Operations With Positive Fractions and Decimals

Summary

Model, compute, estimate and predict outcomes, and check for reasonableness when computing with decimals, fractions and mixed numbers

Main Core Tie

Mathematics Grade 7

Strand: THE NUMBER SYSTEM (7.NS) Standard 7.NS.1

Additional Core Ties

Mathematics Grade 7

Strand: THE NUMBER SYSTEM (7.NS) Standard 7.NS.2

Materials

Fraction Strips or Fraction Towers
Worksheets: " Using Area Models for Adding and Subtracting Fractions", " Using Area Models for Multiplying and Dividing Fractions", Picturing Fraction Operations, Mixed Numbers, " Applying Operations With Fractions", Modeling "Decimal Computations", Maze Gameboard, " Computing With Fractions Journal Page", " Computing With Decimals Journal Page"

- Copy of game cards for each group of 4
(attached)
Calculators
Transparencies: Four questions for problem solving, shopping ads
Dry erase markers
Differentiated Task Choices Overhead

Background for Teachers

Enduring Understanding (Big Ideas):
Computing with rational numbers is essential to mathematical literacy
Essential Questions:

How can patterns models, and pictures be used to estimate and check for reasonableness when performing operations with fractions and decimals?
How do algorithms for operations with fractions and decimals help in computing efficiently?
How does estimation help us in problem solving? Help in determining the reasonableness of a result?
What information is necessary? Extraneous? In solving a problem?

Skill Focus:
Solve problems using fractions and decimals. Predict outcomes. Estimate to check for reasonableness.
Vocabulary Focus:
Denominator, numerator, mixed number, estimation, tenths, hundredths… extraneous information, algorithm
Ways to Gain/Maintain Attention (Primacy):
Forming hypotheses, games, differentiated choices, manipulatives, sketching

Instructional Procedures

Starter-Launch:

Without computing, predict which of these expressions would produce the greatest value? Explain your reasoning.

12 0.3
12 x 0.3
12 + 0.3
12 ÷ 0.3

Now, compute each of the above. Were you correct? Were you surprised?

Discuss the starter asking students how they predicted, what surprised them and what inferences they might make about operations n > 1 and when n < 1. Ask whether 3 and 12 are compatible numbers (3 is a factor of 12) and review that mental division can be done more easily if the numbers are compatible numbers.

Lesson Segment 1: Fractions-How can patterns, models, and pictures be used to estimate and check for reasonableness when performing operations with fractions and decimals? How do algorithms for operations with fractions help us compute efficiently?

Give each team a fraction manipulative such as Fraction Tiles or Fraction Towers. Give them a sheet of graph paper for sketching. Put a transparency on the overhead with these questions:

Problem Solving Questions (Transparency)

What operation will you use to find the answer? Why do you think so?
What information do you need to find the answer?
Will the answer be <, >, or = either of the other numbers? How can you tell?
What is a good estimate for the answer? How did you decide this?

You can use rotating roles to build accountability in the following activity: a manipulator, two coaches, and a checker and an encourager. As they look for a way to show each of the following, discuss the answers to the questions on the transparency. Help the students build the models. Then, have them sketch the model and represent the problem mathematically and write out words for the operation involved.

Have them show each:

one half of one-fourth
a third and a half
a half decreased by a third
one-fourth less than three halves
half of a half
a half divided by a sixth.

Practice With Fractions

Using a model such as Fraction strips, Fraction Equivalency Towers, or an area model will help students in understanding the operation and estimating for reasonableness. The way you phrase the wording for an operation can help students visualize what is being asked. You might use these words:

Addition: How much is ____ and ____?
Subtraction: How much is ____ take away ____?
Multiplication: How much is ____ added ____ times?
Division: How many ____ are in (or will fit into) _____?

Using these words you can work with the students to model and sketch simple fraction computations. The attached "Using Area Models for Adding and Subtracting Fractions", and "Using Area Models for Multiplying and Dividing Fractions" worksheets can guide you through using an area model, but similar ideas can be applied if you would rather use Fraction strips or Fraction Equivalency Towers. As you work through each problem with the class, review how to set up algorithms for computing with fractions and discuss their efficiency and accuracy over models or sketching.

Help the students work through the attached worksheet, "Investigating Operations With Fractions", Investigating Operations With Fractions, to practice answering the transparency questions. They will

need help showing or sketching a model for the fractions involved.
You may find more practice is needed on operations with fractions as well as conceptual ideas for mixed numbers and improper fractions. Two additional worksheets have been attached for this: "Picturing Fraction Operations", and "Mixed Numbers"
Game for practicing algorithms: Fraction Operation Basketball
Divide the class into two teams. Using a garbage can and foam basketball, give the class a problem to work practicing any operation with fractions. Let them work for a minute with a small group to reduce risk, then call on a person to explain how to do the problem using the algorithm. If the person explains correctly, he/she can take a shot at the basket (Let them stand within five feet of the garbage can). If the explanation is incorrect, the other team gets a chance to explain. They can take a foul shot if they explain well. Continue taking turns in explaining problems you give for practicing algorithms for fraction operations.
Journal: Complete the "Computing With Fractions Journal Page" Cornell Notes.
Lesson Segment 2: Decimals-How can patterns, models, and pictures be used to estimate and check for reasonableness when performing operations with fractions and decimals? How do algorithms for operations with fractions help us compute efficiently?
Use "Modeling Decimal Computations" worksheet as a guide for class discussion. When working with multiplication of decimals, use length and width for an area.
Make transparency copies of several newspaper ads to be used for the following game. Put an ad on the overhead for each question in the game. When picturing multiplication with decimals, count the decimal along the width and length and shade the area common to both numbers.
Lesson Segment 3: Practice in Estimating and Computing, and determining reasonableness
Game: Price Is Right Race
Appoint a section on the whiteboard where a representative from each team will write. Give each team a marker for the board. Tell students they will be playing a version of "The Price Is Right". In this game, student teams compete against each other. Transparencies of sales ads are placed on the overhead. The teacher asks the students to work with their group to answer questions (See sample questions below.)
Teams work together to answer the four questions on the transparency for each question. They should actual costs. Each person on the team records the answers to the four transparency questions on their own assignment paper.
After the students have had a couple of minutes to work with their teams to discuss methods without using a calculator and to record their work, the teacher selects a person from each team to go their whiteboard space to write the items they selected, and show the team's reasoning. The first four teams to get this information on the board earn a point. Teams with the highest points at the end of the game will win.
Teacher uses the ads to determine what to fill in blanks with.

- Find three items whose pre-tax cost will be less than $10.
- What is the difference between a higher priced item and a lower priced item? (Teacher chooses the two items from the transparency ad.)
- Which would be greater, 3 of _____ or four of _____
- Find two items whose total cost would be more _____ (give a dollar amount)
- How many _____ could you buy for the price of one _____?
- Jessica is buying two _____. Brian is buying three _____. Who will pay the most?

Have student pairs play the following game to explore patterns in operations:
Maze Game
The attached Maze game is played by two. Each player places a marker on Start on the Game Board. Using 100 as the start number, a turn involves each player choosing one segment as a route to an intersection point as they move toward End. They must choose the route before performing the

indicated operation. They may not move backward or return to an intersection they used previously. When both players have reached End, the player with the least final number wins. All work must be recorded on assignment.
Practice
Rational Numbers Operations War
Materials needed: 1 copy of the cards for each group of 4, calculators for each student to check.
Two players will play against another two players, so that each player has a partner to discuss options with. Have each group cut out the 32 cards. (attached). Have the students place the cards in two stacks: Decimals and Fractions. Shuffle the cards. Each pair draws two cards from either stack they choose, fractions or decimals. Choosing any one operation from +, , x, ÷, the pairs arrange their two cards in either order to create an expression with the greatest possible value. They should write both theirs and their opponent's expressions on their assignment. The pair whose expression has the greatest value collects all four cards and sets them aside. This continues until all cards have been drawn. The player who has collected the greatest number of cards wins the game.
Lesson Segment 4: Summarizing
Journal: Complete the "Computing With Decimals Journal Page" Cornell Notes.

Assessment Plan

performance tasks, questioning, writing

Bibliography

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Authors

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