Math Lab 1 MS 3
Working with Graphs

For best results, print this document front-to-back and place it in a three-ring binder.
Corresponding teacher and student pages will appear on each opening.

TEACHING PATH - MATH SKILLS LAB - CLASS M

NOTE PREPARATORY MATH SKILLS NEEDED TO COMPLETE THIS LAB

There is a Preparatory Math Skills Lab in a separate book entitled *PT Resource Manual* that contains concepts your students should have mastered before they begin this Math Skills Lab. This preparatory lab is coded "PMS1." It is titled, "Learning How to Draw and Measure to Scale." Encourage students who need help with this skill to study the material in PMS1.

RESOURCE MATERIALS

Student Text: Math Skills Lab

Resource Manual: Preparatory Math Skills

CLASS GOALS

1. Teach students how to draw a graph.
2. Teach students how to read a graph.

CLASS ACTIVITIES

1. Take five or ten minutes to go through the Student Exercises. Make sure that your students understand the correct answers.
2. Complete the activities. Students already should have read the discussion material and looked at the examples for each activity before coming to class. You should summarize the main points in each activity, work an example or two, and have students complete the Practice Exercises for each activity on their own.
3. Supervise student progress. Help students obtain the correct answers.
4. Before the class ends, tell your students to read Lab 1E1, "Measuring Voltages," as homework.

Math Skills Laboratory

Lab 1 MS 3

MATH ACTIVITY

Working with Graphs

Part 1: Drawing Graphs

Part 2: Interpreting Graphs

MATH SKILLS LAB OBJECTIVES

When you complete this activity, you should be able to do the following:

1. ***Draw a line graph to represent given information (numbers).***
2. ***Use a line graph to extract certain information.***

LEARNING PATH

1. ***Read the Math Skills Lab. Give particular attention to the Math Skills Lab Objectives.***
2. ***Work the problems.***

ACTIVITY

Working with Graphs

MATERIALS

For this activity, you'll need a ruler (English and metric) and suitable graph paper.

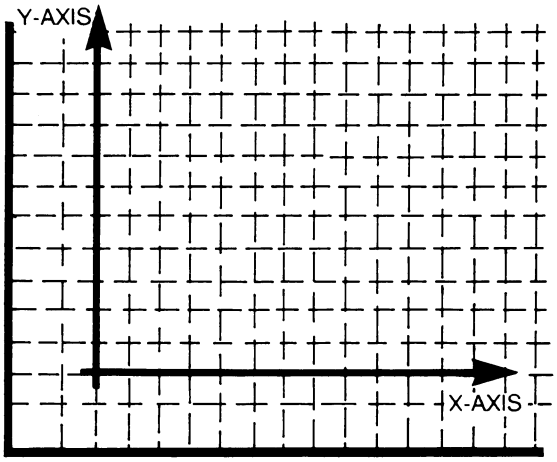
Part 1: *Drawing Graphs*

Graphs are like pictures. A graph is a type of picture that lets you compare one quantity to another. For example, let's consider an object that moves along a straight line. If we record its speed for the first five seconds, we can produce a table of data like the one shown below.

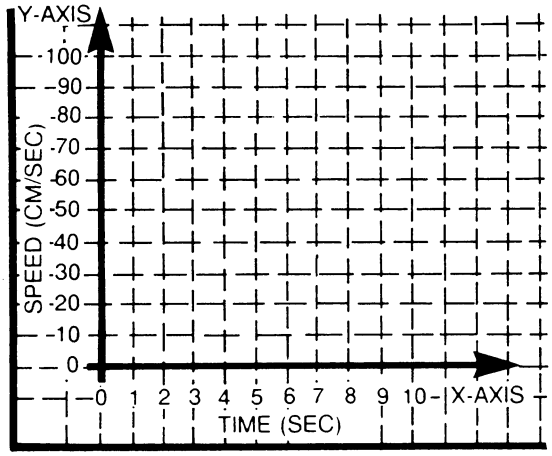
Time in seconds	Speed in cm/sec
0	0
1	12
2	24
3	36
4	48
5	60

Then we can draw a graph that represents this data, as follows.

Step 1: On a piece of graph paper, draw a vertical (up and down) line called the "Y-axis." Then draw a horizontal (across) line called the "X-axis," as shown in the following illustration



Step 2: Next, set up a convenient scale along the Y-axis for the ***speed*** values. For example, if the largest speed value is 60, divide the vertical scale into units from 0 to 100. Also set up a scale along the X-axis for the ***time*** values. For example, if the largest time value is 5, divide the scale into units from 0 to 10. Label each axis appropriately, one for speed, one for time.



Step 3: Now, from the table of data, plot ***each pair*** of values on the graph. For example, when the time is 5 seconds, the corresponding value for the speed is 60 cm/sec. This pair of values is entered on the graph as a single point. Here's how. See Figure 1a. The single point is located by "tracing" a vertical line upward from the 5-sec time point, then by tracing a horizontal line over from the 60-cm/sec speed point. The plotted point is formed where the two lines intersect.

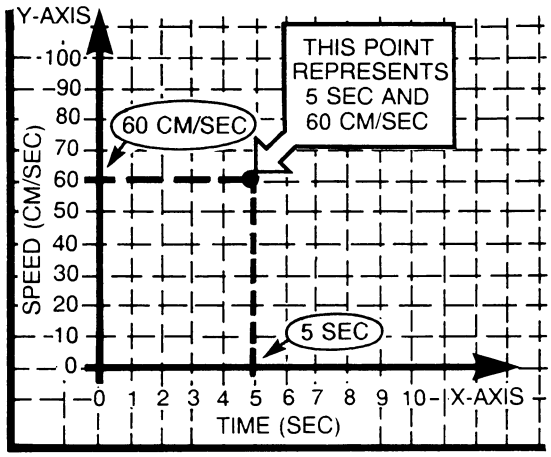


Fig. 1a

Step 4: Continue this point-plotting process for each of the four remaining pairs of values in the data table. When you're finished, you should have five points plotted. Now draw a straight line through these five points. Extend the line past the bottom point and the top point. (See Figure 1b.) The straight-line graph is now complete. It's "a picture" of how the object's speed changes as time increases.

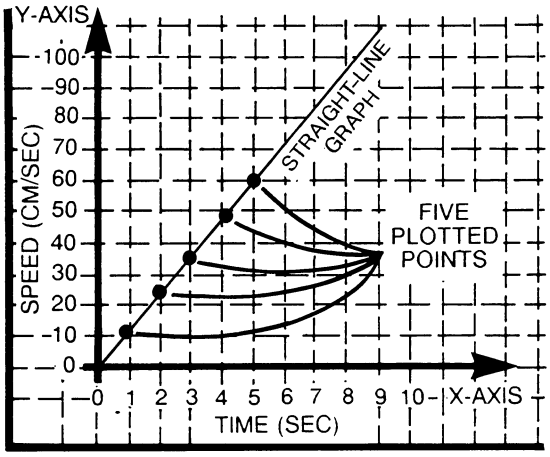
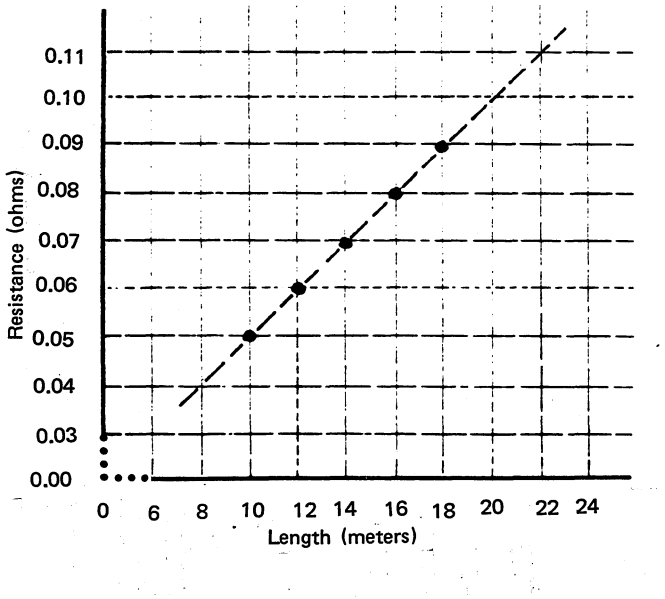


Fig. 1b

SOLUTION TO PRACTICE EXERCISES

Problem 1: The graph should look like the one drawn below. If the zeros of each axis are included, as below, there should be some indication that the scaling is disrupted in this region, as indicated below.



Part 2: *Interpreting Graphs*

Now that we've completed drawing the graph, let's use Figure 1b to obtain information about the speed of the object at times not given in the table of data. Consider the following questions:

Question 1: If the object whose speed has been plotted in Figure 1b were to continue traveling under the same conditions, what would its speed be at the seventh second?

Solution: See Figure 1c.

Step 1: Locate the 7-sec point on the X-axis and draw a vertical line up to the graph line. Mark the intersection point.

Step 2: Draw a horizontal line from the intersection point to the Y-axis. Read the speed on the Y-axis where the horizontal line touches the Y-axis. You may have to estimate. The answer is about 84 cm/sec.

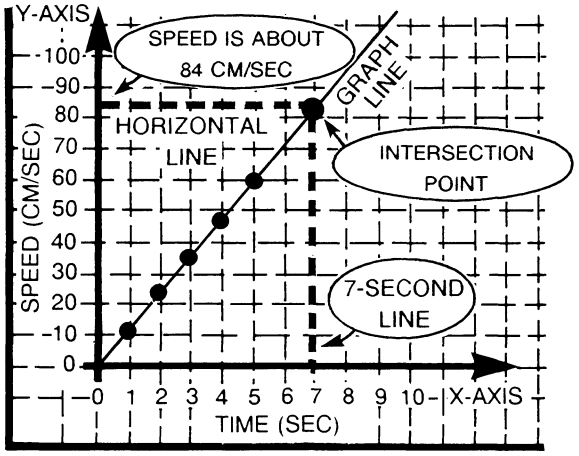


Fig. 1c

Question 2: If the same object were to continue moving under the same conditions, at what time in seconds would it reach a speed of 100 cm/sec?

Solution: See Figure 1d.

Step 1: Locate the 100-cm/sec speed point on the Y-axis. Draw a horizontal line from this point over to the graph line. Mark the intersection point.

Step 2: From the intersection point, draw a line vertically down to the X-axis. Read the correct time on the X-axis where the vertical line just touches the X-axis. You may have to estimate. The answer is about 8.5 sec.

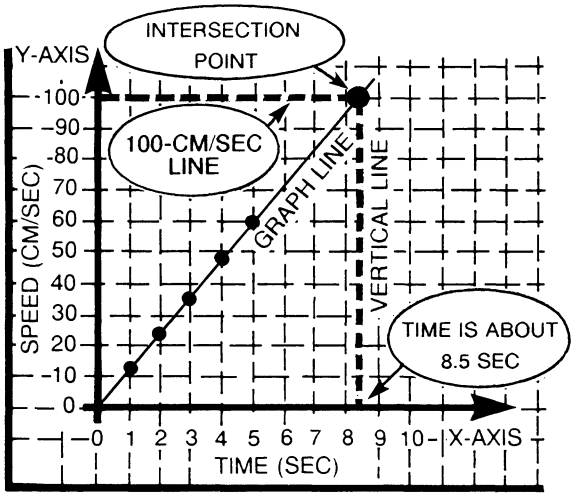


Fig. 1d

PRACTICE EXERCISES

Problem 1: *Making a Graph*

For a given wire, the electrical resistance (R) varies with wire length (L), according to the data given in the table shown.

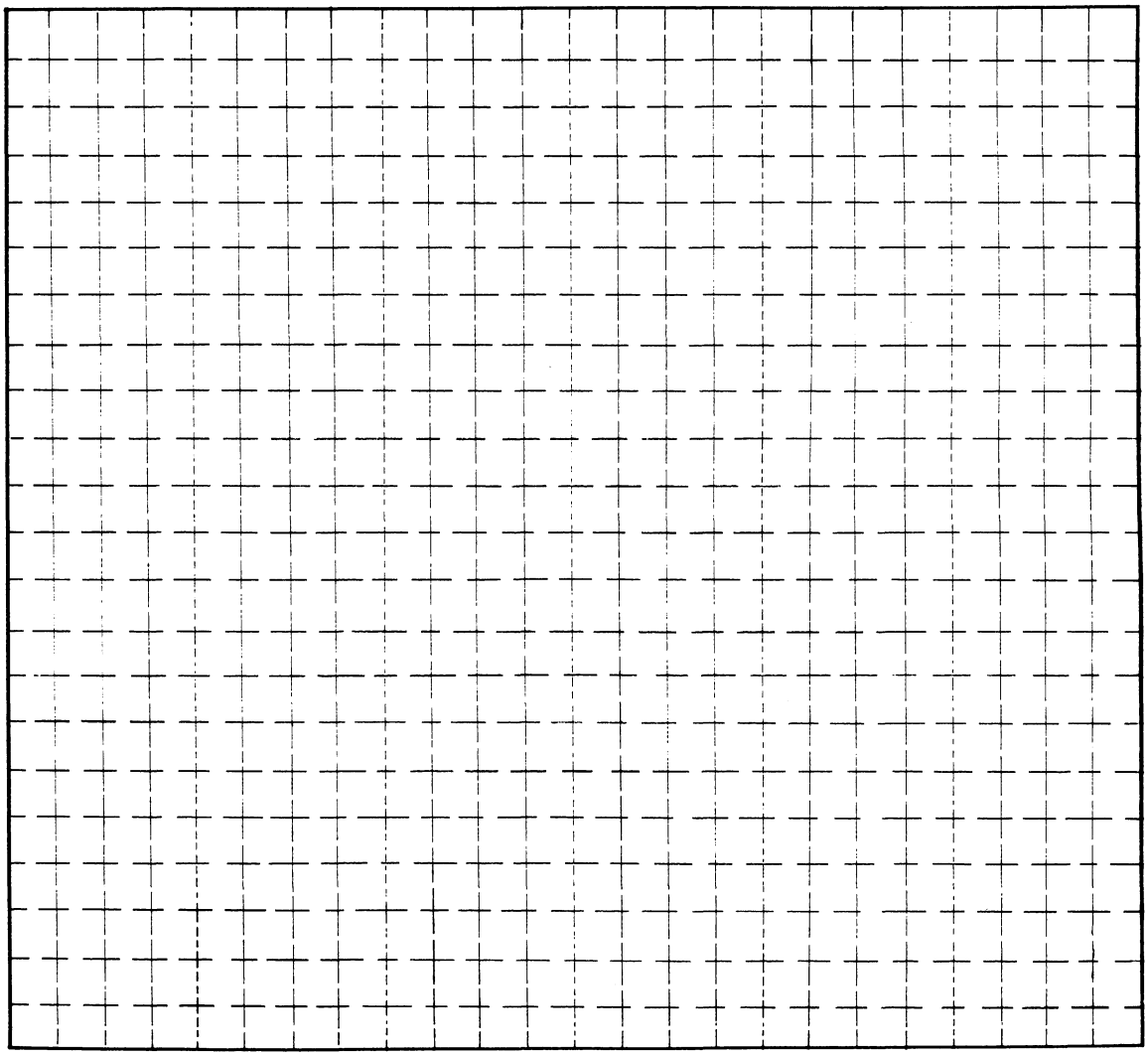
Length of wire (in meters)	10	12	14	16	18
Resistance of wire (in ohms)	0.05	0.06	0.07	0.08	0.09

SOLUTION TO PRACTICE EXERCISES, Continued

Problem 2:

a. Resistance for 13 meters is 0.065 ohms (from graph).
b. Length for 0.075 ohms is 15 meters (from graph).
c. Resistance for 22 meters is 0.11 ohms (from graph).

Plot the data on the grid paper provided. Label the axis with "resistance" along the Y-axis and "length" along the X-axis. Select appropriate scale divisions for each axis. Draw a straight line through the five points that you've plotted.



Problem 2: *Interpreting a Graph*

Use the graph drawn in Problem 1 to answer the following questions:

a. What would be the resistance of 13 meters of this wire?
b. If a piece of this wire has a resistance of 0.075 ohm, what is its length?
c. According to the graph, what should the resistance of 22 meters of this wire be? (***Note***: You may have to extend the straight line drawn in Problem 1 to answer this question.)