CHAPTER 5

Family Letter

Section A

What We Are Learning

Ratios, Rates, and Proportions

Vocabulary
These are the math words we are learning:

cross product for two ratios, the product of the numerator in one ratio and the denominator in the other ratio

equivalent ratios ratios that name the same comparison

proportion an equation stating that two ratios are equivalent

rate compares two quantities measured in different units

ratio a comparison of two numbers or quantities

unit rate a comparison of a quantity to a unit of one

Dear Family,

The student will be learning about ratios, rates, and proportions. A ratio compares two numbers or quantities. A ratio can be written in three different ways.

The local library has 14 part-time workers and three full-time librarians. Write the ratio in all three forms.

Part-time workers to full-time librarians: $\frac{14}{3}$ 14:3   14 to 3

A rate is a special type of ratio that compares two quantities measured in different units. A unit rate is a rate whose denominator is 1. To change a rate to a unit rate, divide both the numerator and denominator by the denominator.

Find the unit rate. Write it in fraction and word form.
Chas read 135 pages in 5 hours.

$\frac{135 \text{ pages}}{5 \text{ hours}}$ — Rate in fraction form.

$\frac{135 \text{ pages} \div 5}{5 \text{ hours} \div 5} = \frac{27 \text{ pages}}{1 \text{ hour}}$ — Unit rate in fraction form.

Chas read 27 pages per hour. — Unit rate in word form.

An equation stating that two ratios are equivalent is called a **proportion.** You can determine whether two ratios are equivalent by writing the ratios in simplest form. If the ratios can be reduced to the same fraction, then the ratios are in proportion.

Determine whether the ratios are proportional.

$\mathbf{\frac{5}{12}, \frac{15}{36}}$

$\frac{5}{12}$ — $\frac{5}{12}$ is already in simplest form.

$\frac{15}{36} = \frac{15 \div 3}{36 \div 3} = \frac{5}{12}$ — Write $\frac{15}{36}$ in simplest form.

Since $\frac{5}{12} = \frac{5}{12}$, the ratios are proportional.

The student will use the cross product rule to solve proportions.

Cross Product Rule		
Words	**Numbers**	**Algebra**
In a proportion, the cross products are equal.	$\frac{2}{5} = \frac{6}{15}$ $2 \cdot 15 = 5 \cdot 6$ $30 = 30$	If $\frac{a}{b} = \frac{c}{d}$, where $b \neq 0$ and $d \neq 0$, then $a \cdot d = b \cdot c$.

Use cross products to solve the proportion.

$\frac{3}{5} = \frac{15}{t}$

$3 \cdot t = 5 \cdot 15$ The cross products are equal.

$3t = 75$ Multiply.

$\frac{3t}{3} = \frac{75}{3}$ Divide each side by 3 to isolate the variable.

$t = 25$

It is important to set up proportions correctly. Each ratio must compare corresponding quantities in the same order. Suppose a boat travels 16 miles in four hours and 8 miles in x hours at the same speed. Either of these proportions could represent this situation.

$\frac{16 \text{ mi}}{4 \text{ hr}} = \frac{8 \text{ mi}}{x \text{ hr}}$ $\frac{16 \text{ mi}}{8 \text{ mi}} = \frac{4 \text{ hr}}{x \text{ hr}}$

Proportions are useful when converting units of measurement.

Convert 15,840 feet to miles.

There are 5,280 feet in 1 mile.

$\frac{\text{feet} \rightarrow}{\text{miles} \rightarrow}$ $\frac{5{,}280}{1} = \frac{15{,}840}{x}$ Set up a proportion.

$5{,}280 \cdot x = 1 \cdot 15{,}840$ The cross products are equal.

$5{,}280x = 15{,}840$ Multiply.

$x = 3$ Divide each side by 5,280.

15,840 feet is equal to 3 miles.

The student will be able to apply these skills to many real life scenarios. Practice giving the student problems that will encourage the use of solving a proportion or converting units.

Sincerely,

Family Letter
Section B

What We Are Learning

Proportions in Geometry

Vocabulary
These are the math words we are learning:

corresponding angles the angles that are in the same relative position in two similar figures

corresponding sides the sides that are in the same relative position in two similar figures

indirect measurement a method of using proportions to find an unknown length or distance in similar figures

scale a ratio between two sets of measurements

scale drawing a proportional two-dimensional drawing of an object

scale factor a ratio that compares the size of a model to the actual size of the object

scale model a proportional three-dimensional model of an object

similar figures that have the same shape but are different sizes

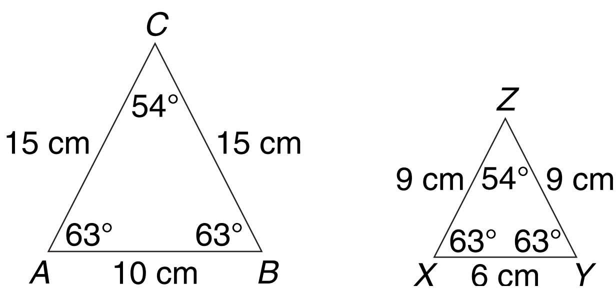
Dear Family,

The student will learn to use ratios to determine whether two figures are **similar.** Similar figures have the same shape but not necessarily the same size.

To determine whether two figures are similar, you must compare the measures of the corresponding angles and the ratios of the lengths of corresponding sides.

Similar Figures
Two figures are similar if • the measures of their corresponding angles are equal. • the ratios of the lengths of their corresponding sides are proportional.

Tell whether the triangles are similar.



The corresponding angles of the figures have equal measures.

$\overline{AB}$ corresponds to $\overline{XY}$.

$\overline{AC}$ corresponds to $\overline{XZ}$.

$\overline{BC}$ corresponds to $\overline{YZ}$.

$\frac{AB}{XY} \stackrel{?}{=} \frac{AC}{XZ} \stackrel{?}{=} \frac{BC}{YZ}$ Write ratios using the corresponding sides.

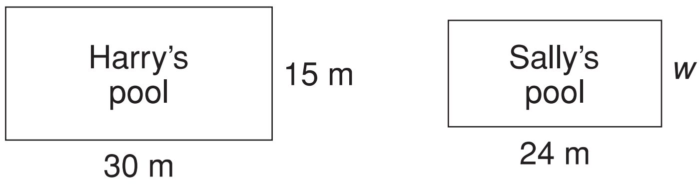
$\frac{10}{6} \stackrel{?}{=} \frac{15}{9} \stackrel{?}{=} \frac{15}{9}$ Substitute the lengths of the sides.

$\frac{5}{3} = \frac{5}{3} = \frac{5}{3}$ Simplify each ratio.

Since the measures of the corresponding angles are equal and the ratios of the corresponding sides are equivalent, the triangles are similar.

The student will use the properties of similar figures to find the measure of unknown lengths or unknown distances by setting up proportions to find the missing value. This form of indirect measurement is applicable to many everyday situations.

Harry and Sally both have rectangular swimming pools that are similar to each other. How wide is the pool at Sally's house?



Let w = the width of Sally's pool.

$\frac{24}{30} = \frac{w}{15}$	Write a proportion using corresponding sides.
$30 \cdot w = 24 \cdot 15$	Find the cross products.
$30w = 360$	Multiply.
$\frac{30w}{30} = \frac{360}{30}$	Solve for w. Divide by 30.
$w = 12$	

Sally's pool is 12 m wide.

Scale models and drawings are proportional representations of objects. The scale factor tells you how the dimensions of a model or drawing are related to the dimensions of the actual object. A scale factor is always the ratio of the model's dimensions to the actual object's dimensions.

An architect's model of a building is 18 inches tall. The actual building is 360 inches tall. What is the scale factor?

$\frac{\text{model height}}{\text{building height}} = \frac{18}{360} = \frac{1}{20}$ Write a ratio. Then simplify.

The scale factor is $\frac{1}{20}$.

The concepts and skills learned in this section are applicable to many activities outside of the math classroom. Provide opportunities for the student to use the skills learned in this chapter in real-world applications.

Sincerely,