TOPIC 1: KINEMATICS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Kinematics: Velocity</th>
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| 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).
LEARNING GUIDE

TOPIC 1: KINEMATICS

<table>
<thead>
<tr>
<th>Element</th>
<th>Learning guide: Lesson 2 Skills:</th>
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<tbody>
<tr>
<td></td>
<td>• Understand that a particle’s motion in spacetime can be described by position, distance, displacement, (average) speed, (average) velocity, and acceleration.</td>
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<tr>
<td></td>
<td>• Interpret and calculate data using velocity–time graphs.</td>
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<td></td>
<td>• Apply speed/velocity/time equations; solve linear equations.</td>
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| 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 1: KINEMATICS

#### Learning Guide: Lesson 3

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<thead>
<tr>
<th>Element</th>
<th>Learning guide: Kinematics: Measuring constant velocity</th>
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</thead>
<tbody>
<tr>
<td>Skills:</td>
<td>• Calculating the arithmetic mean.</td>
</tr>
<tr>
<td></td>
<td>• Graphing linear, or linearised, date, including gradient, area, and intercepts.</td>
</tr>
<tr>
<td></td>
<td>• Graphing and using error bars.</td>
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<tr>
<td>Time</td>
<td>1 hour</td>
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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.**