Topic	Kinematics: Velocity
Element Learning guide: Lesson 1 Skills:	• Understand that a particle's motion in spacetime can be described by position, distance, displacement, (average) speed, (average) velocity, and acceleration. • Interpret and calculate data using distance/displacement–time graphs. • Apply the equations for speed and velocity; solve linear equations.
Time	1 hour

1.

- Watch the video: **Introduction to kinematics**
- Complete the **Skills check**.
- Compare your answers with the solutions provided in the Mark Scheme.
- Note down any of the questions you answered incorrectly.

2.

- Read through the lesson material on Vector and scalar quantities, Vectors in one dimension, and Displacement and distance.
- Ask yourself whether you can:
  - State the difference between scalars and vectors.
  - Explain that, in one dimension, the direction characteristic is captured by +/− signs.
  - Apply Pythagoras's theorem.
- Complete **Check your understanding** questions 1 to 5 and check your answers.

3.

- Read through the lesson material on Velocity and speed
- Ask yourself whether you can:
  - Understand how displacement is used in calculating velocity, whereas distance is used in calculating speed.
  - Use the equations to solve for velocity/speed, displacement/distance, and time given any two of these quantities.
  - Convert between kilometres per hour and metres per second.
- Complete **Check your understanding** questions 6 to 9 and check your answers.

4.

- Read through the lesson material on Distance–time graphs.
- Ask yourself whether you can:
  - Compare gradients and know how to calculate them.
  - Graph linear data and analyse its features.
- Complete **Check your understanding** questions 10 to 13 and check your answers.
- To finish this lesson ask yourself how one could determine whether a body is experiencing a change in velocity (accelerating).

Topic	Kinematics: Acceleration
Element Learning guide: Lesson 2 Skills:	• Understand that a particle's motion in spacetime can be described by position, distance, displacement, (average) speed, (average) velocity, and acceleration. • Interpret and calculate data using velocity–time graphs. • Apply speed/velocity/time equations; solve linear equations.
Time	1 hour

1.

- Watch the video **Introduction to kinematics**
  - Think about how we use everyday words like 'acceleration' and 'deceleration'. Does the video use them the same way, or differently?
- Read through the lesson material on Acceleration.
- Ask yourself whether you can:
  - Explain that acceleration is a vector quantity.
  - Apply the change in velocity equation correctly, for example, that $10\ \text{m s}^{-1} - (-5\ \text{m s}^{-1}) = 15\ \text{m s}^{-1}$.
- Complete **Check your understanding** questions 1 and 2 and check your answers.

2.

- Read through the lesson material on Velocity–time graphs.
- Ask yourself whether you can:
  - Explain why uniform acceleration produces linear velocity–time graphs.
- Complete **Check your understanding** questions 3 to 7 and check your answers.

3.

- Read through the lesson material on Area under a velocity–time graph.
- Ask yourself whether you can:
  - Use basic geometry to calculate the area of rectangles and triangles.
  - Use your calculator to find the square and square root of values.
- Complete **Check your understanding** questions 8 and 9 and check your answers.

Topic	Kinematics: Measuring constant velocity
Element Learning guide: Lesson 3 Skills:	• Calculating the arithmetic mean. • Graphing linear, or linearised, date, including gradient, area, and intercepts. • Graphing and using error bars.
Time	1 hour

1.

- Briefly, in two or three sentences, write down what you know about:
  - How to graph data.
  - How to include error bars on data values.
  - How to draw a best fit line.
  - **Extension**: how to draw a max/min line.

2.

- Read through the lesson material on Measuring constant velocity and Laboratory example: Constant velocity.
- Compare the information with what you wrote down earlier for the following skills:
  - How to graph data.
  - How to include error bars on data values.
  - How to draw a best fit line.
  - **Extension**: how to draw a max/min line.

3.

- Read through the instructions in Investigation: Measuring the acceleration due to gravity.
- Carry out the instructions and compare your findings to the provided solutions.