

# Building a System of Tens

## Math Assessment

This Math Assessment consists of 20 items broken into two sections. The first section contains five open response items. The second section contains 15 multiple choice items. We estimate that this assessment will take approximately 45 minutes to complete.

## Section I

Below are the works of 3 different students solving  $61 - 36$ . Explain each method. Does each method make sense? Why or why not?

$\begin{array}{r} \mathbf{61} \\ -\mathbf{36} \\ \hline 25 \end{array}$ <p>Step 1) <math>60 - 30 = 30</math>            Step 2) <math>1 - 6 = 5</math> in the hole            Step 3) <math>30 - 5 = 25</math></p>	<p>1. Explain the method. Does it make mathematical sense? Why or why not?</p>
$\begin{array}{r} 5 \\ \cancel{6}1 \\ -\mathbf{36} \\ \hline 25 \end{array}$ <p>Step 1) Cross out 6 to make a 5            Step 2) <math>5 - 3</math> is 2            Step 3) <math>6 - 1</math> is 5</p>	<p>2. Explain the method. Does it make mathematical sense? Why or why not?</p>
$\begin{array}{r} \mathbf{61} \\ -\mathbf{36} \\ \hline 25 \end{array}$ <p>Step 1) <math>61 - 36 = 65 - 40 = 25</math></p>	<p>3. Explain the method. Does it make mathematical sense? Why or why not?</p>

Imagine you are a fourth-grade teacher. At the beginning of the year, several of your students are making the same error in multiplication problems:

**Student 1:**

$$24 \times 36 = 20 \times 30 + 4 \times 6 = 600 + 24 = 624$$

**Student 2:**

$$16 \times 18 = 10 \times 10 + 6 \times 8 = 100 + 48 = 148$$

4. Explain what each student might have been thinking. Why does this method give the wrong answer?

5. As their teacher, what is an approach that you might take to help each student understand why this method doesn't work? Include examples to clarify your approach.

## Section II

1. Ms. Wilson's class is working in groups to decompose 391 into hundreds, tens, ones, and tenths. As she walks around, she sees groups have arrived at very different answers. Which of the following ways to represent 391 should she accept as correct? (Mark YES, NO, or I'M NOT SURE for each choice.)

	Yes	No	I'm not sure
a) 3 hundreds + 90 tens + 1 one	1	2	3
b) 2 hundreds + 19 tens + 1 one	1	2	3
c) 3 hundreds + 9 tens + 10 tenths	1	2	3
d) 39 tens + 1 one	1	2	3

2. Mr. Siegel and Mrs. Valencia were scoring their students' work on the practice state mathematics exam. One open-ended question on the exam asked:

**Write the number that is  
halfway between 1.1 and 1.11.**

Mr. Siegel and Mrs. Valencia were interested to see the different answers students wrote. What should the teachers accept as correct? (Mark ONE answer.)

- a) 1.05
- b) 1.055
- c) 1.105
- d) 1.115
- e) I'm not sure.

3. Teachers often offer students "rules of thumb" to help them remember particular mathematical ideas or procedures. Sometimes, however, these handy memory devices are not actually true, or they are not true for all numbers. For each of the following, decide whether it is true all of the time or not. (Mark TRUE FOR ALL NUMBERS, NOT ALWAYS TRUE, or I'M NOT SURE.)

	True for all numbers	Not always true	I'm not sure
a) If the first of two numbers is smaller than a second, and you add the same number to both, then the first sum is smaller than the second.	1	2	3
b) Multiplying a number makes it larger.	1	2	3
c) A negative number plus another negative number equals a negative number.	1	2	3
d) To multiply any number by 10, add a zero to the right of the number.	1	2	3

4. As Mrs. Boyle was teaching subtraction one day, she noticed a few students subtracted in the following way:

$$\begin{array}{r} 13 \\ 63 \\ -28 \\ \hline 35 \end{array}$$

What were these students **most likely** doing? (Mark ONE answer.)

- a) The students "subtracted up," by taking 3 away from 8, and then tried to compensate for this mistake.
- b) The students compensated by subtracting 30 from 63, then dealt with the 8 and 3 in a second step.
- c) The students made a mistake with the standard procedure, crossing out the 2 rather than the 6.
- d) The students added ten to both 63 and 28, then subtracted.
- e) I'm not sure.

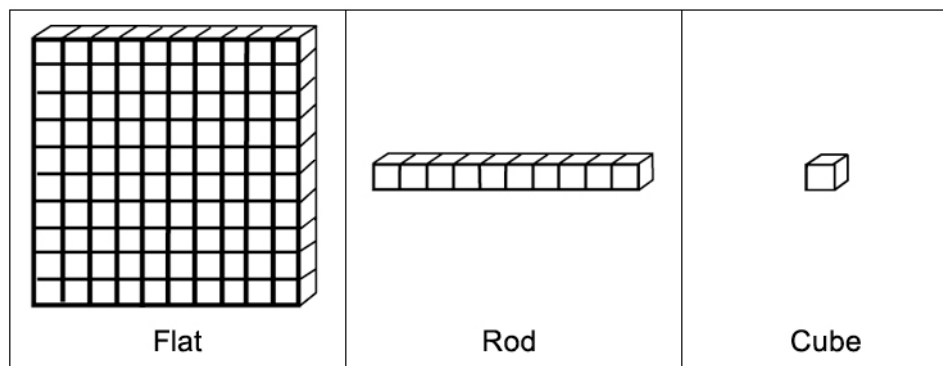
5. Imagine that you are working with your class on subtracting large numbers. Among your students' papers, you notice that some have displayed their work in the following ways:

Method A		Method B		Method C		
<b>932</b>	356	<b>932</b>	932	<b>932</b>	936	976
<b>-356</b>	360	<b>-356</b>	- 300	<b>-356</b>	- 360	- 400
	400		632			576
	900		- 50			
	932		582			
	576		- 6			
			576			

Which of these students is using a method that could be used to subtract any two whole numbers? (Mark ONE answer.)

- a) A only
- b) B only
- c) A and B
- d) B and C
- e) A, B, and C
- f) I'm not sure.

6. Mrs. Kwon decides to try teaching decimals using base ten blocks. She has three kinds of base ten blocks available to her:



When teaching place value with whole numbers, the use of the blocks seems simple. But for decimals, it seems more complex, and she asks Mrs. Carroll next door what she thinks the values of the blocks should be. How should Mrs. Carroll reply? (Mark ONE answer.)

- a) Ones "cubes" become wholes; tens "rods" become tenths; hundreds "flats" become hundredths.
- b) Hundreds "flats" become wholes; tens "rods" become tenths, and ones "cubes" become hundredths.
- c) Either use of the blocks will work.
- d) Neither use of the blocks will work.
- e) I'm not sure.

7. Nathaniel suggested the following idea for doing the problem:

$$\begin{array}{r} \mathbf{0.23} \\ \times \mathbf{95} \\ \hline \end{array}$$

First I ignore the decimal point and do the multiplication, which gives me 2185. Then I use estimation to place the decimal point. I know that 0.23 is about  $\frac{1}{4}$  and 95 is about 100 and  $\frac{1}{4}$  of 100 is 25, so my answer would be 21.85.

Which of the following is most appropriate to say about Nathaniel's approach? (Mark ONE answer.)

- a) It happens to work in this case, but will not work for most problems.
- b) It only works if one of the numbers is a whole number.
- c) It works for any numbers, but some examples are harder to estimate.
- d) It works equally well for all problems.
- e) I'm not sure.

8. Ms. Barber was reviewing her students' division homework and saw that Chad used the following non-standard approach to divide 127 by 7:

**127 divided by 7.**

$$\begin{array}{r} 10 \\ 7 \overline{)127} \\ \underline{-70} \\ 57 \end{array}$$

$$\begin{array}{r} 8 \text{ R } 1 \\ 7 \overline{)57} \\ \underline{-56} \\ 1 \end{array}$$

$$\begin{array}{r} 10 \\ + 8 \text{ R } 1 \\ \hline \boxed{18 \text{ R } 1} \end{array}$$

What is true about Chad's approach?

- a) His approach is not mathematically valid; it is a coincidence that his answer is correct.
- b) His approach is not mathematically valid because he subtracted 70 from 127 instead of subtracting 7 from 12.
- c) His approach is mathematically valid, but could be inefficient with large dividends.
- d) His approach is mathematically valid, but only works with single-digit divisors.
- e) I'm not sure.

9. Mr. Lewis was surprised when one of his students came up with a new procedure for subtraction (pictured below), and he wondered whether it would always work. He showed it to Ms. Braun, next door, and asked her what she thought.

$$\begin{array}{r} 37 \\ - 19 \\ \hline - 2 \\ 20 \\ \hline 18 \end{array}$$

How do you think Ms. Braun should respond? (Mark ONE answer.)

- a) She should tell Mr. Lewis the procedure works for this problem but would not work for all numbers.
- b) She should tell him this does not make sense mathematically.
- c) She should let Mr. Lewis know that this would work for all numbers.
- d) She should say that this procedure only works in special cases.
- e) I'm not sure.

10. When learning about multi-digit subtraction, Mrs. Jackson's class encounters the following problem:

$$\begin{array}{r}
 2916 \\
 \cancel{306} \\
 - 97 \\
 \hline
 209
 \end{array}$$

A student answers "209" by completing the problem on the board as shown above. Mrs. Jackson wants to ensure that other students understand **why the procedure works**, and asks another student to explain this answer. Which explanation(s) should she feel comfortable accepting as evidence this student understands why the procedure works? (Mark YES, NO or I'M NOT SURE for each.)

	Yes	No	I'm not sure
a) You can't take 7 from 6, so you cross out the 0 and make it a 9, and the 6 becomes a 16, and then cross out the 3 and it becomes a 2. Then I take away. 16 take away 9 is 7, 9 take away 9 is 0, and you just have 2.	1	2	3
b) I regrouped 306 to be 2 hundreds, 9 tens, and 16 ones. That's the same amount as 306. Then I could do the problem. I took away 7 from 16, and I took away 9 from 9.	1	2	3
c) I borrowed from the tens place to make the 6 a 16. But since it was a 0, I had to borrow again from the hundreds place, making the 3 a 2. Then I just subtracted.	1	2	3

11. Mrs. M assigned the following problem to her students:

**Use base ten blocks to show the number 16.**

What response are students least likely to give? (Mark ONE answer.)

- a) One tens rod, six cubes
- b) One cube, six cubes
- c) 7 cubes in a pile
- d) 16 cubes in a pile
- e) I'm not sure

12. Suppose you give the following problem to a child who does not yet know how to multiply:

**Miguel has 3 packs of gum.  
There are 5 sticks of gum in each pack.  
How many sticks of gum does Miguel have?**

Which of the following is she least likely to do? (Mark ONE answer.)

- a)  $3 + 3 + 3 + 3 + 3 = 15$
- b)  $5 + 5 + 5 = 15$
- c)  $3 + 5 = 8$
- d) 1, 2, 3, 4, 5; 6, 7, 8, 9, 10; 11, 12, 13, 14, 15
- e) She would be equally likely to do any of these.
- f) I'm not sure.

13. Some students were trying to estimate the answer to the problem:

$$82 \times .53 =$$

Which of the following mistakes would you most likely see elementary school students making? (Mark ONE answer.)

- a) Getting an answer of 0 by rounding off .53 to 0 and rounding off 82 to 80.
- b) Getting an answer of 80 by rounding off .53 to 1 and rounding off 82 to 80.
- c) Getting an answer of 83 by adding .53 to 82 and rounding up.
- d) Getting an answer of 100 by rounding .53 to 100 and 82 to 100 and doing nothing more.

14. You are working individually with Bonny, and you ask her to count out 23 checkers, which she does successfully. You then ask her to show you how many checkers are represented by the 3 in 23, and she counts out 3 checkers. Then you ask her to show you how many checkers are represented by the 2 in 23, and she counts out 2 checkers. What problem is Bonny having here? (Mark ONE answer.)

- a) Bonny doesn't know how large 23 is.
- b) Bonny thinks that 2 and 20 are the same.
- c) Bonny doesn't understand the meaning of the places in the numeral 23.
- d) All of the above.

15. Imagine that you are working with your class on multiplying large numbers. Among your students' papers, you notice that some have displayed their work in the following ways:

Student A	Student B	Student C
<b>Method 1</b> $\begin{array}{r} 35 \\ \times 25 \\ \hline 125 \\ + 75 \\ \hline 875 \end{array}$	<b>Method 2</b> $\begin{array}{r} 35 \\ \times 25 \\ \hline 175 \\ + 700 \\ \hline 875 \end{array}$	<b>Method 3</b> $\begin{array}{r} 35 \\ \times 25 \\ \hline 25 \\ 150 \\ 100 \\ + 600 \\ \hline 875 \end{array}$

Which of these students is using a method that could be used to multiply any two whole numbers?

	Method would work for all whole numbers	Method would NOT work for all whole numbers	I'm not sure
a) Method 1	1	2	3
b) Method 2	1	2	3
c) Method 3	1	2	3