Vectors and Kinematics Notes

4 – Vector Addition and Subtraction

SCALAR	VECTOR

When we draw vectors we represent them as _____.

Vector Addition

Whenever we add vectors we use...

To find the total or resultant vector, simply draw...

Ex: A student in a canoe is trying to cross a 45 m wide river that flows due East at 2.0 m/s. The student can paddle at 3.2 m/.

a. If he points due North and paddles how long will it take him to cross the river?

b. What is his total velocity relative to his starting point in part a?

c. If he needs to end up directly North across the river from his starting point, what heading should he take?

d. How long will it take him to cross the river at this heading?

Vector Addition – Trig Method

In the previous example we added perpendicular vectors which gave us a nice simple right triangle. In reality it's not always going to be that easy.

Ex. A zeppelin flies at 15 km/h 30^{o} N of E for 2.5 hr and then changes heading and flies at 20 km/h 70^{o} W of N for 1.5 hr. What was its final displacement?

In order to solve non-right angle triangles, we will need to be familiar with the **Sine Law** and the **Cosine Law.**

Sine Law:

Cosine Law:

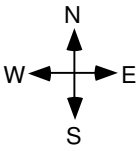
Vector Addition – The Component Method

There is another method that we can use when adding vectors. This method is a very precise, stepwise approach, however it is the only way we can add 3 or more vectors.

- **Draw** each vector
- **Resolve** each vector into x and y components
- Find the **total sum** of x and y vectors
- **Add** the x and y vectors
- **Solve** using trig

REMEMBER: When using x and y components…

Ex. An airplane heading at 450 km/h, 30° north of east encounters a 75 km/h wind blowing towards a direction 50° west of north. What is the resultant velocity of the airplane relative to the ground?



Airplane vector:

x-component:

y-component:

Wind vector:

x-component:

y-component:

Adding the two vectors:

x-components of resultant:

y-components of resultant:

Total resultant:

Vector Subtraction

With vectors a negative sign indicates that…

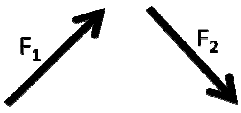
When subtracting vectors we still draw them *tip to tail*, except…

We generally subtract vectors when dealing with a _____ in a vector quantity.

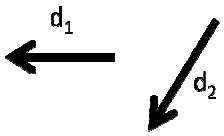
Recall:

Change =

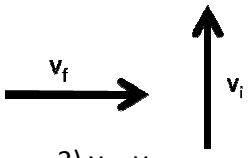
Draw the Following



1) $F_1 + F_2$



2) $d_1 + d_2$



3) $v_f - v_i$

4) $p_2 - p_1$

Ex: A cyclist is traveling at 14 m/s west when he turns due north and continues at 10 m/s. If it takes him 4.0 s to complete the turn what is the magnitude and direction of his acceleration?