Ratios and Proportions

Program 8 Guide

Each episode of *Go Figure?* can be used as an introduction or a "refresher" of basic mathematics concepts presented in a fun and creative way. It may be used in a classroom or an intervention setting. The accompanying CD-ROM edu-game was designed for use by students on an individual basis. The object of the edu-game is to solve a mystery. In order to do this, the student must solve mathematics problems in the specific content areas presented in the video series. Thus the digital video series is used to generate interest and enthusiasm in the presentation of mathematics concepts, and the CD-ROM allows students to practice using the concepts in a "video-game" format.

The three main characters in each DVD video program – the mysterious Pythagleo, plus two students named Carter and Chris who are trying to solve the mystery of Etna High School – discuss the targeted math concepts.

Chris, and to a lesser extent, Carter, verbalizes what each is thinking as they work through problems associated with the math concepts. The DVD programs assume that, like Chris and Carter, your students have already been introduced to the math concepts presented in the episode. The dialog may be too quick for some students. Every step that some of your students will need to solve similar problems on their own may not be mentioned in the programs. Therefore, pausing the DVD to review or present additional information will help adapt the learning situation to the needs of your students. See additional materials about teaching with videos and differentiated instruction in the Introduction of the Teacher Resources Guide.

Ohio Mathematics Content Standards and Benchmarks

Data Analysis and Probability Benchmark

I. Describe the probability of an event using ratios, including fractional notation.

Measurment Benchmarks

A. Select appropriate units to measure angles, circumference, surface area, mass, and volume using:
   • U. S. Customary units; e.g., degrees, square feet, pounds, and other units as appropriate;
   • Metric units; e.g., square meters, kilograms and other units as appropriate.

Math Content

- How to write ratios to compare two quantities
- Write ratios as fractions
- Proportions – two ratios are equal
- Proportions can be used to enlarge something without distorting it.

Episode Notes

- Pythagleo plans a reunion party for the missing students complete with decorations. Pythagleo, Chris, and Carter plan the menu and the amount of food to order. Three foot-long subs can feed four people. The mysterious Emily attended the party.
- If your students have viewed all eight episodes, they are probably wondering why there is not a definitive conclusion to the story. Please encourage the use of the CD-ROM edu-game for each episode that they have viewed. This allows them to practice using the concepts that were presented in the video programs. (It also may give them the answers for which they are looking!!)



- After Chris defines proportion, Pythagelo begins to share information about people offering to do something for others – "like the other night on Main Street." Chris stops Pythagleo in mid sentence and tells him "No, That's a proposition."

Teacher Notes

A ratio is a comparison of two numbers and can be written in many different ways.
Here are three ways:

A. use the word "to" 1 to 3
B. use a colon: 1 : 3
C. use a fraction $\frac{1}{3}$

A proportion is the equality of two ratios such as: $\frac{2}{6}=\frac{1}{3}$

If one of the terms of the proportion is unknown, then the proportion needs to be solved. (The value of the unknow term must be found by isolating the unknown or variable.) To solve the proportion, the opposite operation is performed on both sides of the equation.

Example:

$$\frac{m}{2}=\frac{6}{5}$$

$2\times\frac{m}{2}=\frac{6}{5}\times 2$

Isolate for *m.*

- Since the division operation is given, the opposite operation is multiplication.
- Multiply by 2 since *m* is being divided by 2. Remember – Perform the same operation on each side of the equation.

$$\frac{2\times m}{1\times 2}=\frac{6\times 2}{5\times 1} \text{ or } \frac{2m}{2}=\frac{12}{5}$$

$2\times\frac{m}{2}=\frac{6}{5}\times 2$

Solve the problem.

$m = 2.4$

$$\frac{2m}{2}=m \text{ and } \frac{12}{5}=2.4$$

Cross -Multiply Method

Be sure your students understand why this method works.

The Cross-Multiply Method	**Understanding the Cross-Multiply Method**
$\frac{m}{2}=\frac{6}{5}$ Multiply the opposing numerators and denominators $5 \times m = 2 \times 6$ $5m = 12$	$\frac{m}{2}=\frac{6}{5}$ Multiply each term by a faction equal to one – based on the denominator of the opposite term – so that the terms have common denominators. $\frac{m}{2}\times\frac{5}{5}=\frac{6}{5}\times\frac{2}{2}$ $\frac{m\times5}{2\times5}=\frac{5m}{10}$ and $\frac{6\times2}{5\times2}=\frac{12}{10}$ or $\frac{5m}{10}=\frac{12}{10}$ Isolate for the variable *m*. $\frac{10}{1}\times\frac{5m}{10}=\frac{12}{10}\times\frac{10}{1}$ or $\frac{50m}{10}=\frac{120}{10}$ • Since the division operation is given, the opposite operation is multiplication. • Multiply by 10 since *m* is being divided by 10. • Remember – Perform the same operation on each side of the equation. Reduce the fractions to lowest terms. $\frac{50m}{10}\div\frac{10}{10}=\frac{5m}{1}$ and $\frac{120}{10}\div\frac{10}{10}=\frac{12}{1}$ or $\frac{5m}{1}=\frac{12}{1}$ $\frac{5m}{1}=\frac{12}{1}$ = $5m = 12$ Once students understand the process, they can see that the same answer results when you multiply the numerator of each of a pair of fractions by the denominator of the other.

$5m = 12$ Solve for the variable *m*.

$\frac{5m}{5}=\frac{12}{5}$ Since *m* is multiplied by 5, divide by 5 on both sides of the equation.

$5m \div 5 = m$ and $12 \div 5 = 2.4$

$m = 2.4$

Ratios and Proportions

Worksheet 1

Choice *E*, in multiple-choice questions, is always: *I request help from the teacher*.

You may mark E in addition to one other choice if you think that you have the right answer to the question but you do not feel that you have a complete understanding of the problem.

Your teacher will decide whether to use the two-point or four-point scoring rubric for problems that use numbers, pictures, or words to justify/explain your answer(s). You may request help for these questions, too. Write the word "teacher" by your answer(s).

1. Chris is helping plan a party for her sister, Jillian. Jillian invited 35 friends. Chris wants to make old fashioned strawberry shortcake. Her grandmother's recipe for the shortcake biscuits will make enough for 12 biscuits. Since Jillian's friends like to eat, Chris wants enough so that Jillian and each of her friends get two biscuits. How many recipes should she make so she has enough biscuits?

   A. $2\frac{1}{2}$ B. 4 C. 6 D. 3 E. Teacher

2. For the strawberry shortcake in exercise #1, Chris needs $\frac{1}{2}$ pint of strawberries for each person. How many strawberries should she buy?

   A. 18 quarts B. 9 quarts C. 12 pints D. 6 pints E. Teacher

3. Jillian wants to string popcorn as a decoration for her party. She estimates that it will take 15 popped kernels for every 9 inches of string. She needs 100 feet of stringed popcorn. How many popped kernels does she need?

   A. 20 B. 200 C. 2,000 D. 20,000 E. Teacher

4. Jillian decided to string glass beads instead of popcorn. She can use 7 very large beads for every 9 inches of string. She now wants 240 feet of stringed beads. If the beads cost 13 cents per bead, how much money would it cost buy enough beads to string 240 feet of them?

   A. $31.20 B. $163.80 C. $216.00 D. $291.20 E. Teacher

5. Manny is bringing his favorite cherry flavored Kool-Aid for the 36 people at Jillian's party. He figures that each person will drink two 8-oz. glasses of Kool-Aid. One packet of Kool-Aid will make eight 8-oz. glasses. How many packets should he buy?

   A. 18 B. 9 C. 4 D. 2 E. Teacher

6. How much water would Manny need if he decided to use six packets of Kool-Aid and each packet needed 4 cups?

   A. 6 quarts B. 6 pints C. 6 cups D. 20 cups E. Teacher



7. How much sugar would Manny need if he used 6 packets of Kool-Aid and each packet needed $1\frac{1}{2}$ cups of sugar?

   A. 6 cups B. 8 cups C. 9 cups D. 4 cups E. Teacher

8. Carter has 230 CDs. He saw a CD holder at the store that he really liked. This holder was made for 21 CDs. How many holders does Carter need so all of his CDs will fit?

   A. 8 B. 9 C. 10 D. 11 E. Teacher

9. Chris's parents will open a new restaurant called *The Red Hot Chili Peppers*. The restaurant will have circular tables that seat six people each. How many tables should they purchase if they want seating for 150 patrons at one time (assuming there is sufficient room)?

   A. 25 B. 30 C. 40 D. 50 E. Teacher

10. Chris's parents bought a used coffee maker for their restaurant. The coffee maker needs 2 pre-measured packets of gound coffee beans for 10 cups of perked coffee. If Chris is supposed to make 35 cups of coffee, how many packets does she need?

    A. 5 B. 4 C. 7 D. 10 E. Teacher

Ratios and Proportions
Worksheet 2

Choice *E*, in multiple-choice questions, is always: *I request help from the teacher*.

You may mark E in addition to one other choice if you think that you have the right answer to the question but you do not feel that you have a complete understanding of the problem.

Your teacher will decide whether to use the two-point or four-point scoring rubric for problems that use numbers, pictures, or words to justify/explain your answer(s). You may request help for these questions, too. Write the word "teacher" by your answer(s).

1. A chocolate chip cookie recipe calls for calls 2 cups of flour to make 40 cookies. Pythagleo needs to make 100 cookies. Which proportion can Pythagleo use to find the number of cups of flour he needs to make 100 cookies?

   A. $\frac{2}{40}=\frac{n}{100}$ B. $\frac{40}{100}=\frac{n}{2}$ C. $\frac{40}{2}=\frac{n}{100}$ D. $\frac{2}{n}=\frac{n}{40}$ E. Teacher

2. Students at Western High School in Enigma voted for a mascot for their school: either a new Thor, the Norwegian Elkhound, the mascot of the abandoned Etna High, or Ziggy, the Norse Thunder Bolt. The principal announced that Ziggy won over Thor by a 4 to 3 vote. Which of the following could have been the votes?

   A. Ziggy: 195, Thor: 260
   B. Ziggy: 390, Thor: 325
   C. Ziggy: 260, Thor: 195
   D. Ziggy: 300, Thor: 400
   E. Teacher

3. Carter's dog, Munch, is given 9 dog treats during every two-week period. How many dog treats will Munch get over the course of 10 weeks?

   A. 19 treats B. 23 treats C. 45 treats D. 90 treats E. Teacher

4. Chris and Carter made a model of the mysterious containment room to try to better understand how the room could have been used to contain people back in 1966. The actual room measured 30 feet by 27 feet. The model is 20 inches by 18 inches. What is the scale of the model room to the actual room?

   A. 1 : 3 B. 1 : 12 C. 1 : 18 D. 1 : 36 E. Teacher

5. Chris would like to buy an iPod but the one she wants costs $294. Chris's friend Harper has one like the model Chris wants. Harper decides to sell his current iPod to Chris and use the money to help pay for an even more expensive model. Harper tells Chris he will sell her his current iPod for 15% off the original price. It's only five months old and is in very good condition. Which proportion can be used to find the final price (p) Chris will pay Harper if she buys his iPod?

   A. $\frac{85}{100}=\frac{p}{294}$ B. $\frac{p}{0.15}=294$ C. $\frac{294}{p}=\frac{85}{100}$ D. $\frac{294}{p}=\frac{15}{100}$ E. Teacher



6. Pythagleo loves to eat mashed potatoes. He found a 5 pound bag of instant mashed potatoes that would serve 64 people. How many ounces should Pythagleo use if if he only wants to make two servings?

   A. 2 ozs. B. 2.5 ozs. C. 4 ozs. D. 6 ozs. E. Teacher

7. If you need two pounds of bologna for six sub sandwiches, then how much bologna will you need to make eight sub sandwiches?

   A. $2\frac{1}{2}$ lbs. B. $2\frac{2}{3}$ lbs. C. 3 lbs. D. $3\frac{1}{3}$ lbs. E. Teacher

8. Carter wants all 30 people in his mathematics class to have three pieces of pizza. If each pizza has eight slices, how many pizzas should he order?

   A. 10 B. 11 C. 12 D. 13 E. Teacher

9. Pythagleo was making lemonade. One can of frozen lemonade concentrate will make 64 fluid ounces. Each can of concentrate requires $6\frac{3}{4}$ cups of water. Pythagleo planed to use three cans of frozen concentrate. How many cups of water will he need?

   A. $27\frac{3}{4}$ cups B. 27 cups C. $20\frac{2}{3}$ cups D. $20\frac{1}{4}$ cups E. Teacher

10. Emily is helping to make decorations for Pythagleo's reunion party. She wants two hanging streamers for every 10 square feet of ceiling. If the cafeteria is a rectangle 100 by 60 ft., how many streamers must Emily make?

    A. 1,200 B. 120 C. 100 D. 60 E. Teacher

11. What is the ratio of a right angle to a straight angle?

    A. $\frac{1}{1}$ B. $\frac{1}{4}$ C. $\frac{1}{3}$ D. $\frac{1}{2}$ E. Teacher

Ratios and Proportion

Answer Keys, Program 8: Worksheets 1 – 2

Each question on every worksheet offers the students the option of marking "Teacher" instead of or in conjunction with answering the question. The "Teacher" option is included to support student understanding and achievement. Students may have as much help and guidance as they need to understand concepts and master skills.

Instructors may decide whether to use the two or four point scoring rubric for constructed response problems (problems that use numbers, pictures, or words to justify/explain student answers). See the appendix for the complete rubrics.

Two-Point Scoring Rubric

2 – Complete
1 – Partial
0 – Inadequate

Four-Point Scoring Rubric

4 – Complete
3 – Clear
2 – Partial
1 – Minimal
0 - Inadequate

Worksheet 1

1. C. 6
2. B. 9 quarts
3. C. 2,000
4. D. $291.20
5. B. 9
6. A. 6 quarts
7. C. 9 cups
8. D. 11
9. A. 25
10. C. 7

Worksheet 2

1. A. $\frac{2}{40} = \frac{n}{100}$
2. C. Ziggy: 260, Thor: 195
3. C. 45 treats
4. C. 1:18
5. A. $\frac{85}{100} = \frac{p}{294}$
6. B. 2.5 ozs.
7. B. $2\frac{2}{3}$ lbs.
8. C. 12
9. D. $20\frac{1}{4}$ cups
10. A. 1,200
11. D. $\frac{1}{2}$