iMath Readers

The Science Olympiad:
Proportions and Ratios

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Math Objective

Children understand what a proportion is. Children learn that a proportion shows that two ratios are equivalent. Children use a tape diagram to solve a problem using a proportion. They also use a table to show the parts of a proportion, or its terms. Children understand that they can find a unit rate to find the fourth term in a proportion.

iMath Discover Activity

In this activity, children learn to use a scale, a ratio that compares lengths. Children draw polygons, using a ruler and a protractor. They compare the scale of the shapes.

Materials

- ruler
- protractor
- paper
- pencil

➤ Objectives

Children will:

• use a ruler and a protractor to draw polygons to different scales.
• measure angles so that they are corresponding.
• compare shapes.
• write ratios.
• use a tape diagram.
• use a table of equivalent ratios.
• use a two-step method for calculating a missing term.

Lesson Plan

Before Reading

Investigation	Math Concepts
Ask children to look at the picture on pp. 4. Read the text on p. 5. Ask: *What does this picture remind you of?* Record children's answers on the board.	Connecting to what they know helps children engage in the topic.
Ask: *What is the purpose of a model? Have you built a model before? What did it represent? What was its purpose?* Record children's answers on the board.	Accessing prior knowledge gets children to think about and engage with the topic.

Children join students and Mr. Mead of the science club as they prepare projects and models for the Science Olympiad. They learn to use proportions and ratios. Children use tape diagrams, tables, and models to find proportions.

During Reading

Investigation	Math Concepts
pp. 6–9: Read p. 6 aloud. Ask: *What is a proportion? Let's look up the meaning of the word*. Invite a volunteer to look up the word and read the root word and definition to the class. Say: *A proportion is a mathematical statement that shows that two ratios are equivalent, or the same.* Ask: *Do you remember what a ratio shows?* Read p. 7 aloud. Use colored chalk to draw the tape diagram from that page on the board. Talk students through the text using the diagram. Read p. 8 aloud. Write the proportion on the board and draw the table. Ask: *How much do 24 foam balls cost?* Complete the proportion. Check children's understanding. Have children show how to solve a similar problem with a proportion and a table. (i.e., the cost of 5 apples is $7.00. How much are 25 apples?) Read p. 9 aloud. Show how to work the problem and talk students through the number line diagram.	Children understand that a proportion shows two ratios that are equivalent. They use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios and using tape diagrams and number lines.

During Reading (continued)

Investigation	Math Concepts
pp. 12–13: Invite a volunteer to read p. 12 aloud. Ask: What do you think about being able to generate electricity from a potato? Have children work in pairs to do Internet research to find how to build a potato battery. Then, invite a volunteer to draw and tell how it is done. Read p. 13 aloud. Ask: *How will you set up a proportion to help you solve this problem?* (Refer back to pp. 6–9 if necessary.) Have children show their work using pencil and paper. Have children check each other's work. Walk around to answer questions and correct errors or misunderstandings.	Children use ratio and rate reasoning to solve real-world and proportional problems.
pp. 14–15: Gather children into small groups. Invite a volunteer to read pp. 14–15 aloud. Ask: *What do we need to do first? Next? Last?* Children work together using pencil and paper to find the answer. Demonstrate how to work the problem on the board after children have finished their attempt. Distribute a meter stick and a small ball to each group. Have children measure and tape the wall at height of 100 centimeters. Let them drop the ball and measure and record each rebound height five times. Then have children find the mean rebound height for the drops. Ask: *What is the rebound ratio?* Have the groups make a table of their findings.	Children are introduced to rebound ratios. They understand that a proportion shows two ratios that are equivalent. They use ratio and rate reasoning to solve real-world and mathematical problems. Children find the mean and relate it to solving a proportion. Children conduct a hands-on experiment, find the mean and solve a proportion.
pp. 16–17: Have children read these pages silently. Children work alone to solve this problem using paper and pencil. Walk around and check their work. Demonstrate how to solve the problem on the board. Ask: *Why is it important that an architect's model be built exactly to scale?*	Children use ratio and rate reasoning to solve real-world and proportional problems. They understand the importance of scaling and finding proportions in the work that architects do.
pp. 18–19: Invite a volunteer to read pp. 18–19 aloud. Write the problem on the board. Invite volunteers to show how they would work the problem.	Children demonstrate the use of ratio and rate reasoning to solve real-world problems.

During Reading (continued)

Investigation	Math Concepts
pp. 20–21: Read p. 20 aloud. Write the term on the board as you read. (Mass: the amount of matter in an object or substance. Volume: the space a substance or an object takes up. Density: how much matter is in a certain volume.) Write the ratios on the board and ask children to compare them. Read p. 21 aloud. Demonstrate on the board how to work the problem with input from children.	Children are introduced to using proportions to solve problems of mass, volume, and density. They use ratio and rate reasoning to solve real-world and proportional problems.
pp. 22–23: Have children pair off. Invite children to read pp. 25–26 quietly together and work the problem on p. 26. Provide graph or drawing paper and metric rulers so the pairs can draw the mirror array to scale. Pairs present their solutions and drawings to the larger group.	Children use ratio reasoning to convert real-world measurements to scale. They measure and show a representative model.
pp. 24–26: Children read pp. 25–26 silently. Ask: How do students participating in the Laser Lay-up use math? How do the Science Olympiad volunteers use math? Reread p. 26 aloud. Provide an example of a graduated cylinder to pass around. Children work the problem alone using pencil and paper. Invite volunteers to demonstrate the problem and its solution.	Children understand the importance of mathematical accuracy in science endeavors. They are introduced to a graduated cylinder and solve a ratio problem.
pp. 27–29: Read p. 27 aloud. Have children work the problem on page 27. Say: *Remember that you are finding the total length of wire for two teams.* Read pp. 28–29 aloud. Brainstorm with children to think of different ways to represent the proportion in this problem. Refer them back to pp. 6–9 for ideas. Have volunteers demonstrate at least three different ways to show this problem.	Children use ratio and rate reasoning to solve real-world and proportional problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, number line diagrams, or equations.

During Reading (continued)

Investigation	Math Concepts
pp. 30–31: Invite a volunteer to read pp. 30–31 aloud. Ask: *How can we approach this problem? What is our first step? Next step? Last?* Invite volunteers to show how they would work the problem. Correct any errors in understanding.	Children use ratio and rate reasoning to solve real-world and proportional problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, number line diagrams, or equations.
pp. 32–33: Have children read these pages silently. Provide them with Internet or library time to research more about the inventions of Leonardo da Vinci. Invite children to share which invention of da Vinci's they would most like to build.	Children use the Internet or library to conduct research and report back on their findings.
pp. 34–37: Invite a volunteer to read pp. 34–35 aloud. Gather children into teams to solve the problem on p. 35. The first team to solve the problem and share their answers and strategies correctly wins a point. Read pp 36–37 aloud. Children continue to work in teams to solve the problem on p. 37. The first team to solve the problem and share their answers and strategies correctly wins a point.	Children collaborate to use ratio and rate reasoning to solve real-world and proportional problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, number line diagrams, or equations.
pp. 38–41: Read p. 38 aloud. Children continue to work in teams. The first team to solve the problem and share their answers and strategies correctly wins a point. Read pp. 39–41 aloud. The first team to solve the problem and share their answers and strategies correctly wins a point. Award a medal to the winning team.	Children collaborate to use ratio and rate reasoning to solve real-world and proportional problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, number line diagrams, or equations.
pp. 42–44: Read these pages together. Answer the questions and work the problems together. Ask: *Which strategies do you think work best in this situation?*	Children discuss strategies and use ratio and rate reasoning to solve real-world and proportional problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, number line diagrams, or equations.
p. 45: Read p. 45 aloud together. Discuss with children some possible ways and materials to use. Provide Internet and library time for research.	Children research, measure, and engineer a model bridge.

After Reading

Ask children to restate the key ideas in the book.

Investigation	**Understanding Math**
Children design a proposal for their own Science Olympiad project. Tell them they must use proportions and ratios in their project proposal.	Children engineer and design a project that demonstrates ratio concepts, proportions, and the use ratio reasoning to solve problems.
Children make a tape diagram or a table to show a real-world proportion that they discover at home or at school.	Children use tables of equivalent ratios, tape diagrams, number line diagrams, or equations to show a real-world use of proportions.