

Phys 11C – Eiteneer  
**Worksheet for Lab 02 - Vectors**

Names: \_\_\_\_\_

**PURPOSE**

Vectors are powerful mathematical tools that can be used to solve a variety of problems in the physical sciences. In this worksheet, you will practice solving typical vector problems graphically and using vector components.

**PROBLEMS**

All work should be neatly done on separate pieces of paper that will be turned in with this handout. Be sure to show all work for full credit.

- 1) An arrow is launched with an initial speed of 70m/s at an angle  $35^\circ$  above the horizontal. Find the x and y components of the velocity vector:
  - a) Graphically (i.e., drawing **to scale** on the supplied graph paper).
  - b) Using trigonometry. Write your final answer in vector component form (i.e., using **i**'s and **j**'s).
- 2) An airplane flies at a bearing of  $N57^\circ W$  at a speed of 500mph. Assume the y-axis points north and the x-axis points east. Find the x and y components of the velocity vector.
  - a) Graphically.
  - b) Using trigonometry. Write your final answer in vector component form.
- 3) A box sits on a plane that is tilted  $25^\circ$  above the horizontal. A horizontal force of 30N acts on the box. Use trigonometry to write the force in vector component form using (a) a standard coordinate system, and (b) a coordinate system tilted to align itself with the plane.
- 4) A ship has a top speed of 3m/s in calm water. The current of the ocean tends to push the boat at 2m/s on a bearing of  $S70^\circ W$ . What will be the net velocity of the ship if the captain points his ship on a bearing of  $N55^\circ W$  and applies full power?
  - a) Do the problem graphically. Be sure to clearly indicate the vector heads and tails.
  - b) Repeat the problem using vector components.
- 5) For  $\mathbf{A} = \langle 2, -3 \rangle$ ,  $\mathbf{B} = \langle 4, 5 \rangle$ , and  $\mathbf{C} = \langle 3, -1 \rangle$  find the following graphically and algebraically (**i**'s and **j**'s).
  - a)  $\mathbf{A} + 2\mathbf{B}$
  - b)  $\mathbf{A} - (\mathbf{B} + \mathbf{C})$
  - c)  $5\mathbf{A} - 3\mathbf{C}$
- 6) For the vectors given in Problem 5, determine:
  - a)  $\mathbf{A} \times \mathbf{B}$
  - b)  $\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C})$
  - c)  $\mathbf{A} \times (\mathbf{B} \cdot \mathbf{C})$
  - d)  $\mathbf{A} \cdot \mathbf{B}$
  - e) Find the angle between **B** and **C**, using any method.