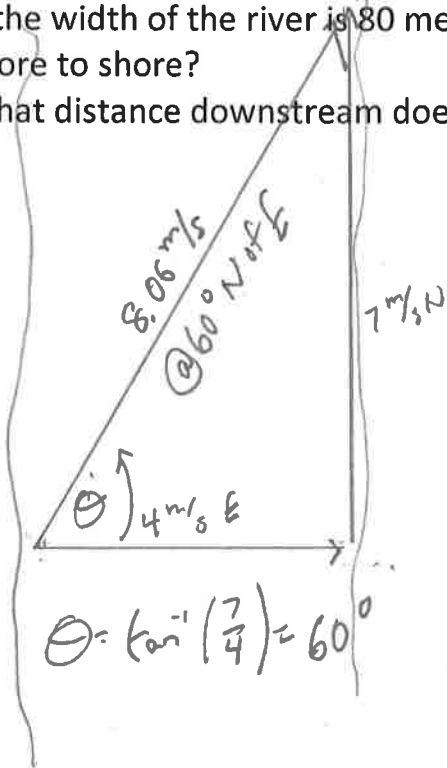


Still More River Problems

1. A motorboat traveling 4 m/s east encounters a current traveling 7.0 m/s north. (from the physics 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?



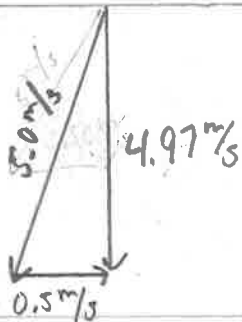
time to cross

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

distance

$$d = vt = (7.0 \text{ m/s})(20 \text{ s}) = 140 \text{ m}$$

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

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

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 = $\frac{d}{t} = 91 \frac{\text{km}}{\text{hr}} @ 17^\circ \text{ W of N}$

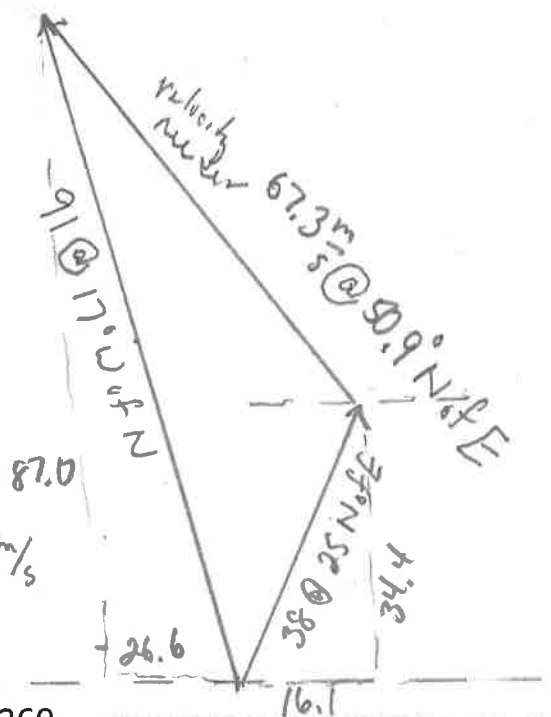
wind velocity = $38 \frac{\text{km}}{\text{hr}} @ 25^\circ \text{ N of E}$

Helicopter + wind = velocity needed

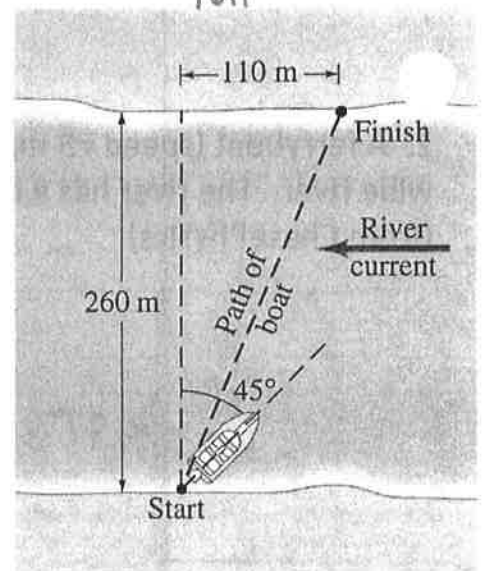
Helicopter = velocity needed - wind

	E/W	N/S	
Helicopter	V_x	V_y	$V_x = 42.7$
Wind	16.1	34.4	$V_y = 52.6$
Needed	-26.6	87.0	$V = \sqrt{V_x^2 + V_y^2} = 67.3 \text{ m/s}$

$\theta = \tan^{-1} \frac{52.6}{42.7} = 50.9^\circ$



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 45° upstream angle. What is the speed of the river's current? (from last year's test)



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

$2.4 - V = \frac{100}{t}$
 $2.4 = \frac{260}{t}$
 $t = \frac{260}{2.4} = 108 \text{ s}$
 $2.4 - V = \frac{100}{108} = 0.923$
 $V = 2.4 - 0.923 = 1.48 \frac{\text{m}}{\text{s}}$