DECIMAL AND PERCENT REPRESENTATIONS 5

Name: Key Date:_____ Period:_____

SECTION 5.1 Constructing Decimals

Big Idea: How do you compare, order, and operate with decimal numbers?

EXPLORATION 1: DECIMAL PLACE VALUE

Throughout elementary school, we mainly work with whole numbers. Yet, money introduces us to the concept of amounts less than 1. While dollar bills represent whole values, the change we get back from a purchase represents parts of a whole. For example, it takes ten dimes to make a dollar. Therefore, one dime is one-tenth of a dollar.

Let's look at a place value chart:

PLACE VALUE CHART

THOUSANDS	HUNDREDS	TENS	ONES	•	TENTHS	HUNDREDTHS	THOUSANDTHS

What similarities do you notice on the chart?

tens, tenths hundreds, hundredths thousands, thousandths
almost mirrored across the decimal

What differences do you notice?

ones doesn't have a pair (there is no oneths)

Think about a nickel. You write its value as 0.05. Because the last digit ends in the hundredths place, you read this as "five-hundredths".

1. Write the following in decimal form. Refer to the place value chart as needed.
   a. Thirty-six hundredths 0.36
   b. Five thousandths 0.005
   c. Six tenths 0.6
   d. Four hundredths 0.04
   e. Twenty-nine thousandths 0.029

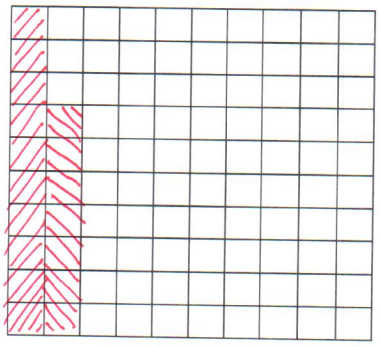
2. Write the following decimals in word form.

   a. 0.07 seven hundredths

   b. 0.001 one thousandth

Sometimes, whole numbers are part of the number. Consider 1.37. This is read, "one AND thirty-seven hundredths". When reading a decimal number, the word "AND" represents the decimal.

EXPLORATION 2: MODELING DECIMALS



We can use decimal grids to model decimals.

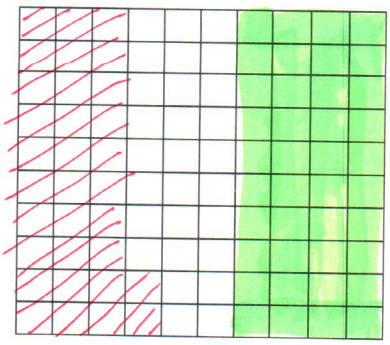
How many columns are in the grid? 10 How many small squares are in a column? 10 How many small squares are in the grid altogether? 100

Shade in one of the columns.

What fraction of the grid is now shaded? $\frac{1}{10}$ Be sure to write your fraction in simplest form. Convert your fraction to a decimal: 0.1

Next, shade 7 more small squares. You should have one column and 7 small squares shaded. What fraction of the grid is shaded altogether? $\frac{17}{100}$

Convert your fraction to a decimal: 0.17



Let's try modeling on the hundredths grid.

First, shade thirty-two hundredths on the grid. Next, use a different color without overlapping the first shading and color in four-tenths of the grid.

Write the number sentence for finding the sum of these two amounts:

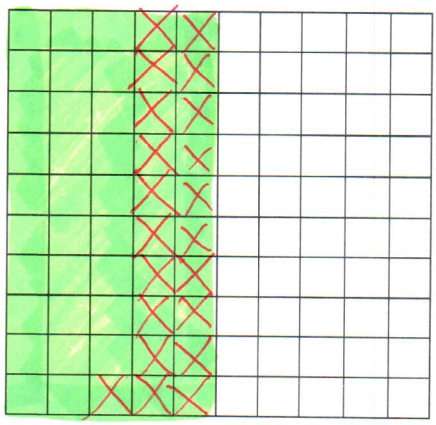
0.32 + 0.4 = 0.72.

You can also use the grid to show subtraction. Consider the problem "Five tenths take away twenty-one hundredths". You will first shade in the five-tenths.

Next, to model subtraction, you will draw an "*x*" over the 21-hundredths.

Now write the number sentence, or equation, that you modeled above:

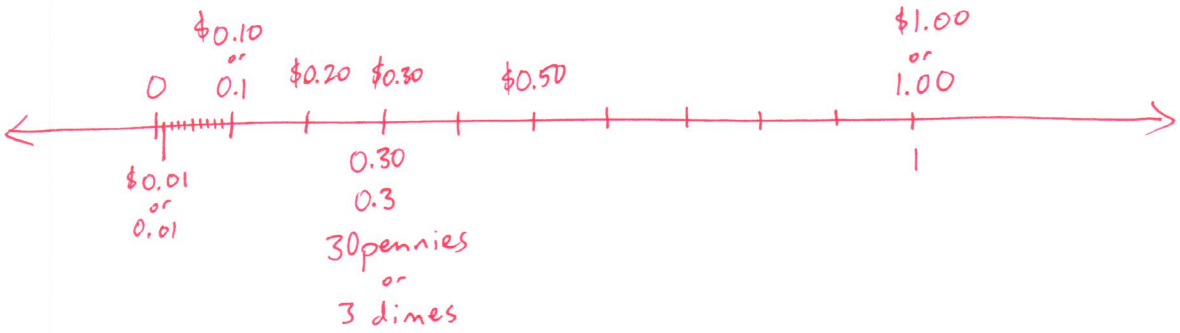
$0.5 - 0.21 = 0.29$.



EXPLORATION 3: LOCATING DECIMAL NUMBERS ON A NUMBER LINE

If we think of the number 1 on the number line as \$1.00, where would we locate half a dollar or \$0.50? Because there are 10 dimes in a dollar, where would \$0.10 be located on the number line? \$0.20? \$0.30? Can you locate \$0.01 or more simply 0.01 on the number line, knowing that there are 10 pennies in a dime?

We know when we write the number 0.30 that there is another way that this decimal can be written. Thirty hundredths can be written as 0.3. How could you show the two numbers 0.3 and 0.30 are really equivalent to each other on the number line?



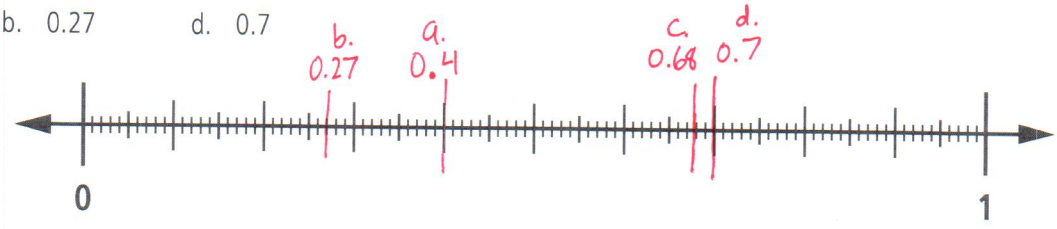
Use a number line like the one below to find the locations of the following decimal numbers. Notice that 0 and 1 are labeled on the number line.

a. 0.4

b. 0.27

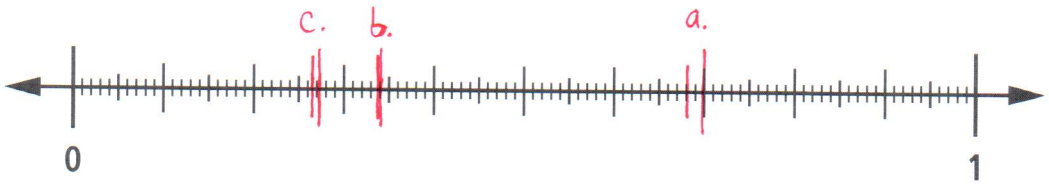
c. 0.68

d. 0.7



For each pair of numbers, determine whether the numbers are equal or not and place the appropriate sign, >, <, =, between the numbers. Justify your answer using the number line.

a. 0.68 < 0.7 b. 0.34 > 0.339 c. 0.268 < 0.271

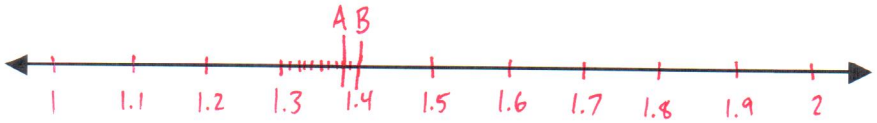


Remember what you have learned about decimals. You know that the number line is one tool that can help you locate decimals, order them, and compare them. The place value chart is another tool that can help you do this. Let's take a look at the next example to understand how the place value chart may be useful.

EXAMPLE 1

In a science project, Jeremy measured the distance two cars traveled. Car A traveled 1.38 meters and Car B traveled 1.4 meters. Which car traveled further? car B

Mark a segment of the number line below to illustrate where Car A and Car B stopped.



EXPLORATION 4: ROUNDING DECIMAL NUMBERS

Like whole numbers, decimals can also be rounded to a specific place value. Consider the number 18.625. If you were asked to round this to the nearest tenth, you begin by underlining the 6 in the tenths place, 18.6̲25. Then, you look to the right of the underlined digit to determine if you should round up or down. Rounding up allows you to increase the underlined digit by 1 while rounding down means the underlined digit remains the same. In our example, the 2 means that the underlined 6 will round down or stay the same: 18.625 will round to 18.6. An equivalent answer is 18.600 but the ending zeros are generally dropped when a decimal number ends in zeros.

To round decimals:

1. Find the place value you want to round to. Call this the specified digit (The underlined place in our previous example above). Look at the digit to the right of it.

2. If the digit to the right is less than 5, do not change the specified digit and drop all digits to the right of it.

3. If the digit to the right is 5 or greater, add one to the specified digit and drop all digits to the right of it.

EXAMPLE 2

Following the instructions just given, round 21.093 to the nearest hundredth.

21.093 rounds to 21.09 (rounded down).

Round the following numbers to the nearest tenth.

a. 16.709 16.7 b. 10.995 11.0 c. 0.471 0.5

d. 1.92587 1.9 e. 102.08 102.1 f. 72.1 72.1

EXPLORATION 5: ORDERING DECIMAL NUMBERS

When alphabetizing two or more words, you ignore beginning letters that are alike until the first different letter to determine which word comes before another. For example, concentrate, concert, and cone are in alphabetical order. Can you see why? Similarly, when ordering numbers, compare the digits starting with the largest place value. Ignore the digits that are alike until the first place value that shows a difference. This process is often easiest to see if you make a vertical column of the numbers you are ordering.

Write the following numbers in order from least to greatest: 3.065, 3.6, 3.56, 3.605, 3.65. Use the box given to align the decimals of each number. ✓ ✓ ✓ ✓ ✓

3	•	0	6	5
3	•	5	6	
3	•	6		
3	•	6	0	5
3	•	6	5	

EXAMPLE 3

Try a few more on your own. Order the next sets of numbers from greatest to least.

a. 1.1, 1.095, 1.9, 1.59 1.9, 1.59, 1.1, 1.095

least to greatest: 1.095 1.1 1.59 1.9

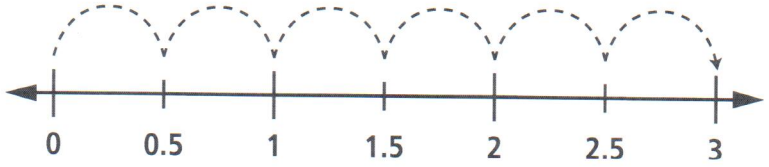
b. 5.1823, 5.1, 5.18023, 5.108 5.1823, 5.18023, 5.108, 5.1

c. 6.08, 6.008, 6.8, 6.088 6.8, 6.088, 6.08, 6.008

EXPLORATION 6: DIVIDING WHEN THE DIVISOR IS GREATER THAN THE DIVIDEND

Sarah spent $3 on 6 chocolate bars. How much did each candy bar cost?

This is a typical division problem where the cost of each candy bar is 3 ÷ 6. You might expect trouble because the divisor is greater than the dividend. Using the linear skip counting model, how long does each skip need to be to travel a distance of 3 units, or 3 dollars in this case, in 6 skips?



You can see that each jump is $0.50 or half a dollar. This represents the fact that each candy bar costs $0.50. If necessary, verify this using the calculator by computing 3 ÷ 6 or adding six skips 0.50 long. The long division method gives us the same result, because there is a decimal point before the 5. You might write the problem like step 1 on the next page. The divisor is greater than the dividend, so modify the long division process by placing a decimal point. Add the two zeros in the dividend because we are working with money and we know that $3 = $3.00 where $0.00 represents no cents. Where does the decimal place appear in the quotient? Why does this make sense?

Before the 5. $0.50 is half of a dollar.

EXAMPLE 4

Look at the steps below used to compute the amount without the use of a number line.

Step 1: $6\overline{)3}$

Step 2:

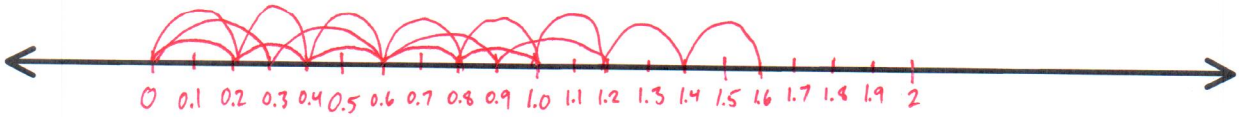
$$\begin{array}{r} 0.50 \\ 6\overline{)\,3.00} \\ -3.00 \\ \hline 0.00 \end{array}$$

Where does the decimal place appear in the quotient? Before the 5.

Try using long division to solve the following:

a. $1 shared among five friends.	b. 15 divided by 20
$\begin{array}{r} 0.2 \\ 5\overline{)1.0} \\ -1.0 \\ \hline 0.0 \end{array}$ 0.2 is $0.20	$\begin{array}{r} 0.75 \\ 20\overline{)15.00} \\ -14.0 \\ \hline 1.00 \\ -1.00 \\ \hline 0.00 \end{array}$ $15 \div 20 = 0.75$

Compute the following division problems by using an abbreviated number line from 0 to 2, like the one below, and finding the quotient using the skip-counting method. Then use the scaffolding method to verify your answer. Make sure the decimal point in the quotient makes sense in the context of the problem. Then use the calculator to confirm your work, if necessary.



a. $1 ÷ 5

$0.2

$\begin{array}{r} 0.20 \\ 5\overline{)1.00} \\ -1.0 \\ \hline 0.0 \end{array}$

b. $1.60 ÷ 8

$0.2

$\begin{array}{r} 0.20 \\ 8\overline{)1.60} \\ -1.6 \\ \hline 0.0 \end{array}$

c. $1.20 ÷ 4

$0.3

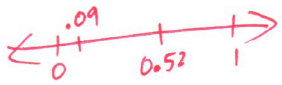
$\begin{array}{r} 0.30 \\ 4\overline{)1.20} \\ -1.2 \\ \hline 0.0 \end{array}$

You will be seeing more decimal division in Section 5.2!

PROBLEMS

1. For each pair of numbers, determine which is greater. Justify your answer using a number line.

a. 0.52 and 0.09 0.52

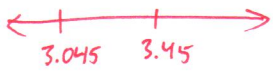


b. 0.82 and 0.819 0.82

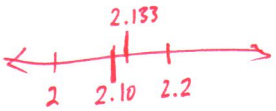
c. 0.268 and 0.259 0.268

d. 1.12 and 1.02 1.12

e. 3.45 and 3.045 3.45



f. 2.133 and 2.10 2.133



2. Round the following number 127.398359 to the specified place value:

a) nearest one's 127

b) nearest tenths 127.4

c) nearest hundredths 127.40

d) nearest thousandths 127.398

3. The cost of a 50-inch flat screen television on sale is $719.29.

a) Round the cost to the nearest dollar. $719

b) Round the cost to the nearest hundred dollars. $700

4. Mr. Garza has some money in his pocket that he intends to divide equally among his four nephews. Use the area model and the scaffolding model to compute how much each nephew receives if he has

   a. $26 in his pocket $6.50

   06.5
   4|26.0
   -24
   2.0
   -2.0
   0.0

   b. $27.40 in his pocket $6.85

   06.85
   4|27.40
   -24
   3.4
   -3.2
   .20
   .20
   0

   .05
   .80
   1.00 Sum = 6.85
   5.00
   4|27.40
   -20.00
   7.40
   - 4.00
   3.40
   - 3.20
   .20
   -.20
   .00

5. Complete the table below.

Decimals	Words
0.017	seventeen thousandths
5.106	Five and one hundred six thousandths
0.9	nine tenths
102.006	One hundred two and six thousandths

6. Order the decimals from least to greatest by vertically stacking the numbers.

a. 8.75, 8.705, 8.075, 8.7	b. 16.97, 17, 16.909, 16.979	c. 85.7, 84.9, 85.78, 84.987 ✓ ✓ ✓ ✓
8.075 8.7 8.705 8.75	16.909 16.97 16.979 17	84.9 84.987 85.7 85.78

7. Nancy has $10 to spend at the movies. If tickets to the matinee cost $2.50, how many tickets can she buy? 4 tickets

10 ÷ 2.50

SUMMARY (What I learned in this section)