BASIC FACTS: Addition & Subtraction

Activity 1: Concrete Materials

Use each of these materials to show the even numbers 0 - 20.

- Cuisenaire rods (Cuisenaire)
- Chips and Loops (set objects)
- Unifix cubes
- Number lines (draw your own)
- Links

1. Which materials do NOT show zero easily?
2. Which materials "easily show 14 as 1 group of ten and 4 ones?
3. Which materials make it "obvious" that 20 is two groups of ten and zero ones?
4. Which materials are structured so that place value concepts are inherent?
5. Distinguish between materials that model a discrete use of number (chips and loops, links...) and a continuous model of number (Cuisenaire rods, number line...).
6. For each material, identify the unit (the representation for one).
7. For each material, represent 8 as a group/length of three and a group/length of five. Which material do you favor? Why?
8. For each material, represent 6 as three groups of 2. Which material do you favor? Why?

Activity 2: Centimeter Materials (Cuisenaire Rods)

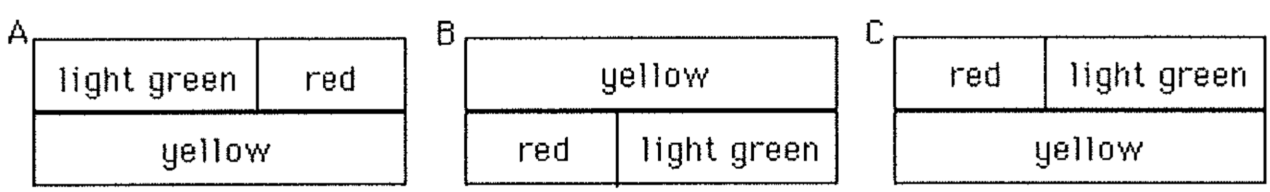
Whole number arithmetic using centimeter rods, a measurement approach to number, is suggested by trains on a track. In this setting, a red-purple train is a different train from a purple-red train, just as the engine-car train differs from the car-engine train.

1. Build all possible 2-car trains as long as the orange rod. Did you build nine different trains? If not, determine the missing or duplicate trains.

2. If the red rod represents the unit, assign three number values to each train (a value to each of the cars and a value to the entire train).

3. Repeat #2 but let the white rod represent the unit. In most whole number arithmetic modeled with Cuisenaire/centimeter rods, it is the white rod that represents the unit.

4. With the white rod as the unit, use three rods to model 2 + 3 = 5.
   Which of the following represents your work?



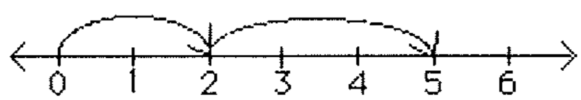
If your work appears as A, you represented 3 + 2 = 5. If your work appears as B, you've represented 5 = 2 + 3. Representation C is correct.

5. Use three rods to model and solve 2 + 3 = _. Number the rods to clarify the order in which you place them on the table. Rephrase this activity in child-like terms.

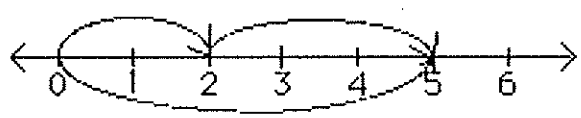
Activity 3: Number lines

Number lines are another measurement approach to number. Some teachers introduce number lines by using colored tape on the floor to model the number line and suggesting crickets, rabbits or kangaroos hopping from a starting place, zero -- "0", in hops of varying length. To model and solve 2 + 3 = _, you and the children might enact a grasshopper starting at "0", taking a hop of length "2", followed by a hop of length "3"; such a grasshopper would be at the same place on the number line as a grasshopper starting at zero and taking a single hop of length "5". That is, don't suggest

and don't suggest



but rather suggest



Model 7 - 2 = _ on the number line. In what ways is the dialogue similar to that for addition problems; in what ways does the dialogue differ?

Model 7 - _ = 4 on the number line. What are the advantages/disadvantages of solving a missing addend subtraction problem on the number line?

Activity 4: More Concrete Materials

Use the prescribed material to solve each open sentence. Maintain records of how the various materials are used. Think through the dialogue you could use with first- and second-grade children.

<u>Chips and Loops:</u>	4 + 3 = _	4 + 0 = _
	4 - 3 = _	4 - 0 = _
<u>Number line:</u>	6 + 2 = _	6 + 0 = _
	6 - 2 = _	6 - 0 = _

Cuisenaire rods:	4 + 5 = _	8 + 5 = _
	8 - 5 = _	13 - 5 = _

Use the Cuisenaire rods to show all basic addition facts with 9 as the sum.

Grid paper:	4 + 6 = _	9 + 5 = _
	9 - 5 = _	14 - 5 = _
Unifix cubes:	3 + 4 = _	8 + 3 = _
	4 - 3 = _	11 - 3 = _
Links:	2 + 3 = _	7 + 4 = _
	3 – 2 = _	11 - 7 = _

Activity 5: Number Properties

1. Show that (1 + 2) + 3 = 1 + (2 + 3) is NOT "easily" suggested on the number line whereas it can be easily suggested with centimeter rods. What mathematical property is being established?

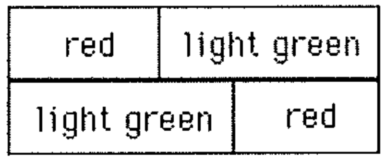
2. Show that 0 + 2 = 2 + 0 can be "easily" suggested with the number line but NOT with the centimeters rods. What mathematical property is being suggested?

3. Which of these materials can "easily" suggest the identity property of addition?

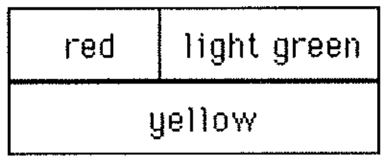
chips/loops	number lines	grid paper
centimeter rods	unifix cubes	

4. How many different ways can you put 10 chips in two rings? Repeat the activity using unifix cubes rather than the chips/loops originally suggested. What are the advantages of each material? Disadvantages?

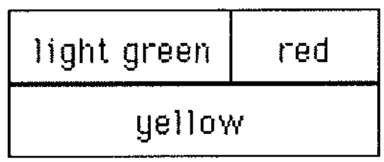
5. To show the commutative property of addition with Cuisenaire rods for $2 + 3 = 3 + 2$, it is adequate to show



rather than to show



and also to show



Discuss with your partner the mathematical differences between these two uses of concrete materials to suggest the commutative property of addition.

How might you suggest the commutative property of addition using unifix cubes? Illustrate a sequence of steps to establish this property of addition.

Digit Deal

Digit Deal is a game for two players.

Materials: One set of digit cards (0 - 9) or digit dice (3 dice numbered 0 - 6, 4 - 9, 2 - 7) for each player.

Rules:
1. Mix cards - deal 3 to each player OR players toss the three dice for their turn.
2. Use all three of your digits, once each.
3. Make the best answers you can for each condition below (some may be impossible.)
4. Score one point for the player with the "best" answer.

	Player 1	Player 2	Best
1. Largest possible number			
2. Smallest possible number			
3. Number closest to 309			
4. Largest even number			
5. Smallest multiple of 3			
6. Even number closest to 501			
7. Odd number closest to 300			
8. Smallest number between 620 & 720			
9. Largest number between 351 & 451			
10. Smallest odd number between 711 & 811			

Of the ten conditions given, identify those most difficult for third grade students.
Identify 3 mathematical topics incorporated into this game.
Create 5 new conditions that might be appropriate for the grade you teach.

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Yorktown Elementary MST Magnet School
4th Grade Math Lesson Plan – Rounding

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Context: This lesson is designed for a 4th grade class at Yorktown Elementary Mathematics, Science, and Technology Magnet School. This inclusion class contains 24 students, 10 of which have learning disabilities. It is co-taught by a 4th grade teacher and a special education teacher. This is the initial lesson on rounding.

Objective: Students will round three digit whole numbers to the nearest 10 and 100.

SOL: SOL 4.1 The student will round whole numbers expressed through millions to the nearest thousand, ten thousand, and hundred thousand.

Materials/ Resources: Sheets of paper numbered from 0 – 100 by tens, placed across the room
Rounding Mountain with marble
Post-it Notes or Erasable Overhead Marker
File cards or slips of paper with two digit numerals

Content and Instructional Strategies:

1. Introduce the need for rounding using some scenario familiar to students such estimating totals. We will start rounding to 10s and 100s and then move larger.
2. Demonstrate how the "Math Rounding Mountain" works when rounding to the nearest hundred. Label places on the mountain 0, 10, 20, 30, etc. Assign "50" just off the peak of the mountain. Ask the students to locate about where 37 would be on the mountain and predict whether a marble placed there would roll to the 0 or to the 100. Try it. Discuss which way does the marble roll? And why?
3. Select random students to round a two-digit number which they draw from the pack of file cards to the closest 100. Check student's answer with the help of a marble on the math mountain.
4. Practice: Call the students' attention to the numerals displayed along one wall and how they are similar to the numerals on the rounding mountain. Tell them that we are going to practice rounding to the nearest 10 and the nearest 100. Divide the class into teams of two. Have a team draw a card with a two-digit number on it, discuss which two numbers on the wall that number is between, stand between those two numbers, and then move to the nearest 10. After explaining why they chose that number to round to, have then move to the nearest 100 and explain. Repeat with several teams.
5. The student will complete a worksheet where several numbers are given. The student will write the two numbers that the given number is between and lastly circle the number that the number would be rounded to. The student will work with a partner to discuss why he/she chose the number that they thought their number should be rounded. The teacher will rotate as this discussion is taking place and listen to the students' responses.
   Ex: 20 26 30 (Then circle the numeral 30.)
6. The teacher will lead a whole group discussion, asking the students to tell what they learned about rounding and to create a rule to describe what they had been doing.
   Step one: Find the digit in the place to which you are rounding.
   Step two: Look at the digit to the right. Round down, if the digit to the right is less than 5. Round up, if the digit to the right is 5 or greater.

7. Sample summary questions
    1. When you stood between your two numbers how did you decide they were correct?
    2. How did you decide which number you should round to?
    3. What is the most important thing you learned today about rounding?
    4. What rule can you use?

Evaluation: Exit Card

Same directions as practice

_______ 52 _______

Differentiation and Adaptations: Having the students work in teams of two with one special education student and one non-special education student will provide support for the special education student. If necessary, the partner could be the teacher.

The amount of practice can be adjusted depending on the needs of the students.

Reflection: Instead of starting with the rule for rounding, the rule is developed as a result of experience. Note that the "5" on the Rounding Mountain is offset so that the marble will roll to the larger number.

Using the Rounding Mountain

Rounding to the Nearest Ten:

Write the tens that the number is between. Then circle the number that the number would round to if you are rounding to the nearest ten.

Example: _____ 26 _____

_20_ 26 _30_ Then circle the numeral 30.

_____ 114 _____ _____ 22 _____ _____ 85 _____

_____ 9 _____ _____ 55 _____ _____ 141 _____

_____ 326 _____ _____ 73 _____ _____ 920 _____

_____ 458 _____ _____ 84 _____ _____ 452 _____

Rounding to the Nearest Hundred:

Write the hundreds that the number is between. Then circle the number that the number would round to if you are rounding to the nearest hundred.

_____ 114 _____ _____ 22 _____ _____ 85 _____

_____ 9 _____ _____ 55 _____ _____ 141 _____

_____ 326 _____ _____ 73 _____ _____ 920 _____

_____ 458 _____ _____ 84 _____ _____ 452 _____

Place Value, Addition, and Subtraction

Activity 1: And Nine More

For each material, represent 93. Building on that representation, then show "and nine more". Describe commonalties and dissimilarities between the various materials emphasizing the transition between the original and final representations.

Popsicle sticks	Dienes Base 10 Materials (units/rods/flats/blocks)
Money	Chip trading materials (colored chips)
Cuisenaire rods	Links

Activity 2: Renaming

This lab emphasized a variety of materials and the transitions from ones to tens to hundreds to thousands and also the transitions from hundreds, to tens, to ones. Be sure you can easily use the materials in Activity 3 to show 123 as 123 ones, then as 12 tens and 3 ones, then as 1 hundred, 2 tens and 3 ones; and also 123 as 1 hundred, 2 tens, and 3 ones, then as 12 tens and 3 ones, then as 123 ones.

Identify a specific computational exercise which would require showing 100 first as 1 hundred, then as 10 tens, and finally as 9 tens and 10 ones.

Activity 3: Increasing Abstraction

Establish at least a partial ordering from least abstract to most abstract for these materials when place value concepts are considered.

Cuisenaire materials	Popsicle sticks and bands
Dienes materials	Bean sticks
Colored chips	Centimeter grid paper
Money	Abacus

Activity 4: Classification

Some place value materials are proportional (e.g., Dienes materials) and some are non-proportional (e.g., money). Other place value materials can be classified as collectable (e.g., popsicle sticks & bands) and exchangeable (e.g., colored chips). Wherever possible, classify the materials below as proportional/non proportional and as collectable/exchangeable.

Popsicle sticks	Dienes Base 10 Materials (units/rods/flats/blocks)
Money	Chip trading materials (colored chips)
Abacus	Centimeter grid paper
Bean sticks	Centimeter/Cuisenaire base ten materials

Background: Definition

Algorithm: A systematic procedure for finding the result of an operation on two numbers when the result is not apparent.

Activity 5: Concrete Materials for +, -

By the end of this laboratory session you should be able to use a variety of physical materials to solve these problems using standard algorithms and to justify each step of that procedure. In your lab notes record pictorially and symbolically each major step of the solution.

$$\begin{array}{r} 85 \\ +27 \\ \hline \end{array} \qquad\qquad \begin{array}{r} 85 \\ -27 \\ \hline \end{array}$$

- •Popsicle sticks
- •Colored Chips
- •Centimeter materials
- •Unifix cubes
- •Dienes materials
- •Links

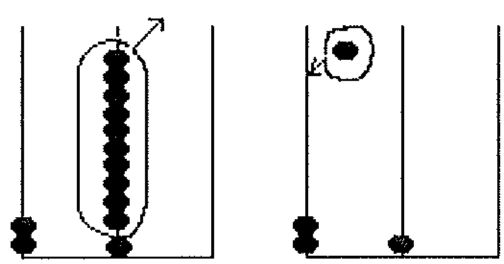
1. Which material(s) are "awkward" to use when solving 85 + 27 = _? Defend your selection.

2. When solving 85 - 27 = _ by the take-away model, what is the least number of materials needed from each set to set-up the problem and solve it?
   Cuisenaire materials _____ Unifix cubes _____
   Popsicle sticks _____ Colored chips _____

3. Subtracting some number from 239 necessitate regrouping. Check the names for 239 that would be used after initial regrouping has been completed.
   ____ 200 + 30 + 9 ____ 200 + 20 + 19 ____ 100 + 130 + 9
   ____ 100 + 120 + 19 ____ 2 + 3 + 9

4. Which of the material(s) are considered <u>proportional</u> models of number?
   ____ Colored chips ____ Unifix cubes
   ____ Cuisenaire materials ____ Dienes materials
   ____ Links ____ Popsicle sticks

5. Using an abacus to ADD two numbers, Sam arrived at the consecutive steps shown below. Which problem was Sam solving?
   ____ 210 + 100 = _ ____ 215 + 95 = _
   ____ 260 + 45 = _ ____ 21 + 10 = _



+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										