Converting between Coordinate Systems

Convert the following questions into the coordinate system specified.

1. A plane is traveling eastward at an airspeed of 500 km/h. But a 90 km/h wind is blowing southward. What are the direction and velocity of the plane relative to the ground?

2. A hiker begins her trip by first walking 25 km due southeast from her base camp. On the second day, she walks 40 km in a direction 60 degrees north of east, at which point she discovers the forest ranger's tower. Determine the magnitude and direction of the total displacement.

3. A bicyclist begins a trip by first bicycling 30 km due northwest. The next day, she continues her journey by traveling 42 km 25° south of west. Determine the rectangular components of the bicyclist's displacement for the first and second days. Determine the rectangular components of the total displacement for the whole trip. Determine the magnitude and direction of the total displacement.

4. Tarzan swings from a tree in a desperate move to save Jane. He swings at a angle of 20° *below* the horizontal. If Tarzan's displacement is equal to 30m, then determine both components of this displacement. Express this vector in polar and rectangular notation.

5. A helicopter is traveling directly *southwest* at 250 m/s. What is the southward component of the plane, and what is the westward component? Express this vector in both forms.

6. A displacement vector is at an angle of 45° to the horizontal axis. If its magnitude is equal to 32 m/s, what are the x and y components? What is the vector in polar coordinates? How about cardinal coordinates

7. (Careful with this one!!) A rowboat stands on the eastern bank of a large river. The river's current is traveling due southward at a speed of 1.3 m/s. The boat wants to get to the west shore, 500 meters distant. If the boat travels a total distance of 750 meters across the river, at what angle did it cross? How far down the shore did it arrive relative to its original position? If the boat travels at its maximum speed of 3 m/s, at what angle must it launch at in order to land directly across from the river from its original position? What will be its velocity relative to the shoreline?

8. While exploring a cave, a spelunker starts at the entrance and moves the following distances. She travels 75 m north, 250 m east, 125 m north of east at an angle 30 ˚, and 150 m south. Find the **resultant displacement** from the cave entrance. Express this vector in both **polar and rectangular notation**.

9. (Serway p.109 #26) A person walks 100 m east, then 300 m south, then turns 30° SW and walks 150 m. Finally the person walks 200 m at 60° NW. At the end of the trip what is the person's resultant displacement?

10. The Clinton family begins a vacation trip by driving 700 km west. Then the family drives 600 km south, 300 km east, and 400 north. Where will the Clintons end up in relation to their starting point? Solve graphically for the resultant vector.

11. While Ray is on a camping trip with his boy scout troop, the scout leader hands each boy a compass and map. The directions on Ray's map read as follows: "Walk 500.0 m north, 200.0 m east, 300.0 m south, and 400.0 m west." If he follows the map, what is Ray's displacement?

12. Every March, the swallows return to San Juan Capistrano, California after their winter in the south. If the swallows fly due north and cover 200 km on their first day, 300 km on their second day, and 250 km on their third day, draw a vector diagram of their trip and find their total displacement for the 3-day journey.

13. Find the x and y components of the following vectors: Some components will be negative

a. 242 N at 331º

b. 34.0 m/s at 210.0º

c. 15.0 m at 12.0º

d. 21 m/s/s at 90.0º

e. 242 N at 32.8º N of E

f. 134.0 m/s at 14.0º S of W

g. 33.0 m at 62.0º S of E

h. 28.9 m/s/s at 47.60º N of W

14. From the x and y components given, find the direction (angle) and magnitude of the resultant. Include N of E, S of E, etc.

a. x = 120. N, y = 345 N

b. x = 31 m/s, y = 8.0 m/s

c. $x = -15\ m/s^2$, $y = 12\ m/s^2$

d. x = 155 m, y = 98.0 m

e. x = 0.010 C, y = 0.025 C

15. A displacement vector **A** has a magnitude of 5.0 m and points in an easterly direction. A second displacement vector, **B**, points north and has a magnitude of 9.7m. Find the magnitude and angle of the vector sum.

16. An electrical field vector **E**, has a magnitude of 7.1 N/C (N/C is the unit) and makes an angle of 33° N of E. Find the x & y components of **E**.

17. A magnetic field vector **B**, is 65.0° S of E and has a magnitude of 6.52 tesla (T). Find the x & y components of **B**.

18. A velocity vector **v**, is 81.2° N of W and has a magnitude of 19.5 m/s. Find the x & y components of **v**.

19. A displacement vector **M** has a magnitude of 37.89 m and points in the west direction. A second displacement vector, **P**, points north and has a magnitude of 29.7m. Find the magnitude and angle of the vector sum.