NAME _____ **PERIOD** ____

UNIT 4 PRACTICE PROBLEMS **AP PHYSICS**

4.1 THE COMPONENTS OF A VECTOR

1. Find the x and y components of vector **r**, of magnitude r = 75 m, if its angle relative to the x-axis is **(a)** 35.0° and **(b)** 65.0°.
2. The x and y components of a vector **r** are r_x = 14 m and r_y = -9.5 m. **(a)** Find the direction and magnitude of the vector **r**. **(b)** If both r_x and r_y are doubled, how does the magnitude and direction change?
3. You drive a car 660 ft to the east, then 370 ft to the north. What is the magnitude and direction of your displacement?
4. A treasure map directs you to start at a palm tree and walk due north for 12.0 m. You are then to turn 90° and walk 25.0 m; then turn 90° again and walk 5.00 m. Give the distance from the palm tree, and the direction relative to north, for each of the four possible locations of the treasure.

4.2 ADDING AND SUBTRACTING VECTORS

5. A vector **A** has a magnitude of 50.0 m and points in a direction 20.0° below the positive *x* axis. A second vector, **B**, has a magnitude of 70.0 m and points in a direction 50.0° above the positive *x* axis. **(a)** Sketch the vectors **A**, **B**, and **C=A+B**. **(b)** Using the component method of vector addition, find the magnitude and direction of the vector **C**.
6. An air traffic controller observes two airplanes approaching the airport. The displacement from the control tower to plane 1 is given by the vector **A**, which has a magnitude of 220 km and points in a direction 32° north of west. The displacement from the control tower to plane 2 is given by the vector **B**, which has a magnitude of 140 km and points 65° east of north. **(a)** Sketch the vectors **A**, -**B**, and **D=A-B**. Notice that **D** is the displacement from plane 2 to plane 1. **(b)** Find the magnitude and direction of the vector **D**.
7. A basketball player runs down the court, following the path indicated by the vectors **A**, **B**, and **C** in Figure 3–38. The magnitudes of these three vectors are A=10.0 m, B=20.0 m, and C=7.0 m. Find the magnitude and direction of the net displacement of the player using **(a)** the graphical method and **(b)** the component method of vector addition. Compare your results.

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UNIT 4 PRACTICE PROBLEMS AP PHYSICS

4.3 RELATIVE VELOCITY

8. As an airplane taxies on the runway with a speed of 16.5 m/s, a flight attendant walks toward the tail of the plane with a speed of 1.22 m/s. **(a)** What is the flight attendant's speed relative to the ground? **(b)** Find the time it takes for the boat to reach the opposite shore if the river is 25 m wide.
9. The pilot of an airplane wishes to fly due north, but there is a 65 km/h wind blowing toward the east. **(a)** In what direction should the pilot head her plane if its speed relative to the air is 340 km/h? **(b)** Draw a vector diagram that illustrates your result in part (a). **(c)** If the pilot decreases the air speed of the plane, but still wants to head due north, should the angle found in part (a) be increased or decreased? Explain.
10. You are riding on a Jet Ski at an angle of 35° upstream on a river flowing with a speed of 2.8 m/s. If your velocity relative to the ground is 9.5 m/s at an angle of 20.0° upstream, what is the speed of the Jet Ski relative to the water?