

Motion on a Position vs Time Graph

Name:

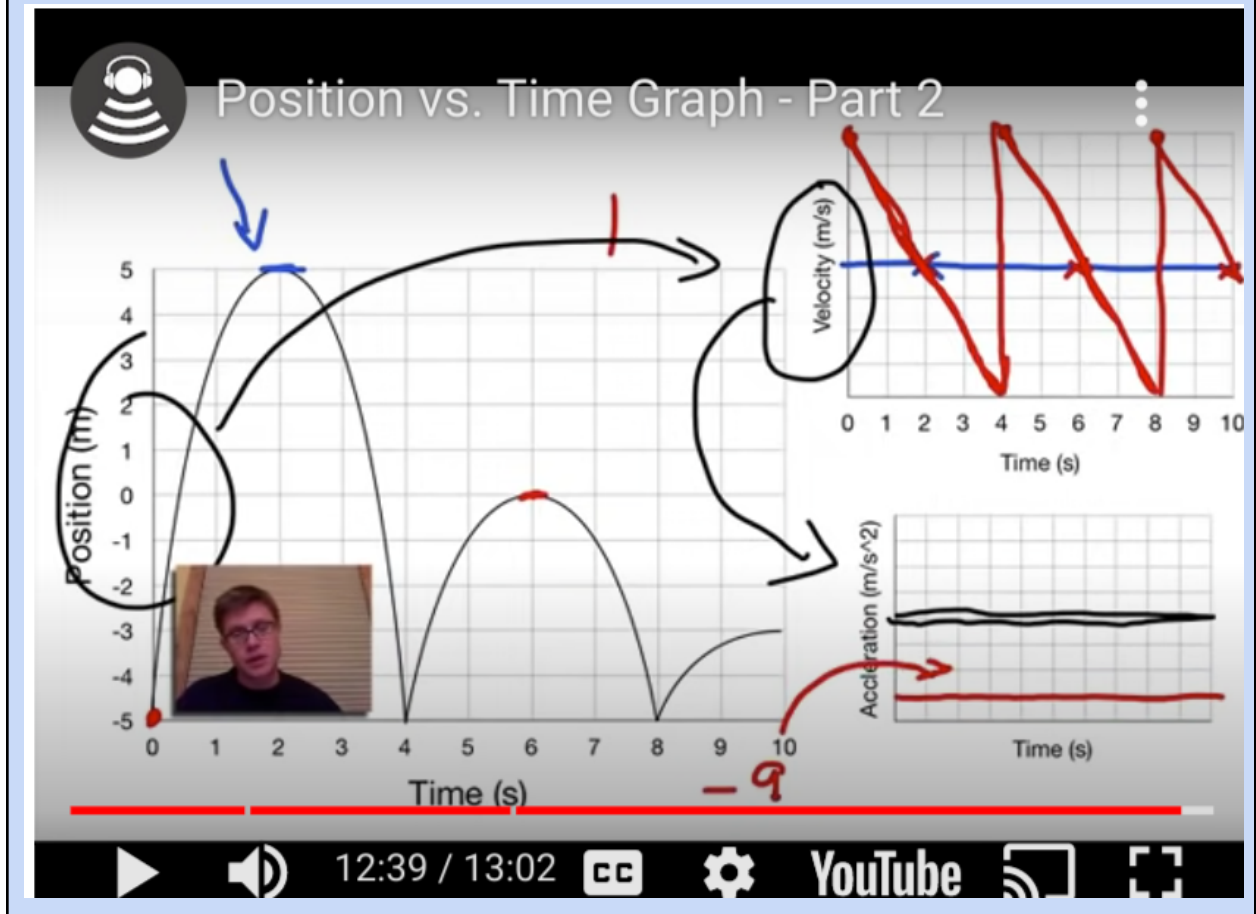
INTRODUCTION:

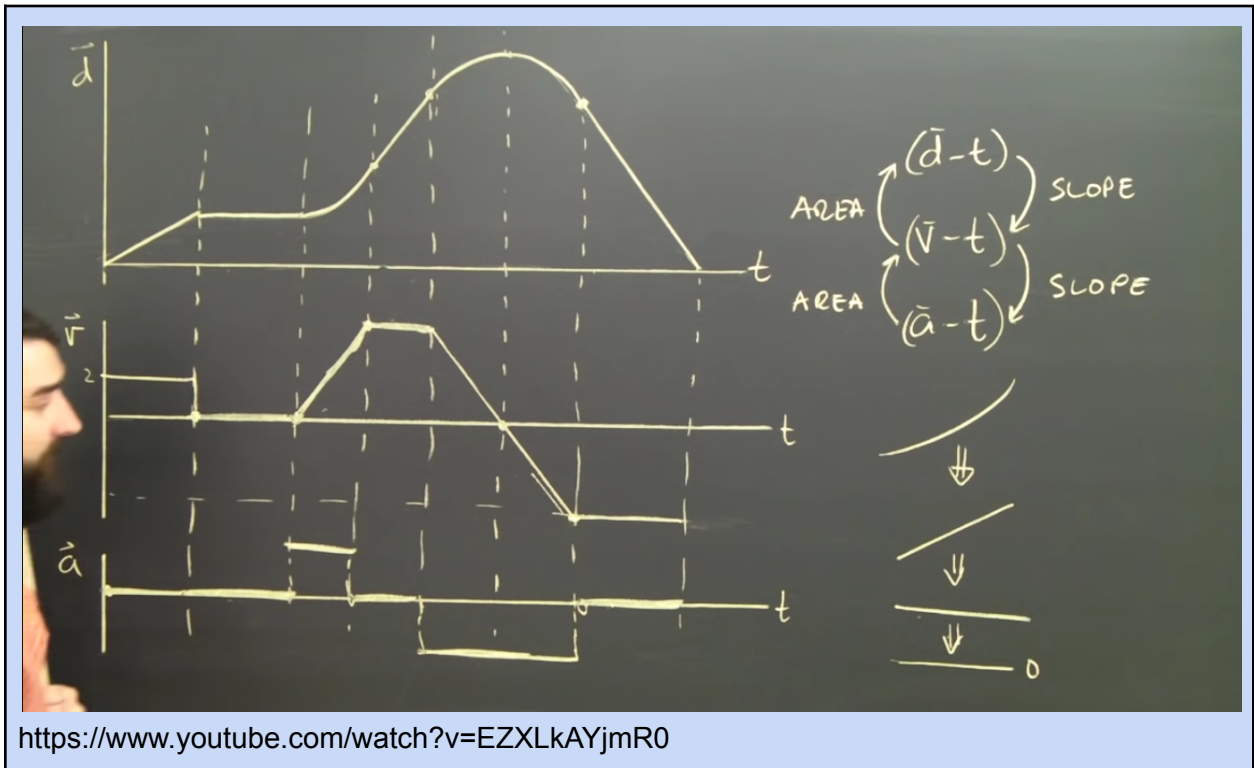
In this activity you will read about and then explore how to describe motion on a position vs time graph. Remember the slope of a Position vs Time graph is the Velocity. ***Velocity is the rate of speed in which something happens in a particular direction.***

BACKGROUND INFORMATION:

Complete this reading: [Position vs Time Graphs \(ck-12\)](#). Then summarize your learning (2pts)

- 1) The slope of a position v time graph equals velocity.
- 2) The slope of the velocity v time graph equals acceleration
- 3) When plotting the slope, identify the places where the slope equals zero.
- 4) The slope of a curve like x^2 line is a straight line with constant slope (2).
- 5) The slope of the inclined line is a horizontal line.
- 6) The slope of the horizontal line is zero.
- 7) (I think the graph below is a little inaccurate: it could better show that the slope of the position-time curve is decreasing with each bump).

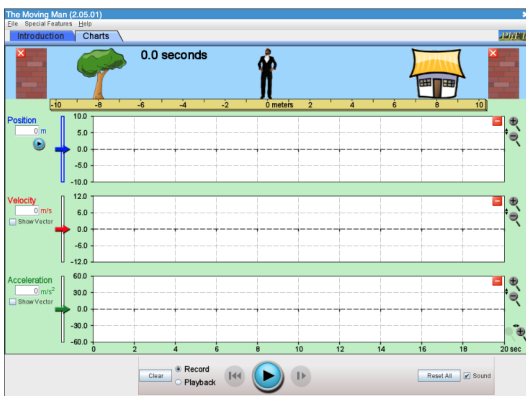




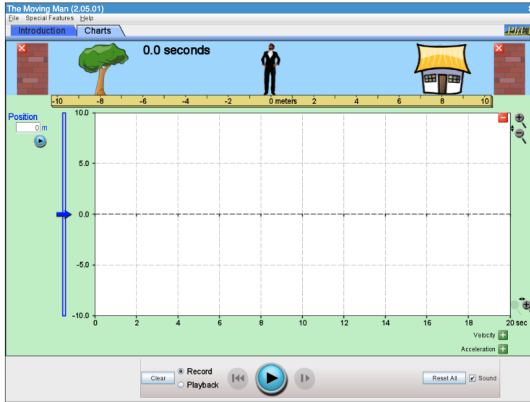
Note: You may find it helpful to review the Live Class recording from 10/10 if you missed class.

SIMULATION SET UP:

1. Open the [Moving Man Phet Simulation](#). It will take a second to load.
2. Click on "Charts" found on the top left next to "Introduction"
3. You will get this image:



3. Click on the red square with the white dash in "velocity" then the red square in acceleration to make your The Moving Man look like this:



4. You should now only have the **Position** vs Time graph showing.

EXPLORE

1. Start your simulation by clicking on the play button at the bottom. If you don't click the play button your graph will not work.



Clear your graph and start at the origin, Zero:

2. Start your sim and don't move your man.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

The flat slope indicates that the man is not moving

The screenshot shows the 'The Moving Man' simulation interface. At the top, it says '4.0 seconds'. Below that is a horizontal axis labeled '0 meters' with a man icon at the center. To the right is a house icon. Below the axis is a position vs. time graph. The vertical axis is labeled 'Position' and ranges from -10.0 to 10.0. The horizontal axis is labeled 'Time' and ranges from 0 to 20. A blue line is drawn at Position = 0.0, extending from Time = 0 to Time = 4. The graph has a grid. At the bottom, there are controls for 'Velocity' and 'Acceleration'.

Clear your graph and start at the origin, Zero:

- 3. Move your man quickly to the right, positive velocity, and then stop him.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

Sudden motion to the right makes a steep positive slope. The slope is flat when the man stops.

The screenshot shows the PhET simulation 'The Moving Man (2.05.01)'. The interface includes a browser window with the URL phet.colorado.edu/sims/cheerpj/moving-man/latest/moving-man.html?simulation=moving-man. The simulation area shows a man character on a horizontal axis from -10 to 10 meters. A house icon is at 8 meters. A tree is at -8 meters. The time is 7.9 seconds. Below the axis is a position-time graph. The y-axis is labeled 'Position' and ranges from -10.0 to 10.0 meters. The x-axis is labeled 'Time' and ranges from 0 to 20 seconds. The graph shows a blue line that is flat at 0 meters until 4.5 seconds, then rises steeply to 10 meters at 7.9 seconds, and then remains flat at 10 meters. The simulation controls include a play button, a velocity control (+/-), and an acceleration control (+/-).

Clear your graph and start at the origin, Zero:

4. Move your man quickly to the left, negative velocity, and then stop him.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

When the man was still at the origin, the position for flat at the zero level. When the man was moved quickly to the left, the position fell steeply from 0 to -10 and then flat-lined.

The screenshot shows the PhET simulation 'The Moving Man (2.05.01)'. The interface includes a top navigation bar with 'Introduction' and 'Charts' tabs. The main simulation area shows a man standing on a number line from -10 to 10 meters. A tree is at -8m and a house is at 8m. The time is 8.1 seconds. Below the simulation is a position vs. time graph. The y-axis is labeled 'Position' and ranges from -10.0 to 10.0 meters. The x-axis is labeled 'Time' and ranges from 0 to 20 seconds. The graph shows a blue line that is flat at 0.0 meters until approximately 2.0 seconds, then drops steeply to -10.0 meters, and remains flat at -10.0 meters thereafter. A vertical blue arrow on the left indicates the current position is -10.0 m. On the right side of the graph, there are controls for 'Velocity' and 'Acceleration', both with '+' signs.

Clear your graph and start at the origin, Zero:

- 5. Move your man quickly at first (either direction) and then slow to a stop. Then move your man in the opposite direction quickly and then slow to a stop. positive velocity quickly at first then slow to a stop.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

Moving quickly right ($t = 0, t = 1$) make a steep slope upward. As the man slows ($t = 2$ to $t = 4.5$) there is a gentle slope upward. When he stops ($t = 5$) the slope is flat. When he goes quickly left ($t = 5.5$ to $t = 6$) the slope is steep downward. When he stops at the origin at $t = 6$, the slope is flat. When he continues to the left slowly, there is a downward slope until $t = 12$. Then he suddenly moves right making a steep upward slope until $t = 13$. He slows and stops at $t = 17$.

The screenshot shows the 'The Moving Man' simulation interface. At the top, the title bar reads 'The Moving Man (2.05.01)'. Below it are menu options: 'File', 'Special Features', and 'Help'. There are two tabs: 'Introduction' and 'Charts', with 'Charts' selected. The main display area shows a scene with a tree on the left and a house on the right, with a man standing in front of the house. A horizontal axis at the top is labeled '0 meters' and ranges from -10 to 10. A vertical axis on the left is labeled 'Position' and ranges from -10.0 to 10.0. A blue line graph plots the man's position over time. The graph shows a steep upward slope from (0,0) to (1,10), a gentle upward slope to (4.5,10), a flat line at 10m until t=5, a steep downward slope to (6,0), a flat line at 0m until t=6, a gentle downward slope to (12,-10), a steep upward slope to (13,0), a gentle upward slope to (17,10), and a flat line at 10m until t=19.7. The simulation interface includes a top bar with '19.7 seconds', a scene with a tree and a house, and a bottom bar with 'Position' and '10 m'. There are also buttons for 'Velocity' and 'Acceleration' with plus signs.

Clear your graph and start at the origin, Zero:

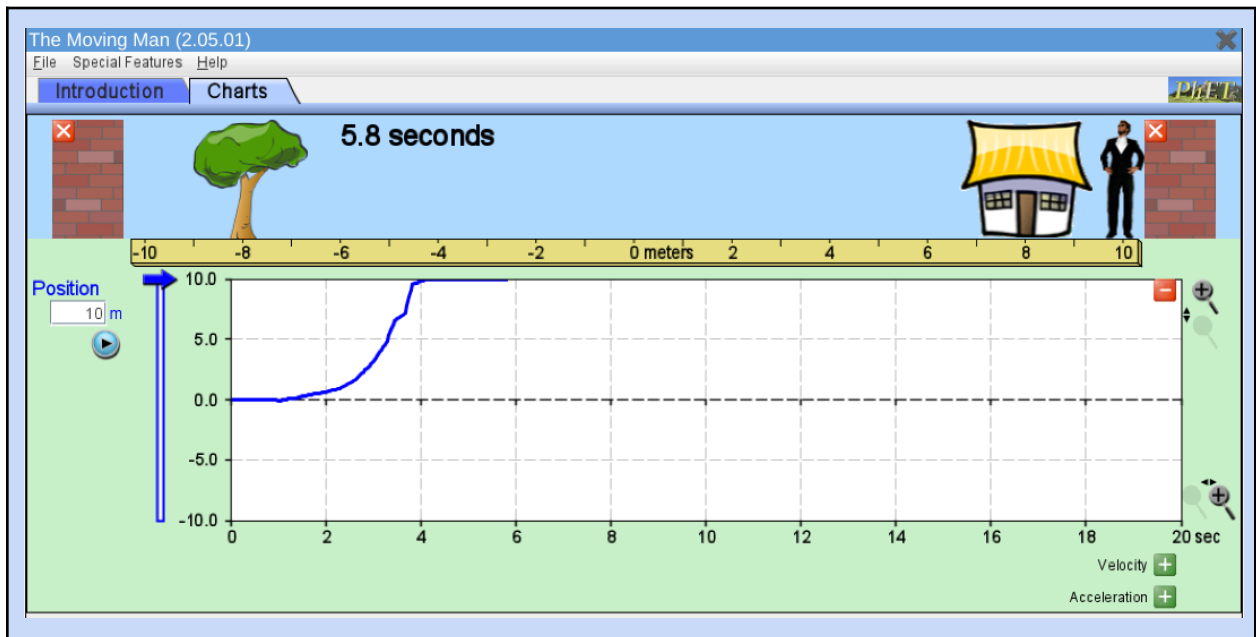
- 6. Move your man to the right, positive velocity, then to the left, negative velocity, crossing the origin. Do this 10 times.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

The slope made a steep positive for motion to the right, and a steep negative for motion to the left. The wave crossed the zero point.

Clear your graph and start at the origin, Zero:

- 7. Move your man slowly at first then speed up.
 - a. Take a screenshot and enter it in the box below.
 - b. Answer in the box: What do you notice about the slope? What does that tell you?

Moving slowly to right makes slight upward curve, speeding up makes a much more steep upward curve.



ANALYZE:

1. What does the slope on the position vs time chart or graph mean? How do you know?

The slope on a position vs time chart indicates the velocity. Velocity is the change in position over the change in time, the rise over the run, or the slope of the position vs time curve.

2. What does velocity describe? Use evidence from the blue charts to support your answer.

Velocity describes the slope of the position vs time graph. Graph 7 shows show the slope increases with increasing velocity. Chart 6 shows a deep narrow wave in the position vs time, and the slope changes from steep positive to steep negative as the velocity changes from positive to negative rapidly.

3. Compare and contrast position and velocity. How are they related?

The velocity is based on the change of position per unit time. The velocity is the slope of the position vs. time slope.

- a) If the velocity is zero, the position vs time graph will be flat.
- b) If the velocity curve is flat but non-zero, the velocity is constant and the position vs time curve will change at a constant rate. It will be a straight rising line if the velocity is a positive constant, and a straight negative line if the velocity is a constant negative.
- c) If the velocity is increasing linearly, then the position vs time graph will be curved.
- d) When there is a flat tangent point on the position vs time curve, the velocity is zero.

