

# SOAR: Intervention Survey

GRADES  
6 and Up

Ratios and Proportional Reasoning



## **Ratios and Proportional Relationship Survey Grades 6 and Up**

The Operations and Algebraic Thinking Survey for Ratios and Proportional Relationship is an informal survey designed for students who show indication, based on the universal screener, of not performing at a satisfactory level. The survey focuses on the common types of ratio and proportional relationship problems and allows the user to view student performance through the lens of sense-making, use of representations, use of strategies, and mathematical explanations.

### **Survey Categories**

- I. Approaches to Solving Simple Contextual Ratio Problems
- II. Approaches to Solving Simple Contextual Problems Using Proportional Reasoning

### **Five Mathematical Practice Standards**

Five areas related to the CCSS for Mathematical Practice can be used to determine an understanding of each situational word problem. These include

- Making Sense of Simple Contextual Problems Involving Ratios and Proportions;
- Using Models/Representations to Solve Simple Contextual Problems Involving Ratios and Proportions;
- Using Appropriate Tools Strategically (Strategies) to Solve Simple Contextual Problems Involving Ratio and Proportions;
- Looking for and Making Use of Multiplicative Relationships in Simple Contextual Problems Involving Ratios and Proportions (via identifying the meaning of the ratio).

### **Rationale for the Design of the Survey**

Situational problems are at the core of this survey. In grade 6, students work with ratio problems including those involving unit pricing and constant speed. In grade 7, students work to determine unit rates associated with ratios involving numbers less than one/fractions, including ratios of lengths, areas and other quantities measured in like or different units. Students in grade 7 must understand, represent, and be prepared to use proportional relationships to solve problems.

Note: This survey has not been designed to measure a student's ability to compute, though computation is required by the survey. It is suggested that either the universal screener or a separate computation assessment be used to measure computational skills.

## **Materials Needed**

To administer this survey, you will need the Ratios and Proportional Reasoning Checklist, Student Prompt Book: Ratios and Proportional Reasoning, paper, grid paper and pencil, as well as 36 blocks, chips, or tiles (three different colors), and these directions.

## **Administration of the Survey**

The survey can be completed as a one-on-one interview (approximately 20 minutes for each section). The survey can be given to a small group of students as well. If the survey is used with a small group of students, it will be important to vary the students who are called on first as to minimize the influence other students' responses have on the results. This will help ensure you get an actual measure of each student's ability to solve the word problems.

- Students in Grade 6, whose performance on the universal screener suggests a need for additional support, will need to complete most of Category I.
- Students in Grade 7 and up whose performance on the universal screener suggests a need for additional support, may need to complete Categories I and II.

Before starting the survey, fill out the information on the top of the checklist, including the date on which you are giving the survey. As previously noted, a copy of each of the word problems is provided in the Student Prompt Book that should be used during the survey. The teacher is encouraged to read the word problems to the students since this is not a test of a student's reading ability.

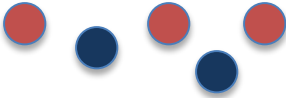
*Note: We recommend the use of the Student Prompt Book so that students are able to see and hear the word problem, as well as refer back to the word problem, as necessary. Students who are only hearing the word problems must rely on working memory to remember the word problem rather than making sense of the mathematics represented by the word problem.*

Start the survey by saying: *"I like to learn about how my students are thinking about and solving problems. This is why we are meeting. I am going to give you a word problem. You can use any materials on the table to solve the word problem. Notice we have counters, square tiles, \_\_\_\_\_. I want you to talk out loud about how you are solving the word problem so I know how you are thinking about the situation. If you need a word problem repeated, please ask me to repeat the problem."* If needed, repeat this statement throughout the survey.

This survey is a tool designed to find out where students are in their learning; therefore, the interview questions provided on the next several pages are limited and reflect only those questions that probe for student understanding.

**Note:** *Italics* in the document call out teacher speech.




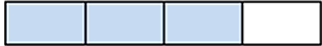
**Category I: Approaches to Solving Simple Contextual Ratio Situational Word Problems**

Item Number and Situational Word Problem	Interview Questions
<p><b>Write a Ratio Described in a Context Problem</b></p> <p>1a. There are 4 elephants at the zoo. What is the ratio of the elephants’ ears to the elephants’ eyes? <b>(Simple Ratio)</b></p> <p>b. After 10 minutes, you notice that you have walked 7 laps. What is the rate at which you are walking? <b>(Rate)</b></p> <p>c. 40% of the pizzas sold at Speedy’s Pizzeria are pepperoni pizzas. What is the ratio of pepperoni pizzas to all pizzas sold at Speedy’s Pizzeria? <b>(Percent)</b></p> <p><b>Given Part:Part, Requires Part:Whole Problem</b></p> <p>2. Ricardo notices that the ratio of red houses (light grey) to blue houses (dark grey) on his street can be represented with the diagram below. If Ricardo’s street has 20 houses and all are either red or blue, how many houses on his street are blue?</p> <div style="text-align: center;">  </div> <p><b>Given Part:Whole, Requires Part:Part Problem</b></p> <p>3. In Sarah’s class, 1 out of 5 students did not turn in homework on Tuesday. If there are 30 students in Sarah’s class on Tuesday, how many students <i>did</i> turn in homework?</p>	<p><b>Makes Sense</b></p> <ul style="list-style-type: none"> <li>• <i>What does the problem describe?</i></li> <li>• <i>What do you have to figure out in the problem?</i></li> <li>• <i>Tell me how you thought about the problem.</i></li> </ul> <p><b>Creates Representations</b></p> <ul style="list-style-type: none"> <li>• <i>Tell me about your representation.</i></li> <li>• <i>What does it tell you about the problem?</i></li> </ul> <p><b>Uses Reliable Strategies</b></p> <ul style="list-style-type: none"> <li>• <i>How did you figure out ____?</i></li> <li>• <i>Show me how you determined the ratio.</i></li> <li>• <i>Show me how you can figure out ____.</i></li> </ul> <p><b>Provides Explanation</b></p> <ul style="list-style-type: none"> <li>• <i>What do the numbers tell us about in the ratio?</i></li> <li>• <i>Do they tell us the same thing?</i></li> </ul>

**Category I: Approaches to Solving Simple Contextual Ratio Situational Word Problems (*continued*)**

Item Number and Situational Word Problem	Interview Questions
<p><b>Unit Rate or Price Problem</b></p> <p>4. You need to buy 24 cupcakes for your party tonight. You have \$6.00. Cindy’s Bakery sells 3 cupcakes for \$1.00. Do you have enough money to buy 24 cupcakes? Explain why or why not.</p>	<p><b>Makes Sense</b></p> <ul style="list-style-type: none"> <li>• <i>What does the problem describe?</i></li> <li>• <i>What do you have to figure out in the problem?</i></li> <li>• <i>Tell me how you thought about the problem.</i></li> </ul>
<p><b>Constant Speed Problem</b></p> <p>5. Mr. Smith rides a motorcycle to school each day. He travels at a rate of 30 miles per hour.</p> <p>a. How long does it take him to get to school if the distance he travels is 10 miles?</p> <p>b. At that rate, how far will he be able to travel in 4 hours?</p>	<p><b>Creates Representations</b></p> <ul style="list-style-type: none"> <li>• <i>Tell me about your representation.</i></li> <li>• <i>What does it tell you about the problem?</i></li> </ul>
<p><b>Measurement Conversion Problem</b></p> <p>6. A map is drawn using a scale of 150 kilometers to 3 centimeters. The distance between Pittsburgh and Philadelphia is 500 kilometers. How far apart will the two cities be on the map?</p>	<p><b>Uses Reliable Strategies</b></p> <ul style="list-style-type: none"> <li>• <i>How did you figure out ____?</i></li> <li>• <i>Show me how you determined the ratio.</i></li> <li>• <i>Show me how you can figure out ____.</i></li> </ul>
<p><b>Percent Problem</b></p> <p>7. 20% of the pizzas that Speedy Pizza Shop sells are sausage pizzas.</p> <p>a. What is the ratio of sausage pizzas to all of the pizzas sold today?</p> <p>b. If the pizza shop sells 45 pizzas, how many of them are sausage?</p>	<p><b>Provides Explanation</b></p> <ul style="list-style-type: none"> <li>• <i>What do the numbers tell us about in the ratio?</i></li> <li>• <i>Do they tell us the same thing?</i></li> </ul>

Category I: Approaches to Solving Simple Contextual Ratio Situational Word Problems (*continued*)

Item Number and Situational Word Problem	Interview Questions
<p><b>Recognizing Ratios in Models</b></p> <p>8. What ratio is modeled in the diagram below? Explain in words how you made your decision.</p> <p>a. <b>(Parts Represented in Picture Form)</b></p>  <p>b. <b>(Parts Represented in Tape Diagram)</b></p>  <p>c. <b>(Parts Represented in Double-Number Line)</b></p>  <p>d. <b>(Part and Whole Represented in Table)</b></p>  <p>Shaded: Ounces of water</p> <p>Unshaded: Ounces of juice</p>	<p><b>Connects Ratio to a Visual Model</b></p> <ul style="list-style-type: none"> <li>• <i>What do you know about the word problem?</i></li> <li>• <i>What do you have to figure out in the word problem?</i></li> <li>• <i>Tell me how you thought about the problem.</i></li> <li>• <i>What is the solution to the word problem?</i></li> </ul> <p><b>Identifies Meaning of the Ratio</b></p> <ul style="list-style-type: none"> <li>• <i>Explain how you made your decision.</i></li> <li>• <i>Tell me what your numbers represent.</i></li> </ul>

**Category II: Approaches to Solving Simple Contextual Situational Word Problems Using Proportional Reasoning**

Item Number and Situational Word Problem													
<b>Test for Proportionality Problem</b>													
<p>9. The table below contains ticket-buying data from 3 different classrooms. Is the relationship between the number of students who purchased tickets to the school dance and the total number of students in the class a proportional relationship? Justify your answer.</p>													
<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 15%;">Class A</th> <th style="width: 15%;">Class B</th> <th style="width: 15%;">Class C</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Students who Purchased Tickets</td> <td style="text-align: center; padding: 5px;">18</td> <td style="text-align: center; padding: 5px;">24</td> <td style="text-align: center; padding: 5px;">15</td> </tr> <tr> <td style="padding: 5px;">Total Number of Students</td> <td style="text-align: center; padding: 5px;">24</td> <td style="text-align: center; padding: 5px;">32</td> <td style="text-align: center; padding: 5px;">20</td> </tr> </tbody> </table>			Class A	Class B	Class C	Students who Purchased Tickets	18	24	15	Total Number of Students	24	32	20
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<b>Unit Rate Problem</b>													
<p>10. Trent gets thirsty when he mows lawns. He often buys 6 bottles of sports drink for \$9.36.</p> <p>a. At that price, how much does Trent pay for 1 bottle of sports drink?</p> <p>b. If Trent wants to buy 21 bottles of sports drink, how much money will he need?</p> <p>c. Write an equation to express the relationship between the number of bottles of sports drink he buys and the price he pays.</p>													

	Interview Questions
<b>Makes Sense</b>	<ul style="list-style-type: none"> <li><i>Tell me about the model.</i></li> <li><i>How does the model show <math>4 \times 8</math>?</i></li> </ul>
<b>Creates Representations</b>	<ul style="list-style-type: none"> <li><i>Tell me about the factors, the four and the eight. Where are these in each model?</i></li> </ul>
<b>Uses Reliable Strategies</b>	<ul style="list-style-type: none"> <li><i>Tell me what you did to figure out the where the four is represented in each model.</i></li> </ul>
<b>Provides Explanation</b>	<ul style="list-style-type: none"> <li><i>Tell me what the numbers mean in the model and the equation.</i></li> <li><i>Where are the groups in each model?</i></li> <li><i>How does the model show division?</i></li> </ul>



**Category II: Approaches to Solving Simple Contextual Situational Word Problems Using Proportional Reasoning**  
*(continued)*

Item Number and Situational Word Problem	Interview Questions
<p><b>Graphing Problem</b></p> <p>11. The graph below shows the number of toys that students in 6 middle school classes collected for charity.</p> <p>a. Is the relationship between the number of students in the class and the number of toys collected a proportional relationship?</p> <p>b. If the relationship is proportional, write an equation that shows the relationship between the number of students in the class and the number of toys collected. If the relationship is not proportional, explain how you know.</p> <div style="text-align: center;"> </div> <p><b>Constant Rate Problem</b></p> <p>12. It takes Lola 20 minutes to walk her dog <math>\frac{1}{2}</math> mile. What is her walking rate in miles per hour?</p> <p><b>Percent Problem</b></p> <p>13. Michael needs to buy a new pair of sneakers and his favorite style of sneakers normally cost \$75.00. There is a 20% discount on sneakers at the mall.</p> <p>a. If he buys his favorite sneakers at the mall, how much money will he save?</p> <p>b. How much will his sneakers cost at the discount price?</p>	<p><b>Makes Sense</b></p> <ul style="list-style-type: none"> <li>Tell me about the model.</li> <li>How does the model show <math>4 \times 8</math>?</li> </ul> <p><b>Creates Representations</b></p> <ul style="list-style-type: none"> <li>Tell me about the factors, the four and the eight. Where are these in each model?</li> </ul> <p><b>Uses Reliable Strategies</b></p> <ul style="list-style-type: none"> <li>Tell me what you did to figure out the where the four is represented in each model.</li> </ul> <p><b>Provides Explanation</b></p> <ul style="list-style-type: none"> <li>Tell me what the numbers mean in the model and the equation.</li> <li>Where are the groups in each model?</li> <li>How does the model show division?</li> </ul>