

Unit Rates and Proportional Reasoning

4-2

© CONTENT STANDARDS

7.RP.1

What You'll Learn

To find unit rates and unit costs using proportional reasoning

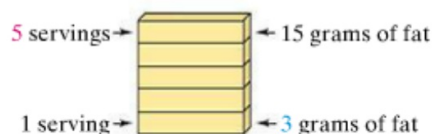
🔊 **New Vocabulary** rate, unit rate, unit cost

Why Learn This?

You make decisions about the foods you eat every day. Looking at rates such as grams of fat per serving can help you stay healthy.

A **rate** is a ratio that compares two quantities measured in different units. There are 15 grams of fat in 5 servings of canned soup. The rate of grams of fat per serving is $\frac{15 \text{ grams of fat}}{5 \text{ servings}}$.

The rate for one unit of a given quantity is the **unit rate**. To find a unit rate, divide the first quantity by the second quantity. For a rate of $\frac{15 \text{ grams of fat}}{5 \text{ servings}}$, the unit rate is 3 grams of fat per serving.



The model shows that
$$\text{total fat} \div \frac{\text{number of servings}}{\text{fat per serving}} = \text{fat per serving}$$

EXAMPLE**Finding a Unit Rate Using Whole Numbers**

- 1 A package of cheddar cheese contains 15 servings and has a total of 147 grams of fat. Find the unit rate of grams of fat per serving.

$$\begin{array}{l} \text{grams} \rightarrow \\ \text{servings} \rightarrow \end{array} \frac{147}{15} = 9.8 \quad \leftarrow \text{Divide the first quantity by the second quantity.}$$

The unit rate is $\frac{9.8 \text{ grams}}{1 \text{ serving}}$, or 9.8 grams of fat per serving.

Examples

- 1 **Finding a Unit Rate Using Whole Numbers** You earn \$33 for 4 hours of work. Find the unit rate of dollars per hour.

$$\begin{array}{l} \text{dollars} \rightarrow \\ \text{hours} \rightarrow \end{array} \frac{33}{4} = \boxed{8.25} \quad \leftarrow \text{Divide the first quantity by the second quantity.}$$

The unit rate is $\frac{\boxed{\$8.25}}{\boxed{1 \text{ hour}}}$, or $\boxed{\$8.25}$ per hour.

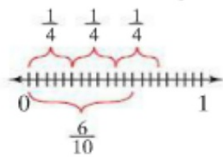
Quick Check

1. Find the unit rate for 210 heartbeats in 3 minutes.

You can also find unit rates from data expressed as fractions or decimals.

EXAMPLE Finding a Unit Rate Using Fractions

- 2 Cindy walks $\frac{6}{10}$ mile in $\frac{1}{4}$ hour. What is her speed in miles per hour?



$$\text{miles to hours} = \frac{6}{10} \text{ to } \frac{1}{4} \rightarrow \text{Write the ratio.}$$

$$\text{miles} \div \text{hours} = \frac{6}{10} \div \frac{1}{4} \rightarrow \text{Divide the first quantity by the second quantity.}$$

$$= \frac{24}{10} = \frac{12}{5} \rightarrow \text{Simplify.}$$

$$= 2\frac{2}{5} \rightarrow \text{Write as a mixed number.}$$

Cindy walks $2\frac{2}{5}$ miles per hour.

- 2 **Finding a Unit Rate Using Fractions** Ely walks $\frac{7}{8}$ mile in $\frac{1}{3}$ hour. What is his speed in miles per hour?

miles to hours = $\frac{7}{8}$ to $\frac{1}{3}$ → Write the ratio.

miles \div hours = $\frac{7}{8} \div \frac{1}{3}$ → Divide the first quantity by the second quantity.

= $\frac{21}{8}$ → Simplify.

= $2\frac{5}{8}$ → Write as a mixed number.

Ely walks $2\frac{5}{8}$ miles per hour.

2. Find the unit rate for $\frac{3}{10}$ mile in $\frac{3}{4}$ hour.

A unit rate that gives the cost per unit is a **unit cost**. To find the unit cost of an item, divide the total cost of the item by the number of units in the item.

EXAMPLE Using Unit Cost to Compare

- 3 **Smart Shopping** Two sizes of shampoo bottles are shown. Which size is the better buy? Round to the nearest cent.

Divide to find the unit cost of each size.

$$\begin{array}{l} \text{cost} \rightarrow \frac{\$3.99}{13.5 \text{ fl oz}} \approx \$0.29/\text{fl oz} \\ \text{size} \rightarrow \end{array}$$

$$\begin{array}{l} \text{cost} \rightarrow \frac{\$6.19}{16 \text{ fl oz}} \approx \$0.39/\text{fl oz} \\ \text{size} \rightarrow \end{array}$$

Since $\$0.29 < \0.39 , the 13.5-fl-oz bottle is the better buy.



Example

- 3 **Using Unit Cost to Compare** Find each unit cost. Which is the better buy?

3 lb of potatoes for \$.89

5 lb of potatoes for \$1.59

Divide to find the unit cost of each size.

$$\begin{array}{l} \text{cost} \rightarrow \frac{\$.89}{3 \text{ lb}} \approx \boxed{\$.30/\text{lb}} \\ \text{size} \rightarrow \end{array}$$

$$\begin{array}{l} \text{cost} \rightarrow \frac{\$1.59}{5 \text{ lb}} \approx \boxed{\$.32/\text{lb}} \\ \text{size} \rightarrow \end{array}$$

Since $\boxed{\$.30/\text{lb}} < \boxed{\$.32/\text{lb}}$, $\boxed{3 \text{ lb of potatoes}}$ for $\boxed{\$.89}$ is the better buy.

You have an assignment worksheet and time to begin working on it. Calculators will be helpful to you as you complete this worksheet. If you do not have one of your own, use the calculator on your computer.

Name _____ Class _____ Date _____

Practice 4-2 Unit Rates and Proportional Reasoning

Write the unit rate for each situation.

- | | |
|---|--|
| 1. travel 250 mi in 5 h
_____ | 2. earn \$75.20 in 8 h
_____ |
| 3. read 80 pages in 2 h
_____ | 4. type 8,580 words in 2 h 45 min
_____ |
| 5. complete $\frac{3}{4}$ of a puzzle in $\frac{7}{8}$ h
_____ | 6. drink $\frac{4}{5}$ L in $\frac{1}{4}$ h
_____ |

Find each unit price. Then determine the better buy.

- | | |
|---|--|
| 7. paper: 100 sheets for \$.99
500 sheets for \$4.29

_____ | 8. peanuts: 1 lb for \$1.29
12 oz for \$.95

_____ |
| 9. crackers: 15 oz for \$1.79
12 oz for \$1.49

_____ | 10. apples: 3 lb for \$1.89
5 lb for \$2.49

_____ |
| 11. mechanical pencils: 4 for \$1.25
25 for \$5.69

_____ | 12. bagels: 4 for \$.89
6 for \$1.39

_____ |

13. a. Yolanda and Yoko ran in a 100-yd dash. When Yolanda crossed the finish line, Yoko was 10 yd behind her. The girls then repeated the race, with Yolanda starting 10 yd behind the starting line. If each girl ran at the same rate as before, who won the race? By how many yards?

- b. Assuming the girls run at the same rate as before, how far behind the starting line should Yolanda be in order for the two to finish in a tie?

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