## ***FIFTH GRADE MATHEMATICS***
## ***UNIT 3 STANDARDS***

Dear Parents,

We want to make sure that you have an understanding of the mathematics your child will be learning this year. Below you will find the standards we will be learning in Unit Three. Each standard is in bold print and underlined and below it is an explanation with student examples. Your child is not learning math the way we did when we were in school, so hopefully this will assist you when you help your child at home. Please let your child's teacher know if you have any questions. ☺

**MGSE5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.**

This standard includes multiplying by multiples of 10 and powers of 10, including $10^2$ which is $10 \times 10=100$, and $10^3$ which is $10 \times 10 \times 10 =1,000$. Students should have experiences working with connecting the pattern of the number of zeros in the product when you multiply by powers of 10.

Examples:

$$2.5 \times 10^3 = 2.5 \times (10 \times 10 \times 10) = 2.5 \times 1,000 = 2,500$$

Students should reason that the exponent above the 10 indicates how many places the digit is moving (and understand that you are multiplying or making the number 10 times greater three times) when you multiply by a power of 10. Since we are multiplying by a power of 10 the digits move to the left.

$$350 \div 103 = 350 \div 1,000 = 0.350 = 0.35$$

$^{350}/_{10} = 35$ $\quad$ $(350 \times {}^{1}/_{10})$ $\quad$ $^{35}/_{10} = 3.5$

$(35 \times {}^{1}/_{10})$ $\quad$ $^{3.5}/_{10} = 0.35$ $\quad$ $(3.5 \times {}^{1}/_{10})$

This will relate well to subsequent work with operating with fractions. This example shows that when we divide by powers of 10, the exponent above the 10 indicates how much the value of the digits are increasing or decreasing (how many times we are dividing by 10, the number becomes ten times smaller). Since we are dividing by powers of 10, the digits shift places to the right.

Students need to be provided with opportunities to explore this concept and come to this understanding; this should not just be taught procedurally.

Examples:

Students might write:

- $36 \times 10 = 36 \times 10^1 = 360$
- $36 \times 10 \times 10 = 36 \times 10^2 = 3600$
- $36 \times 10 \times 10 \times 10 = 36 \times 10^3 = 36,000$
- $36 \times 10 \times 10 \times 10 \times 10 = 36 \times 10^4 = 360,000$

Students might think and/or say:

I noticed that every time, I multiplied by 10 I added a zero to the end of the number. That makes sense because each digit's value became 10 times larger. To make a digit 10 times larger, I have to move it one place value to the left.

When I multiplied 36 by 10, the 30 became 300. The 6 became 60 or the 36 became 360. So I had to add a zero at the end to have the 3 represent 3 one-hundreds (instead of 3 tens) and the 6 represents 6 tens (instead of 6 ones).

Students should be able to use the same type of reasoning as above to explain why the following multiplication and division problem by powers of 10 make sense.

$523 \times 10^3 = 523,000$ The place value of 523 is increased by 3 places.
$5.223 \times 10^2 = 522.3$ The place value of 5.223 is increased by 2 places.
$52.3 \div 10^1 = 5.23$ The place value of 52.3 is decreased by one place.

**<u>MGSE.5.NBT.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.</u>**

This standard builds on the work from $4^{th}$ grade where students are introduced to decimals and compare them. In5th grade, students begin adding, subtracting, multiplying and dividing decimals. This work should focus on concrete models and pictorial representations, rather than relying solely on the algorithm. The use of symbolic notations involves having students record the answers to computations (2.25 × 3= 6.75), but this work should not be done without models or pictures. This standard includes students' reasoning and explanations of how they use models, pictures, and strategies. Before students are asked to give exact answers, they should estimate answers based on their understanding of operations and the value of the numbers.

Examples:

- **3.6 + 1.7**

A student might estimate the sum to be larger than 5 because 3.6 is more than 3½ and 1.7 is more than 1½.

- **5.4 – 0.8**

A student might estimate the answer to be a little more than 4.4 because a number less than 1 is being subtracted.

- **6 × 2.4**

A student might estimate an answer between 12 and 18 since 6 × 2 is 12 and 6 × 3 is 18. Another student might give an estimate of a little less than 15 because s/he figures the answer to be very close, but smaller than 6 × 2½ and think of 2½ groups of 6 as 12 (2 groups of 6) + 3(½ of a group of 6).
Students should be able to express that when they add decimals they add tenths to tenths and hundredths to hundredths. So, when they are adding in a vertical format (numbers beneath each other), it is important that they write numbers with the same place value beneath each other. This understanding can be reinforced by connecting addition of decimals to their understanding of addition of fractions. Adding fractions with denominators of 10 and 100 is a standard in fourth grade.

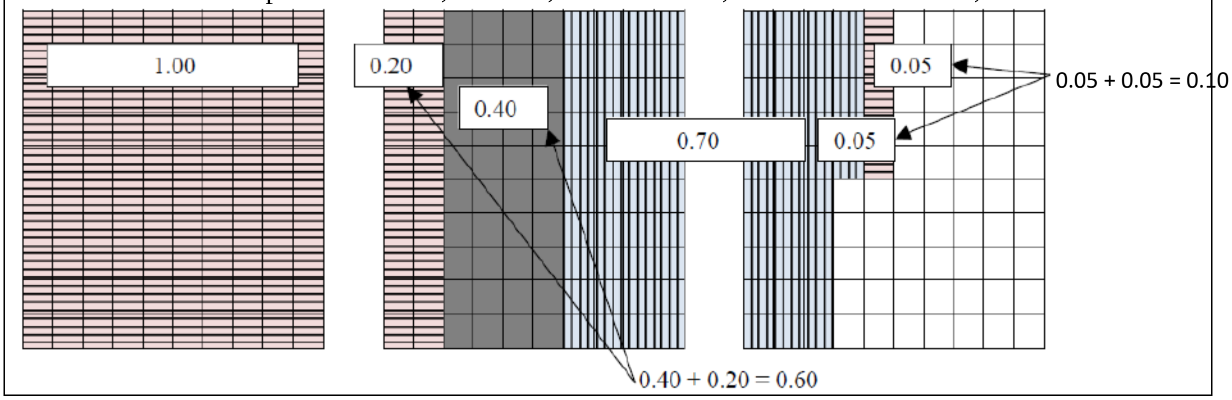
Example: 4 - 0.3

3 tenths subtracted from 4 wholes. One of the wholes must be divided into tenths.

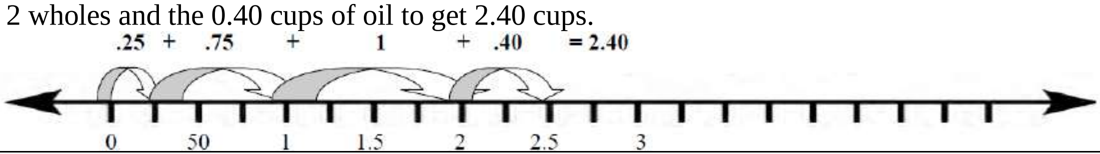
The solution is 3 and $^{7}/_{10}$ or 3.7.

Example:
A recipe for a cake requires 1.25 cups of milk, 0.40 cups of oil, and 0.75 cups of water. How much liquid is in the mixing bowl?

**Student 1:** 1.25 + 0.40 + 0.75
First, I broke the numbers apart. I broke 1.25 into 1.00 + 0.20 + 0.05. I left 0.40 like it was. I broke 0.75 into 0.70 + 0.05.
I combined my two 0.05's to get 0.10. I combined 0.40 and 0.20 to get 0.60. I added the 1 whole from 1.25. I ended up with 1 whole, 6 tenths, 7 more tenths, and another 1 tenths, so the total is 2.4.

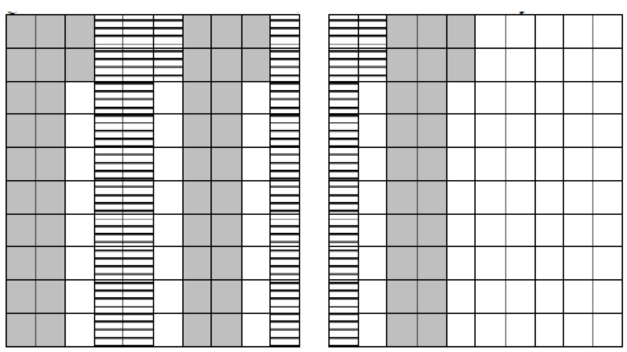



**Student 2**
I saw that the 0.25 in the 1.25 cups of milk and the 0.75 cups of water would combine to equal 1 whole cup. That plus the 1 whole in the 1.25 cups of milk gives me 2 whole cups. Then I added the 2 wholes and the 0.40 cups of oil to get 2.40 cups.




**Example of Multiplication:**

A gumball costs $0.22. How much do 5 gumballs cost? Estimate the total, and then calculate. Was your estimate close?

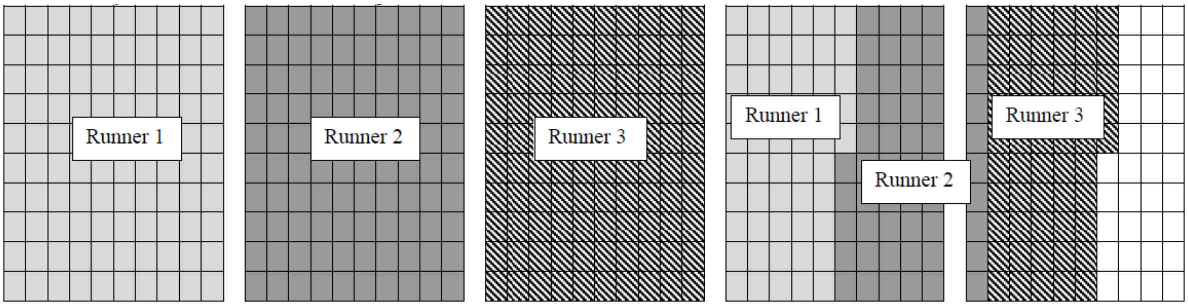


I estimate that the total cost will be a little more than a dollar. I know that 5 20's equal 100 and we have 5 22's. I have 10 whole columns shaded and 10 individual boxes shaded. The 10 columns equal 1 whole. The 10 individual boxes equal 10 hundredths or 1 tenth. My answer is $1.10.

My estimate was a little more than a dollar, and my answer was $1.10. I was really close.

**Example of Division:**

A relay race lasts 4.65 miles. The relay team has 3 runners. If each runner goes the same distance, how far does each team member run? Make an estimate, find your actual answer, and then compare them.



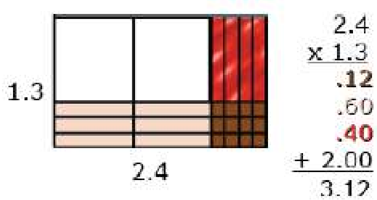

My estimate is that each runner runs between 1 and 2 miles. If each runner went 2 miles, that would be a total of 6 miles which is too high. If each runner ran 1 mile, that would be 3 miles, which is too low.

I used the 5 grids above to represent the 4.65 miles. I am going to use all of the first 4 grids and 65 of the squares in the 5th grid. I have to divide the 4 whole grids and the 65 squares into 3 equal groups. I labeled each of the first 3 grids for each runner, so I know that each team member ran at least 1 mile. I then have 1 whole grid and 65 squares to divide up. Each column represents one-tenth. If I give 5 columns to each runner, that means that each runner has run 1 whole mile and 5 tenths of a mile. Now, I have 15 squares left to divide up. Each runner gets 5 of those squares. So each runner ran 1 mile, 5 tenths and 5 hundredths of a mile. I can write that as 1.55 miles.

My answer is 1.55 and my estimate was between 1 and 2 miles. I was pretty close.

**Example of Multiplication:**

An area model can be useful for illustrating products.




Students should be able to describe the partial products displayed by the area model.

For example, "$^{3}/_{10}$ times $^{4}/_{10}$ is $^{12}/_{100}$.

$^{3}/_{10}$ times 2 is $^{6}/_{10}$ or $^{60}/_{100}$.

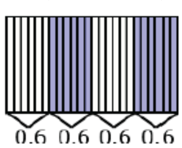
1 group of $^{4}/_{10}$ is $^{4}/_{10}$ or $^{40}/_{100}$.

1 group of 2 is 2."

**Example of Division:**

***Finding the number in each group or share***

Students should be encouraged to apply a fair sharing model separating decimal values into equal parts such as 2.4 ÷ 4 = 0.6.




**Example of Division:**

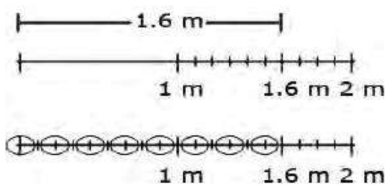
***Finding the number of groups***

Joe has 1.6 meters of rope. He has to cut pieces of rope that are 0.2 meters long. How many can he cut?

**Example of Division:**

***Finding the number of groups***

Students could draw a segment to represent 1.6 meters. In doing so, s/he would count in tenths to identify the 6 tenths, and be able identify the number of 2 tenths within the 6 tenths. The student can then extend the idea of counting by tenths to divide the one meter into tenths and determine that there are 5 more groups of 2 tenths.




Students might count groups of 2 tenths without the use of models or diagrams. Knowing that 1 can be thought of as $^{10}/_{10}$, a student might think of 1.6 as 16 tenths. Counting 2 tenths, 4 tenths, 6 tenths, …, 16 tenths, a student can count 8 groups of 2 tenths.

Use their understanding of multiplication and think, "8 groups of 2 is 16, so 8 groups of $^{2}/_{10}$ is $^{16}/_{10}$ or $1^{6}/_{10}$."

## Common Misconceptions

Students might compute the sum or difference of decimals by lining up the right-hand digits as they would whole number. For example, in computing the sum of 15.34 + 12.9, students will write the problem in this manner:

$$\begin{array}{r} 15.34 \\ +\quad 12.9 \\ \hline 16.63 \end{array}$$

To help students add and subtract decimals correctly, have them first estimate the sum or difference. Providing students with a decimal-place value chart will enable them to place the digits in the proper place.