<table>
<thead>
<tr>
<th>Topic</th>
<th>Kinematics: Velocity</th>
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</thead>
<tbody>
<tr>
<td>Element</td>
<td>Teaching guide: Lesson 1 Skills:</td>
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<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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<td>• Interpret and calculate using distance/displacement–time graphs.</td>
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<td>• Apply the equations for speed and velocity; solve linear equations.</td>
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<tr>
<td>Time</td>
<td>1 hour</td>
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1. In reference to the video Introduction to kinematics, check in with the class about:
   - Concepts of position; coordinate system; time interval; rate of change in general and of position in particular; speed; velocity; and acceleration.
   - Concepts of vector and scalar.
   - Everyday use of the phrases ‘speed up’, ‘slow down’, ‘shortest distance’, ‘stationary’, etc.
   - Ask students to note down the questions from the Skills check that they found challenging and/or got incorrect.

2. Ask the students to read through the lesson material on Vector and scalar quantities, Vectors in one dimension, and Displacement and distance.
   - Confirm through their answers to Check your understanding questions 1 to 5 that students understand the key concepts and skills:
     - Vector quantities have size and direction.
     - Direction in one dimension is captured by + or – signs.
     - The application of Pythagoras’s theorem.

3. Ask the students to read through the lesson material on Velocity and speed
   - Confirm through their answers to the Check your understanding questions 6 to 9 that students understand the key concepts and skills:
     - The use of displacement in calculating velocity, the use of distance in calculating speed.
     - Using linear equations to solve for velocity/speed, displacement/distance, and time given any two of these quantities.
     - The ability to convert between kilometres per hour and metres per second.

4. Ask the students to read through the lesson material on Distance–time graphs.
   - Confirm through their answers to Check your understanding questions 10 to 13 that students understand the key concepts and skills:
     - How to compare gradients and how to calculate them.
     - How to graph linear data and analyse its features.
   - Finish the lesson by doing a think–pair–share exercise on how one could determine whether a body is experiencing a change in velocity (accelerating).
### Topic: Kinematics: Acceleration

#### Teaching 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 from velocity–time graphs.
- Apply the speed/velocity/time equations; solve linear equations.

#### Time
- 1 hour

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1. In reference to the Introduction to kinematics video, check in with the class about:
   - Everyday use of the words ‘acceleration’ and ‘deceleration’. Point out the correct usage, including the opposing signs for velocity and deceleration.
   - Enquire informally whether students know what it is that all accelerating systems share (the answer being forces), as a precursor to the next lesson.

2. Ask the students to read through the lesson material on Acceleration.

3. Confirm through their answers to Check your understanding questions 1 and 2 that students understand the key concepts and skills:
   - Acceleration is a vector quantity.
   - Applying the change in velocity equation correctly, for example \( 10 \text{ m s}^{-1} - (-5 \text{ m s}^{-1}) = 15 \text{ m s}^{-1} \).

2. Ask the students to read through the lesson material on Velocity–time graphs.

3. Confirm through their answers to the Check your understanding questions 3 to 7 that students understand the key concepts and skills:
   - Why uniform acceleration produces linear velocity–time graphs.

3. Ask the students to read through the lesson material on Area under a velocity–time graph.

3. Confirm through their answers to Check your understanding questions 8 and 9 that students understand the key concepts and skills:
   - The use of basic geometry to calculate the area of rectangles and triangles.
   - Using a calculator to find the square and square root of values.
### Topic: Kinematics: Measuring constant velocity

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<tr>
<th>Element</th>
<th>Teaching guide: Lesson 3 Skills:</th>
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<tbody>
<tr>
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<td>• Calculating the arithmetic mean.</td>
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<tr>
<td></td>
<td>• Graphing linear, or linearised, data, including gradient, area, and intercepts.</td>
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<td>• Graphing and using error bars.</td>
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| Time   | 1 hour |

1. Do a think–pair–share exercise with students 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. In small groups, ask students to read through the material on Measuring constant velocity and Laboratory example: Constant velocity.
   - Confirm, through class/small group discussion, that students understand the key concepts and 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. In pairs, ask students to read through and complete the instructions in the material entitled Investigation: Measuring the acceleration due to gravity.
   - Follow up either with a discussion of their findings in class or in pairs with the provided solutions.