Ratios and Rates

Introduction: Rates are ratios that are generally written as fractions, and are read with the word "per". There are several versions of this. If I am hiking, and I go 5 miles in 2 hours, you could say I was going 2 1/2 or 5/2 miles per hour. You could also say that it takes me 2.5 or .4 hours per mile (do you see the division or fraction?). Both of these are a rate in the most general sense, though usually we give precedence to the first version (where we are comparing to a time unit, for example, "hours"). I can also phrase these rates in ratio language: The ratio of my distance to time is 5mi:2hrs or 5/2mi:1hrs, and the ratio of my time to distance is 2hrs:5mi or 2/3hrs:1mi. Linguistically, the word per means "for each", and mathematically, "per" indicates division, so 5/2 miles per hour, is 5mi/2hr, and when you are including your units to do dimensional analysis for problem solving, you always write mi/hr for miles per hour.

Problems: write each situation as a rate in at least two ways

1. Example: The beetle crawled 8 feet in 3 minutes:

The beetle walks at a rate of 8/3 ft per min or ft/min
The beetle takes 3/8 of a minute per foot (or min/ft) when he walks

2. My model car can cross the 20 foot room in 6 seconds.

3. There are 70 trees growing on the 10 acre plot of land.

4. My best friend can eat three ice cream cones in 10 minutes.

5. I often find as many as 14 worms in digging out a small, 6 square foot, garden area.

Problems with Rates

6. Car A went 20 miles in 30 minutes, and car B went 15 miles in 20 minutes. Which car was faster? Show or explain how you got the answer.

7. If a solitary bee (a species of bee which does not live in or create hives) needs 2/9 of an acre of foraging territory, and if you need at least 150 bees to keep a viable population, answer:

a. What is the number of bees you can expect to find per acre?

b. How many acres of land do you need per bee?

c. How many acres of land do you have to conserve to have a viable population?

8. Use dimensional analysis (keep your units in your calculations) as you solve:
James makes $6.50 per hour. How long will he have to work to make $100?

9.Use dimensional analysis (keep your units in your calculations) as you solve:
If John has read 200 of the 350 pages in his novel in the past 5 hours, how long will it take him to finish?
a. What are the (two) rates you could use in this problem?

b. Solve the problem: