Graphing Motion (Part 1)

Up to this point, we have described motion in terms of definitions and mathematical equations. Another way to describe motion is using graphs. In this lesson we will examine one type of graph and what it tells us about the motion of an object.
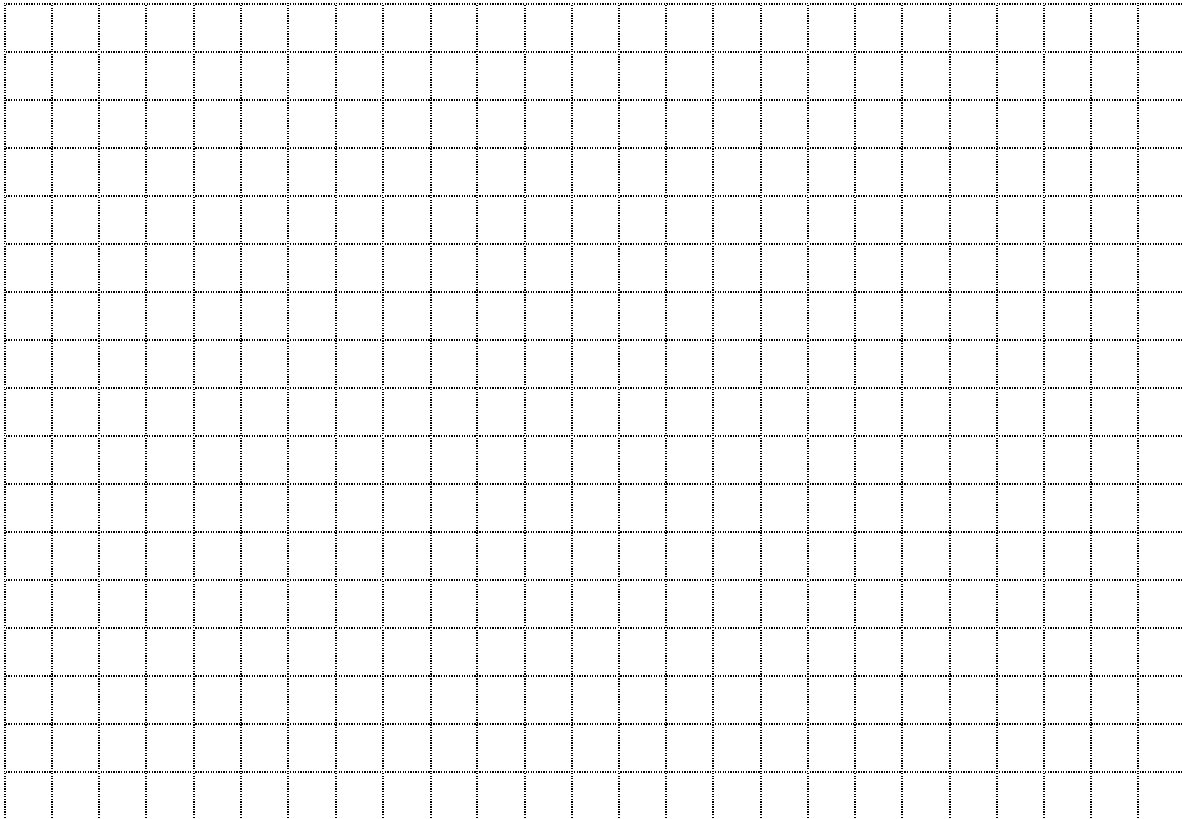
Position-Time Graphs

A position-time graph describes the position of an object as a function of time. When plotting a position-time graph:

- Place position on the y-axis.
- Place time on the x-axis.
- Plot the data points.
- Connect the data points using either straight line segments or smooth curves.

Example 1

The following data describes the position of a white-tailed deer at various times. Plot the position-time graph of the deer's motion.

Position (m)	0	13	25	40	51	66	78
Time (s)	0	1.0	2.0	3.0	4.0	5.0	6.0

A position-time graph can be used to determine:

1. The position of the object at a given time.

Example 2
What is the position of the deer in Example 1 at t = 2.5 s?

2. The displacement of the object over a given time interval.

Example 3
What is the displacement of the deer in Example 1 from t = 2.0 s to t = 5.0 s?

3. The velocity of the object over a given time interval.

Example 4
What is the velocity of the deer in Example 1?

Summary
On a position-time graph:

1. The object's position at a given time is found by reading the graph.

2. The object's displacement over a given time interval is found by
   a. Locating the initial position (see #1).
   b. Locating the final position (see #1).
   c. Displacement = Final Position – Initial Position

3. The object's velocity over a given time interval is given by the slope of the graph in that interval.

A position-time graph can also be used to provide a description of the motion of an object.

Example 5
The position-time graph below represents non-uniform motion (in other words, the velocity is not constant).

a. Describe the motion of the object in each segment of the graph (A to F).

A _____

B _____

C _____

D _____

E _____

F _____

b. Calculate the velocity of the object in each segment of the graph (B to E).

c. Calculate the average velocity of the object from t = 0 to t = 10 s.

Homework
Motion Worksheet #4
Uniform Motion Worksheet
Velocity from Position-Time Graphs Worksheet

Motion Worksheet #4

1. Given the data table below:

Position (m)	0	6	6	−10	−10	−4	0
Time (s)	0	2.0	6.0	10	12	13	18

    a. Plot the position-time graph.
    b. Describe the motion of the object in each segment of the graph.
    c. Calculate the velocity of the object in each segment of the graph.
    d. Calculate the average velocity from t = 4 s to t = 12 s.

2. Given the position-time graph below:

    a. Describe the motion of the object in each segment of the graph.
    b. Calculate the velocity of the object in each segment of the graph.
    c. Calculate the average velocity from t = 0 to t = 14 s.