Distance vs Displacement

Physics · CBSE Class 9 · Motion · PrayogX short notes

▸ **Video explanation:** Watch the PrayogX reel on Instagram

In one line: distance counts the **whole path**; displacement only looks at the **straight line from start to end**, with its direction.

Comparison

Feature	Distance	Displacement
Meaning	Total length of the path travelled	Shortest straight-line distance from the initial to the final position, with direction
Type	Scalar (size only)	Vector (size + direction)
Can it be zero while moving?	No, it only increases	Yes, after returning to the start
Depends on the path?	Yes	No, only on start and end
SI unit	metre (m)	metre (m)

Rules to remember

|Displacement| ≤ Distance (equal only for motion in a straight line in one direction).

For two perpendicular walks a and b: **displacement = $\sqrt{(a^2 + b^2)}$**.

Worked examples

- **4 m east, then 3 m north:** distance = 4 + 3 = 7 m; displacement = $\sqrt{(4^2 + 3^2)}$ = 5 m, about 37° north of east.
- **Home → school → home (1 km each way):** distance = 2 km; displacement = 0.
- **Half a circle of radius r:** distance = πr; displacement = 2r (the diameter).
- **One full lap of a circular track:** distance = 2πr; displacement = 0.

Common mistakes

- Adding the legs to get displacement (4 + 3 = 7). Use the straight line from start to end instead.
- Giving displacement without a direction.
- Thinking zero displacement means no movement.

Quick check

1. A runner goes 6 m north then 8 m east. Find the distance and the displacement. *14 m; √(36 + 64) = 10 m.*
2. Can displacement be greater than distance? *Never.*
3. A car goes 5 km forward and 5 km back. Displacement? *0 km.*

Takeaway

> **Distance counts the path; displacement only sees start and end.**

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