

# Rational Number Project

<b>Fraction Operations and Initial Decimal Ideas Lesson 13: Overview</b>	<b>Materials</b> <ul style="list-style-type: none"><li>• Orange and yellow crayons, pencils or markers</li><li>• Meter sticks for each student pair</li><li>• Transparency 1 and transparency of Student Page C</li><li>• Student Pages A, B, C</li></ul>
Students use a meter stick as a model for decimals by connecting this new model to the 10 x 10 grid model.	

## Teaching Actions

### Warm Up

How long is your desk in meters?

- More than one meter?
- More than .5 meters?
- Less than .5 meters?
- Between .5 meters and .75 meters?

### Large Group Introduction

1. Hand out Student Page A, a picture of the 10 x 10 grid, to each student and ask students to shade the decimal .74. Show this on the classroom grid as well. Review that if the unit is the whole square, then the vertical bar is a tenth of the square and the small square is 1-hundredth of a square. We can see that .74 is 7 full tenths and 4-hundredths more or 74 hundredths.
2. Explain that they are going to model decimals using a different manipulative. Give each pair a meter stick. Explain that the whole stick is the unit.
3. Direct students to cut the 10 x 10 grid showing .74 apart into vertical strips; tape the strips together to form one long strip. Match the paper strip to the meter stick.

## Comments

The purpose of this activity is to make the transition from a 10 by 10 grid to a number line (as represented by the meter stick.) As with all measuring activities, there will be inaccuracy. Be prepared for students' taped lines to equal a little more or a little less than 0.74 meters. This is a good time to discuss the approximate nature of all measurements, the possibility of various answers, the possibility that the same person might get a slightly different result in a second measurement, etc.

See Additional Notes to the teacher for Lesson 13 for background information on students' use of a number line.

This activity is transitioning from an area model (grid) to a length model (number line). The taped-together strips emphasize length characteristics even though the area idea is still present.

## Teaching Actions

4. Ask: what do you notice? How are the two models alike and different?
5. Ask: What does each mark on the stick means? How do these marks match up with the orange tenths and yellow hundredths from the 10 x 10 grid? If you partitioned one small square into ten parts, what mark on the meter stick would match that small amount?
6. Conclude that the meter stick is partitioned into 10 equal parts; 100 equal parts; and 1000 equal parts.
7. Have students find 74-hundredths on the meter stick and ask them why that is 7 tenths and 4 hundredths more. Refer to it as a distance from 0 to .74 on the meter stick.
8. Name the parts for the students or ask if they know the special names. Match each name with the markings on the meter stick. Record this information on the board.
  - Decimeter (dm) = 1-tenth of the meter
  - Centimeter (cm) = 1-hundredth of the meter
  - Millimeter (mm) = 1-thousandth of the meter
9. Ask: How many tenths make up the whole 10 x 10 grid? How many dm in one meter? How many 100ths make up the whole 10 x 10 grid? How many cm in one meter? How many 1000ths make up the whole 10 x 10 grid? How many mm in one meter?
10. Ask: If the length of a table I have at home measures 4 dm, 3 cm and 5 extra mm, what part of one meter is the length of this table? Find that mark on your meter stick.
11. Repeat for other lengths. Find the point on the meter stick and name it as a decimal part of the whole meter.
  - 2 cm and 7 mm extra ( $\frac{2}{100} + \frac{7}{1000}$ ; 0.027)
  - 4 dm, 5 mm extra ( $\frac{4}{10} + \frac{5}{1000}$ ; 0.405)

## Comments

You might want to draw a sketch of a meter stick on the board and label the dm, cm and mm.

Record the measurements in different ways:  $\frac{4}{10} + \frac{3}{100} + \frac{5}{1000}$  or  $\frac{435}{1000} = 0.435$ . Work from fraction notation to decimal notation.

Connect to the more common language: zero tenths, 2 hundredths, and 7 thousandths

## Teaching Actions

- 7 dm, 2 cm ( $\frac{7}{10} + \frac{2}{100}$ ; 0.72)
- 8 dm, 2 cm, 7 mm ( $\frac{8}{10} + \frac{2}{100} + \frac{7}{1000}$ ; 0.827)

## Small Group/Partner Work

12. Assign Student Page B. Students measure lengths of objects in the room and record the amounts as dm, cm and mm; then translate those amounts to a decimal part of the meter.

## Wrap Up

13. Explain that they now have used two models to show decimals – the 10 x 10 grid and a meter stick.
14. Show transparency of 0.38 with number line below it. Ask students to describe the number line and to find 0.38 on it. Draw a length to .38 on the number line.
15. Ask: How are the two models alike and different?
16. End lesson by completing Student Page C together. (Make a transparency; students should have their own copies).
17. Encourage students to explain how to translate from the symbols to the 10 x 10 grid to the number line.

### Translations:

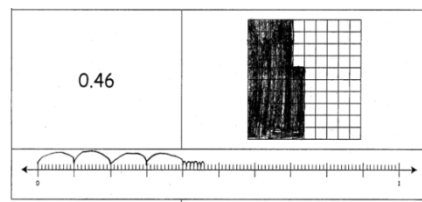
- Concrete to picture to verbal
- Symbolic to picture to verbal

## Comments

The number line is partitioned to show tenths and hundredths.

Start with the 10 x 10 grid first and then translate to the number line.

In this example notice how the student used loops to jump over 4-tenths and then used smaller loops to count over 6-hundredths more. The connection between the 10 x 10 grid and the number line is clear in this student's work.



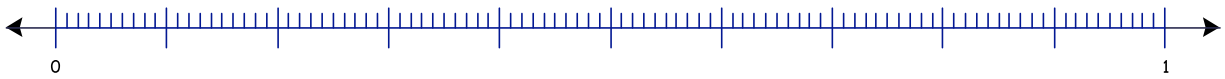
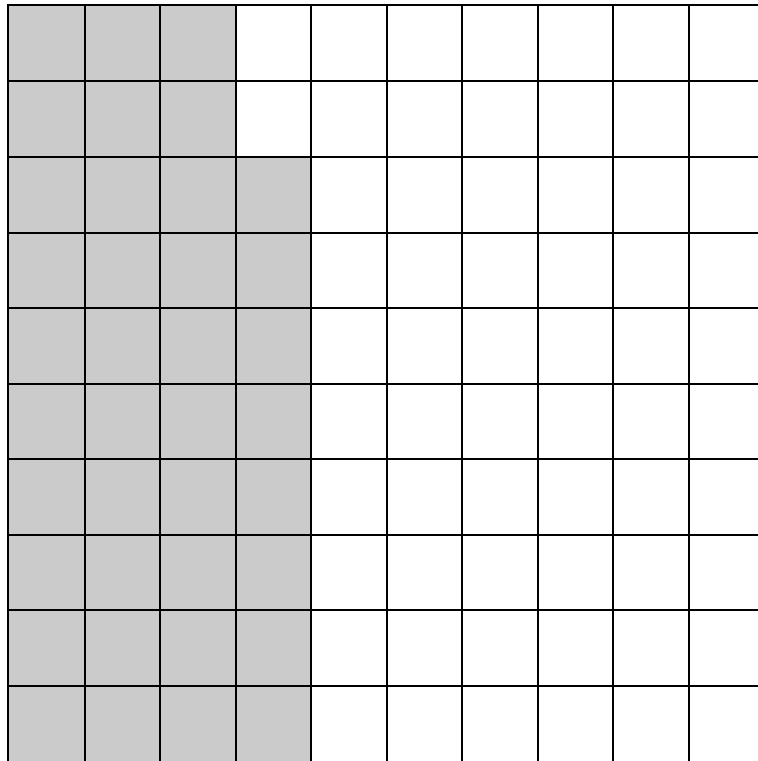
## Additional Notes to the Teacher

### Lesson 13

In the first teaching experiment we completed all the lessons pertaining to fraction operations before beginning decimal lessons. We did notice from classroom observations and student interviews that the students had difficulty using the number line model for fraction addition and subtraction. But when the number line model was introduced to students during the decimal unit, they seemed comfortable using this model to identify decimal amounts. On the decimal posttest, 92% and 96% of the students correctly located or identified a decimal in hundredths on a line partitioned into tenths and hundredths. While students' performance on decimal operations was less than we hoped, students were more successful showing addition on a number line (59%) than when solving just symbolic problems (35% - 48%). We addressed issue of the number line model and students performance on decimal operations in our second teaching experiment.

For the second teaching experiment we rearranged the sequence introducing our work with decimals prior to introducing the number line for fraction operations. We believed that if students had experience with number line for decimals, then the transition to using a number line for fraction operations would be easier. Students seemed to have an easier time with fraction number lines during the second teaching experiment. We also added more examples where students partitioned number lines to show different fractions before asking students to use number line to add and subtract. Students were quite adept at using the number line for fraction multiplication in certain situations.

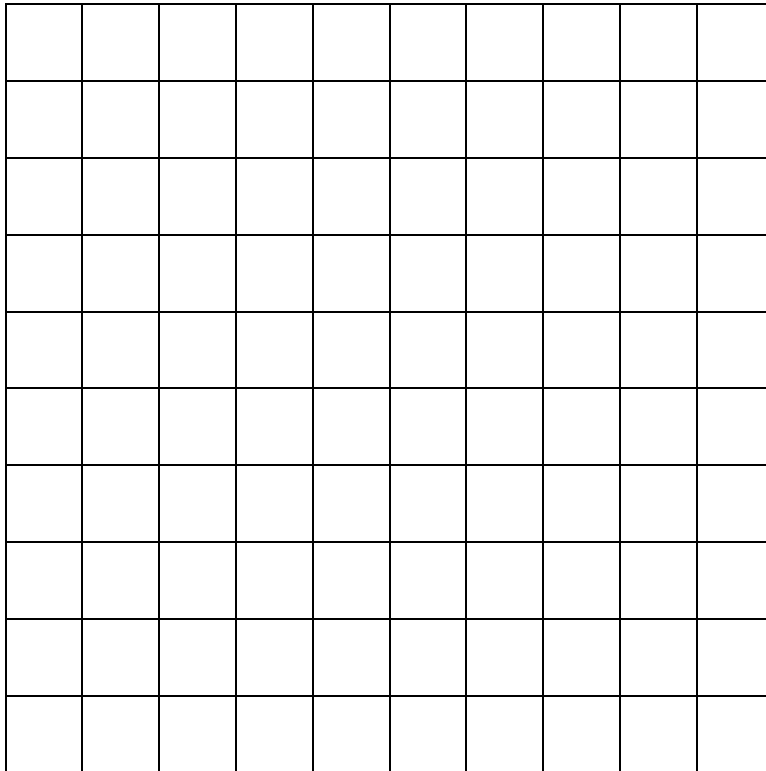
**0.38**



How long is your desk in meters?

- More than one meter?
- More than .5 meters?
- Less than .5 meters?
- Between .5 meters and .75 meters?

Name \_\_\_\_\_



## Using Your Meter Stick

Complete the chart with a partner. The first length is given to you. Talk to each other as you complete each section of the table. Make sure you agree with each other on all the data you put in the table.

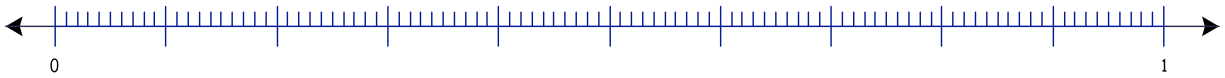
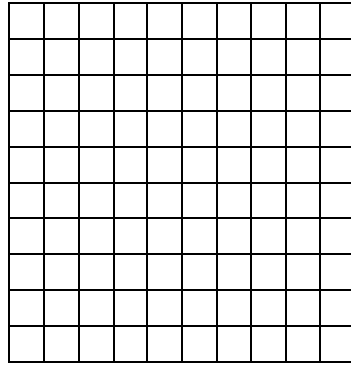
Length	How many full dm?	How many full cm extra?	How many full mm extra?	How many mm in all?	What part of a meter stick is this length?
Height of a regular sheet of paper	2	7	9	279	0.279
Desk width					
Desk length					
Desk height					

**Find one or two lengths greater than one meter but less than 3 meters. Measure the lengths as accurately as you can. Use meters as your unit. Your measurements should include decimals. Record what you measured and its length below.**

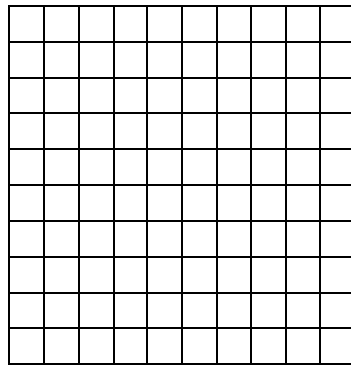
Name \_\_\_\_\_

Represent each decimal amount on the 10 by 10 grid and on the number line.

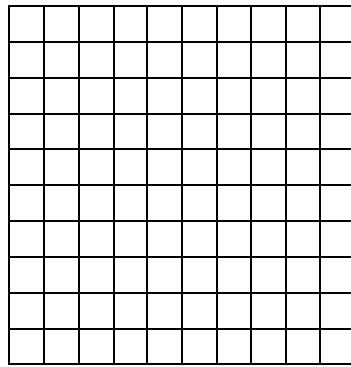
0.09



0.46



0.12



## Post Lesson Reflection

Lesson \_\_\_\_\_

1) Number of class periods allocated to this lesson: \_\_\_\_\_

2) Student Pages used: \_\_\_\_\_

3) Adaptations made to lesson: (For example: added extra examples, eliminated certain problems, changed fractions used)

4) Adaptations made on Student Pages:

5) To improve the lesson I suggest: