

Kinematics

Straight-line motion | constant acceleration

REVISION r1 · 2026-09-12

01 Check the conditions

Use these equations only when acceleration is constant throughout the chosen interval, along one fixed axis.

Choose +x first. Keep signed velocities, acceleration and displacement consistent with it.

u = initial velocity; v = final velocity (m/s)

a = acceleration (m/s²); t = elapsed time (s)

$\Delta x = x - x_0$ = displacement (m)

Revision aid: first learn position, velocity and acceleration. Scope excludes projectiles and variable acceleration.

02 Choose what you need

$v = u + at$	displacement not needed
$\Delta x = ut + \frac{1}{2}at^2$	final velocity not needed
$v^2 = u^2 + 2a\Delta x$	time not needed
$\Delta x = \frac{1}{2}(u + v)t$	acceleration not needed explicitly

All four still require constant acceleration.

v^2 does not tell you the sign of v . Use direction and time information.

Δx is signed displacement. If motion reverses, find distance by adding the lengths travelled on each side of the turn.

03 Contrast: displacement or distance?

Take right as positive. A particle has $u = +4$ m/s and constant $a = -2$ m/s² for 4 s. Find final velocity, displacement and distance.

Pause here and try before reading the check.

$$v = 4 - 2 \times 4 = -4 \text{ m/s}$$

$$\Delta x = 4 \times 4 + \frac{1}{2} \times (-2) \times 4^2 = 0 \text{ m}$$

Turn: $0 = 4 - 2t$, so $t = 2$ s. It travels 4 m right, then 4 m left. Distance = 8 m.

Same starting and ending position: zero displacement, but nonzero distance. The particle reverses because the stated acceleration continues after it stops.

<https://preparena.in/revision-sheets/kinematics-constant-acceleration/> · Sources: OpenStax College Physics 2e, §2.5 Motion Equations for Constant Acceleration in One Dimension; NEET (UG) 2026 syllabus, Appendix III, Physics Unit 2 Kinematics (relations for uniformly accelerated motion)

A revision aid, not complete teaching and not a promise of marks.

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