## VECTOR OPERATIONS

### Review Questions

**14.** Can a vector have a component equal to zero and still have a nonzero magnitude?

**15.** Can a vector have a component greater than its magnitude?

**16.** Explain the difference between vector addition and vector resolution.

**17.** How would you add two vectors that are not perpendicular or parallel?

### Conceptual Questions

**18.** If **A** + **B** equals 0, what can you say about the components of the two vectors?

**19.** Under what circumstances would a vector have components that are equal in magnitude?

**20.** The vector sum of three vectors gives a resultant equal to zero. What can you say about the vectors?

### Practice Problems

***For problems 21–23, see Sample Problem A.***

**21.** A girl delivering newspapers travels three blocks west, four blocks north, and then six blocks east.

**a.** What is her resultant displacement?

**b.** What is the total distance she travels?

**22.** A quarterback takes the ball from the line of scrimmage, runs backward for 10.0 yards, and then runs sideways parallel to the line of scrimmage for 15.0 yards. At this point, he throws a 50.0-yard forward pass straight down the field. What is the magnitude of the football's resultant displacement?

**23.** A shopper pushes a cart 40.0 m south down one aisle and then turns 90.0° and moves 15.0 m. He then makes another 90.0° turn and moves 20.0 m. Find the shopper's total displacement. (There could be more than one correct answer.)

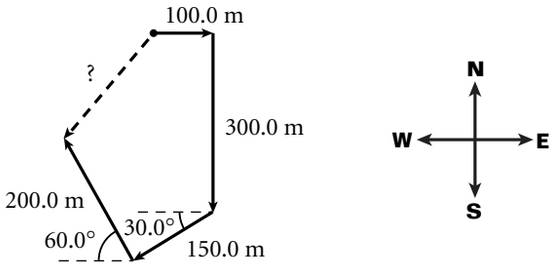
***For problems 24–25, see Sample Problem B.***

**24.** A submarine dives 110.0 m at an angle of 10.0° below the horizontal. What are the two components?

**25.** A person walks 25.0° north of east for 3.10 km. How far would another person walk due north and due east to arrive at the same location?

***For problem 26, see Sample Problem C.***

**26.** A person walks the path shown below. The total trip consists of four straight-line paths. At the end of the walk, what is the person's resultant displacement measured from the starting point?




## PROJECTILE MOTION

### Review Questions

**27.** A dart is fired horizontally from a dart gun, and another dart is dropped simultaneously from the same height. If air resistance can be neglected, which dart hits the ground first?

**28.** If a rock is dropped from the top of a sailboat's mast, will it hit the deck at the same point whether the boat is at rest or in motion at constant velocity?

**29.** Does a ball dropped out of the window of a moving car take longer to reach the ground than one dropped at the same height from a car at rest?

**30.** A rock is dropped at the same instant that a ball at the same elevation is thrown horizontally. Which will have the greater speed when it reaches ground level?

### Practice Problems

***For problems 31–33, see Sample Problem D.***

**31.** The fastest recorded pitch in Major League Baseball was thrown by Nolan Ryan in 1974. If this pitch were thrown horizontally, the ball would fall 0.809 m (2.65 ft) by the time it reached home plate, 18.3 m (60 ft) away. How fast was Ryan's pitch?



## 3 REVIEW

**14.** Yes, the second component could be nonzero.

**15.** No, the hypotenuse is always greater than the legs.

**16.** Vector addition is combining vectors to find a resultant vector. Vector resolution is breaking a vector into its component vectors.

**17.** by resolving both vectors into their vector components, adding the corresponding components together, and finding the vector sum of the summed components

**18.** They are equal and opposite.

**19.** if the vector is oriented at 45° from the axes

**20.** They form a closed triangle when laid head to tail.

**21.** **a.** 5 blocks at 53° north of east

**b.** 13 blocks

**22.** 42.7 yards

**23.** 61.8 m at 76.0° S of E (or S of W), 25.0 m at 53.1° S of E (or S of W)

**24.** 108 m, −19.1 m

**25.** 2.81 km east, 1.31 km north

**26.** $2.40 \times 10^2$ m at 57.2° south of west

**27.** Both hit at the same time.

**28.** yes, neglecting air resistance

**29.** no, neglecting air resistance

**30.** The vertical components of each velocity vector will be the same, but the thrown ball will also have a horizontal component of velocity. As a result, the thrown ball will have a greater speed.

**31.** 45.1 m/s