3.2.9: Position vs. Time Graphs

Figure 2.8.1

Drawing line graphs can help you understand motion. In this article, you'll learn how to draw position-time graphs and how they show velocity.

Q: What's missing from the graph being drawn in the picture above?

A: The x- and y-axes are missing.

Graphing Position and Time

The motion of an object can be represented by a position-time graph like Graph 1 in the **Figure** below. In this type of graph, the y-axis represents position relative to the starting point, and the x-axis represents time. A position-time graph shows how far an object has traveled from its starting position at any given time since it started moving.

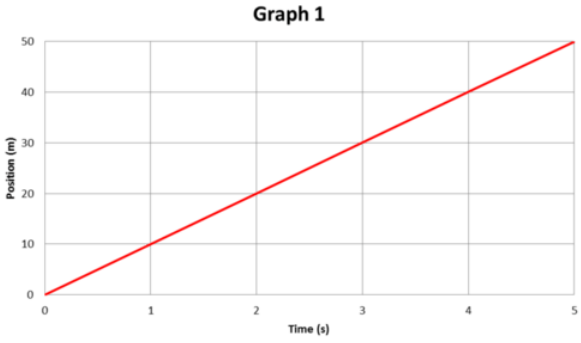

Figure 2.8.2

Q: In the **Figure** above, what distance has the object traveled from the starting point by the time 5 seconds have elapsed?

A: The object has traveled a distance of 50 meters.

Slope Equals Velocity

In a position-time graph, the velocity of the moving object is represented by the slope, or steepness, of the graph line. If the graph line is horizontal, like the line after time = 5 seconds in Graph 2 in the **Figure** below, then the slope is zero and so is the velocity. The position of the object is not changing. The steeper the line is, the greater the slope of the line is and the faster the object's motion is changing.

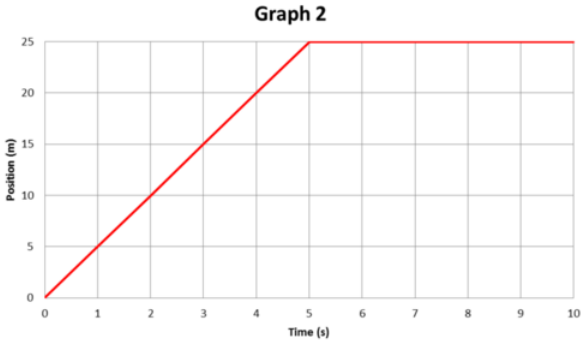

Figure 2.8.3

Calculating Average Velocity from a Position-Time Graph

It's easy to calculate the average velocity of a moving object from a position-time graph. **Average velocity** equals the change in position (represented by Δd) divided by the corresponding change in time (represented by Δt):

$$v_{avg} = \frac{\Delta d}{\Delta t}$$

For example, in Graph 2 in the **Figure** above, the average velocity between 0 seconds and 5 seconds is:

$$v_{avg} = \frac{\Delta d}{\Delta t} = \frac{(25\text{m} - 0\text{m})}{(5\text{s} - 0\text{s})} = \frac{25\text{m}}{5\text{s}} = 5\text{m/s}$$

Watch this two-part video series for more position vs. time graph examples.

Use the following PLIX Interactive to make a position-time graph for a runner who changes speed during their run:

Summary

- Motion can be represented by a position-time graph, which plots position relative to the starting point on the y-axis and time on the x-axis.
- The slope of a position-time graph represents velocity. The steeper the slope is, the faster the motion is changing.
- Average velocity can be calculated from a position-time graph as the change in position divided by the corresponding change in time.

Review

1. Describe how to make a position-time graph.
2. What is the slope of a line graph? What does the slope of a position-time graph represent?
3. Can a line on a position-time graph have a negative slope, that is, can it slope downward from left to right? Why or why not?
4. In Graph 1 in the **Figure** above, what is the object's average velocity?

Additional Resources

Study Guide: Motion Study Guide

Real World Application: The Bullet Drop

PLIX: Play, Learn, Interact, eXplore: Irwin and Ruthie

Video: