

SOAR: Intervention Survey

GRADES
3 to 6

Number and Operations: Fractions

Number and Operations: Fractions Survey Grades 3 to 6

The Number and Operations Survey for Fractions is an informal survey for students in Grades 3 through 6. It is designed for students who show an indication, based on the universal screener, of not understanding fractions as numbers or operating with fractions. The survey focuses on understanding of and operating with fractions, and allows the user to view student performance through the lens of making use of the structure of fractions, modeling fractions, relationships and operations, attending to precision, and providing explanations and constructing arguments.

Survey Categories

- I. Understands and Compares Fractions
- II. Adds and Subtracts Fractions
- III. Multiplies and Divides Fractions

Three Mathematical Practices

Three mathematical practices can be used to determine an understanding of fractions and operating with fractions. These include

- making use of the structure of mathematics, specifically the meaning of the numerator and denominator;
- creating and using models of mathematics to represent fractions, relationships, and operations; and
- providing valid explanations for and constructing viable arguments about mathematical ideas and relationships.

Materials Needed

To administer this survey, in addition to this document, you will need

- [Fractions Checklist](#) to record your observations about student performance,
- [Fractions Student Prompt Book](#) that contains each of the survey items in print, and
- scrap paper for students to use, as needed.

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 understanding of fractions and operating with fractions.

- Students in Grade 3 whose performance on the universal screener suggests a need for additional support will need to complete most* of Category I.
- Students in Grade 4 whose performance on the universal screener suggests a need for additional support will need to complete all of Category I and some* of Category II
- Students in Grade 5 or Grade 6 whose performance on the universal screener suggests a need for additional support will need to complete all of Categories I and II, and most* of Category III.

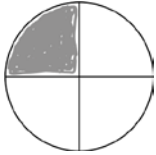
Before starting the survey, fill out the information on the top of the checklist, including the date on which you are giving the survey. As previously noted, a copy of each survey item is provided in the Student Prompt Book which should be used during the survey. The survey items include word problems.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


Start the survey by saying, *"I like to learn about how my students are thinking about fractions. This is why we are meeting. I want you to talk out loud about your strategy so I know how you are thinking about the problem. If you need a problem repeated, please ask me to repeat the problem."* If needed, repeat this statement to them throughout the survey.

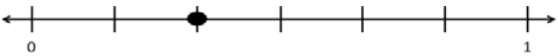
* Item numbers that designate a grade-break have a note in greyed text.


Category I: Understands and Compares Fractions

Names Fractions

1a. 

1b. 

1c. 

1d. 

<p>Models Mathematics</p>	<p>Names and writes fractions from visual models.</p> <p><i>Regional Models (.a and 1b.):</i></p> <ul style="list-style-type: none"> • What fraction of the cake (diagram) is shaded? • Write a fraction for the shaded area of the cake (diagram). <p><i>Number Lines (1c. and 1d.):</i></p> <ul style="list-style-type: none"> • What fraction is marked on the number line? • Write a fraction for the point marked on the number line.
<p>Understands Structure of Fractions</p>	<p>Identifies the meaning of the numerator and denominator.</p> <ul style="list-style-type: none"> • Tell me about what you have written. • Tell me what this (point to the numerator) means. • Tell me what this (point to the denominator) means.
<p>Provides Explanation</p>	<p>Relates the written fraction to the visual model.</p> <ul style="list-style-type: none"> • How does the fraction you've written describe the cake/number line?

Represents Fractions

2a. Show $\frac{1}{4}$ using either the circle or the square.

2b. Show $\frac{3}{4}$ using either the circle or the square.

2c. Show $\frac{3}{8}$ on the number line.

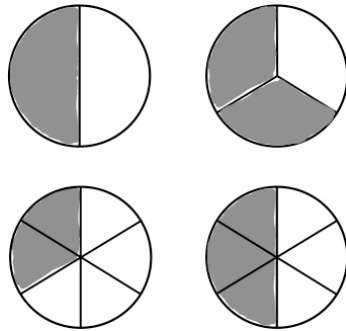
2d. Show $\frac{5}{3}$ using the number line, circle, or square.

<p>Models Mathematics</p>	<p>Creates a visual model of a fraction.</p> <ul style="list-style-type: none"> • How does the diagram (or number line) show the fraction?
<p>Understands Structure of Fractions</p>	<p>Makes use of the meaning of the numerator and denominator.</p> <ul style="list-style-type: none"> • How did you use the denominator to show the fraction? • How did you use the numerator to show the fraction?
<p>Provides Explanation</p>	<p>Relates the visual model to the written fraction.</p> <ul style="list-style-type: none"> • How does the fraction you've written describe the cake/number line?

Category I: Understands and Compares Fractions *(continued)*

Identifies Equivalent Fractions

3a. What do you notice about the diagrams below?



3b. A student claims that $\frac{1}{2} = \frac{3}{6}$. Do you agree or disagree?

Models Mathematics	<i>No representations required.</i>
Understands Structure of Fractions	<p>Recognizes equivalence.</p> <ul style="list-style-type: none"> • What do the fractions show? • Which fractions show the same portion? • What does it mean when two fractions are “equivalent”?
Provides Explanation	<p>Constructs a viable argument.</p> <ul style="list-style-type: none"> • How do you know that $\frac{1}{2}$ is equal, equivalent, to $\frac{3}{6}$? • Show me why you agree or disagree with the claim that $\frac{1}{2} = \frac{3}{6}$ using a diagram. <p>OR</p> <ul style="list-style-type: none"> • Why do you think that $\frac{1}{2}$ and $\frac{3}{6}$ are not equal, are not equivalent?

Compares Fractions

4a. Is $\frac{4}{5}$ greater than or less than $\frac{2}{5}$?

4b. Which fraction is greater, $\frac{1}{2}$ or $\frac{1}{4}$?

Ask 4c and 4d only if the student is in Grade 4 or higher. If the student is in Grade 3, end the survey after 4b.

4c. Which fraction is greater, $\frac{2}{3}$ or $\frac{3}{6}$?

4d. Compare $\frac{3}{5}$ and $\frac{7}{8}$.

Models Mathematics	<p>Represents the relationship between fractions.</p> <ul style="list-style-type: none"> • Create a diagram to show the two fractions being compared. • How would you record that comparison using the greater than or less than symbol?
Understands Structure of Fractions	<p>Comparisons with common denominators or numerators.</p> <ul style="list-style-type: none"> • Why can you use the numerator/denominator to compare the fractions? <p>Comparison with unlike denominators</p> <ul style="list-style-type: none"> • How can knowing $\frac{1}{2}$ help you determine which of the following is greater, $\frac{3}{5}$ or $\frac{7}{8}$?
Provides Explanation	<p>Comparisons with common denominators or numerators</p> <ul style="list-style-type: none"> • How do you know ____ is greater than ____? <p>Comparison with unlike denominators</p> <ul style="list-style-type: none"> • How do you know ____ is greater than ____?

Category II: Adds and Subtracts Fractions

Adds/Subtracts Fractions with Common Denominators

- 5a. Solve these expressions: $\frac{2}{8} + \frac{4}{8}$ and $\frac{3}{6} - \frac{2}{6}$.
- 5b. Jamie walked $\frac{2}{4}$ of a mile to her friend’s house. Then she walked an additional $\frac{1}{4}$ of a mile home. What is her total distance walked?
- 5c. Sam has $\frac{5}{6}$ of an orange. He gives $\frac{2}{6}$ of the entire orange to his brother. How much of the orange does he have left?

Adds/Subtracts Fractions with Unlike Denominators

Ask only if the student is in Grade 5 or higher. If the student is in Grade 4, skip ahead to #7.

- 6a. Solve the equations. $\frac{2}{5} + \frac{3}{4} = \underline{\quad}$ $\frac{2}{5} + \frac{3}{5} = \underline{\quad}$
- 6b. Dan has $\frac{3}{4}$ of a bottle of water. He drinks $\frac{3}{8}$ of the bottle. How much of the bottle does he have left?
- 6c. Brad walked a total of $\frac{7}{8}$ of a mile. Brad walked $\frac{3}{4}$ of a mile when it was raining. How far did Brad walk when it was sunny?

<p>Models Mathematics</p>	<p>Models addition and subtraction of fractions. (BOTH Common Denominators and Unlike Denominators)</p> <p>Equations</p> <ul style="list-style-type: none"> How can you represent this equation with a diagram or number line? How does your diagram/number line show the equation? <p>Word Problems</p> <ul style="list-style-type: none"> Write an equation that helps you solve the problem. Why did you write that equation?
<p>Understands Structure of Operating with Fractions</p>	<p>Recognizes structure of addition and subtraction of fractions. (BOTH Common Denominators and Unlike Denominators)</p> <p>Equations</p> <ul style="list-style-type: none"> What do you need to do to solve this equation? What is the solution to the equation? <p>Word Problems</p> <ul style="list-style-type: none"> Tell me what is happening in the word problem. What do you need to figure out in the word problem? What is the solution to the word problem? <p>(ONLY Unlike Denominators)</p> <ul style="list-style-type: none"> How is solving $\frac{2}{5} + \frac{3}{4}$ different from solving $\frac{2}{5} + \frac{3}{5}$?
<p>Provides Explanation</p>	<p>Articulates reason for having same-sized pieces when adding or subtracting fractions. (Common Denominators)</p> <ul style="list-style-type: none"> Tell me how you solved _____. Why are you able to add the numerators? <p>(Unlike Denominators)</p> <ul style="list-style-type: none"> What did you have to do before adding ___ and ____? Why did you have to do this?

Category III: Multiplies and Divides Fractions

Multiplies a Whole Number by a Fraction

- 7a. How much is 5 groups of $\frac{1}{2}$?
- 7b. If Jared eats $\frac{3}{4}$ of a sandwich three times this week, how many sandwiches will he have eaten altogether?
- 7c. Jared’s family bought 5 boxes of cookies. They eat $\frac{2}{3}$ of 5 boxes of cookies. How much did they eat?

Multiplies a Fraction by a Fraction

Ask only if the student is in Grade 5 or higher. If student is in Grade 4, end the survey after 7.

- 8a. Solve $\frac{1}{2} \times \frac{2}{3} = \underline{\hspace{2cm}}$.
- 8b. Solve $\frac{4}{5} \times \frac{3}{4} = \underline{\hspace{2cm}}$.
- 8c. Karen has $\frac{2}{3}$ of her juice box left. Her brother drinks $\frac{3}{4}$ of that. How much of the juice box does her brother drink?

<p>Models Mathematics</p>	<p>Models multiplication of a fraction by a whole number.</p> <ul style="list-style-type: none"> • Draw a diagram that represents what is happening in the problem. • Write an equation that helps you solve the problem. <p>Models multiplication of a fraction by a fraction.</p> <ul style="list-style-type: none"> • Write an equation to help you solve the word problem. • What diagram can you create to show $\underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$?
<p>Understands Structure of Operating with Fractions</p>	<p>Recognizes the structure of multiplying with a fractional factor.</p> <ul style="list-style-type: none"> • Tell me what is happening in the problem. • What do you need to figure out in the problem? • What is the solution to the word problem? <p>Recognizes the structure of multiplying with two fractional factors.</p> <ul style="list-style-type: none"> • What does it mean to multiply a fraction by a fraction? • What do you know from the word problem? • What do you need to figure out in the word problem? • What is the solution to the equation (or word problem)?
<p>Provides Explanation</p>	<p>Relates the diagram to the equation or story problem. (ALL items)</p> <ul style="list-style-type: none"> • What does each of the numbers in the equation you wrote mean? • How does the diagram you drew describe what is happening in the word problem? • How does the equation you wrote describe what is happening in the word problem?

Category III: Multiplies and Divides Fractions (*continued*)

Divides with a Fraction

9a. Solve $1 \div \frac{1}{5} = \underline{\hspace{2cm}}$.

9b. Solve $3 \div \frac{1}{5} = \underline{\hspace{2cm}}$.

9c. Solve $\frac{1}{5} \div 3 = \underline{\hspace{2cm}}$.

Divides with Two Fractions

Ask only if the student is in Grade 6 or higher. If the student is in Grade 5, end the survey after 9c.

10. $\frac{1}{4} \div \frac{2}{3} = \underline{\hspace{2cm}}$.

<p>Models Mathematics</p>	<p>Models division involving fractions (ALL equations).</p> <ul style="list-style-type: none"> • Show me $\underline{\hspace{1cm}} \div \underline{\hspace{1cm}}$ with a diagram. • Tell me about the diagram you created.
<p>Understands Structure of Operating with Fractions</p>	<p>Divides a whole number by a unit fraction.</p> <ul style="list-style-type: none"> • What does it mean to divide? • What is the relationship between the unit fraction and the whole? • What is the solution to $\underline{\hspace{1cm}} \div \underline{\hspace{1cm}}$. <p>Divides a fraction by a fraction.</p> <ul style="list-style-type: none"> • What do you know from the equation? • How might you solve this equation? • What is the solution to $\underline{\hspace{1cm}} \div \underline{\hspace{1cm}}$. <p>Divides a unit fraction by a whole number.</p> <ul style="list-style-type: none"> • What do you know from the equation? • How might you solve this equation? • What is the solution to $\underline{\hspace{1cm}} \div \underline{\hspace{1cm}}$.
<p>Provides Explanation</p>	<p>Relates the diagram to the equation (ALL items).</p> <ul style="list-style-type: none"> • How does the diagram you drew match the equation?