Kinematics (AS)

P1 Understand and use fundamental quantities and units in the S.I. system: length, time, mass; understand and use derived quantities and units: velocity, acceleration, force, weight.

Q1 Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration.

Q2 Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph.

Q3 Understand, use and derive the formulae for constant acceleration for motion in a straight line.

For a brief commentary on this content go to the MEI outline SoW.

Pre-requisites

- Know how to calculate the gradient of a line and the area of regular shapes.
- Know the standard units for measuring distance, speed and acceleration.
- Solving simple linear and quadratic equations.

Common student errors

- Confusing displacement with distance and total distance travelled.
- Confusing average speed with average velocity.
- Assuming negative acceleration always implies deceleration; not appreciating that velocity and acceleration can have different directions
- Not establishing the correct values, including signs, for the ‘suvat’ variables.

Teaching it!

- A series of videos designed to support students on this topic. (Coming soon)
- Traffic (Velocity): GeoGebra version of 20 interactive simulations, based on a GCSE Standards Unit resource. The ‘Velocity’ simulations focus on linear distance-time graphs.
- Distance-time graph game: An addictive interactive game by David Wees – good as an introduction to motion graphs.
- Walk-sorting: An interactive card sort activity from Underground Mathematics.
- Constant acceleration: A set of problems that could be used as a noughts and crosses activity.

Getting them thinking

- Describe a journey that would be useful in clarifying the differences between displacement, distance and total distance travelled.
- What can you conclude about a journey if the average velocity is zero?
- When is it simplest to use constant acceleration equations and when is it better to draw a motion-time graph?
- By drawing and analysing an appropriate velocity-time graph, derive the constant acceleration equations.