PHYS 141 – Physics
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Lecture Supplement 2: Intro Vector Worksheet A

1. Define a vector and a scalar. What is the difference between the two?

2. Provide three examples of vector quantities and three of scalar quantities.

3. State the magnitude and direction of each of the vectors given below.

a) **r** = -30 m (displacement vector)
b) **v** = 60 m/s west (velocity vector)
c) **F** = 20 N at $-45°$ (force vector)
d) **p** = $-50\ kg \cdot {}^{m}/_{s}$ at 25° (linear momentum vector)

4. Provide a graphical example of a 1-dimensional vector (1D) and one of a 2-dimensional vector (2D). Be sure to include reference axes with labels in each case.

5. 1D Vectors. Let vector **A** = +3 units and let vector **B =** -6 units. Do the following:

a) State the magnitude and direction of vectors **A** and **B**.
b) Draw a "scaled" representation of vectors **A** and **B** (choose a convention for + and – directions).
c) Find **A** + **B** and show graphically (for convenience, you can let **C** be the sum of the two vectors).
d) Find **A** - **B** and show graphically (for convenience, you can let **C** be the sum of the two vectors).

6. 2D Vectors. Given the vector **N** =72 units with $\theta = 200\ °$, do the following:

a) Find the x and y components of **N.**
b) Sketch the vector **N.** Be sure to label axes and show the scale used.
c) What do the x and y components represent?

7. 2D Vectors. Let vector **A** = 3 units west, vector **B =** 6 units 30° north of east, and vector **C** = 8 units 45° southeast. Do the following:

a) Sketch all three vectors on the same coordinate plane.
b) Find the x and y components of all three vectors.
c) Find **A** + **B** and show graphically.
d) Find **A** - **B** and show graphically.
e) Find **A** + **B + C** and show graphically.
f) Find **A + B – C** and show graphically.

8. Car 1 exits a rest stop and travels northbound on a highway for 25 miles. Car 1 then turns around to backtrack to a missed exit and travels directly southbound for 7 miles. Do the following:

a) Draw position vectors for Car 1's northbound position and Car 1's southbound position.
b) Draw the change in position vector (displacement) of Car 1's journey.

9. Squirrel sitting on a deck railing starts running along a straight line over a length of 12m due west. Squirrel then runs due east for 8m. Squirrel then runs due east for 10m. Finally, Squirrel runs due west again for 4m and then pauses (Why? We don't know but one can guess squirrels are kind of nutty). Do the following:

a) Draw a position vector for each leg of Squirrels journey.
b) Draw the change in position vector from Squirrel's final position from initial.
c) *What would be the average velocity of Squirrel if the whole adventure took 6 minutes (put final answer in m/s)*

10. An airline jet flies due N with a constant speed of 500 mil/hr for 2 hours. A second jet heads due South and travels with a constant speed of 700 mil/hr for 3 hours. Do the following:

a) Draw a velocity vector representing the velocity of each jet as best you can.
b) After 6 hours, how far apart would you expect the jets to be?

***11.** What is a vector cross product? How does it differ from vector addition and subtraction?