Sara's Hike

Students are asked to solve a problem involving ratios.

Subject(s): Mathematics
Grade Level(s): 6
Intended Audience: Educators

Freely Available: Yes

Keywords: MFAS, equivalent ratios, plot, table

Instructional Component Type(s): Formative Assessment

Resource Collection: MFAS Formative Assessments

ATTACHMENTS

MFAS_SarasHike_Worksheet.docx

FORMATIVE ASSESSMENT TASK

Instructions for Implementing the Task
This task can be implemented individually, with small groups, or with the whole class.

1. The teacher asks the student to complete the problems on the *Sara's Hike* worksheet.
2. The teacher asks follow-up questions, as needed.

TASK RUBRIC

Getting Started

Misconception/Error

The student is unable to use ratio and rate reasoning to solve problems.

Examples of Student Work at this Level

The student:

- Subtracts the numbers of miles in two consecutive entries to determine the number of hours, e.g., the student subtracts 12 from 20 getting 8 hours.

Hours	5	8	2
Miles	20	12	10

- Attempts to use multiplicative reasoning but:
  - Confuses units of distance and time when making comparisons.

  - Estimates quantities rather than calculating them precisely.

Questions Eliciting Thinking

Can you explain your strategies for solving these problems?

What about the problems indicated that you should subtract?

If you hiked 20 miles in 5 hours (maintaining the same rate), how far did you hike after the first hour?

Instructional Implications

Provide basic instruction on ratios and rates. Illustrate ratios and rates with examples from a variety of contexts. Model the use of ratio language to describe or explain ratios and rates. For example, explain that if the ratio of time to distance travelled is 1:4, then every hour, Sara can travel 4 miles. Provide opportunities for the student to write specified ratios and rates in problem contexts. Demonstrate how wording in the problem may indicate the order in which the ratio or rate is written. Make explicit the *multiplicative* relationship between two quantities compared in a ratio and the role of multiplication and division in generating equivalent ratios. Give the student additional opportunities to write and interpret ratios and rates in the context of a variety of problems.

Introduce the student to the concept of a unit rate and guide the student to calculate unit rates from given rates. Then work with the student in using the unit rate to find other equivalent rates. Encourage the student to use a table to organize and summarize a set of equivalent rates. Ask the student to find and describe a relationship among related values in the table (e.g., the number of miles is always four times the number of hours) and relate this relationship to the unit rate. Then encourage the student to describe the unit rate using the language of ratios (e.g., for every hour that Sara walks, she travels 4 miles).

Moving Forward

Misconception/Error

The student uses ratio or rate reasoning but is unable to correctly solve one or both problems.

Examples of Student Work at this Level

The student:

- Correctly calculates a unit rate, 4 mph, and interprets it as the number of hours it will take Sara to hike 12 miles. The student correctly calculates the number of miles Sara can hike in 2 hours.

- Correctly calculates the length of time it would take for Sara to hike 12 miles but multiplied this result (i.e., 3 hours) by 2 hours to determine how far Sara can hike in 2 hours.

When asked what should be true of the graph of equivalent rates, the student does not indicate that the graph should be linear.

Questions Eliciting Thinking

What should be true of the ratios shown in the table? What should happen when you graph equivalent ratios?

What is the significance of the four that results from dividing 20 by five? What is the unit of measure?

I see that you multiplied two by three. What are the units of measure for these values? Does it make sense to multiply a number of hours by another number of hours to calculate a distance?

Instructional Implications

Guide the student to attend to the units of measure of quantities in the problems. Review how the unit rate, 4 mph, can be used to find both the amount of time it takes Sara to hike a given distance and the distance Sara can travel in a given amount of time. Emphasize the meaning of the units of measure in reasoning about the relationship among quantities in the problems.

Remind the student that equivalent ratios are linearly related. Encourage the student to write equations to model equivalent ratio relationships (e.g, $m = 4h$) and to observe that the graph of a set of equivalent ratios is always a line that passes through the origin.

Almost There

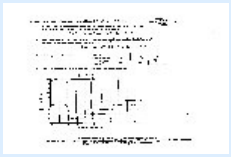
Misconception/Error

The student makes errors in showing or explaining work.

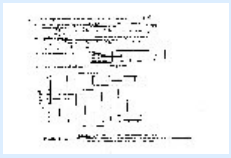
Examples of Student Work at this Level

The student:

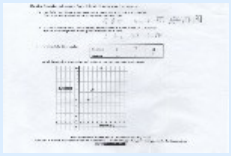
- Supplies answers without supporting work or explanation.



- Provides an incomplete or unclear explanation such as, "because of multiplication."



- Writes $\frac{1}{4}+\frac{1}{4}=\frac{2}{8}$ (rather than $\frac{1\times 2}{4\times 2}=\frac{2}{8}$) to calculate a ratio equivalent to $\frac{1}{4}$.



Questions Eliciting Thinking

Can you explain how you found your answers? How did you know what to multiply?

It looks as if you are saying that $\frac{1}{4}+\frac{1}{4}=\frac{2}{8}$. Can you think of a better way to show how you are creating equivalent ratios?

Instructional Implications

Model how to write supporting work for problems involving rates and ratios. Assist the student in clearly explaining the meaning of rates and ratios in the context of problems. Expose the student to the explanations of his or her peers at the *Got It* level. Provide more opportunities for the student to write supporting work and justify his or her reasoning in solving equivalent ratio problems.

Got It

Misconception/Error

The student provides complete and correct responses to all components of the task.

Examples of Student Work at this Level

The student correctly calculates the amount of time it would take Sara to hike 12 miles (3 hours) and the distance Sara can hike in 2 hours (8 miles). The student shows supporting work clearly and completely, correctly completes the table, and graphs the pairs of values.

Questions Eliciting Thinking

If Sara can hike 20 miles in 5 hours, how fast is she travelling?

How long would it take Sara to hike 7.5 miles? 75 miles?

If Sara hikes for 0.5 hours how many miles would she travel?

Can you write an equation that represents the data in the table and the graph?

Instructional Implications

Encourage the student to write a proportion to show the relationship between pairs of equivalent ratios. Model the use of proportion language when reading the equation (i.e., 5 is to 20 as 3 is to *m)*. Allow the student to use strategies based on an understanding of equivalent ratios to find missing values rather than techniques such as cross multiplying.

ACCOMMODATIONS & RECOMMENDATIONS

Special Materials Needed:

- *Sara's Hike* worksheet

SOURCE AND ACCESS INFORMATION

Contributed by: MFAS FCRSTEM
Name of Author/Source: MFAS FCRSTEM
District/Organization of Contributor(s): Okaloosa
Is this Resource freely Available? Yes
Access Privileges: Public
License: CPALMS License - no distribution - non commercial

Related Standards

Name	Description
MAFS.6.RP.1.3:	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?* c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. e. Understand the concept of Pi as the ratio of the circumference of a circle to its diameter. ([1]See Table 2 Common Multiplication and Division Situations) **Remarks/Examples:** **Examples of Opportunities for In-Depth Focus** When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.