

## Exploring Motion Graphs

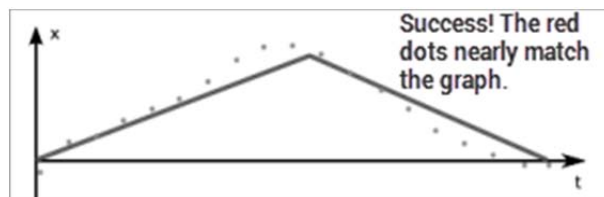
### Part I: Explore the Controls

In your web browser (mobile phones not recommended), navigate to [www.gigaphysics.com](http://www.gigaphysics.com), then click **Virtual Labs** in the heading bar and **Exploring Motion Graphs** in the list of labs.

Before you try to create specific motion graphs, use your mouse to drag the caterpillar back and forth a bit. You will find that the caterpillar will automatically stay on the ground; you need only worry about left and right motion. When you release the mouse button, you will see red dots in the graph area that reflect the way you moved the caterpillar. You'll explore why the graph looks the way it does in the next section.

### Part II: Investigate Position vs. Time Graphs

Set the **Type of graph** menu to position vs. time and the **Choose a graph** menu to position graph 1. This means that the vertical axis represents the position, or location, of the caterpillar along the ground, while the horizontal axis represents the elapsed time. Now drag the caterpillar to try to create a graph that looks like this one. It's OK if you aren't quite right the first time, or even if you have to take a wild guess. The whole point of this activity is to explore and learn by trying different things. Keep trying until you can figure out how the caterpillar should move in order to create this graph, then answer the two questions that follow.



What did the caterpillar have to do when the graph stopped going upward and started going downward?

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What did the caterpillar have to do in order for the graph to return to the horizontal axis at the end?

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Now switch the **Choose a graph** menu to position graph 2. As before, experiment until you are able to learn how to produce the graph on the screen, then answer the questions that follow.

On a position vs. time graph, what does it mean when the graph has a perfectly horizontal segment such as the three found in position graph 2?

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What does it mean when the position vs. time graph is below the horizontal axis instead of above it?

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Now switch to position graph 3, and experiment until you can create the graph.

The first segment of this graph is much steeper than the final segment. What did you have to do with the caterpillar to make the first portion of the graph steep and the final segment less steep?

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Finally, try position graph 4. This time, the graph is a curved segment that gradually gets steeper. What do you have to do with the caterpillar to create this feature of the graph?

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### **Part III: Investigate Velocity vs. Time Graphs**

Now change the **Type of graph** menu to velocity vs. time and select velocity graph 1. These graphs are different. Instead of representing the location of the caterpillar as on the position vs. time graph, the vertical axis now represents the velocity of the caterpillar, or how fast it is moving. As before, experiment until you learn how to create the first velocity graph and answer the first two questions.

What does it mean when a velocity vs. time graph has a straight horizontal segment?

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What did you have to do with the caterpillar to match the second, higher horizontal segment?

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Switch to velocity graph 2 and, after creating the graph, answer the next question.

What does it mean when the velocity graph is below the horizontal axis instead of above it?

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Now try velocity graph 3. What did you have to do with the caterpillar to make the velocity vs. time graph return to the horizontal axis at the end?

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Finally try graph 4. What did you have to do with the caterpillar to create the final segment that slopes downward below the horizontal axis?

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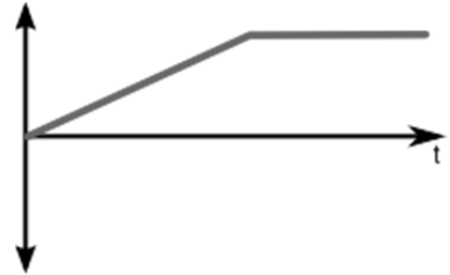
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### Part IV: Review and Apply

Complete the table below contrasting the meaning of different graph features on a position vs. time graph with the same features on a velocity vs. time graph.

Graph feature	Meaning on a position vs. time graph	Meaning on a velocity vs. time graph
horizontal segment		
at horizontal axis		
below horizontal axis		

Suppose that the graph at the right is a position vs. time graph that describes the motion of a dog. Write a brief description of what the dog is doing in this graph.



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Now suppose that the same graph instead depicts the dog's velocity vs. time graph. Write a brief description of what the dog is doing in this graph.

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