Name: KEY

Date: _____

Section C D F

The Masters School
Mr. Alex Rawson
Physics

Relative Velocity I

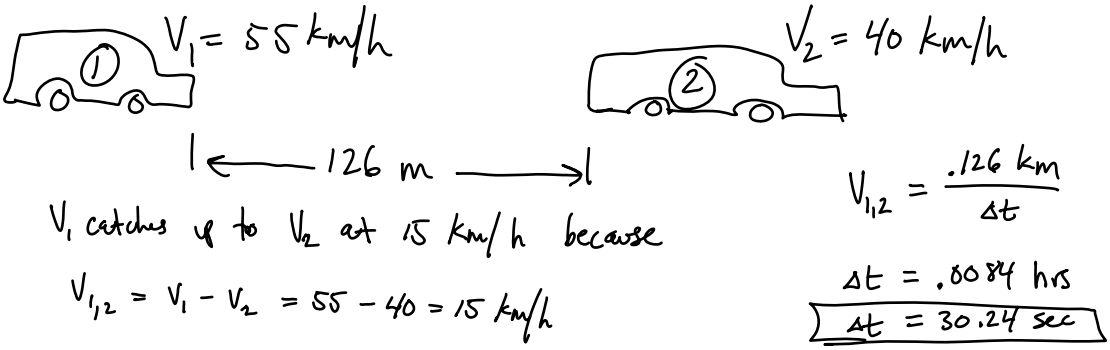
1. If you are walking at constant velocity of 5 km/h and a car passed you by at the speed of 20 km/h from behind, what is the car's velocity from your viewpoint?

$V_{person} = 5$ km/h

$V_{car} = 20$ km/h

$V_{car,\,person} = V_{car} - V_{person} = 15$ km/h

2. How long, in seconds, does it take an automobile traveling 55.0 km/h to become even with a car that is traveling in another lane at 40.0 km/h if the cars' front bumpers are initially 126 m apart?



V_1 catches up to V_2 at 15 km/h because

$V_{1,2} = V_1 - V_2 = 55 - 40 = 15$ km/h

$V_{1,2} = \frac{.126 \text{ km}}{\Delta t}$

$\Delta t = .0084$ hrs

$\Delta t = 30.24$ sec

3. A plane can travel with a speed of 80 mph with respect to the air. Determine the resultant velocity of the plane (magnitude only) if it encounters a
   a. 10 mph headwind
   b. 10 mph tailwind
   c. 10 mph crosswind
   d. 60 mph crosswind

4.

a) $80 - 10 = 70$ mph

b) $80 + 10 = 90$ mph

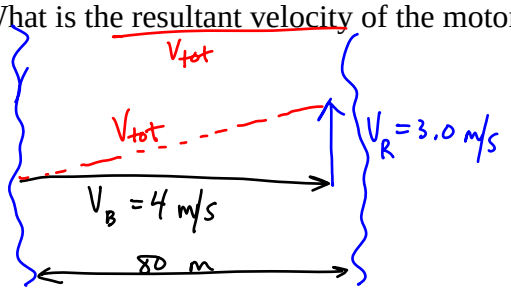
c) $\sqrt{80^2 + 10^2} = 80.62$ mph

d) $\sqrt{80^2 + 60^2} = 100$ mph

V_B

A motor boat traveling 4 m/s, East encounters a current traveling 3.0 m/s, North.

a. What is the resultant velocity of the motor boat?



$V_{river} = V_R = 3.0$

$V_{tot}^2 = 4^2 + 3^2$

$V_{tot} = 5$ m/s

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?

Δx_{east}

$\Delta x_{east} = 80$ m

$V_{east} = 4$ m/s

$\Delta t = 20$ sec

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

$V_{north} = 3$ m/s

$\Delta t = 20$ sec

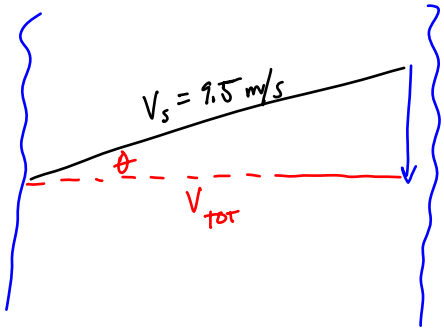
$\Delta x = 60$ m

$V_{swimmer} = V_s$

5. A swimmer can swim at a speed of 9.5 m/s. If a river has a downstream current of 3.75 m/s:

V_R

a. What direction must he swim to swim directly across the river?



$\theta = \sin^{-1}\left(\frac{3.75}{9.5}\right)$

$\theta = 23.25°$ upstream

b. What would his resultant velocity be relative to the bank?

$a^2 + b^2 = c^2$

$a^2 = c^2 - b^2$

$a^2 = 9.5^2 - 3.75^2$

$a^2 = 8.73$ m/s