Displacement and total distance

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

1. $v(t) = 3$ m/s on $[0, 5]$. Find displacement and distance. [3 marks]

Velocity is positive throughout; integrate 3 over 5 seconds.

Answer: Both 15 m.

2. $v(t) = -2$ m/s on $[0, 4]$. Find displacement and distance. [3 marks]

Velocity remains negative; integrate speed 2 for distance.

Answer: Displacement -8 m; distance 8 m.

3. $v(t) = t - 1$ m/s on $[0, 3]$. Find displacement and distance. [3 marks]

Split at 1: contributions $-\frac{1}{2}$ and 2.

Add signed values or magnitudes as needed.

Answer: $\frac{3}{2}$ m and $\frac{5}{2}$ m.

4. $v(t) = (t-2)^2$ m/s on $[0, 4]$. Does it change direction at 2? Find distance. [3 marks]

Velocity is nonnegative on both sides of 2.

$[\frac{(t-2)^3}{3}]_0^4 = \frac{16}{3}$.

Answer: No; distance $\frac{16}{3}$ m.

5. $v(t) = 2t$ m/s and initial position is 5 m. Find position at 3 s. [3 marks]

Displacement $= \int_0^3 2t\,dt = 9$ m.

Position $5 + 9 = 14$ m.

Answer: 14 m

6. $v(t) = \cos t$ m/s for $0 \le t \le \pi$. Find distance. [3 marks]

Split at $\frac{\pi}{2}$. Integrals are 1 and -1; add their magnitudes.

Answer: 2 m