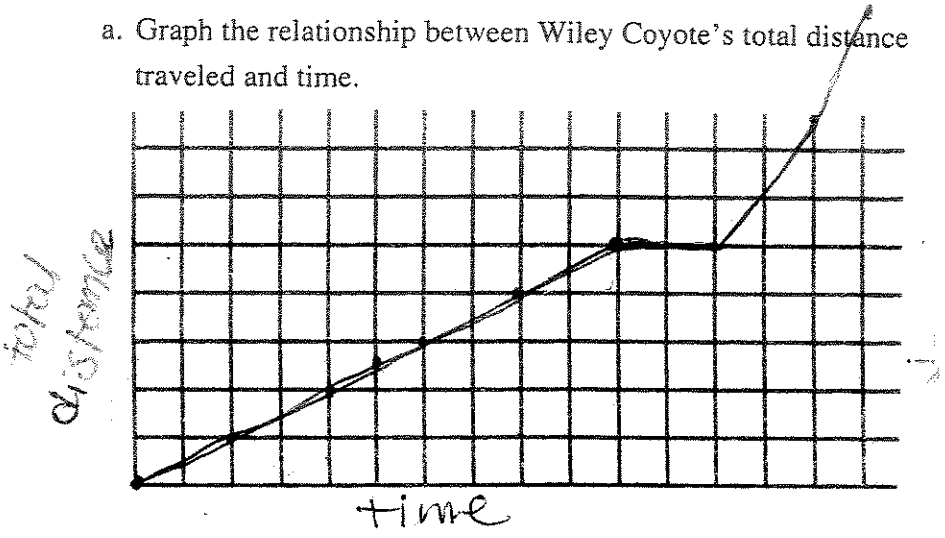
Exercises for Section 13.1 1-4

* 1. Consider the following situation:

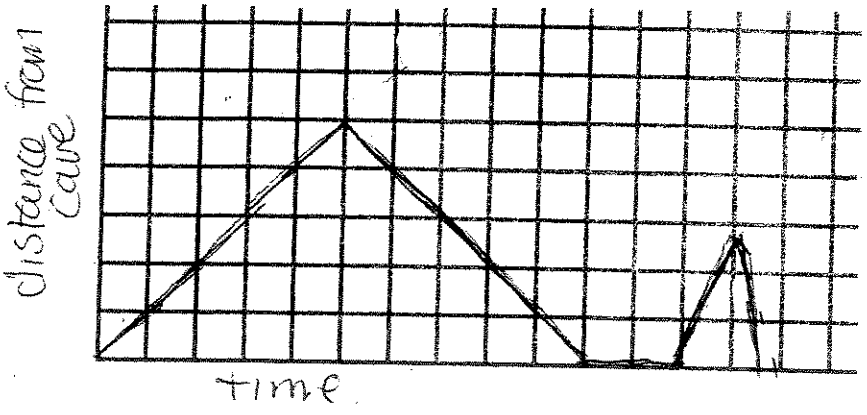
Hint: use same time scale for both

> Wiley Coyote leaves his cave walking at a slow yet constant rate. He walks to the edge of a cliff. He is planning to build a catapult that will hit the roadrunner by firing a large boulder. Just as Wiley Coyote reaches the cliff, he remembers that he left the large rubber band for the catapult back in his cave. He turns around and walks back to his cave at the same pace as before. It takes him several minutes in the cave to find the large rubber band for the catapult. He realizes that he better hurry so he starts running (at a constant speed). About halfway to the cliff, he remembers that he left the boulder at home also. He turns around and runs home, at an even faster (yet constant) speed.

a. Graph the relationship between Wiley Coyote's total distance traveled and time.

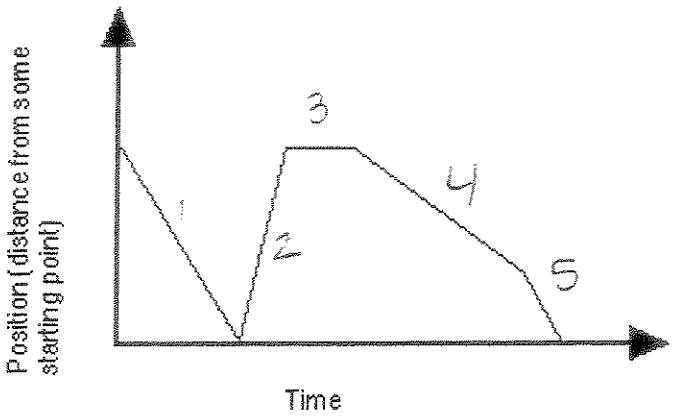


b. Create a second graph, this time graphing Wiley's position (i.e., his distance from the cave) and time.



c. Compare the two graphs. How are they alike? How are they different?

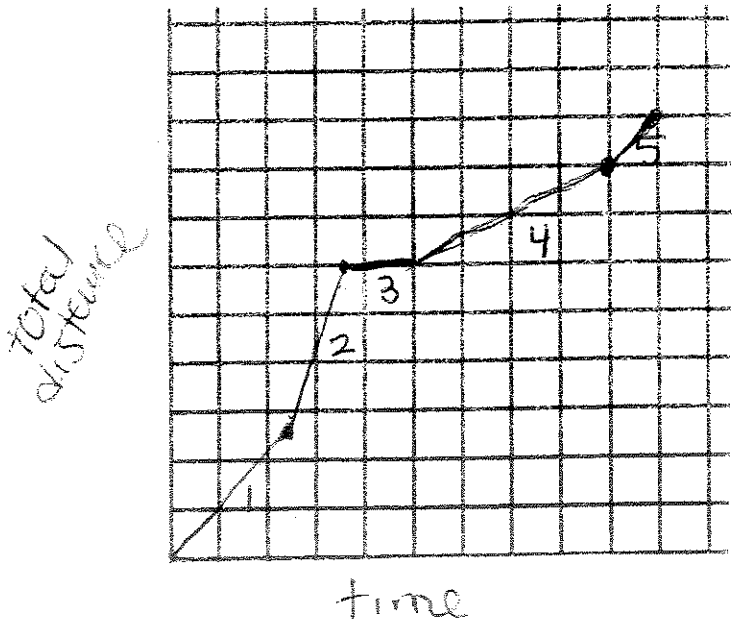
2. The following graph shows a new journey taken by Wiley Coyote.



a. Write a story that could be represented by this graph. (Remember this graph shows Wiley's distance from a starting point, like his cave. It's not a graph of the total distance traveled.)

1. going home fast
2. going away from home faster
3. staying in that place
4. heading home slowly
5. finishing trip to home fast

b. Construct a new graph of the relationship represented in the graph above. This time, graph the total distance traveled over time.



6. Consider the following situation.[ii]

♦ An explorer went to visit a jungle village. She drove the first 25 mi of the trip along a rough road at a steady speed of 20 mi/h. She had to go the next 3 mi by canoe, at a speed of 5 mi/h. Then she had to cut her way through 12 mi of dense jungle and could manage a speed of only $\frac{3}{4}$ mi/h. Finally, she came to a path and walked the last 13 mi at a speed of 4 mi/h. How long did it take her in all to reach the village? ♦

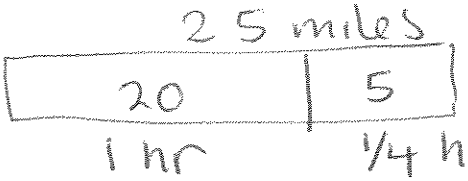
Answer the question, explaining your reasoning. (Drawings may be useful.)

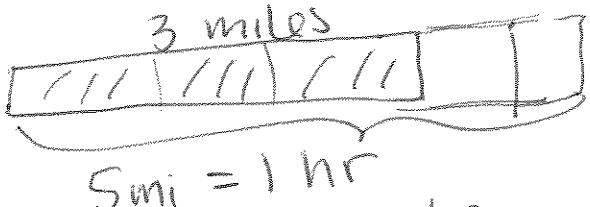
25 mi ÷ 20 mph = 1.25 hours

3 mi ÷ 5 mph = .6 hours

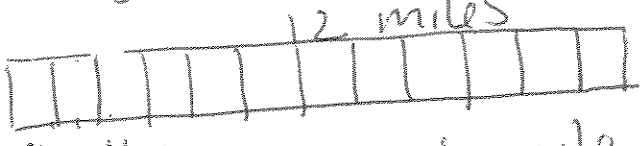
12 mi ÷ $\frac{3}{4}$ mph = 16 hours

13 mi ÷ 4 mph = 3.25 hours





$= \frac{3}{5} = .6$ hrs



3/4 = 1hr for each mile

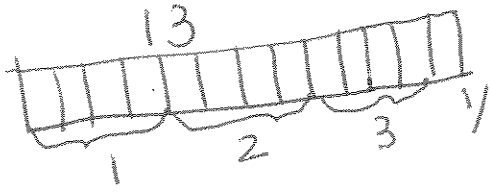
+1/4

3/4 = 1 hrs x 12 = 12 hrs

12 x 1/4 = 4 x $\frac{3}{4}$

= 4 x 1hr = 4 hrs

16 hrs



= 3.25 hrs

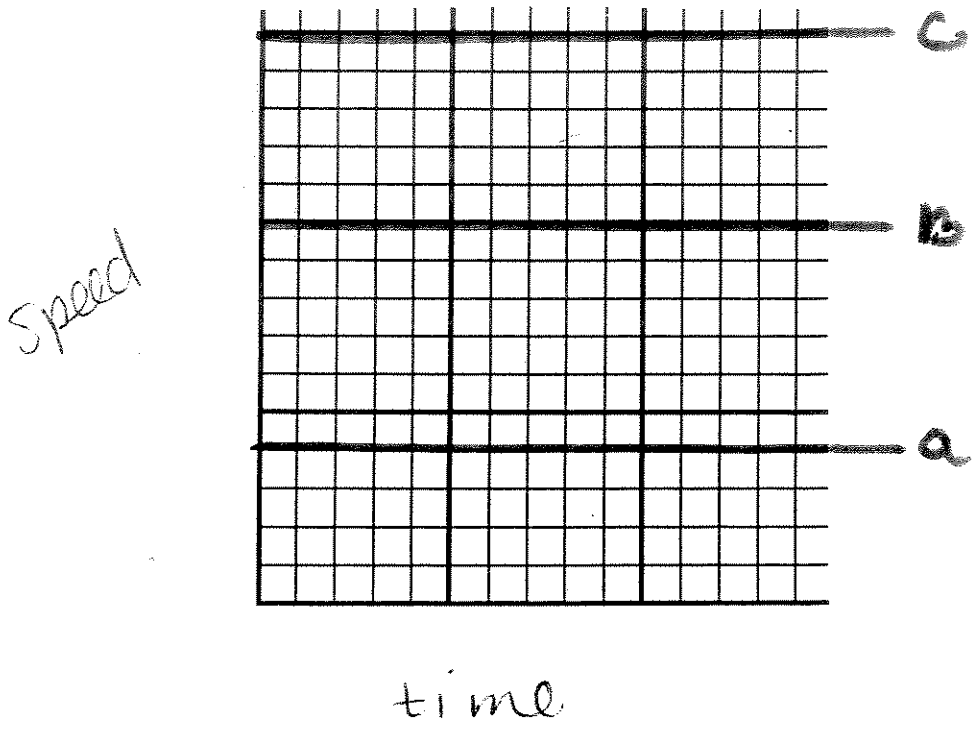
Exercises for Section 13.3

1. Graph each of the following situations, using the same speed/time graph. Then compare the graphs: How are they alike, and how are they different?

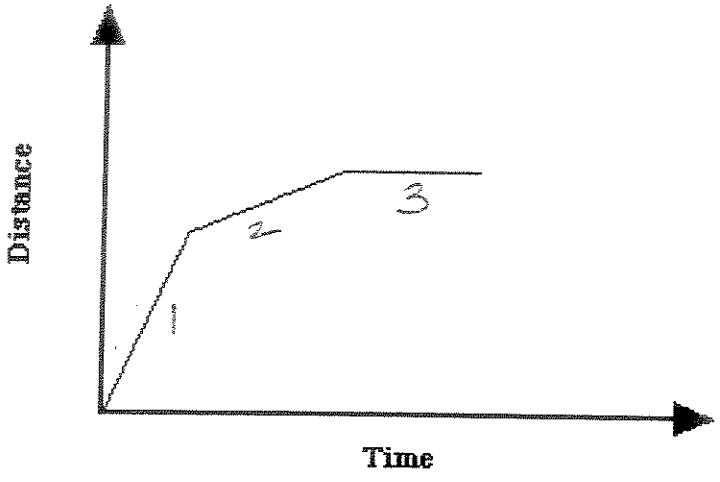
   a. Wiley Coyote walks at a constant speed of 4 mph.

   b. Wiley Coyote runs at a constant speed of 10 mph.

   c. Wiley Coyote gets in a go-cart and travels at a constant speed of 15 mph.

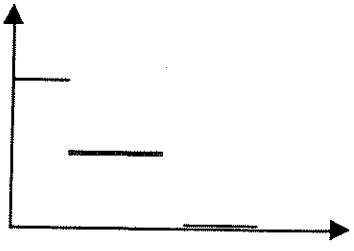


3. Construct a new graph of the relationship represented in the graph below. This time, graph the speed at which the object is traveling over time.



1. fast 2. slow 3. stop

3. Speed

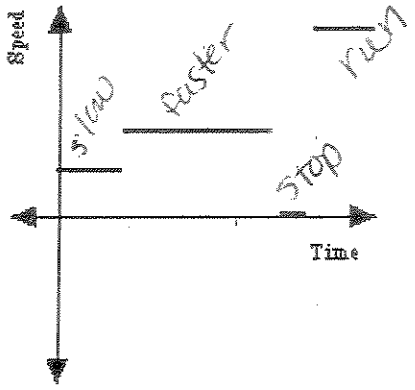


Time

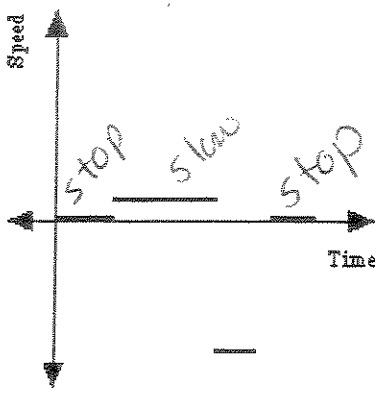
All three parts of the graph are straight horizontal line segments, indicating constant speed. They differ by their positions on the vertical axis; the height signifies the speed in each of the cases.

6. For each graph, write a story about a journey that Bart Simpson took that could be described by the graph. If the graph represents an impossible situation, explain why.

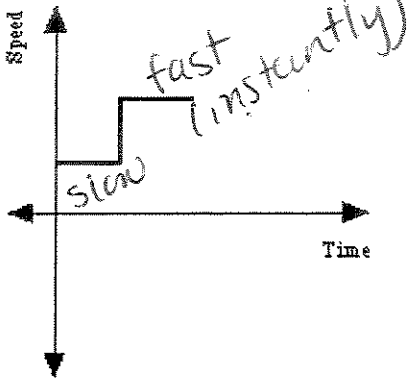
a.



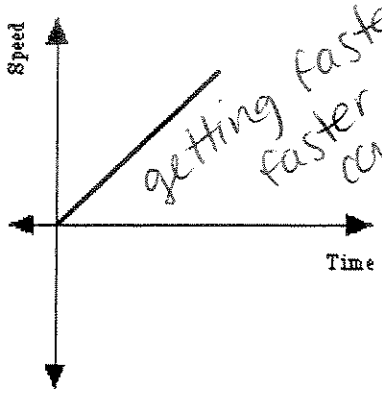
b.



c.

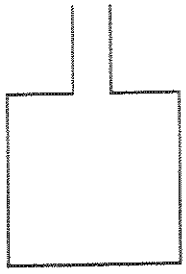


d.

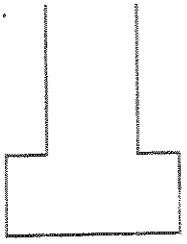


8. Each of the containers pictured below (side views) is being filled with water at a steady rate. Sketch qualitative graphs that show the height of the water in the container as time goes on. Assume that the water keeps running for a while after the container is full.

a.



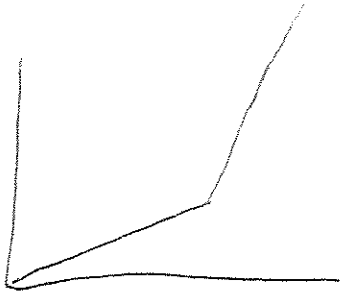
b.



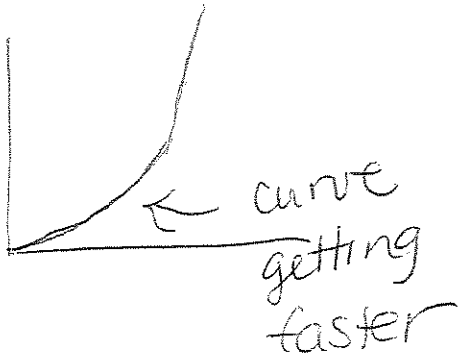
c.

a

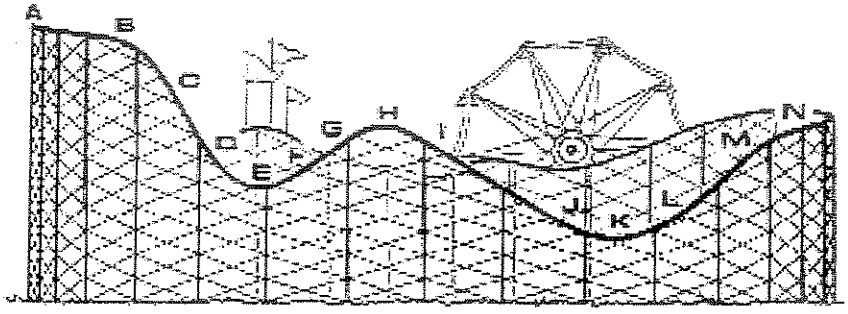
b

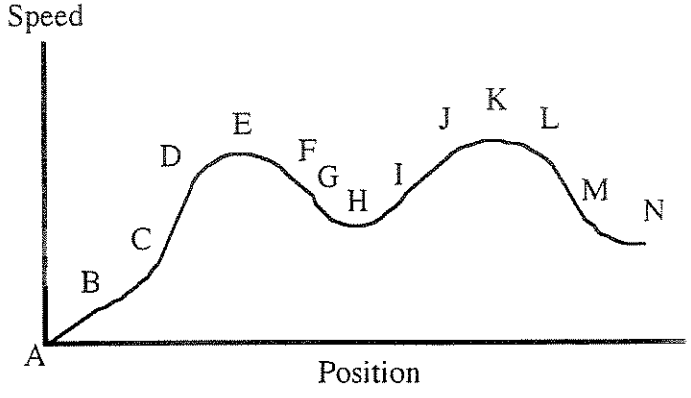


c



9. Sketch a qualitative graph for the *speed* for the roller coaster pictured below, versus its position on the track. (The sketch and problem are from the National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards for School Mathematics*, p. 83, 1989, as an example of reasoning about graphs.)



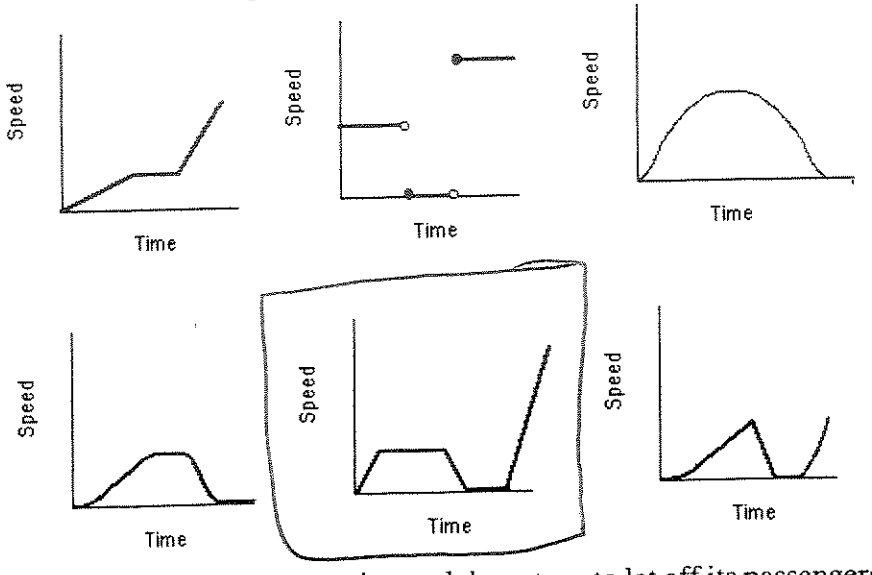


1 – 7

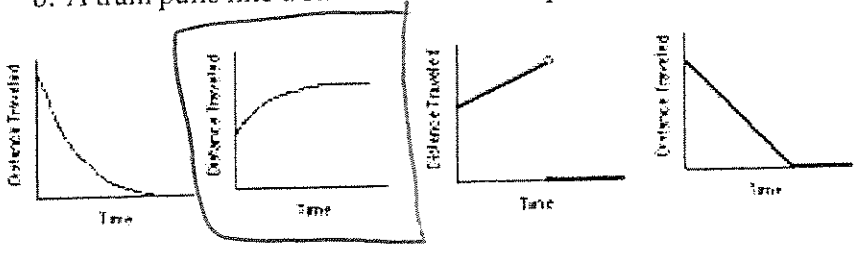
Exercises for Section 13.4

1. Circle <u>one</u> graph that best represents the following situation. Explain why you selected that graph.

   a. Tanya starts to run up Mount Soledad on Mt. Soledad Mountain Road. She begins at a stand-still and quickly gets up to a comfortable yet slow pace. She runs at this <u>constant rate</u> until she gets to the top of Mt. Soledad. She slows to a stop and enjoys the view for about 15 minutes. Then she runs down the steep side of the Mountain on Via Capri Road, going <u>faster and faster</u> until she reaches her top speed.

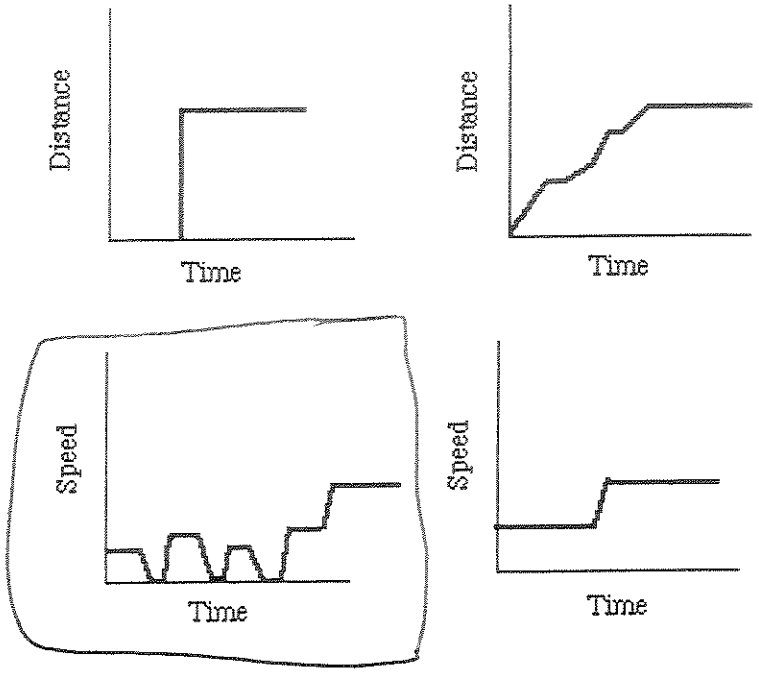


   b. A train pulls into a station and then stops to let off its passengers.



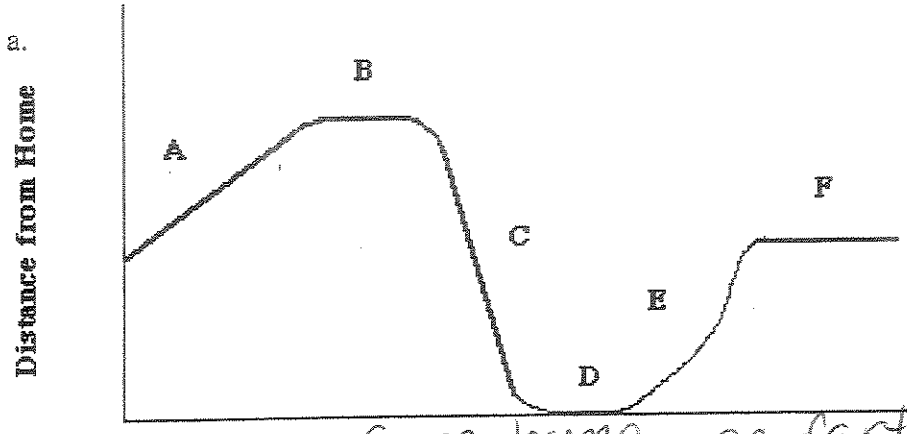
1 cont.

c. Armando scales a rock wall at a very slow and erratic pace, stopping many times. When he reaches the top, he walks along the plateau at a brisk yet constant rate.



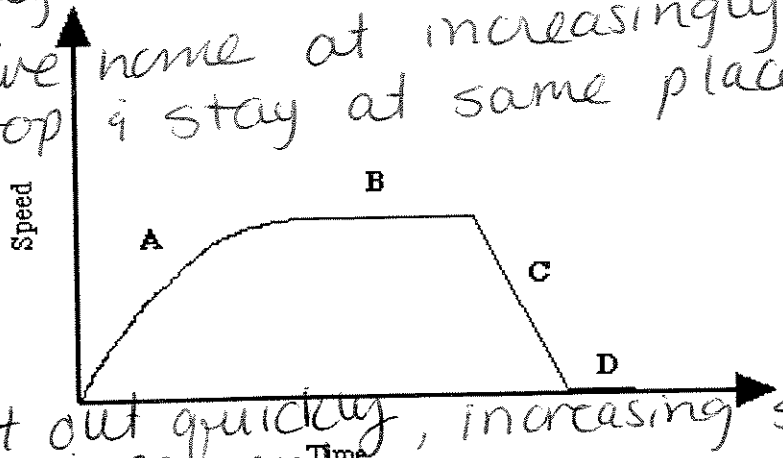
2. Tell a story about a journey that could be represented by each graph. Tell what happened in each lettered section. Be sure to talk about the speed represented by each section.

a.



A. start away from home - go farther away slow but constant
B. stay there a while
C. go back home quickly
D. stay home
E. leave home at increasingly faster speed
F. stop & stay at same place as starting spot.

b.

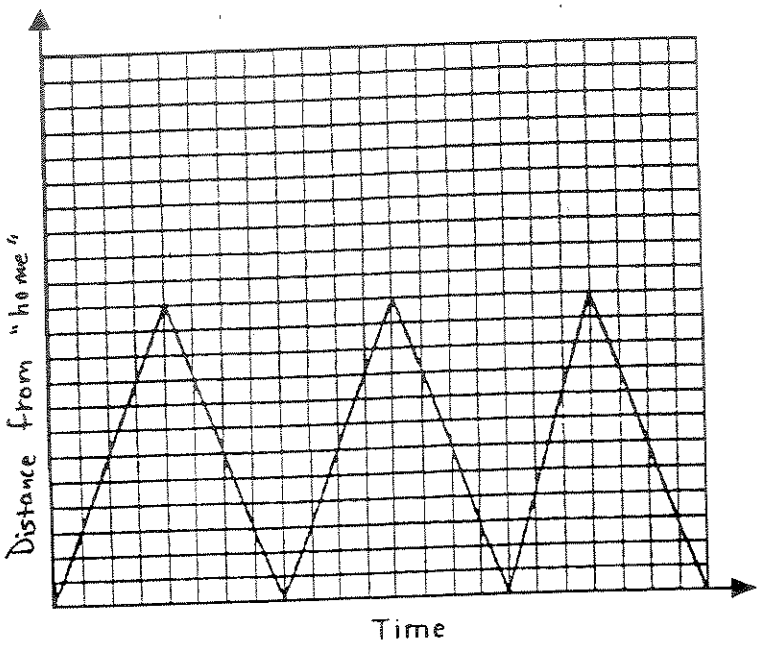


A. start out quickly, increasing speed up to cruising speed (slower & slower rate)
B. stay at speed for a while
C. slow quickly & constantly to a stop at D

3. Suppose the graph in Exercise 2b represents Janet's bike ride. For part of her ride, Janet was going up a steep hill and became very tired. Which segment of the graph might reflect that part of her ride? Explain.

Part C - her speed is slowing at a constant rate & she stops at the top of the hill at D

5. The work from two students follows. They were both asked to write a story for a journey that could be represented by the following graph. For each student, describe what you think the student understands mathematically and what he or she doesn't understand.



STUDENT #1:

This is a graph of me going upstairs to bed. It took me 4 hours to get up the hall, and I walked the same way going back down. I reached the bottom in half time it took me to reach the top. I continued doing this for 16 hours straight. The last few hours I got tired and didn't make it up the steep hill but a less steep hill.

NO
This student is looking at the graph as a picture, not a distance time graph

STUDENT #2:

A Math Story

The Sea Hog (Militaries latest lard powered submarine) is prepared to go. The Admiral who will navigate the vessel is explaining to the crew why lard is a better fuel in time of defense situ.

The Sea Hog sets off. By the time it is 12 miles out to sea the Admiral realizes that he had carelessly left the weapons back at the port. He sets back at the same speed he set out at. About 3 mph (lard is not a very good submarine fuel as far as speed is concerned).

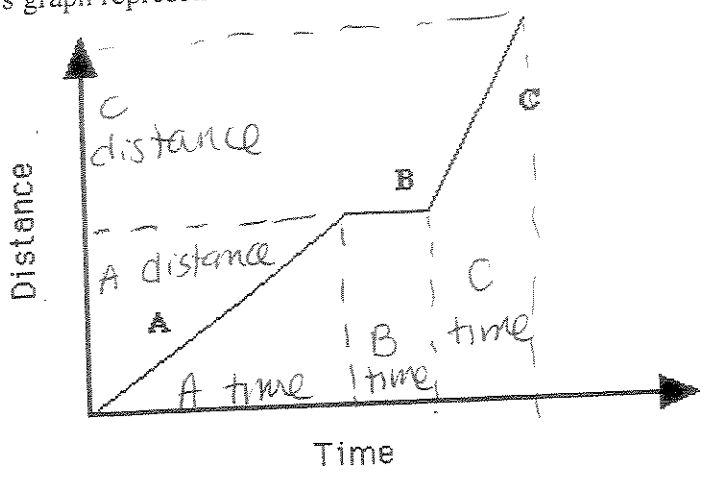
The admiral had called ahead and asked for the weapons to be ready on port by the time he returned to avoid delay. When he had reached port he didn't need to stop or even slow down. They just threw the weapons in.

The Sea Hog sets out again at about 3 mph until again about 12 miles from shore. Both it was to the admirals surprise that this was not really his crew. He was back at the dock.

When the Admiral had returned the submarine couldn't even stop or slow down. The wrong crew jumped off the right crew jumped on. Once the vessel was 12 miles out that it was discovered that there wasn't enough lard to make the trip. (I can't tell you to where the trip was. TOP SECRET you know). They had back and decided to try again tomorrow.

This one matches much better!

7. This graph represents Jordan's bike trip.



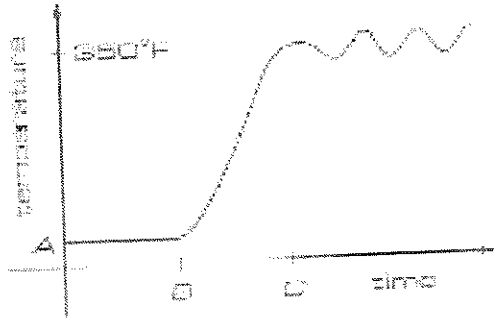
a. During which segment of Jordan's trip took the most time? How do you know? A

b. During which segment of his trip did Jordan go the farthest? How do you know? C

c. During which segment of his trip did Jordan travel the fastest? C
Explain how you know. Use distance and time in your argument.

d. Explain how you know that Jordan stopped during Segment B.
Use time and distance in your argument.
There is no distance for time B

8. Interpret the following graph that gives information about an oven. Why is the last part of the graph wiggly?



Once the oven reaches baking temperature, it turns off the element, but when the oven cools a little, it turns the element back on until desired temperature is reached again, then turns off, etc.