Estimate, Solve, and Justify Contextual Problems

Strand:	Computation and Estimation
Topic:	Estimate, solve, and justify multistep contextual problems involving operations with real numbers
Primary SOL:	**7.CE.1 The student will estimate, solve, and justify solutions to multistep contextual problems involving operations with rational numbers.**

a) Estimate, solve, and justify solutions to contextual problems involving addition, subtraction, multiplication, and division with rational numbers expressed as integers, fractions (proper or improper), mixed numbers, and decimals. Fractions may be positive or negative. Decimals may be positive or negative and are limited to the thousandths place.

Materials

- How to Use QR Codes in the Classroom (optional)
- What is a Rational Number? graphic organizer (attached)
- Problem Situations graphic organizer (attached)
- Understand-Plan-Solve-Check Problem Solving Template (attached)
- Contextual Problems Recording Sheet (attached)
- Contextual Problems Using Rational Numbers activity sheet (attached)
- Contextual Problems Using Rational Numbers – QR Codes activity sheet (attached)
- Exit Ticket (attached)

Vocabulary

From earlier grades: f*raction (proper and improper), integer, decimals, mixed number*
From current grade*: rational number*

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Lead a class discussion about the characteristics of a rational number. Ask each student to go to the board and write a rational number. Different types of numbers should be provided. Explain that the goal is to complete contextual word problems using these types of numbers. Following this event, ask students to take notes on the *What is a Rational Number?* graphic organizer.

2. Ask the students to refer to the *Problem Situations* graphic organizer. Lead a whole group discussion in which students pose a scenario that would match the situations described under each operation. The use of key words is not an effective strategy for students to use when problem solving, so asking students to recognize various situations when these operations may be needed to solve a problem is encouraged. As students work on problems, have them add to this list as appropriate.

3. Teachers will provide students with the opportunity to use problem-solving strategies to apply computational skills involving positive and negative rational numbers expressed as

integers, fractions, and decimals, along with the use of percents within contextual situations. An example problem-solving strategy is the Understand-Plan-Solve-Check model (see graphic organizer).

4. Complete the following teacher-led examples:
   - Today's high temperature in Chicago was 12°F and the low temperature was 15.1°F less than the high. Yesterday's low temperature was 3°F. What was the difference between the two low temperatures?
   - An industrial factory makes $4\frac{3}{5}$ yards of chain every minute. The cost of each yard of chain is $6.59. What is the total cost for the yards of chain produced in 10 minutes?
5. Place students in groups of three or four. Give each student a *Contextual Problem Recording Sheet* to show their work as they complete the QR code activity. If technology is not available, the teacher can provide each group with a copy of the contextual problems.
6. Ask students to independently complete the Exit Ticket and submit it before leaving. The data collected from this activity can be used to plan for upcoming lessons.

Assessment

- **Questions**
  - Where do you see rational numbers in real life?
  - Are there multiple ways to solve a single problem?
  - How do you know that you have provided a reasonable answer?
  - What role does estimation play in solving contextual word problems?
  - What are some key words and phrases that may represent a specific operation?

- **Journal/writing prompts**
  - Describe ways that rational numbers are present in real life.
  - Write a paragraph to explain how to solve one of the problems.
  - Will rational numbers be present in the career that you hope to pursue after high school? If so, explain where the rational numbers might appear.

- **Other Assessments**
  - Use the exit ticket as an assessment.
  - Observe the strategies that students use to complete the station activities.
  - Ask the students to explain how they solved a specific problem.
  - Write a contextual problem that includes rational numbers and requires at least two steps to solve.

Extensions and Connections (for all students)
- List three different ways rational numbers are present within the Science curriculum.
- Provide a magazine or newspaper to each group and have them find rational numbers present within the articles.
- Create a real-world problem that contains at least three rational numbers and a minimum of two operations.
- Create a Venn diagram that compares rational and irrational numbers.

Strategies for Differentiation

- Ask students to draw a visual representation of the word problem.
- Provide individual whiteboards and dry-erase markers to students so that they can show the mathematical process needed to arrive at the correct answer.
- Provide students with a calculator to use throughout the lesson.
- Have students work with a partner to complete the Which Operation Should I Use? activity.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

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How to Use QR Codes in the Classroom

1. Before the lesson, locate tablets or devices with a QR reader app on the desktop. There are many free brands of the QR app reader.

2. Students with a device can download the app at home and bring the device to class on the day of the assignment (optional).

3. The following three steps are necessary to view the mathematics problem on the device:
   o Open the QR reader on the device.
   o Hold the device over a QR Code so that it's clearly visible within the device's screen.
   o Some devices will automatically capture the code. If needed, press the button to snap a picture.

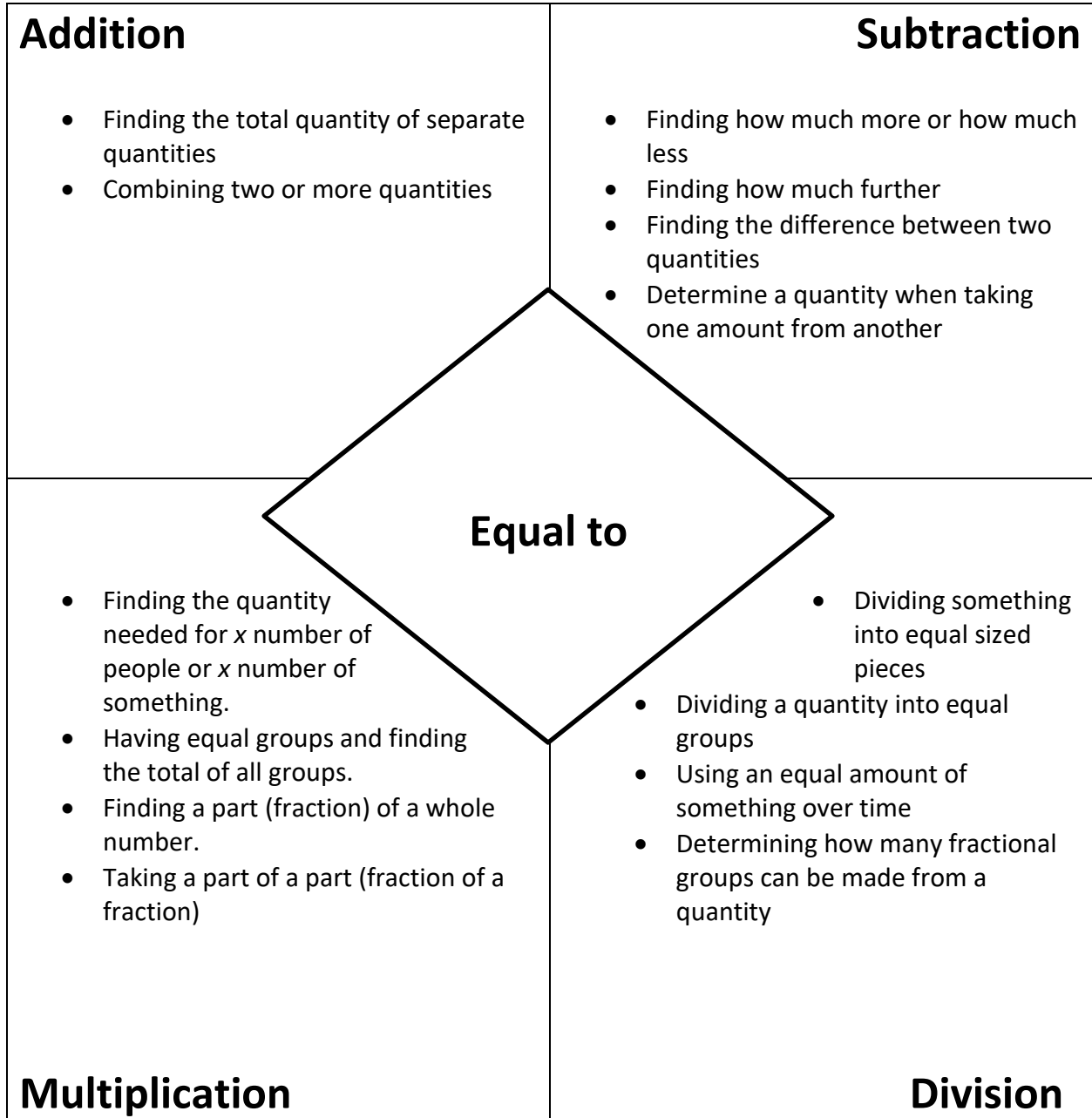4. The mathematics problem will appear on the device once it is correctly scanned.

What is a Rational Number?

Fill in the following boxes with characteristics and examples of rational numbers.

Characteristics	Examples

Problem Situations

There are different types of problem situations that can occur when applying mathematics to solve problems in various contexts. The following chart helps students understand that there are various situations in which operations are used to solve a problem. Have students use this chart as they tackle problems. Encourage students to add their own problem situations to the chart.

Addition	**Subtraction**
• Finding the total quantity of separate quantities • Combining two or more quantities	• Finding how much more or how much less • Finding how much further • Finding the difference between two quantities • Determine a quantity when taking one amount from another
Multiplication • Finding the quantity needed for *x* number of people or *x* number of something. • Having equal groups and finding the total of all groups. • Finding a part (fraction) of a whole number. • Taking a part of a part (fraction of a fraction)	**Division** • Dividing something into equal sized pieces • Dividing a quantity into equal groups • Using an equal amount of something over time • Determining how many fractional groups can be made from a quantity

Equal to

Understand-Plan-Solve-Check Problem Solving Template

The following sample template helps students to map out their thinking and devise a plan to solve contextual problems. Have students use this template as they tackle problems. They may write their solutions in the center box.

Understand
Read the problem. Re-Read the problem
Imagine the Problem or Draw a picture
Annotate: Underline or highlight the important information in the problem.

Make a Plan: Decide what to do and how to solve the problem. Will you add, subtract, multiply or divide? **Plan**

Solve
Solve: Carry out your plan showing all work that represents your thinking.

Check
Think Back:
Does my final answer make sense?
Is there a better way to solve this problem?

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Contextual Problems Recording Sheet

Solve each contextual problem. Be sure to show your work in each box.

1.	2.
Answer _____	Answer _____
3.	**4.**
Answer _____	Answer _____
5.	**6.**
Answer _____	Answer _____

Contextual Problems Using Rational Numbers

1. Alicia had $-11 in her checking account. She did some chores and earned $44.50. She decided to pay for her and a friend to go to the movies, and each ticket cost $6.25. How much money does she have left in her checking account?

2. There are 30 students in Mrs. Woodward's class, and $\frac{1}{5}$ of the class has their own cellphone. Of this group of students, $\frac{1}{2}$ of them are allowed to use social media. How many of the students have a cellphone and can use social media?

3. Joe bought a box of laundry detergent that contains 195 scoops. Each load of laundry uses $2\frac{1}{2}$ scoops. How many loads of laundry can he do with this one box? The box of detergent was $19.99. How much is he paying for each load that he washes?

4. Edward started his hike at an elevation of 115 feet below sea level. Throughout the hike he ascended 3,200 feet and then descended 676 feet. How much did his elevation change? How much did his elevation change from the start of the hike to the end of the hike?

5. Mr. and Mrs. Jones wanted to plan a fun day with their two children. An adult ticket to the local amusement park is $20. A child's ticket is 40 percent less than the adult ticket. What is the total amount for a family of four to enter the park?

6. Josh rents a kayak at a nearby state park. He pays a flat rate of $12.99 plus $3.75 for each hour that he spends in the water. How much did Josh spend if he was on the river for $4\frac{1}{2}$ hours?

Contextual Problems Using Rational Numbers – QR Codes

1.	2.
3.	4.
5.	6.

Contextual Problems Using Rational Numbers
(Actual Problems – for use if QR Code Reader Not Available)

1.	2.
Alicia had - $11.00 in her checking account. She did a few chores and made $44.50. She decided to pay for her and a friend to go to the movies and each ticket costs $6.25. How much money does she have left in her account?	There are 30 students in Mrs. Woodward's class and $\frac{1}{5}$ of the class has their own cell phone. Of this group of students, $\frac{1}{2}$ of them are allowed to use social media. How many of the students have a cell phone and can use social media?
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Exit Ticket

Solve the following contextual problems. Show your work.

1. Mark owes his sister $15. He earned $20 for mowing the grass. He gave $\frac{1}{5}$ of his earnings to a local charity and then paid his sister. Does Mark have enough to repay his sister the full amount? Why or why not?

2. The seventh graders at the middle school are going on a field trip to the aquarium. They will spend $4\frac{1}{4}$ hours at the aquarium. The students will need to visit five exhibits while they are there. If the time is evenly distributed, how many minutes will the students spend at each exhibit?

3. Mary's mom gave her $100 to go shopping. She bought a shirt for $22.65 and a skirt for $33.31. She had a coupon for 10 percent off her total purchase. How much change did she receive from the cashier?