

Physics > Big idea PFM: Forces and motion > Topic PFM2: Moving by force > PFM2.2: Motion graphs

Progression toolkit: Motion graphs

Learning focus	Information about the motion of an object can be summarised on a distance-time graph: the plot shows the object's distance from the start at a given time and the slope (gradient) at that point shows its speed.				
As students' conceptual understanding progresses they can:					
As students' conceptual understanding progresses they can:	Read values of distance or time off the axes of a distance-time graph for a plotted point P	Describe the changes to an object represented by a move from one point on a distance-time graph to another	Describe motion of an object represented by straight lines on a distance-time graph	Explain how a distance-time graph shows the changing position of an object	Explain how a distance-time graph shows the changing speed of an object B
Diagnostic questions	Off the line	Plot story	Line story	Where's Sally?	The speed of Dwight
Diagnostic questions			Two slopes		
Response activities	Plot the line	Speedy graphs			

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<p>Off the line</p> <p>1. Use the graph to match the correct distance to each time. Rule a line between each time and the correct distance.</p> <table border="1"> <thead> <tr> <th>Time</th> <th>Distance</th> </tr> </thead> <tbody> <tr> <td>5 s</td> <td>23 m</td> </tr> <tr> <td>10 s</td> <td>25 m</td> </tr> <tr> <td>7.5 s</td> <td>40 m</td> </tr> <tr> <td>3 s</td> <td>46 m</td> </tr> <tr> <td>6 s</td> <td>48 m</td> </tr> <tr> <td></td> <td>60 m</td> </tr> <tr> <td></td> <td>80 m</td> </tr> </tbody> </table>	Time	Distance	5 s	23 m	10 s	25 m	7.5 s	40 m	3 s	46 m	6 s	48 m		60 m		80 m	<p>Plot story</p> <p>A car moves along a flat. A graph is plotted to represent its motion. The picture of the car shows what the plot represents.</p> <p>2. WHICH CAR DOES THE NEW PLOT REPRESENT? Put a tick (✓) in the box next to the best answer.</p>	<p>Line story</p> <p>Zara is doing her sprint training. The picture of the car shows what the plot represents.</p> <p>1. What does the part of the graph between X and Y tell you about Zara? Put a tick (✓) in the box next to the best answer.</p> <p>A She starts at 20m. <input type="checkbox"/></p> <p>B She starts at 40m. <input type="checkbox"/></p> <p>C She starts at 60m. <input type="checkbox"/></p> <p>D She starts at 80m. <input type="checkbox"/></p> <p>2. What is Zara doing when she reaches the point marked Z? Put a tick (✓) in the box next to the best answer.</p> <p>A She stops at the start. <input type="checkbox"/></p> <p>B She starts from the start. <input type="checkbox"/></p> <p>C She starts from the start. <input type="checkbox"/></p> <p>D She starts from the start. <input type="checkbox"/></p>	<p>Two slopes</p> <p>Two toy cars move along the same straight line.</p> <p>3. At the moment that X, which car has a bigger speed? Put a tick (✓) in the box next to the best answer.</p> <p>A Red car. <input type="checkbox"/></p> <p>B Green car. <input type="checkbox"/></p>	<p>Where's Sally?</p> <p>Sally is running up and down in front of a motion sensor. The motion sensor is used to draw a graph of her movement.</p> <p>The graph represents Sally's motion. The distance-time graph shows where the graph shows about how Sally is moving. Put a tick (✓) in the box next to the best answer to show what you think.</p> <table border="1"> <thead> <tr> <th>Statements about Sally</th> <th>I am sure they're right</th> <th>I think they're right</th> <th>I think they're wrong</th> <th>I am sure they're wrong</th> </tr> </thead> <tbody> <tr> <td>At A Sally is running her fastest</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>At B Sally is running towards the start</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>At C Sally has stopped</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>At D Sally is behind the starting line</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Statements about Sally	I am sure they're right	I think they're right	I think they're wrong	I am sure they're wrong	At A Sally is running her fastest					At B Sally is running towards the start					At C Sally has stopped					At D Sally is behind the starting line				
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<p>The speed of Dwight</p> <p>Dwight is running up and down in front of a motion sensor. The motion sensor is used to draw a graph of her movement.</p> <p>1. Which letter on the graph represents where Dwight is going the fastest?</p> <p>2. Which letter on the graph represents where Dwight is speeding up?</p> <p>3. Which letter on the graph represents where Dwight is going the slowest?</p> <p>4. Which letter on the graph represents where Dwight is turning round?</p>	<p>Plot the line</p> <p>Alex is running using a sensor. He runs steadily for 10 min.</p> <p>1. Plot a graph to show the steady Alex's run. Use your graph to find out how far he runs in 10 minutes.</p> <table border="1"> <thead> <tr> <th>Distance / km</th> <th>Time / minutes</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>10</td> </tr> <tr> <td>4</td> <td>20</td> </tr> <tr> <td>6</td> <td>30</td> </tr> <tr> <td>8</td> <td>40</td> </tr> <tr> <td>10</td> <td>50</td> </tr> </tbody> </table>	Distance / km	Time / minutes	2	10	4	20	6	30	8	40	10	50	<p>Speedy graphs</p> <p>We can use a motion sensor and data logger to plot graphs in real time.</p> <p>Apparatus and materials:</p> <ul style="list-style-type: none"> Motion sensor Cart Connecting cables Dynamic trolley <p>Procedure:</p> <p>Set up the equipment and practice moving your own graphs. What does the graph look like when:</p> <ol style="list-style-type: none"> The trolley is moving at a steady speed? The trolley is moving at a faster steady speed? The trolley is not moving? The trolley starts slowly and speeds up? The trolley starts quickly and slows down? 	<p>Speedy graphs</p> <p>1. Do you move the trolley to make this graph?</p> <p>2. How do you 'move' the trolley differently to make this graph?</p> <p>3. You need two kinds of motion to make this graph.</p> <p>4. What is the trolley doing when the line on the graph is vertical?</p> <p>5. Can you move the trolley to make this graph?</p> <p>6. How do you 'move' the trolley differently to make this graph?</p> <p>7. Why is this a more realistic graph?</p> <p>8. Show us your own distance-time graph to try.</p>																														
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