PHYSICS HOMEWORK #11 — KINEMATICS

TWO DIMENSIONAL KINEMATICS

[Remember that ALL vectors must be described by BOTH magnitude and direction!]

1. You walk 250. steps North and then 400. steps East. What is your displacement? (**Distance and direction** from the starting point!) $250^2 + 400^2 = x^2$ $x = 471.7m$ $32°$ N of E

2. An automobile goes 45.0 miles West, then 45.0 miles North, and finally 15.0 miles East. What is the final displacement of the car? $45^2 + 30^2 = x^2$ 54.1mi = x $56°$ N of W $\tan^{-1}\left(\frac{45}{30}\right) = 56°$

3. Your car is heading North on Route 9 with a velocity of 45.0 mph. A second car is also heading North but with a velocity of 60.0 mph. What is the velocity of the second car relative to your car?
   60−45mph = 15mph

4. One car is heading West on I_80 with a velocity of 75 km/hr while another car is heading East at 92 km/hr. What is the velocity of the second car relative to the first car?
   92−75 −167 km/hr

5. You are on a railroad passenger train and you are walking toward the front of the train with a velocity of 6.00 mph relative to the passenger car in which you are riding. At the same time the train itself is moving down the tracks at 37.0 mph. What is your velocity as measured by observer at rest along the railroad tracks? 37+6 = 43 mph

6. A boat, which has a speed of 12.0 mph while traveling in still water, heads directly down a river, which has a current of 7.00 mph. What will be the speed of this boat relative to an observer standing along the banks of the river?
   12+7mph = 19mph

7. The same boat in #6 turns around and heads back upstream. What will the speed of this boat now be as measured by an observer standing along the banks of the river?
   12−7 = 5mph

8. Suppose that this boat is now aimed directly across the river. What will be the velocity of this boat (speed **and** direction!) as measured by an observer standing along the banks of the river?
   $\tan^{-1}\left(\frac{12}{7}\right) = 59.7°$ off center $7^2 + 12^2 = v^2$ $v = 13.9$mph

9. An airplane, which has an airspeed of 235 mph, heads directly West. The wind, in turn, is blowing due South with a velocity of 45.0 mph. What will be the velocity of this airplane as measured by an observer on the ground?
   $\tan^{-1} \frac{45}{235}$ 10.8° S of W $v^2 = 235^2 + 45^2$ v = 239.3mph

10. An airplane, which has an airspeed of 575 km/hr, heads directly East. The wind is blowing with a velocity of 82.0 km/hr on a heading of 35.0° West of South. What will be the resulting velocity of this airplane as measured from the ground?

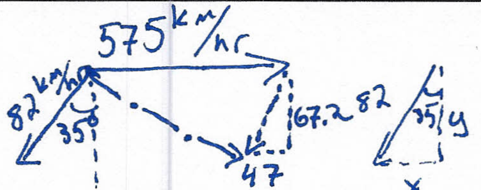
11. A boat, which has a speed of 13.0 m/s in still water, heads down a river which has a current of 4.00 m/s;
    a. How long will it take for the boat to reach a point 220. meters downstream?
    This boat then reverses direction and returns to the point of origin.
    b. How long will it take to return to the starting point?

A) 13.0 m/s → 4.00 m/s = 17 m/s, x = 220m $v = \frac{x}{t}$ $t = \frac{x}{v} = \frac{220}{17} = 12.9$ s

B) 4 → ← 13 = 9 m/s $t = \frac{x}{v} \Rightarrow \frac{220m}{9\frac{m}{s}} = 24.\overline{4}$ s

Answers to opposite side:	12a. 13.9 m/s at 30.3° downstream	b.40.0 s	c. 280. m
12d. 556 m at 30.3° downstream	13a. 22.9° upstream	b. 66.3 s	14. 347 mph at 19.7° SW
15. 479 mph at 7.79° NW	16. 935 km/hr at 26.2° EN	17. 711 m at 24.0° downstream	
18. 421 km/hr at 41.5° SW	19. 519 mph at 43.9° NE		

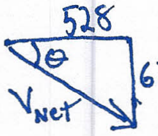
10)



$\frac{y}{82} = \cos(35)$
$y = 67.2$ km/hr

$\frac{x}{82} = \sin(35)$
$x = 47.0$ km/hr

$v^2 = 528^2 + 67.2^2$
v = 532.3 km/hr



$\tan^{-1}\theta = \frac{67.2}{528}$
θ = 7.25° South of East