Lessons 7.1& 7.2 (F'11)

OBJECTIVES:
1. To write a decimal in expanded form.
2. To convert from decimals to fractions and fractions to decimals.
3. To review the algorithms for addition, subtraction, multiplication and division of decimals.
4. To use scientific notation.
5. To review mental math.

From *Principles and Standards* page410

Students in grades 6-8 should:
Work flexibly with fractions, decimals, and percents to solve problem;
Compare and order fractions, decimals, and percents efficiently and find their approximate location on a number line;
Develop an understanding of large numbers and recognize and appropriately use exponential, scientific, and calculator notation;…
Understand the meaning and effects of arithmetic operations with fractions, decimals, and integers. (page 214)

In 1585 Simon Stevin, a Dutchman, wrote *La Disme*, the first book on the use on decimals. The word *decimal* comes from the Latin *decem.*

Try This--A carpenter agrees that during a specified 30 hour period he be paid $15.50 every hour that he works and that he be pay $16.60 every hour he does not work. At the end of the week, he finds he has earned $476.00. How many hours did he work?

RELATING TO MONEY

One of everyone's first encounters with a decimal is in the context of money. A child sees the price of a new Wii game is $25.84.
Let's look at different ways to express this money amount.

$25.84 =_____
(words)

EXPANDED NOTATION

$25.84 means 2 tens + 5 ones + 8 dimes + 4 pennies

means $2 \cdot 10 + 5 \cdot 1 + 8 \cdot \frac{1}{10} + 4 \cdot \frac{1}{100}$

means $2 \cdot 10^{1} + 5 \cdot 10^{0} + 8 \cdot 10^{-1} + 4 \cdot 10^{-2}$

Remember:
This number is read twenty five **and** eighty- four hundredths.

2	8	4	.	4	6	2
Hundreds	Tens	Units		Tenths	Hundredths	Thousandths

Try This—Place each number in the correct box

	Tens	Units	.	Tenths	Hundredths	Thousandths	Ten-thousandths
12.458							
45.8903							
0.678							

Now read each of the above numbers to your neighbors.

TRY THESE-- WRITE IN EXPANDED NOTATION USING POWERS OF 10.

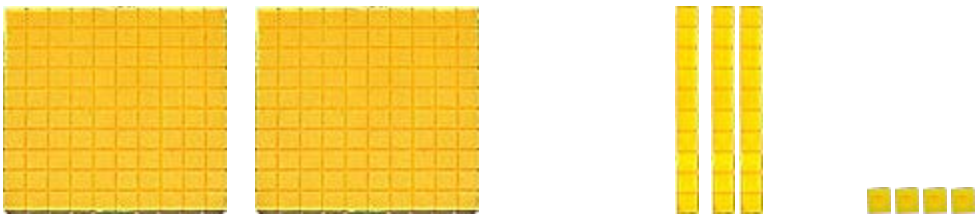
1. 32.567
2. 678.0234
3. 0.4572
4. 32,567.098

Decimals

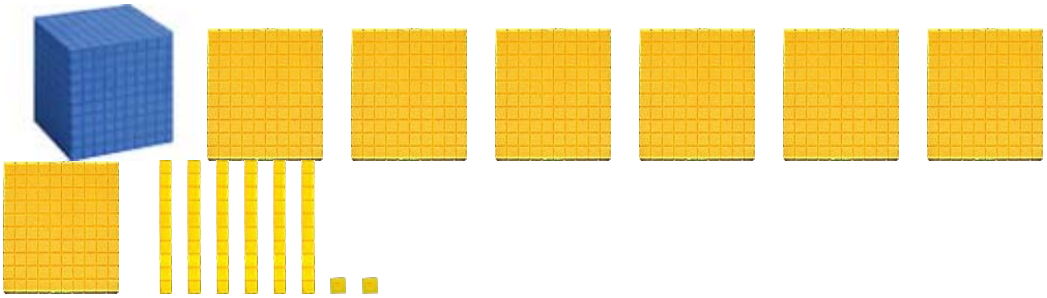
Concrete materials

a. Base ten blocks-We can use Base-10 blocks to help model decimals. We will need to change what each block represents for each problem. The unit block should always represent the "smallest place" in the number.

1. 2.34 2 flats, 3 longs, 4 cubes

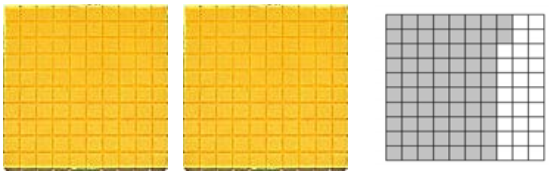


2. 1.762 1 block, 7 flats, 6 longs, 2 cubes



b. Decimal squares

1. 2.72



Convert each fraction to a decimal without using a calculator.

1. $\frac{32}{100}=\frac{30+2}{100}=\frac{30}{100}+\frac{2}{100}=\frac{3}{10}+\frac{2}{100}=0.3+0.02=0.32$

Try This: Read the fraction and then write as a decimal.

$\frac{9}{10}$ $\frac{47}{100}$ $\frac{7}{1000}$

ACTIVITY (Fractions to Decimals)

What was your answer to Question #15?

This leads us to the next Theorem.

Theorem 7.1

A rational number $\frac{a}{b}$ in simplest form can be written as a terminating decimal if and only if the prime factorization of the denominator contains no primes other than 2 or 5.

To determine whether a rational number can be represented as a terminating decimal, we only need to consider the prime factorization of the denominator, but the fraction must be in simplest form first.

Which of the following can be written as a terminating decimal? .

1. $\frac{7}{8}$ 2. $\frac{21}{28}$ (Is it reduced?) 3. $\frac{37}{768}$ 4. $\frac{11}{250}$ 5. $\frac{1}{75}$

If the denominator is not a power of 10, as in $\frac{2}{5}$, we can convert it so it is. $\frac{2}{5} = \frac{\quad}{10}$ which is _____ (as a decimal)

Let's look at the powers of 10 and see what they have in common. First, write the prime factorization of each of the following:

10 100 1,000 10,000

What do we see in common?

How is the exponent(s) related to the number of zeros in the original number?

Using what we just concluded above, we can easily change the following fractions to decimals.

$\frac{4}{5^2}$ $\frac{3}{8}$

Try These: 1. $\frac{1}{250}$ 2. $\frac{1}{2^3 \cdot 5^2}$

Repeat using a calculator.

Ordering Decimals

1. Convert to rational numbers: 0.063 $\frac{63}{1000}$ 0.045 $\frac{45}{1000}$
2. Compare decimals:

    1. Line up the numbers by place value
    2. Start at the left and find where the digits differ
    3. Compare these digits. The number with the larger digit is greater
    4. NEGATIVES ARE IN REVERSE

Compare 0.063 0.045

Tenths	Hundredths	Thousandths

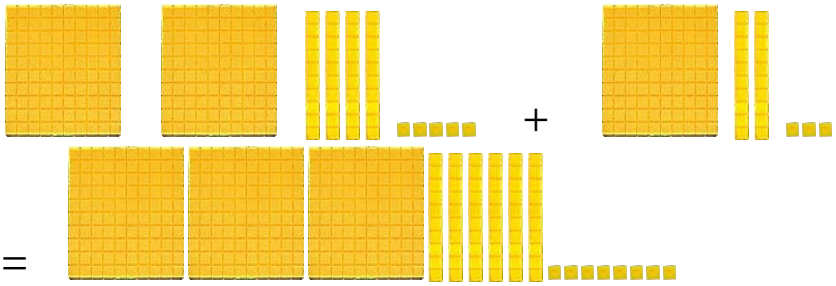
Try These: Order from greatest to least:

3.45 3.35 3.42 3.451

Add 2.45 + 1.23

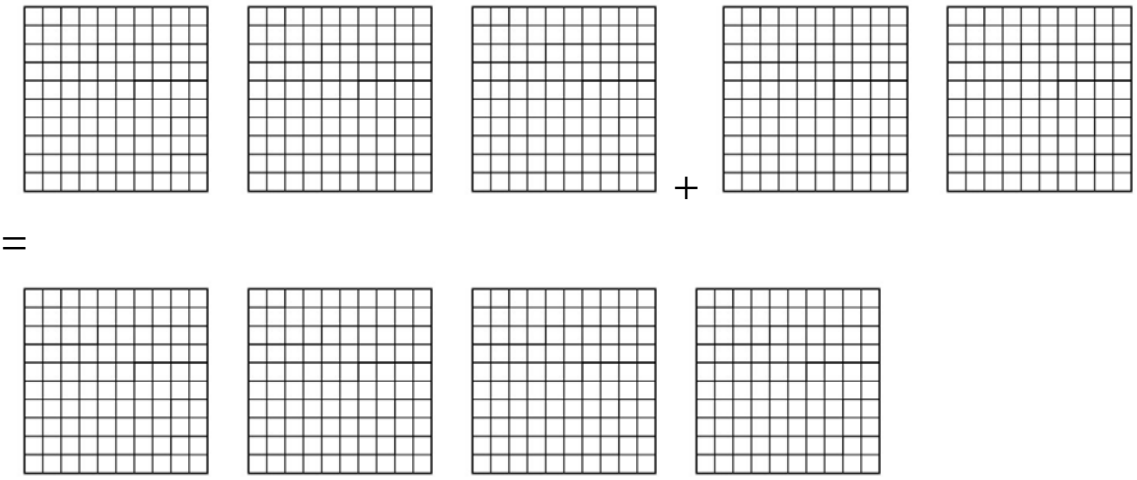
1. Concrete- base ten blocks Represent each number. Combine. Regroup

2.45 + 1.23



2. Decimal Square Shade each number. "Read" entire shaded portion.

2.45 + 1.23



3. Fractions 2.45 + 1.23 Write as a mixed number. Combine. Regroup

Algorithm

ALGORITHM FOR ADDITON AND SUBTRACTION OF DECIMALS:

1. Align the number according to place value (or the decimal point).
2. Add or Subtract.
3. Place the decimal point directly below the other points.

4. 2.45 + 1.23 Align numbers according to place value. Add.

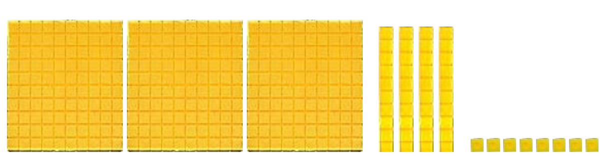
5. Number line 1.4 + 1.3

←--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--→

Subtraction

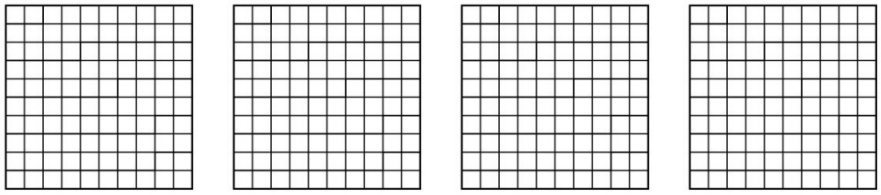
1. Concrete 3.48 – 1.33

Represent only the first number. Take away the second number, regrouping if necessary.



2. Decimal Squares 3.48 – 1.33

Shade only the first number. "Cross out" the second number.



3. Fractions 3.48 – 1.33

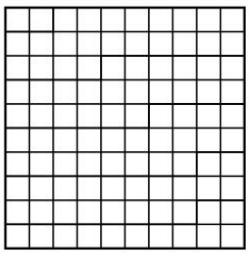
Write as a fraction. Subtract. Regroup.

4. Algorithm 3.48 – 1.33

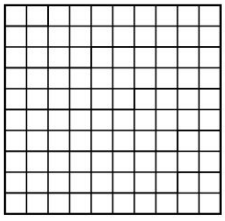
Align numbers according to place value (or the point). Annex zeros if necessary. Subtract.

Multiplication

Suppose you baked a pan of brownies. You gave 0.5 of the brownies to your grandparents and save 0.5 for you and your family. If you eat 0.5 of the saved brownies, how much is left for your family?



TRY THIS-- Use decimal squares to illustrate 0.6 x 0.5



Multiply (2.14)(3.6)

$$(2.14)(3.6) = \frac{214}{100}\times\frac{36}{10} = \frac{214\times 36}{10^2\times 10^1} = \frac{7704}{10^3} = 7.704$$

Algorithm- If there are n digits to the right of the decimal point in one number and m digits to the right of the decimal point in a second number, multiply the two numbers, ignoring the decimals, and then place the decimal point so that there are n + m digits to the right of the decimal point in the product.

In other words:

1. Disregarding the decimal point, multiply the numbers
2. Count how many digits lay to the right of BOTH decimals points.
3. Place the decimal point in the product so that it has this many digits to the right of the point.

Try These: 1. (4.5)(1.25) 2. 0.003 x 0.15 3. 2.56 x 10,000

Division

1. Fractions $9.42 \div 3 = \frac{942}{100} \div 3 = \frac{942}{100} \times \frac{1}{3} = \frac{942}{300} = \frac{314}{100} = 3.14$

2. Money $9.42 \div 3$

3. Understanding the algorithm

$13.65 \div 0.26 = \frac{13.65}{0.26} \times \frac{100}{100} = \frac{1365}{26} =$ $0.26\overline{)13.65} = 26\overline{)1365}$

This process is usually described as "moving" the decimal point two places to the right in both the dividend and the divisor. This process is usually indicated with arrows. When the divisor is not a whole number, we can obtain a whole-number divisor by multiplying both the divisor and dividend by a power of 10 (ie. moving the decimal point).

Try These--1) $0.63 \div 0.7$ 2) $12.144 \div 0.12$ 3) $9 \div 0.75$

Scientific Notation is another way to write a very large or very small number.

Definition of Scientific Notation-

In scientific notation a positive number is written as the product of a number greater than or equal to 1 and less than 10 and an integer power of 10.

A number written in ***scientific notation*** satisfies the following criteria:

It is the product of:

1. A number greater than or equal to 1 and less than 10.
2. An integer power of 10.

TRY THESE--Write each number in scientific notation.

1. 436,000
2. 0.000000035

2. Convert each of the following to the STANDARD FORM OF A NUMBER

1. 3.76×10^{-3}
2. 3.19×10^{5}

Mental Computation

1. Breaking and Bridging $6.8 + 4.8 + 2.84$

$(6.8 + 4) + 0.8 + 2.84$

$10.8 + 0.8 + 2.84$

$11.6 + 2 + 0.84$

$13.6 + 0.84 = 14.44$

2. Using compatible numbers.

$$\begin{array}{r} 6.47 \\ 8.76 \\ 3.53 \\ +\ 2.24 \\ \hline \end{array}$$

3. Making compatible numbers.

$$\begin{array}{rl} 9.54 & 9.50 + 0.04 \\ +\ 3.26 & \underline{3.25 + 0.01} \\ & 12.75 + 0.05 = 12.80 \end{array}$$

4. Balancing with decimals in subtraction.

$$\begin{array}{rll} 6.89 & 6.89 + 0.08 & 6.97 \\ -\ 3.92 & -(3.92 + 0.08) & \underline{-\ 4.00} \\ & & 2.97 \end{array}$$

5. Balancing with decimals in division.

$$0.25\overline{)9} \qquad 4(0.25)\overline{)4(9)} = 1\overline{)36}$$

ROUNDING DECIMALS

Round to the nearest…	Ten	Unit	Tenth	Hundredth	Thousandth
7.24562					
Try This 398.5398					
9.9873					

Estimating decimal computation using rounding

Try This--

1. Estimate the cost of Sue's groceries.

   $3.85, $0.99, $4.14, $6.92

2. Estimate the cost of a frozen turkey that sells for $0.89 per pound and weighs 14.87 pounds

Class work

Homework Course Compass Section 7.1& 7.2 and page 418 A#5, 13,15,16, 17 page 419 B#4, 11 page 433 #A 2, 8, 9, 11, #B 2, 8, 9, 15, 18, 19, 27