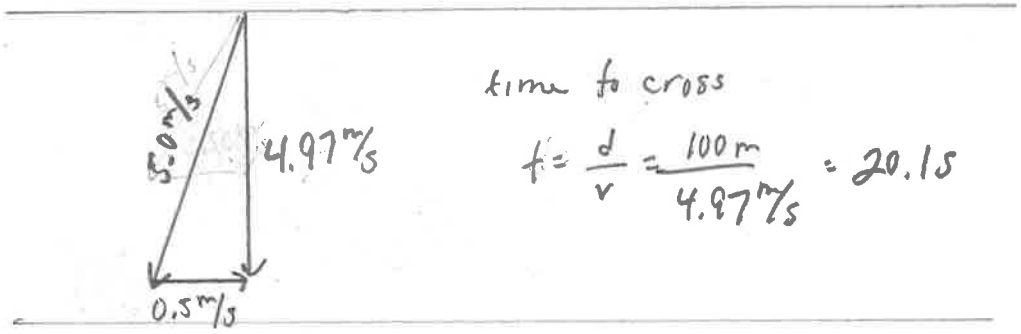
time to cross

$$t = \frac{d}{v} = \frac{80\,m}{4\,m/s} = 20\,s$$

distance

$$d = vt = (7.0\,m/s)(20\,s) = 140\,m$$

2. A ferryboat (speed =5 m/s) needs to arrive at a point directly South across a 100 meter wide river. The river has a current of 0.50 m/s toward the east. Find the ferry's time to cross. (from ChasePhysics)



time to cross

$$t = \frac{d}{v} = \frac{100\,m}{4.97\,m/s} = 20.1\,s$$

3. A helicopter, flying where the average wind velocity is 38 km/h [25° N of E], needs to travel a displacement of 182 km [17° W of N] relative to the ground on a schedule of 2.0 h. Determine the required airspeed the helicopter must obtain. (from Northwestern University)

velocity needed $= \frac{d}{t} = 91 \frac{km}{hr}$ @ 17° W of N

wind velocity: $38 \frac{km}{hr}$ @ 25° N of E

$\vec{Helicopter} + \vec{wind} = \vec{velocity\ needed}$

$\vec{Helicopter} = \vec{velocity\ needed} - \vec{wind}$

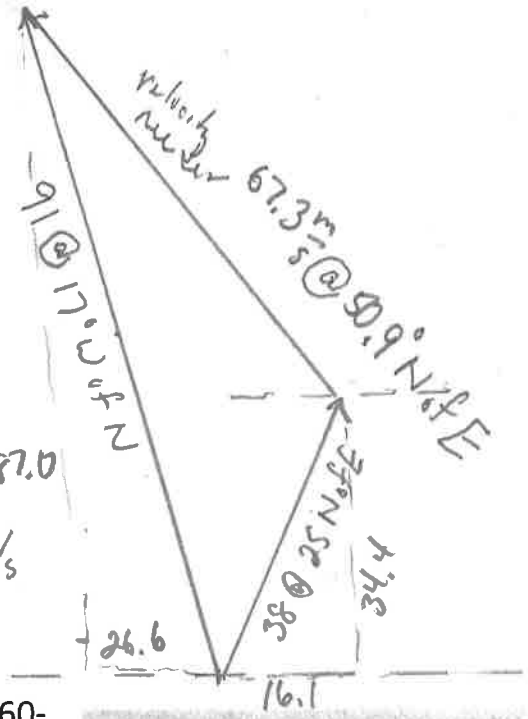
	E/W	N/S
Helicopter	V_x	V_y
Wind	16.1	34.4
Needed	−26.6	87.0

$V_x = 42.7$

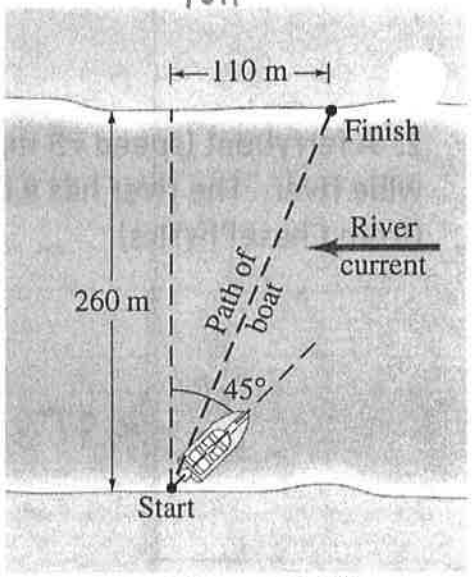
$V_y = 52.6$

$V = \sqrt{V_x^2 + V_y^2} = 67.8 \frac{m}{s}$

$\theta = \tan \frac{52.6}{42.7} = 50.9°$



4. A boat, whose speed in still water is 3.4 m/s must cross a 260-m-wide river and arrive at a point 110 m upstream from where it starts. To do so, the pilot must head the boat at a 45º upstream angle. What is the speed of the river's current? (from last year's test)



	E/W	N/S
Boat	$3.4\cos 45 = 2.4$	$3.4\sin 45 = 2.4$
River	0	$-V$
Result	$260/t$	$110/t$

$2.4 = \frac{260}{t}$

$t = \frac{260}{2.4} = 108 s$

$2.4 - V = \frac{100}{t}$

$2.4 - V = \frac{100}{108} = 0.923$

$V = 2.4 - 0.923 = 1.48 \frac{m}{s}$