What Are Distance and Displacement?

Worksheet

Distance is a scalar - the total length of the path traveled. Displacement is a vector - the straight-line distance and direction from the starting point to the ending point.

$$s = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

Questions

1. Which of the following is a vector quantity?

A) Distance
B) Speed
C) Displacement
D) Time

2. A person walks 5 m forward and then 5 m back to the start. What is their displacement?

A) 10 m
B) 5 m
C) 0 m
D) 2.5 m

3. A hiker walks 6 m east and 8 m north. What is the magnitude of the displacement?

A) 14 m
B) 10 m
C) 2 m
D) 48 m

4. Which statement is always true?

A) Distance is always less than displacement
B) Displacement is always less than distance
C) Distance is always the magnitude of displacement
D) Distance and displacement are always equal

5. A runner completes one full lap of a 400 m circular track, ending where they started. Find the distance and displacement.

6. A person walks 3 m east, then 4 m north. Find the distance and displacement.

7. A car drives 10 km north, then 6 km south. Find the distance and displacement.

8. Define: What is distance?

9. Define: What is displacement?

10. Define: Can displacement be zero while distance is not?

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Answer Key

1. C) Displacement - Displacement has both magnitude and direction, making it a vector; distance, speed, and time are scalars.

2. C) 0 m - Displacement depends only on start and end position - since they returned to the start, displacement is 0.

3. B) 10 m - Displacement = (6 + 8) = 100 = 10 m.

4. C) Distance is always the magnitude of displacement - The path length (distance) is always at least as large as the straight-line displacement.

5. Distance = total path length = 400 m Displacement = final position initial position = 0 m (same start/end point)

6. Distance = 3 + 4 = 7 m (sum of path segments) Displacement = (3 + 4) = 25 = 5 m (northeast direction)

7. Distance = 10 + 6 = 16 km Displacement = 10 6 = 4 km north (net change in position)

8. A scalar quantity: the total length of the path an object travels.

9. A vector quantity: the straight-line change in position from start to end, with direction.

10. Yes - e.g., walking a full loop and returning to the start gives zero displacement but nonzero distance.

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