7.RP Molly's Run

Alignments to Content Standards: 7.RP.A.1

Task

Molly runs $\frac{1}{3}$ of a mile in 4 minutes.

a. If Molly continues at the same speed, how long will it take her to run one mile?

b. Draw and label a picture showing why your answer to part (a) makes sense.

IM Commentary

This task asks students to solve a problem in a context involving constant speed. This task provides a transition from working with ratios involving whole numbers to ratios involving fractions. This problem can be thought of in several ways; in particular, this problem also provides an opportunity for students to work with the "How many in one group?" interpretation of division. To recall briefly, in a multiplication problem such as

$$\frac{1}{3} \times ? = 4,$$

the $\frac{1}{3}$ represents the fraction of a group which is equal to 4. In this problem, the $\frac{1}{3}$ refers to $\frac{1}{3}$ of a mile and the 4 tells us how many minutes it takes Molly to run $\frac{1}{3}$ of a mile. So the $?$, the time it takes Molly to run one mile, can be found by performing the division problem $4 \div \frac{1}{3}$. Alternatively, thinking in the language of ratios, the ratio

$$\frac{1}{3} : 4$$

is equivalent to the ratio

$$1 : ?$$

This is because Molly's speed does not change throughout the run. Students should be familiar with dividing a whole number by a unit fraction from 5th grade (see 5.NF.7), so in some ways this task can be thought of as a natural extension of that standard. Since students are just learning about dividing fractions by fractions, a problem involving constant speed that can also be solved by dividing a fraction by a fraction would be especially challenging for sixth grade.

This problem is suitable for instruction or assessment. If used for instruction, it could be combined with the task "5.NF How many marbles?" which models the division problem $4 \div \frac{1}{3}$ from the how many in one group perspective. 6.RP Molly's Run is both more abstract than "5. NF How many marbles?" and more closely related to ratios. The relative abstractness of the two problems is seen in the pictures: while "5.NF How many marbles?" has a very concrete picture of groups of marbles, the picture here is a number line.

Solutions

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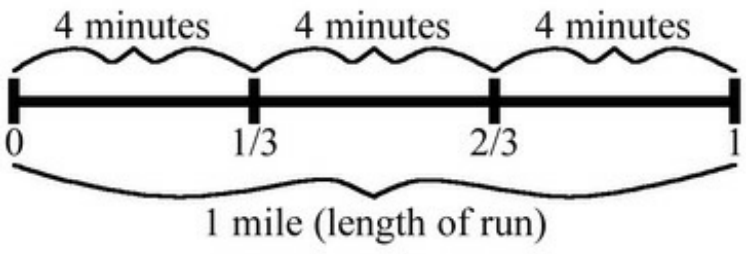
Solution: 1

a. If Molly runs $\frac{1}{3}$ of a mile every four minutes, then 2×4 minutes is is $\frac{2}{3}$ of this time. Similarly 3×4 minutes is $\frac{3}{3}$ of Molly's time to run a mile. Since $\frac{3}{3} = 1$, this means that it takes $3 \times 4 = 12$ minutes to run one mile.

b. The following picture illustrates this reasoning:



since there are 3 groups of 4 minutes, the picture shows why

$$3 \times 4$$

represents the solution to the problem. It is important to note that the constant speed Molly is running is shown in the picture by the equally spaced intervals of both time and distance: traveling at a constant speed means that equal distances are traveled in equal times.

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Solution: 2

a. Alternatively, the question can be viewed as a division problem: we are given that 4 minutes is $\frac{1}{3}$ of the amount of time it takes Molly to run one mile. If we let ? represent the time it takes her to run 1 mile, then we can write this symbolically as:

$$\frac{1}{3} \times \ ? \ = 4$$

This multiplication problem is equivalent to the following division problem:

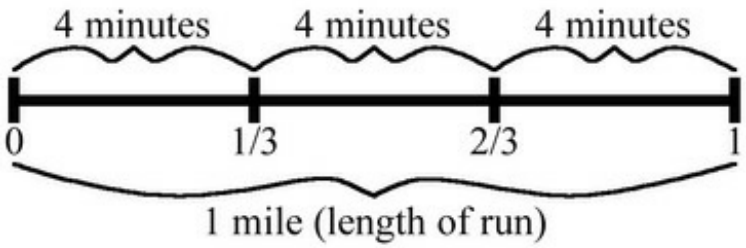
$$4 \div \frac{1}{3} = ?$$

Since

$$4 \div \frac{1}{3} = 4 \times 3 = 12$$

it will take Molly 12 minutes to run 1 mile at this speed.

b. Note that the same picture works for this way of viewing the problem:



We just need to interpret the picture slightly differently as $\frac{1}{3}$ of what number is 4? In fact, this picture shows why dividing by $\frac{1}{3}$ is the same as multiplying by 3.