

The Dot System

Part III

Introduction

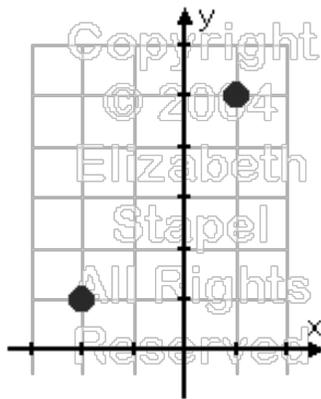
In Part I and II, we discussed the basic mathematical concept of plotting points on a coordinate plane in order to identify an object's exact location in space. Next, we will learn how to define the motion of an object traveling in space. As before, for the success of the entire band, every performer must master the information in this packet.

Defining Motion of an Object:

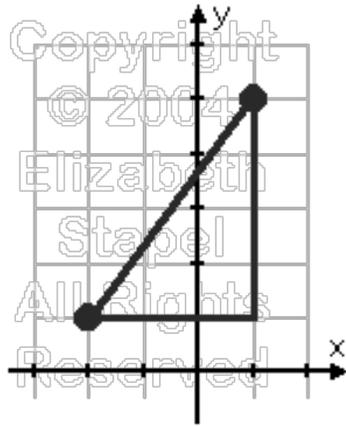
In addition to identifying the precise location of a point in space, the coordinate system can also be used to define the motion of an object that is traveling on the coordinate plane. To understand how to define motion, a few key terms are required:

1. Vector – A way to define the motion of an object. A vector has two parts:
 - a. The magnitude (distance) an object has traveled.
 - b. The direction the object has traveled.
2. Midpoint – The point that is directly half way between two points on a the coordinate plane.

For example, let's say that an object is moving on the coordinate plane in a straight line. The object starts at $(-2, 1)$ and ends at $(1, 5)$:



And if we connect the points, a diagonal line will be formed. This diagonal line can be divided into two component vectors: a vector representing the distance traveled along X-axis (horizontal direction), and a vector representing the distance traveled along the Y-axis (vertical direction)



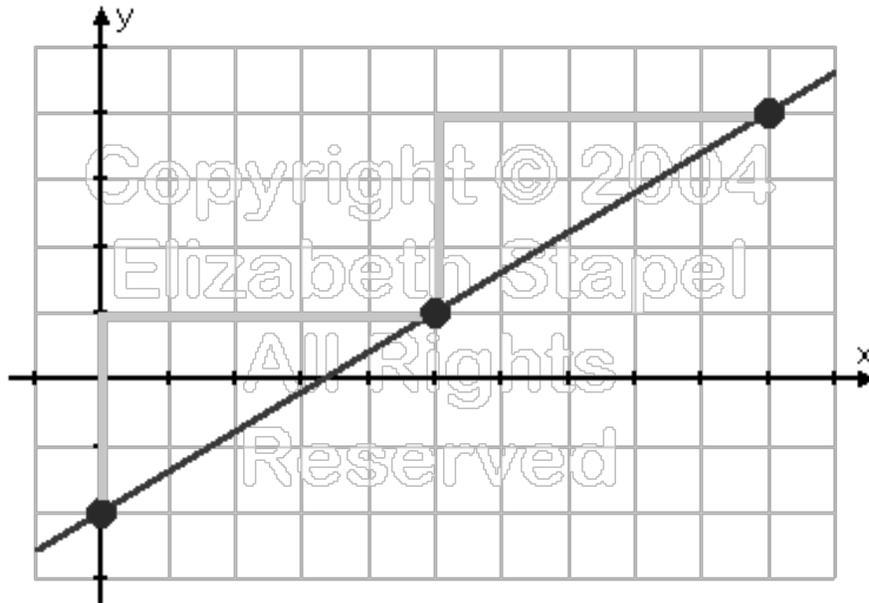
For this particular example, the vector along the X-axis would be 3 units in the positive direction and the vector along the Y-axis would be 4 units in the positive direction.

Now, trace the diagonal line with a pencil, stopping at a few arbitrary positions along the path. You will notice that as the object travels along the diagonal line, it is traveling along the X-axis and Y-axis simultaneously. In other words, for every position along the diagonal line, there will be a corresponding position along the X-axis and a corresponding position along the Y-axis.

Finding the midpoint of a traveling object:

Using the concept of vectors, we can now calculate the exact midpoint along an object's path. If you recall, the object's diagonal path is the result of traveling along the X-axis and Y-axis simultaneously. If we calculate half of the vector along the X-axis, and half of the vector along the Y-axis, we will have calculated half of the distance traveled along the diagonal path. With this, we know the exact coordinates of the object's midpoint.

For example, let's say an object starts at $(0,-2)$ and ends at $(10,4)$:



The object's vector along the X-axis would be 10 units in the positive direction, and the vector along the Y-axis would be 6 units in the positive direction. To find the midpoint we would calculate half of the vector along the X-axis to be 5 units in the positive direction, and half of the vector along the Y-axis to be 3 units in the positive direction. With this we can pinpoint the midpoint at $(5,1)$.

Assignment #3

The following assignment is designed to assess your understanding of the application of the basic concepts outlined in the packet. You are expected to **FOLLOW INSTRUCTIONS EXACTLY AS THEY ARE EXPLAINED**. In other words, there is no room for interpretation of the instructions. If you have any questions, **ASK A DIRECTOR OR STAFF MEMBER**. Please complete the assignment and **TURN IT IN TO YOUR SECTION LEADER BY THE END OF THE DAY TODAY**.

- I. **ON THE COORDINATE PLANE PROVIDED**, Using a sharp **PENCIL**, plot the following points on the blank coordinate plane provided. Be sure to write the corresponding coordinate number next to the point on the coordinate plane. **PLEASE BE PRECISE**:
 1. START: (0, 7) END: (2, 3)
 2. START: (-2, 8) END: (3, 6)
 3. START: (-5, -5) END: (5, 5)
 4. START: (3, -5) END: (6, 2)
 5. START: (-1, 4) END: (2, -6)
 6. START: (-2, 2) END: (4, 7)
 7. START: (-6, 0) END: (1, -3)
 8. START: (0, 0) END: (-2, 8)
 9. START: (3, 2) END: (6, 3)
 10. START: (4, 1.5) END: (4, 2)
 11. START: (-4, -3) END: (1, 6)
 12. START: (1, -3) END: (-4, 8)
- II. **ON THE COORDINATE PLANE PROVIDED**, Using a ruler, draw a straight-line path connecting the dots.
- III. **ON THE COORDINATE PLANE PROVIDED**, Using a ruler, draw the vectors (along the X-axis and Y-axis) for all twelve straight-line paths.
- IV. **ON THE COORDINATE PLANE PROVIDED**, Neatly write the magnitude (distance traveled) for all vectors.
- V. **ON THE COORDINATE PLANE PROVIDED**, Plot the midpoints for all twelve straight-line paths.
- VI. **ON THE ANSWER SHEET PROVIDED**, list the coordinates for the midpoint for all twelve straight-line paths.
- VII. Write your name on **BOTH THE ANSWER SHEET AND THE COORDINATE PLANES PROVIDED**. **YOU WILL TURN IN ONLY THESE DOCUMENTS**.

NAME: _____

INSTRUMENT: _____

1. MIDPOINT: _____

2. MIDPOINT: _____

3. MIDPOINT: _____

4. MIDPOINT: _____

5. MIDPOINT: _____

6. MIDPOINT: _____

7. MIDPOINT: _____

8. MIDPOINT: _____

9. MIDPOINT: _____

10. MIDPOINT: _____

11. MIDPOINT: _____

12. MIDPOINT: _____