MathLinks

NUMBERS in BASE TEN 2
STUDENT PACKET

DECIMAL CONCEPTS

Parent (or Guardian) signature _____

MY WORD BANK

Explain the mathematical meaning of each word or phrase, using pictures and examples when possible. (See section 1.5.) Key mathematical vocabulary is underlined throughout the packet.

area model for fractions	equivalent fractions
place value number system	

EVERYDAY EXAMPLES

1. List some real-world examples for which fractions and decimals are used.

Everyday Uses of Fractions	Everyday Uses of Decimals

2. Are there any fractions above for which you know the decimal equivalents? If so, list those fractions and decimals here.

3. Are there any decimals above for which you know the fraction equivalents? If so, list those decimals and fractions here.

BASE-10 BLOCKS, FRACTIONS, AND DECIMALS

We will use an area model to explore fraction and decimal concepts. We will use pictures, numbers, and words to represent fractions and decimals.

GETTING STARTED

Write the number represented by each sum.

1. 5 +20
2. 600 + 30
3. 500 + 6 + 30

Write the digits in the correct place to form a number.

4. Five tens, four ones
5. Eight ones, six tens
6. Two ones, three hundreds

For the number 3,051:

7. In what place is the 3?
8. What is the value of the 3?
9. What is the name of the digit in the hundreds place?

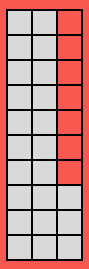
If the 6 was changed to a 9:

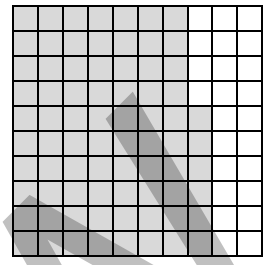
10. By how much would the value of 2,006 change?
11. By how much would the value of 14,563 change?
12. By how much would the value of 65,302 change?

DEFINING BASE-10 BLOCKS

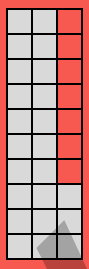
Follow your teacher's directions.

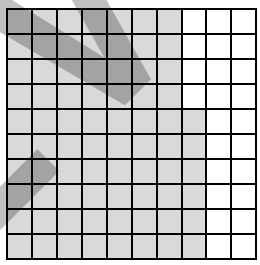
(1) 

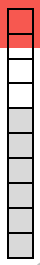
(2) 

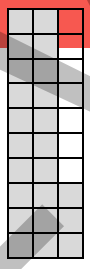
(3) 

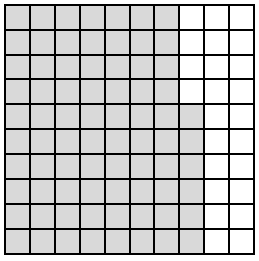
(4) 

(5) 

(6) 

(7) 

(8) 

(9) 

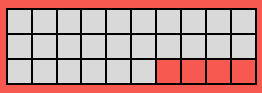
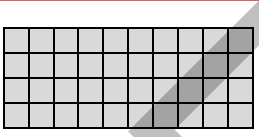
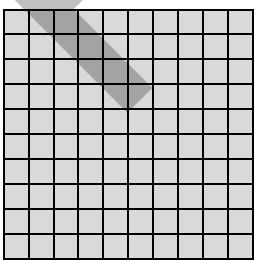
10. Write the value of each base-10 block when the value of the whole is given.

Base-10 block:	**small square**	**stick**	**big square**
Value:	1		
		1	
			1

PRACTICE 1

1. Record the meaning of area model for fractions with an example in My Word Bank.

Use the base-10 values from the previous page to name these shaded area model parts using word names and fractions.

		If the big square is the whole	If the stick is the whole
2.			
3.			
4.			
5.			
6.			
7.			

8. Which fractions from problems 2-7 represent the same value? How do you know?

BASE-10 PLACE VALUE SYSTEM

Follow your teacher's directions.

(1)

Name of the place	**Hundreds**	**Tens**	**Ones**	**Tenths**	**Hundredths**	**Thousandths**
Value of the place (whole number or fraction form)						
Value of the place (whole number or decimal form)						

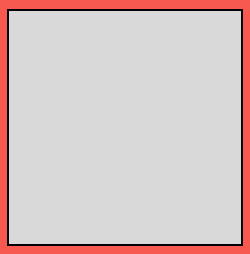
For the number, 723.045:

2. Write the whole number part in words.
   a. What is the value of the 2? _____ (in words) _____ (as a number)
   b. Write the part after the decimal in words.
   c. Write the part after the decimal as a fraction.
   d. Write the entire number in words.
3. Compare the value of the 2's in 202.

4. Compare the value of the 4's in 0.44

5. Look up the phrase <u>place-value number system</u> and write its meaning in My Word Bank.

PRACTICE 2

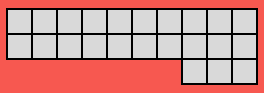
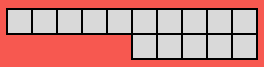
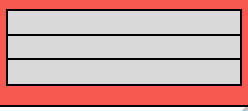
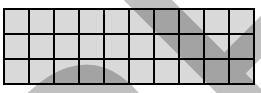


represents 1

represents $0.1 = \frac{1}{10}$

represents $0.01 = \frac{1}{100}$

Write each pictorial representation using words, in fraction form, and in decimal form.

	Diagram	Word Name	Fraction	Decimal
1.				
2.				
3.				
4.				
5.				

6. Which problems above represent <u>equivalent fractions</u>? Write these equivalents as fractions and decimals. Record the meaning of this phrase in My Word Bank.

Use the pictorial representations above to support your answers.

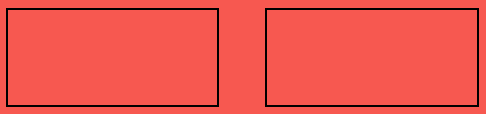
7. Explain why the following statement is **incorrect**: 0.23 > 0.3.

8. Why is the value of 0.03 less than the value of 0.3?

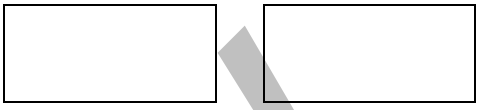
MAKE A WHOLE!

Follow your teacher's directions.

(1)



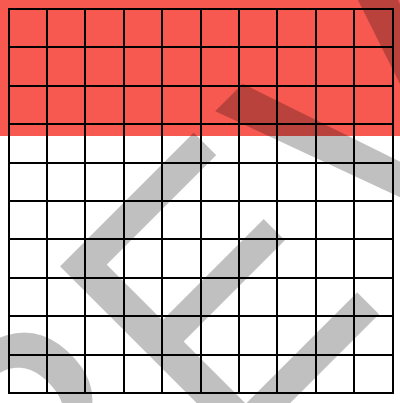
(2)

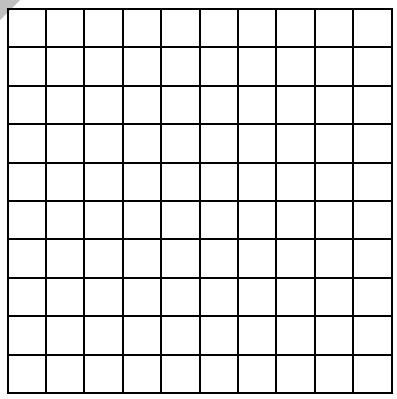


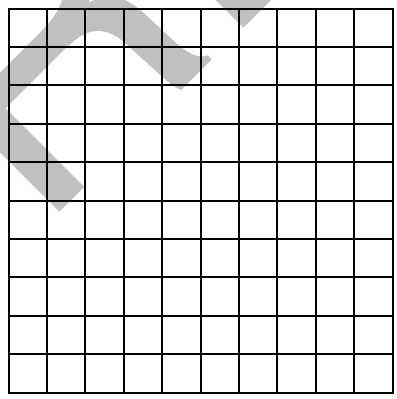
(3)-(4)

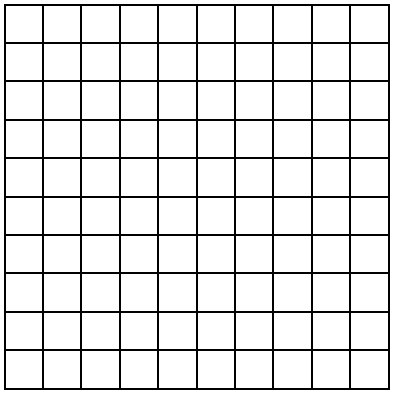
Rules for "Make a Whole!"

- Play several rounds of this game with a partner. Alternate who starts each round.
- Each game is played on one big square.
- Shuffle the cards. Each player draws 5 cards. Set the remaining cards aside for other rounds.
- Player 1 chooses one of his cards to start, states its value, shades the square, and discards it.
- Player 2 chooses one of her cards, states its value, shades the same square, and discards it.
- Play continues with the remaining cards until one player shades exactly ONE whole (the winner), or no more cards can be played (the last player to shade is the winner.)









5. Describe a strategy you liked to use for this game.

DECIMALS ON THE NUMBER LINE

We will locate decimals on a number line.

GETTING STARTED

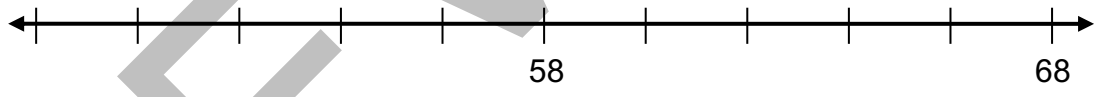
For each number line below, label all tick marks.

1.

2.

3.

4.

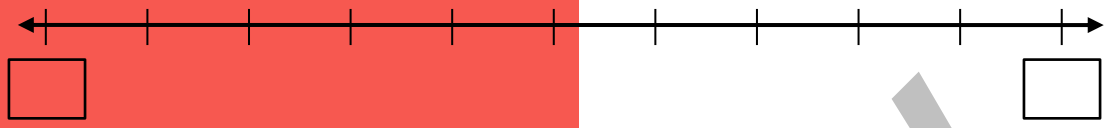


5. Select a number line from problems 2, 3, or 4 above. Explain how you determined how to label the tick marks.

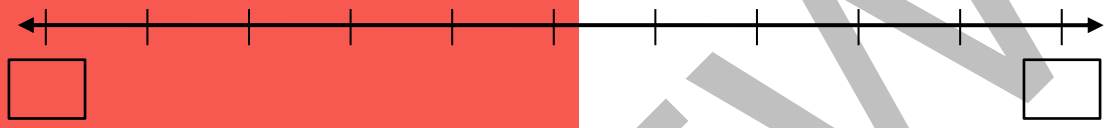
NUMBER LINES WITH TENTHS

Follow your teacher's directions.

(1)

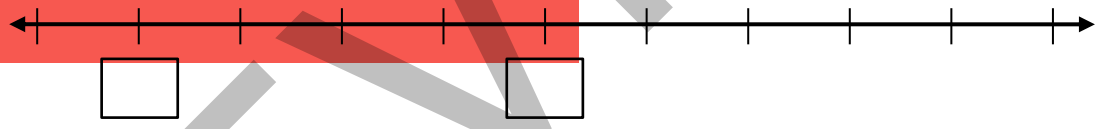


(2)

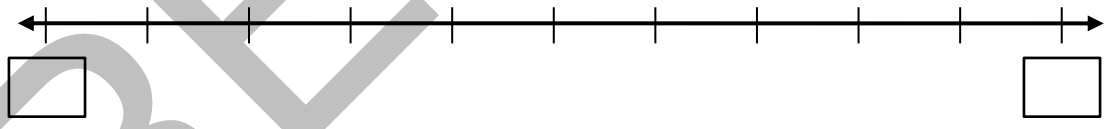


(3)

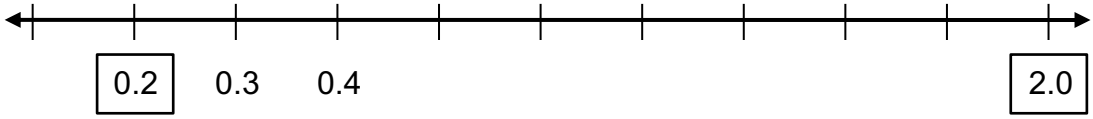
(4)



(5)



6. Jaime is starting to label tick marks on the number line below between 0.2 and 2. What mistake is Jaime making, and how should she fix it?



PRACTICE 3

Part 1: For each line below, label all tick marks using whole numbers and decimals.

1.

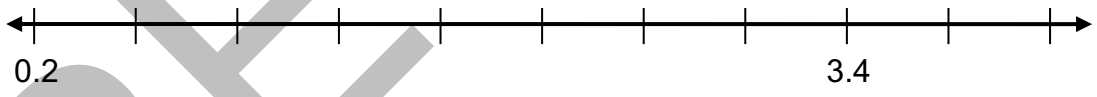
2.

3.

4.

5.

6.



Part 2: Locate the following points on each line and label them.

Line 1: A(4) B(6)	Line 4: J(1.9) K(1.0) L(1.6) M(0.5)
Line 2: C(35) D(45) E(40)	Line 5: N(2.0) P(4) Q(3)
Line 3: F(4.7) G(4.5) H(4.1) I(4.3)	Line 6: R(1.4) S(3.4)

Part 3: Connect the following sets of points using a colored pencil.

A→B→D→C→A Lift pencil	L→ J→P Lift pencil
E→G Lift pencil	Q→ S Lift pencil
I→F→Q→N→I Lift pencil	N→R Lift pencil
K→M→H Lift pencil	

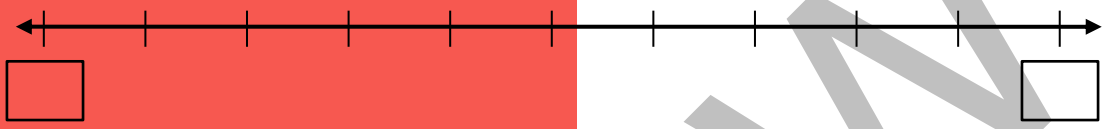
What did you draw? Embellish your drawing if you wish.

NUMBER LINES WITH HUNDREDTHS

Follow your teacher's directions.

(1)

(2)



(3)

4.

5.

6. For problem 4 or 5 above, explain how you labeled the tick marks?

7. Marcus says that 0.394 is greater than 0.6 and Arianna disagrees. Explain who is correct.

THE DECIMAL CHALLENGE

Play this game with a partner.

You Will Need:

- 2 players
- The same cards from the Make a Whole! game from the previous lesson.

The objective of this game is to end up with all the cards (or more cards than your opponent after a given amount of time).

Rules:

- Start by dealing out the deck, one card at a time, face down, so that each player has the same number of cards. Don't look at them.
- Simultaneously, each player turns over one card. The player whose card has the greater value picks up both cards and puts them face down at the bottom of his/her pile. If both players turn over a card with the same value, they enter a *skirmish.*

Skirmish:

- Each player puts a card, face down, on top of their just-played tied card and then one face up. Whoever has the face-up card with the greater value takes all 6 cards.

The first person to get all the cards (or the most cards after a given amount of time) wins.

1. Andrew and Cooper were playing the decimal challenge game. Cooper played 0.78 and Andrew played $\frac{80}{100}$. Who won?

2. Trevor played $\frac{7}{100}$ and Diana played 0.07. Who won?

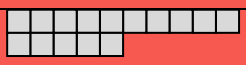
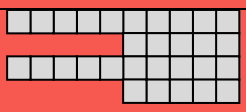
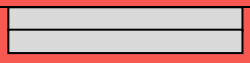
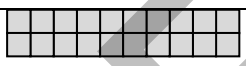
3. Alex thinks 0.33 beat 0.5 because 33 > 5. What mistake is Alex making?

WRITING EQUIVALENT NUMBERS IN DIFFERENT FORMS

We will write equivalent numbers as fractions, decimals, and in words.

GETTING STARTED

Write each pictorial representation using its word name, in fraction form, and in decimal form. Assume the area of the big square is equal to 1, and that the parts below are small squares and sticks.

	Diagrams	Word Name	Fraction	Decimal
1.				
2.				
3.				
4.				
5.				

6. Problems _____ and _____ represent the same value. Write these equivalents as fractions and decimals.

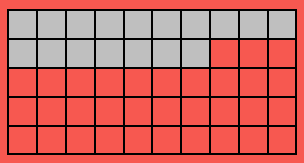
fractions	=
decimals	=

DENOMINATORS EQUAL TO 100

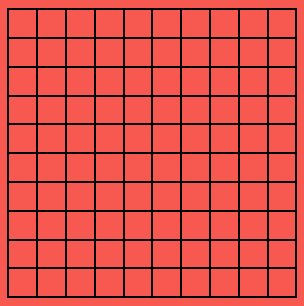
Follow your teacher's directions.

(1)

A



B

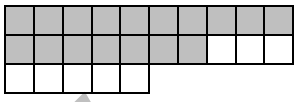


$\frac{\square}{50} \cdot \frac{\square}{2} = \frac{\square}{100} = 0.\_\_\_\_$

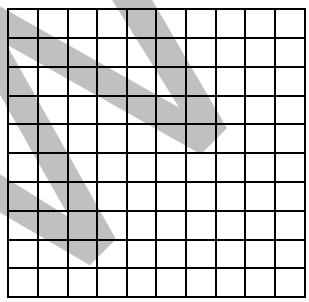
Word name:

2.

A



B



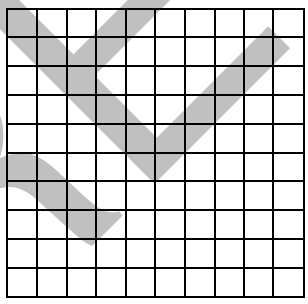
$\frac{\square}{25} \cdot \frac{\square}{\square} = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

3.

A

B



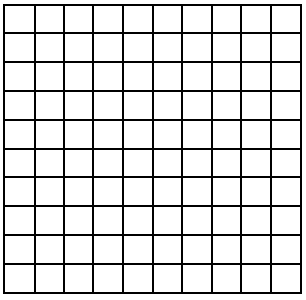
$\frac{\square}{10} \cdot \frac{1}{\square} = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

4.

A

B



$\frac{\square}{5} \cdot \frac{1}{\square} = \frac{\square}{100} = 0.\_\_\_\_$

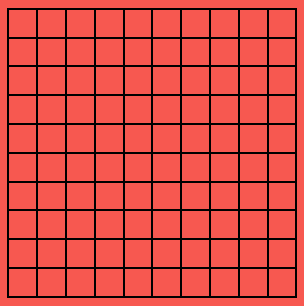
Word name:

PRACTICE 4

For each problem, write the shaded part in figure A as a fraction. Shade figure B so that the same fractional part is shaded. Then fill in the big 1 calculation, complete the equation, and write the word name.

1.

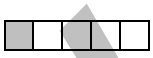
A 

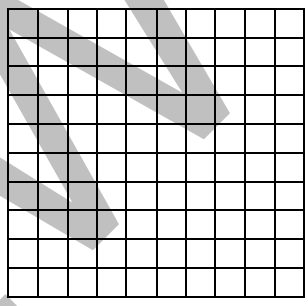
B 

$\frac{\square}{\square} \cdot 1 = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

2.

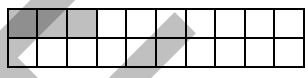
A 

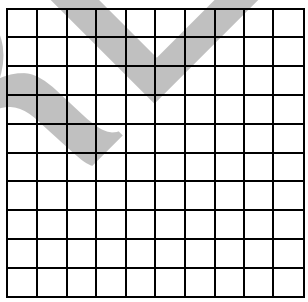
B 

$\frac{\square}{\square} \cdot 1 = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

3.

A 

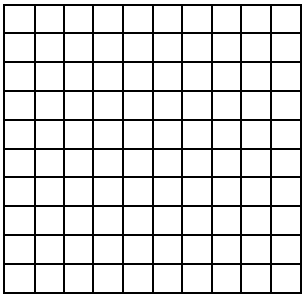
B 

$\frac{\square}{\square} \cdot 1 = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

4.

A 

B 

$\frac{\square}{\square} \cdot 1 = \frac{\square}{100} = 0.\_\_\_\_$

Word name:

REVIEW

ORDER IT!

Play this game with a partner.

Need:

- 2 or more players
- The same cards from the previous two games in this packet.

The object of this game is to get five numbers in a row, in order from left to right, from least value to greatest value. Adjacent cards may, or may not, have equal values.

Once a card is placed on the table face up, it may not be moved to another location. However, a new card may be placed on top of it.

- Shuffle all the cards and place the cards face-down in a pile.
- To begin, put 5 cards face-up in the center, from left to right in the order they are drawn.
- The first player draws a card from the pile and places it **on top of** one of the existing face-up cards. If all of the cards are now in order from least to greatest, then player 1 wins. If not, then play continues.
- The next player draws a card from the pile and places it **on top of** one of the existing face-up cards. If all the cards are now in order from least to greatest, then the player wins. If not, then play continues until all five cards are in order from least to greatest.

In order to win, a player must convince his or her opponents with a reasonable argument that the cards are in order from least to greatest, though adjacent cards may, or may not, have equal values.

1. Play two rounds of Order It! Record one of the winning ordered card sequences here.

_____ _____ _____ _____ _____

2. Explain how you know the numbers are in order.

PLANTING GARDENS

Six students planted square gardens of the same size. Represent the **planted portions** in different ways. Use hundred squares to help as needed.

		Judy planted twenty-two fifths of her garden.	Jane planted seven tenths of her garden.	Jamal planted two fifths of his garden	Elian planted sixteen twentieths of his garden.	Eden planted eighteen fiftieths of his garden.
1.	Write as a fraction.	$\frac{2}{25}$				
2.	Write as an equivalent fraction with denominator of 100 using a big 1 calculation.	$\frac{2}{25} \bullet \frac{4}{4}$	$\frac{7}{10} \bullet$			
3.	Write as a decimal.					
4.	Write the word name for problem 3 above.					

5. Who planted the most? Who planted the least?

Which representation above was most helpful for you to determine these answers?

Represent the **unplanted portion** of the garden in different ways. Hundred squares may help.

6.	Write as a decimal.					
7.	Write the word name for problem 6 above.					
8.	Write as a fraction with a denominator of 100.					

POSTER PROBLEM: ORDERING ON A NUMBER LINE

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D.
- Each group will start at a numbered poster. Our group start poster is _____.
- Each group will have a different colored marker. Our group marker is _____.

Part 2: Do the problems on the posters by following your teacher's directions.

	A		B		C		D	
Poster 1 (or 5)	0	1	$\frac{3}{10}$	$\frac{5}{20}$	$\frac{15}{50}$	$\frac{37}{100}$	$\frac{1}{2}$	$\frac{2}{10}$
Poster 2 (or 6)	0	1	$\frac{4}{5}$	$\frac{1}{4}$	$\frac{49}{100}$	$\frac{15}{20}$	$\frac{20}{50}$	$\frac{5}{10}$
Poster 3 (or 7)	0	1	$\frac{35}{100}$	$\frac{3}{4}$	$\frac{9}{10}$	$\frac{3}{5}$	$\frac{2}{100}$	$\frac{25}{50}$
Poster 4 (or 8)	0	1	$\frac{99}{100}$	$\frac{4}{25}$	$\frac{8}{10}$	$\frac{2}{5}$	$\frac{30}{50}$	$\frac{10}{20}$

A. Make a number line that is nearly the width of your paper, and put the numbers 0 and 1 on it. Put 0 at the far left and 1 at the far right.

B. Copy the two B fractions only, change them to decimals, and estimate their placement on the number line. Explain in writing how you decided their relative placement.

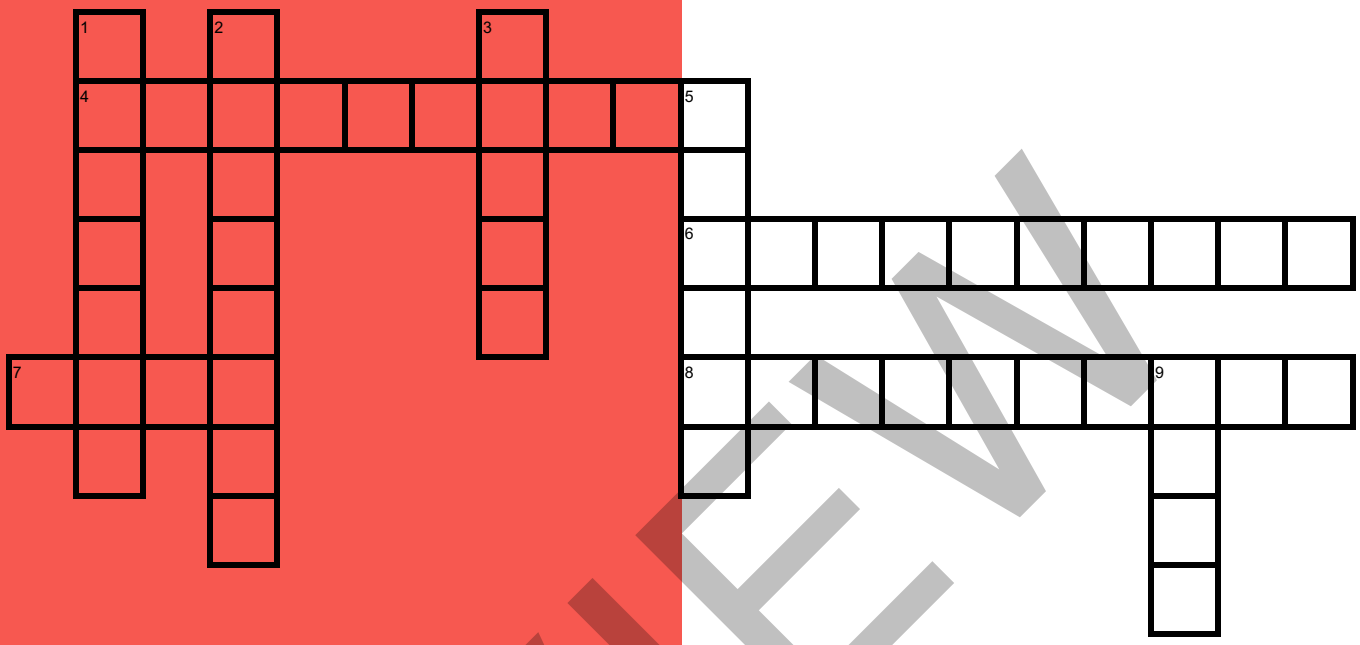
C. Repeat steps from part B above for the C fractions only.

D. Repeat steps from part B above for the D fractions only.

Part 3: Return to your start poster.

- Check all the work on the poster.
- Be prepared to share one strategy that was explained particularly well.
- Rewrite one strategy that could be stated better here.

VOCABULARY REVIEW



Across

4 The numbers $\frac{2}{3}$ and $\frac{4}{6}$ are examples of ____ fractions.

6 The numbers $\frac{2}{5}$, $\frac{4}{10}$, and 0.4 all have the same location on the ____ ____ (two words).

7 Common names for ____-10 blocks are small squares, sticks, and big squares.

8 In the number 357.246, the 4 is in the ____ place.

Down

1 The ____ name for the fraction $\frac{7}{10}$ is 0.7.

2 In the number 357.246, the 3 is in the ____ place.

3 For the number 59.35, the value of each 5 is determined by its ____.

5 In the number 357.246, the 2 is in the ____ place.

9 In the number 357.246, the 5 is in the ____ place.

DEFINITIONS, EXPLANATIONS, AND EXAMPLES

Word or Phrase	Definition
area model for fractions	An area model for fractions represents fractions pictorially using figures in the plane. In this model, a figure is divided into pieces of equal area, and some of the pieces are shaded. The number of shaded pieces is the numerator of the fraction, and the total number of pieces is the denominator. A figure representing $\frac{3}{8}$: 
equivalent fractions	The fractions $\frac{a}{b}$ and $\frac{c}{d}$ are equivalent if they represent the same point on the number line. This occurs if the results of the division problems $a \div b$ and $c \div d$ are equal. Since $\frac{1}{2} = 1 \div 2 = 0.5$ and $\frac{3}{6} = 3 \div 6 = 0.5$, the fractions $\frac{1}{2}$ and $\frac{3}{6}$ are equivalent. Pictorially: 
place value number system	A place value number system is a positional number system in which the value of a digit in a number is determined by its location or place. In the number 7,865.23, the 8 is in the hundreds place and represents 800. The 3 is in the hundredths place and represents 0.03. ten millions millions hundred thousands ten thousands thousands hundreds tens ones • tenths hundredths thousandths ten thousandths

Decimal Place Value

Our place value number system is a positional number system in which the value of a digit in the number is determined by its location or place. In our "base-10" place value system, each place represents a power of 10.

Name of place	hundreds	tens	ones	tenths	hundredths	thousandths
Value of the Place: fraction form	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
Value of the Place: decimal form	100	10	1	0.1	0.01	0.001

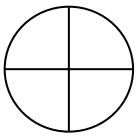
For the number: 274.843

Name of place	hundreds	tens	ones	tenths	hundredths	thousandths
Expanded form #1	200	70	4	0.8	0.04	0.003
Expanded form #2	2(100)	7(10)	4(1)	$8\left(\frac{1}{10}\right)$	$4\left(\frac{1}{100}\right)$	$3\left(\frac{1}{1000}\right)$
Expanded form #3	2(100)	7(10)	4(1)	8(0.1)	4(0.01)	3(0.001)
In words:	Two hundred seventy-four and eight hundred forty-three thousandths					

Area Model for Fractions

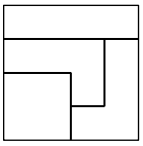
One useful model for fractions is the area model. In an area model, the whole is represented as the area of some specified shape. Then fractions are represented as areas of shapes that can be compared to the whole.

If the circle is defined as 1 whole, and each part is of equal area, then each part represents $\frac{1}{4}$ of the whole.



These parts are all the exact same size and shape.

If the rectangle is defined as 1 whole, and each part is of equal area, then each part represents $\frac{1}{4}$ of the whole.



These parts are not all the same size and shape, but they still have equal area.

Fraction Equivalence: The "Big One"

The "big 1" is a notation for 1 in the form of a fraction $\frac{n}{n}$ $(n \neq 0)$. For example,

$$1 = \frac{1}{1} = \frac{2}{2} = \frac{3}{3} = \frac{4}{4} = \frac{5}{5} = \ldots$$

We can use the following picture to help remind us that these fractions are equivalent to 1:

$$1 = \boxed{\frac{8}{8}}$$

The big 1 can be used to show equivalence of fractions. For example,

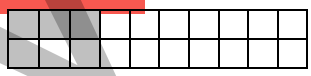
$$\frac{2}{5} \times \boxed{\frac{10}{10}} = \frac{20}{50} \qquad \text{or} \qquad \frac{20}{50} \div \boxed{\frac{10}{10}} = \frac{2}{5}$$

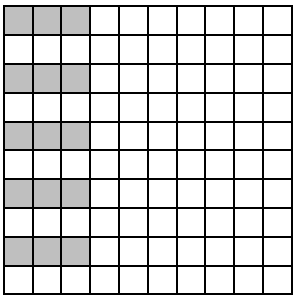
Making Copies of Figures to Illustrate Equivalence

Making copies of an area model creates a new area model with the same fractional amount shaded. An area model that is in hundredths is easily converted to a decimal.

For example, to show that $\frac{3}{20} = \frac{15}{100} = 0.15$ we copy the 20-square pattern below five times to obtain the 100-square grid. Using the big 1, this equivalence can be written:

$$\frac{3}{20} \bullet \boxed{\frac{5}{5}} = \frac{15}{100} = 0.15$$





Multiplying the numerator by 5 represents copying the shaded parts five times, and multiplying the denominator by 5 represents copying the total number of parts five times.

9 781614 459699