LESSON 12.5

Modeling Motion

You will need:

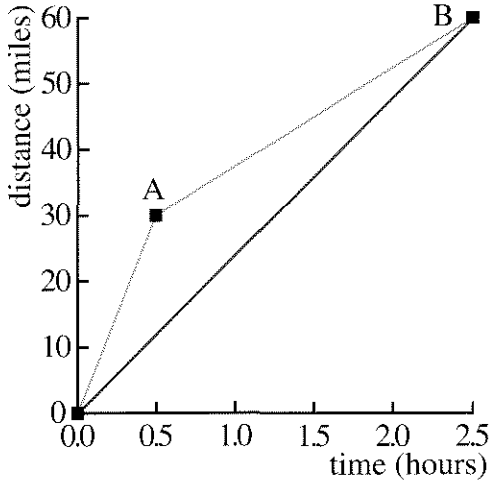
graph paper

AVERAGE SPEED

Definition: Average speed is total distance traveled divided by total travel time.

1. Joan goes to work at 6 A.M. She averages 60 mph on the interstate highway. She returns during rush hour, when she averages 15 mph. What is her average speed for the round trip if she travels 30 miles in each direction?

Many problems in this lesson can be understood better by making distance-time graphs, like this one about Joan's commute.



2. Explain how the coordinates of points A and B were obtained from the given information.

3. How does Joan's morning speed of 60 mph show up on the graph? Her return speed? Her average speed?

4. Joan calculated her average speed by adding the two speeds and dividing by 2.

$$(60 + 15)/2 = 37.5$$

Explain why this is wrong.

5. Jill traveled for two hours at 30 mph and two hours at 60 mph. Jack traveled for 90 miles at 30 mph and for 90 miles at 60 mph. Which of them had an average speed of 45 mph? Which one did not? Explain.

6. *Generalization*

a. I travel for t hours at v mph and t more hours at w mph. What is my average speed?

b. I travel to work, which is d miles away, at v mph, and travel back at w mph. What is my average speed?

RELAY RACE

Alaberg High's Track Team has a relay race team. These tables show the times in seconds of the individual runners in the 4 × 100 meter race at the meet with the Lean County School. The runners are listed in running order.

Alaberg	
Mal	12.2
Cal	12.0
Hal	12.4
Zal	11.4

Lean	
Neil	12.1
Neal	12.3
Alan	12.2
Allen	10.9

7. Imagine you are the radio announcer for this event. Describe the teams' performances. Who was ahead at various times? How did it end up? What was the key to the winning team's victory?

8. a. Compare the median running times for the two teams.
b. Compare the mean running times for the two teams.
c. Which is more relevant to winning the race?

9. Find each runner's speed in m/sec.

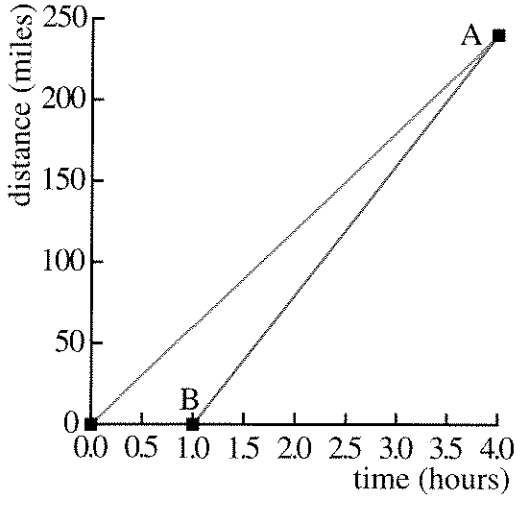
10. Find the average speed of each team in m/sec.

11. Show how each student answered problem 10 and find their answers.
a. Andrea divided 100 by the mean running time for each team.
b. Beth divided 400 by the total time for each team.
c. Carolyn took the average of the individual members' speeds.

12. Summary Discuss the three methods presented in problem 11. Which ones are equivalent to each other? Which one is incorrect? Explain.

CATCH UP AND MEET

13. Jane is traveling at 60 mph along a road. She has traveled for four hours when Joe catches up with her. How fast must Joe have been traveling if he left the same place one hour after Jane?

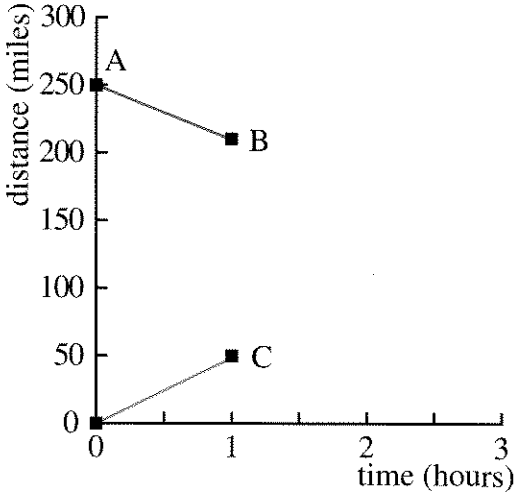


14. Look at the graph in problem 13. Explain how the coordinates of points A and B were chosen, and how the graph can help solve the problem.

15. Jim is traveling at 40 mph. Jorge leaves two hours later and travels at 50 miles per hour. How long until he catches up? How far have they gone?

16. Juan leaves at noon and travels at 45 mph. Jo leaves two hours later. How fast must she travel to catch up by:
a. 8 P.M.? b. 8:30 P.M.?
c. 11 P.M.? d. *H* P.M.?

17. Jacquey and Gigi start out at the same time, traveling towards each other. Jacquey travels at 50 mph. Gigi travels at 40 mph. They start out 250 miles apart. When and where do they meet?



18. The graph shows Jacquey and Gigi's progress during the first hour. (Jacquey's graph starts at the origin.) Explain how the coordinates of points A, B, and C were obtained, and how to use a graph like this to solve problem 17.

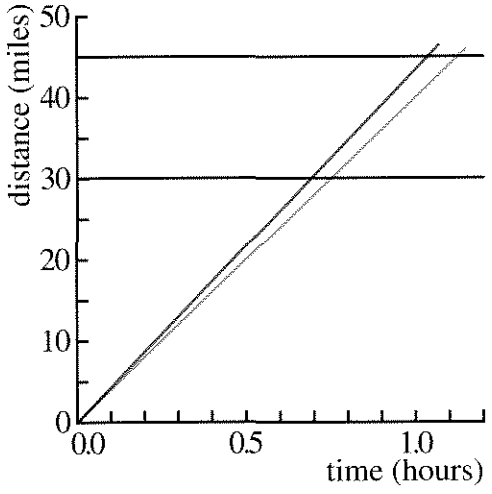
19. Greg starts out going towards Cary, traveling 50 mph. Cary starts out two hours later going 40 mph, going towards Greg. If they are 250 miles apart to begin with, when and where do they meet?

SAVING TIME

Paige travels to work so early that he meets hardly any traffic. He can drive at the speed limit the whole way. He wishes that the speed limit, which is 40 mph, would be raised so that he could sleep a little later in the morning.

20. How many minutes would Paige save if the speed limit were raised to 45 mph and he lives 30 miles from work?

21. Tara lives on the same road, 45 miles from work. How much time would she save?



22. Explain how you can use a graph like this one to think about problems 20 and 21.

23. **Generalization** How much time would be saved for people who live d miles from work if the speed limit were raised from 40 to 45 mph?

24. If Leon lives 60 miles from work, to what would the speed limit have to be raised (from 40 mph) in order for him to save

a. 6 minutes? b. 12 minutes?

25. Rina is taking a 60-mile trip. Which is greater: the time saved if she can travel 50 mph instead of 40 mph, OR the time saved if she can travel 60 mph instead of 50 mph? Explain.