

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

Reading and Writing in Math

Kitty Rutherford
 NC Department of Public Instruction
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SELF-ASSESSMENT:

A Journey of Change

PUBLIC SCHOOLS OF NORTH CAROLINA
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Conference description

Come experience how reading, writing, and mathematics comes together in an effective lesson to empower students' mathematical thinking. Explore strategies that actively engage students in meaningful learning that makes a difference in students' mathematics achievement.

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Professional Development Resources	Webinars	Conference Presentations
Elementary (K-5)	Elementary (K-5)	Conferences (K-12)
Secondary (6-12)	Secondary (6-12)	

CCSS for Writing

- Writing standard CCSSI 2010b calls for elementary school students to write across the curriculum, which includes mathematics.
- CCSS1c list three writing types, narrative, which may be more central to other subjects, the definitely remaining two apply to mathematics. Mainly, “an argument is a reasoned, logical way of demonstrating that the writer’s position,... or conclusion is valid” and “informational/explanatory writing conveys information accurately” (p. 24).



Writing & Math

- The process of writing requires gathering, organizing, and clarifying thoughts. It demand finding out what you know and don't know. It calls for thinking clearly.
- Similarly, doing mathematics depends on gathering, organizing, and clarifying thoughts, finding out what you know and don't know, and thinking clearly.

Although the final representation of a mathematical pursuit looks very different from the final product of a writing effort, the mental journey is, at its base, is the same – making sense of an idea and presenting it effectively.

SELF-ASSESSMENT: [mathsolutions.com/documents/2004](#) MATH CONFERENCE ON EXCEPTIONAL CHILDREN
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More Marilyn Burns



Writing in Math

- Innovative teachers can make writing an invaluable part of math instruction.
- Writing in math class supports learning because it requires students to organize, clarify, and reflect on their ideas.
- Incorporating a mix of writing activities gives me broader insights into my students' math experiences.

SELF-ASSESSMENT: [mathsolutions.com/documents/2004](#) MATH CONFERENCE ON EXCEPTIONAL CHILDREN
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Math & Writing Strategies



Writing in Math Class? Marilyn Burns

1. Talk with students about the purpose of their writing.
2. Establish yourself as the audience.
3. Use students' writing in classroom instruction.
4. Have students discuss their ideas before writing them.
5. Provide prompts.
6. Give individual help to students who don't know what to write.
7. Post math word lists.
8. Ask students to revise and edit.
9. Read students' work to evaluate your teaching and to assess progress.

SELF-ASSESSMENT: [http://mathsolutions.com/w](#) MATH CONFERENCE ON EXCEPTIONAL CHILDREN
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Task: Class Party



- Suppose there are 25 students in your class and you have \$10 for a class party.
- Tell how you would spend the money and explain why you would spend it that way. Use as much of the \$10 as you can, but do not spend more than \$10. (There is no tax.) Be sure your plan works for a class of 25.

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Task for 4th GRADE (4-4) (STEP 1) (EAL) CHILDREN



25 students

Class Party

\$10.00 

Item	Cost
pitcher of lemonade (10 servings)	\$2.50
paper cups (package of 24)	69¢
Ice cream bar	30¢
oatmeal cookies	99¢
bag of popcorn (20 servings)	\$1.09
napkins (package of 50)	49¢

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Task for 4th GRADE (4-4) (STEP 1) (EAL) CHILDREN

Every body needs something.

$\$2.50 \text{ lemonade} \times 2 = \5.00

$\$7.50$ that's more than half of $\$10$. Maybe everybody can get half a serving.

$25 \times 2 = 2 \times 12 \frac{1}{2}$

Now I only need 2 pitchers

$2 \times \$2.50 = \5.00

$\$5.00$ is much better. Oh yes, I have $\$5.00$ left. If I also need napkins which are $49¢$ I only need 2 packs.

I have $\$5.00$

$\begin{array}{r} + 49 \text{ more spent} \\ \hline \$5.49 \end{array}$

Now that I have spent $\$5.49$ I have $\$4.51$ left. Now everybody needs something to eat. I think popcorn would be

I have spent $\$5.49$

$= \$1.09$ for popcorn

$= 2 \times \$1.09$

Now I have $\$3.42$ left. But wait, I want to go and see how I want to get pop for the lemonade. I don't need 2 packages.

$\begin{array}{r} 69 \text{¢} \\ + 30 \text{¢} \\ \hline \$0.99 \end{array}$

Oh yes, now I'm good, but I only have $\$2.43$ left. Well, it's not enough to buy popcorn so I'll buy oatmeal cookies.

$\begin{array}{r} 99 \text{¢} \\ + 99 \text{¢} \\ \hline \$1.98 \end{array}$

$\begin{array}{r} \$2.43 \\ + \$1.98 \\ \hline \$4.41 \end{array}$

I have bought everything I need and I have $\$4.41$ left. Now we can have the party!

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4th GRADE CONFERENCE ON EXCEPTIONAL CHILDREN

Class Party

750
+ 138
<hr/>
\$888
+ 109
<hr/>
\$997

I need lemonade and since there are only 10 servings in a pitcher I need three pitchers so $2.25 + 2.25 + 2.25 = 7.50$. I have \$2.50 left to spend. Now I need paper cups for the lemonade so $1.39 \times 3 = 4.17$. My party is not a party to eat at. You eat before you come, just in case I will buy a bag of popcorn that has 30 servings. Now if someone gets hungry they have something to eat. I have 3¢ left over.

That's funny!

SELF-ASSESSMENT: ● ● ● ● ● ● ● ●

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Class Party Jan 24

For the pitchers of lemonade I did it served 10 I know that there were 20 students but 2 pitchers cost 4.50 but there were 20 students I added another pitcher which cost 2.25. I didn't care about remaining cost \$7.50. Then I looked at the 10 paper cups which was another \$4.17. I had 20 dollars. I had to pay 2 pitchers and 4.17 for cups. I decided not to buy ice cream bars because $2.25 \times 20 = 45$. Then I looked at the oatmeal cookies. I bought a package of 16 for \$1.99. I doubled it and got 32 which cost \$3.98. After that I looked at the bag of popcorn which cost \$3.99. I thought that was quite a bit. I looked at the raisins a package of 5 for \$1.99. Now in the hand out to add this up $7.50 + 4.17 + 3.98 + 1.99 = 17.64$. I found out that that was to long and went over my budget so I - 1.99 from that and got \$15.65. Then I decided not to buy the oatmeal cookies so I - 1.99 from that which got me \$13.66. Then I knew the only thing I could do was to look for the cheapest numbers to 45 which was 49¢ the Raisins. So I didn't buy the raisins. This is what I would buy for a class party with 20 students!

SELF-ASSESSMENT: ● ● ● ● ● ● ● ●

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What questions could you ask?

Gathering Seashells

The children were picking up seashells at the beach.
The graph shows the number of shells that each child picked up.

	Our Shells								
Katie									
Bridget									
Jackie									
Allison									
Kim									
	1	2	3	4	5	6	7	8	9



SELF-ASSESSMENT: ● ● ● ● ● ● ● ●

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What questions could you ask?

ShIPLEY Aquarium

Admission Cost

Adults - \$8.00

Children (ages 3 and over) - \$6.50

Children (ages 2 and under) – Free



Headline Stories

- Headlines sum up a story.
- Equations are like newspaper headlines—short and to the point.
- Equations are connected to word problems the same way a headline is connected to a news story.
- Using headlines can help you see students' understandings and misunderstandings.



Headline Stories

Solve the equation and write a word problem that goes with it.

$$5 \times 1.5 = n$$

$$n = 7.5$$

$$\begin{array}{r} 5 \\ \times 1.5 \\ \hline 75 \\ 50 \\ \hline 750 \end{array}$$

Shyvester had five honey badgers, Sebastian had 1.5 honey badgers. They were in a contest to see who had the most honey badgers if you multiplied them, how many did they have?



Headline Stories

Solve the equation and write a word problem that goes with it.

$$5 \times 1.5 = n$$

$$n = 7.5$$

$$\begin{array}{r} 2 \\ 15 \\ \times 5 \\ \hline 75 \end{array}$$

You have 5 pets. A dog, cat, hamster, parrot, and turtle. Each pet gets 1.5 cups of food. How many cups of food do you need to feed all the pets?



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Headline Stories

Headline: $52 \div 4 = \square$

Headline stories can be as easy or as difficult as you make them!

Students might be asked to write problems about equations that include fractions, decimals, percents, or variables.

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Teaching and Learning Mathematics

- The rules and procedures of mathematics makes little sense to many students. They memorize examples, they follow the rules/procedures, do homework, and take test, but they do not understand what it means.
- It's great to get the answer, but what good is it if you can't explain it to anyone? apply it? understand it?
- Getting started: Describe what we did in class or discuss the most difficult problem.

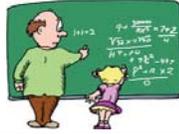
Courtneyman, J. (1992). *Writing To Learn Mathematics: Strategies That Work*. Heinemann, 361 Hanover St., Portsmouth, NH 03801-3912.

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Translate using Symbols

- 4 dollars and 10 cents is greater than 4 dollars and 5 cents
- One-fourth of 16 is 4
- Doubling a number then adding six more



Translate the Symbols

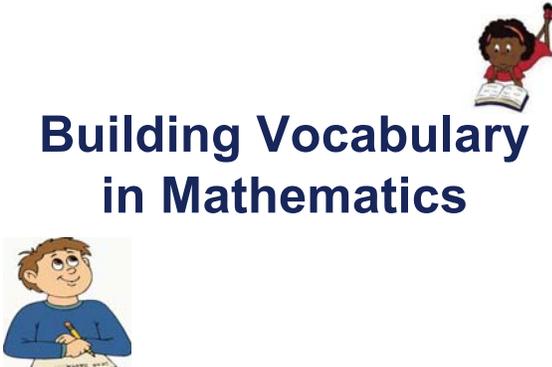
- $12 = 7 + 5$
- $4 + x = 6$
- $3 \times 4 > 2 \times 5$



Which Is More Challenging?

- | | |
|--|-----------------------------|
| • 4 dollars and 10 cents is greater than 4 dollars and 5 cents | • $12 = 7 + 5$ |
| • One-fourth of 16 is 4 | • $4 + x = 6$ |
| • Doubling a number then adding six more | • $3 \times 4 > 2 \times 5$ |





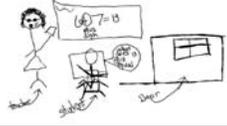
Building Vocabulary in Mathematics

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Learning math is like learning a new language...

Students may excel in computation, but their ability to apply their skills will suffer if they do not understand the math vocabulary used in instructions and story problems. One of the strategies used in this study to strengthening students' ability to communicate mathematically was the modified Frayer model.



Visual Vocabulary	
<p>Word: Addition</p> <p><i>a mathematical operation in which the sum of the number of items is calculated by adding them together</i></p>	<p>Example: 2+3</p>
<p>Picture:</p> 	<p>Homophone: 4-5</p>

Bruun, F., Diaz, J.M., & Dykes, V.J. (2015). The Language of Mathematics. *Teaching Children Mathematics*, 21(9), 530-538.

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Learning math is like learning a new language...



Visual Vocabulary	
<p>Word: Subtraction</p> <p><i>the operation or process of finding the difference between two numbers, using the formal sign</i></p>	<p>Example: 10-2</p>
<p>Picture:</p> 	<p>Homophone:</p>

Bruun, F., Diaz, J.M., & Dykes, V.J. (2015). The Language of Mathematics. *Teaching Children Mathematics*, 21(9), 530-538.

Model used to work on new mathematical vocabulary or review a past mathematical vocabulary. Teachers can check student work for understanding and identify misconceptions.

"Addend means...I 'addend' school everyday" instead of attend school every day.

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A meaningful *driving question* motivates kindergartners to engage...

Dear Children,
 I have a lovely story that I want to surprise some preschoolers with, but I am in a bit of a pickle. I am going to buy one puppet that appears in the story, but I can't decide which one. I was wondering if you could listen to the story and help me decide which puppet to buy.
 Thank you,
 Miss Rice, preschool teacher



Hourigan, M., & Leavy, A. (2016). Practical Problems: Using Literature to Teach Statistics. *Teaching Children Mathematics*, 22(5), 282-291

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Making math meaningful using mathematics vocabulary...

Oral language can affect not only reading proficiency but also math proficiency.

Students were making connections because conversations among partners included specific vocabulary.



"I observed students *attending to precision*, which I had once seen as unattainable."



Pace, M. H., & Ortiz, E. (2015). Oral Language Needs: Making Math Meaningful. *Teaching Children Mathematics*, 22(8), 498-500.

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Task: Listen...



Estimate how much money I have.

- I have less than a one dollar.
- I have more than half a dollar.
- I have all dimes.
- I have more than half a dozen coins.
- I have more than the value of 3 quarters.
- There is an odd digit in the amount I have.

Starters and Stumpers – Marcy Cook

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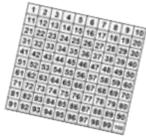
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1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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Estimate how many pieces of paper I have...

- There is enough for every person in the class to have one piece, with some left over.
- It is not a number you hear when counting by tens.
- It is not a number you hear when counting by fives.
- It is between 30 and 70.
- It is less than 50.
- It is more than 39.
- It is even with 2 different digits.
- It is less than 46.



Starters and Stumpers – Marcy Cook

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I estimate how many legs are on all the bugs.

clue1- It is an even number

clue2- The number is more than 90 but less than 99

clue3- The number in the tens place is an odd number, and the number in the ones place is even.

clue4- If you add the ones and the tens together it equals 15

96




Michael

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Recommendations...



- Establish the expectation to write regularly
- Connect oral and written discourse
- Attend to writing task that promote mathematical reasoning
- Focus on mathematical argumentation

Casa, T.M., (2015). The right time to start writing. *Teaching Children Mathematics*, 22(5), 269-271.

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Research Study... Writing to Learn in Math



The Results

Multiplication:	Pre	Post
Test	41%	77%
Control	54%	76%
Geometry:	Pre	Post
Test	17%	70%
Control	23.5%	60.3%

Assignment: What is a plane? What is a line? How are they alike? How are they different?

plane: To go on for ever up and sideways, like a book

line: A line is something that goes straight forever

A line and a plane both go straight forever. They are different because a plane goes sideways too.

Evans, C. S. (1984). Writing to learn in math. *Language Arts*, 828-835.

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Building Vocabulary Sort and Label



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Possible Sort and Label

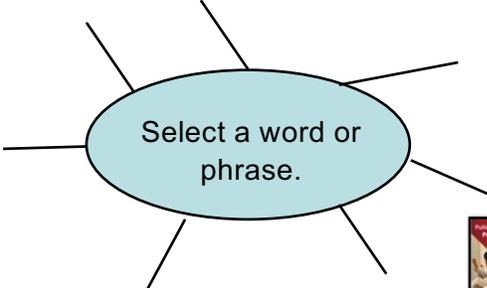
- sum, minus, join, compare, subtract, add, take apart, plus
- pint, foot, measuring cup, ounce, inch, scale, yard, pound, ruler
- square, trapezoid, hexagon, rectangle, rhombus, triangle, pentagon
- expression, equation, addition, operation, inequality, comparison, variable, division



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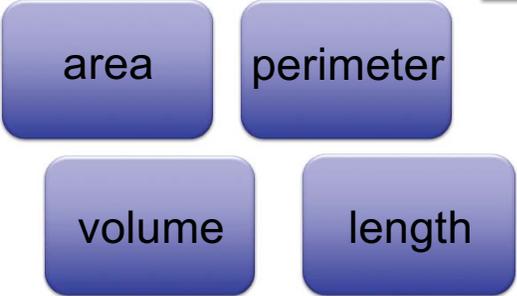
Word Webs

Select a word or phrase.



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Mystery Words



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Let's Create a Number Web!

Select a number.



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Number Web

Number Webs encourage flexibility with numbers.



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Word Boxes

Definition

Picture

Real life example

word

Other words



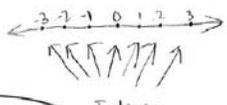
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Definition Two of the exact same pieces Some shapes can be cut more than one way	Picture 
Real life example face butterfly some kites  A	Other words -equal -line of symmetry half -pieces

Symmetry



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Definition A number without decimals or fraction either positive or negative	Picture 
Real life example <ul style="list-style-type: none">• Money• Temperature• Elevation• Football gain/Loss of yards	Other words <ul style="list-style-type: none">• Negative• Positive• Numbers• Addition/Subtraction

Integer



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Building Vocabulary in Mathematics



Watch Out!

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Key Words

“Math is not about decoding clues but about reasoning and making sense of situations.”

“Flexibility in thinking about operations is essential.”



Casa, T.M., (2014). The right time to start writing. *Teaching Children Mathematics*, 21(4), 197-198.

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Avoiding Key Words

- Key words are misleading.
- Many problems have no key words.
- The key word strategy sends a terribly wrong message about doing mathematics.

A sense making strategy will *always* work.

Van de Walle & Lovin (2006)

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+ adding keywords	- subtracting words
sum, equals	difference,
total, altogether	take away, spent
regroup	gave away, gone
	take away, left
* multi. words	÷ divis. words
how much,	divisor, dividend,
times, products,	divide into groups,
factors, repeated	remainders, split,
addition, groups,	share
# of groups	

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Nicole had 100 peices of candy. She divided it up and gave away 10 peices to 5 friends. What is the total ~~of~~ peices Nicole has now?

Mrs. Kitty had 25 pencils in all. 5 students earned a pencils each from Mrs. Kitty for their great math stratigy. What is the total num ber of pencils Mrs. Kitty has now?

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**Make sense of the problem.
Key words don't work...**

4 Kim and Sara sold bags of cookies.

- Each bag had 8 cookies.
- Kim sold 4 bags of cookies.
- Sara sold 5 bags of cookies.

What is the total number of cookies Kim and Sara sold?

A 72
B 60
C 52
D 17

A. 27%
B. 8 %
C. 6%
D. 60%

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**Make sense of the problem.
Key words don't work...**

12 Each of 5 boys ate $\frac{2}{3}$ of a pizza. What is the total amount of pizza the boys ate?

A $4\frac{1}{3}$ pizzas
B 4 pizzas
C $3\frac{1}{3}$ pizzas
D 3 pizzas

A. 12%
B. 66 %
C. 9%
D. 14%

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**Make sense of the problem.
Key words don't work...**

13 There are 24 boxes. Two of the boxes are empty. Each of the other boxes contains 2 erasers. How many erasers are there altogether?

A 22
B 24
C 44
D 48

A. 46%
B. 9%
C. 29%
D. 17%

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**Make sense of the problem.
Key words don't work...**

1 Tammy has 6 vases of tulips. There are 9 tulips in each vase. What is the total number of tulips in the vases?

A 15
B 36
C 54
D 63

A. 22%
B. 2%
C. 73%
D. 3%

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STANDARDS FOR MATHEMATICAL PRACTICE

- 1 Make sense of problems and persevere in solving them.
- 2 Reason abstractly and quantitatively.
- 3 Construct viable arguments and critique the reasoning of others.
- 4 Model with mathematics.
- 5 Use appropriate tools strategically.
- 6 Attend to precision.
- 7 Look for and make use of structure.
- 8 Look for and express regularity in repeated reasoning.

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Speaking in Mathematics



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Eliminate It!

- As a group, decide on the concept that should be eliminated with reasoning or math data to back up your decision.
- There may be more than one way to eliminate an item!
- Create your own.



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Eliminate It



add	subtract
multiply	join
rectangle	cylinder
circle	triangle
21	63
17	84
$y + y + y$	$3y$
y^3	$2y + y$

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Agree or Disagree?

75% is more than $\frac{2}{3}$.

Tell why you agree or disagree.



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Agree or Disagree?

Agree or Disagree?

75% is more than $\frac{2}{3}$.

Tell why you agree or disagree.

I agree that 75% is greater than $\frac{2}{3}$
 75% is the same as $\frac{3}{4}$ because 4 25 make 100
 and 75% is 3 25 $\frac{3}{4}$ is greater than $\frac{2}{3}$.




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Agree or Disagree?

Agree or Disagree?

5 nickels are worth more than 3 dimes.

Tell why you agree or disagree.

I disagree because a dime is worth 10¢ and there are 3.
 $10+10+10=30$. NICKELS ARE WORTH 5¢
 and there are 5 nickels. $5+5+5+5+5=25$. 25¢ is less than 30¢.



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Agree or Disagree?



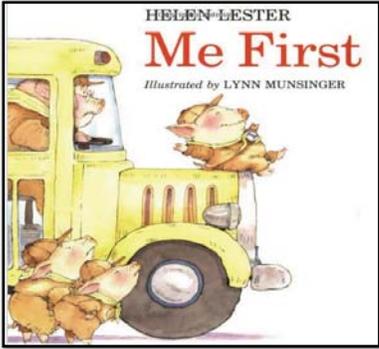
- Jim has 12 pencils and Annie has 8. Jim has more than Annie.
- $7 + 3$ and $4 + 6$ are the only ways to make 10.
- 9 is an even number.
- 6 tens and 3 ones is the same as 5 tens and 13 ones.
- 3 jars of peanut butter for \$7.50 is a better deal than 4 jars of peanut butter for \$10.20.

Reading in Mathematics



CCSS for Reading

- Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.
- Determine the meaning of words and phrases as they are used in a text, distinguishing literal from nonliteral language.



Helen Lester
Me First
Illustrated by LYNN MUNSINGER

<https://www.youtube.com/watch?v=VtBAwjyXFY> Lester, H. (1995). *Me first*. Houghton Mifflin Harcourt.

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Me First!

Pinkerton and his four pink plump friends were getting ready for a trip when 1 fell down. How many pigs were left standing?

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What questions do you have?



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Contact Information



Kitty Rutherford
kitty.rutherford@dpi.nc.gov

Website:
www.ncdpi.wikispaces.net

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**THANK
YOU!**



For all you do for our students!

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