Graphing and Motion Tutorial

Part I – Graph Matching

Match the Position Graph

Use the mouse to drag the rear bumper of the toy monster truck (the red ball). The goal of this exercise is to match the position vs. time graphs as shown in the animation (position is given in centimeters and time is given in seconds).

After you have successfully matched the three position graphs answer the following questions.

1. Describe, in words, the motion required to replicate Position Graph 1.

2. How does the motion required to replicate Position Graph 2 differ from the motion for Position Graph 1?

3. Now consider Position Graph 3. There are essentially three segments to this graph. In the first segment you must remain stationary. In the second segment the graph is down and steep and in the third segment the graph is upward and less steep. How does the motion differ in the last two segments in terms of direction and speed?
Match the Velocity Graph

Use the mouse to drag the rear bumper of the toy monster truck (the red ball). The goal of this exercise is to match the velocity vs. time graphs as shown in the animation (position is given in centimeters and time is given in seconds). After you have successfully matched the three velocity graphs answer the following questions.

1. Were you surprised by anything while you were matching the velocity graphs? Explain.

2. Describe the motion you need to match the first graph.

3. Describe the motion you need to match the second graph. Did you always move the mouse in same direction? If not, at what point did you change the direction of motion.

4. Describe the motion you need to match the third graph. Did you always move the mouse in same direction? If not, at what point did you change the direction of motion.
Part II – Graph Predicting

Given a Motion …
You are shown the motion of an object over time. After viewing the motion using the link above,

a) Sketch a graph for position vs. time.

b) Sketch a graph for velocity vs. time.

c) Sketch a graph for acceleration vs. time.

Now discuss your graphs with your partners. Do your predictions match? Once you feel confident in your responses check using the link below. DO NOT click the link below until you have WRITTEN down and DISCUSSED your predictions.

Where you correct? If not, explain.
Given a Position Graph...
You are shown a graph representing the position of an object over time. After viewing the graph using the link above,

a) Describe in words what the motion would look like.

b) Sketch a graph for velocity vs. time.

c) Sketch a graph for acceleration vs. time.

Now discuss your description and graphs with your partners. Do your predictions match? Once you feel confident in your responses check using the link below. DO NOT click the link below until you have WRITTEN down and DISCUSSED your predictions.

Where you correct? If not, explain.
Given a Velocity Graph…
You are shown a graph representing the velocity of an object over time. After viewing the graph using the link above,

a) Describe in words what the motion would look like.

b) Sketch a graph for position vs. time.

c) Sketch a graph for acceleration vs. time.

Now discuss your description and graphs with your partners. Do your predictions match? Once you feel confident in your responses check using the link below. DO NOT click the link below until you have WRITTEN down and DISCUSSED your predictions.

Where you correct? If not, explain.
Given an Acceleration Graph…
You are shown a graph representing the acceleration of an object over time. After viewing the graph using the link above,

a) Describe in words what the motion would look like.

b) Sketch a graph for position vs. time.

c) Sketch a graph for velocity vs. time.

Now discuss your description and graphs with your partners. Do your predictions match? Once you feel confident in your responses check using the link below. DO NOT click the link below until you have WRITTEN down and DISCUSSED your predictions.

Where you correct? If not, explain.

Now view this set of graphs. Notice that the acceleration graph is identical to the one above. The velocity graph is shifted and the position graph is completely different. What is going on? Are these graphs also correct? Explain.
**Part III – Mathematical Connections**

In this section you are given a graph of either x(t) or v(t) and asked find a mathematical function. Try to figure out the correct formula using ideas from kinematics rather than just guessing and plugging.

**Find x(t) given a x(t) graph.** (Note that the graph depicts the position as a function of time.)

\[ x(t) = \]

**Find v(t) given a x(t) graph.** (Note that the graph depicts the position as a function of time.)

\[ v(t) = \]

**Find a(t) given a x(t) graph.** (Note that the graph depicts the position as a function of time.)

\[ a(t) = \]

**Find x(t) given a v(t) graph.** (Note that the graph depicts velocity as a function of time)

\[ x(t) = \]

**Find v(t) given a v(t) graph.** (Note that the graph depicts velocity as a function of time)

\[ v(t) = \]

**Find a(t) given a v(t) graph.** (Note that the graph depicts velocity as a function of time)

\[ a(t) = \]