Helping Teachers Connect Assessing Numerical Proficiency and Classroom Instruction

Marilyn Burns

NCSM 2013

Tuesday, 11:15 AM – 12:15 PM

Math Solutions
FOUNDED BY MARILYN BURNS

MRI
Math Reasoning Inventory

Find out what students really understand about math

Funded by the Bill & Melinda Gates Foundation

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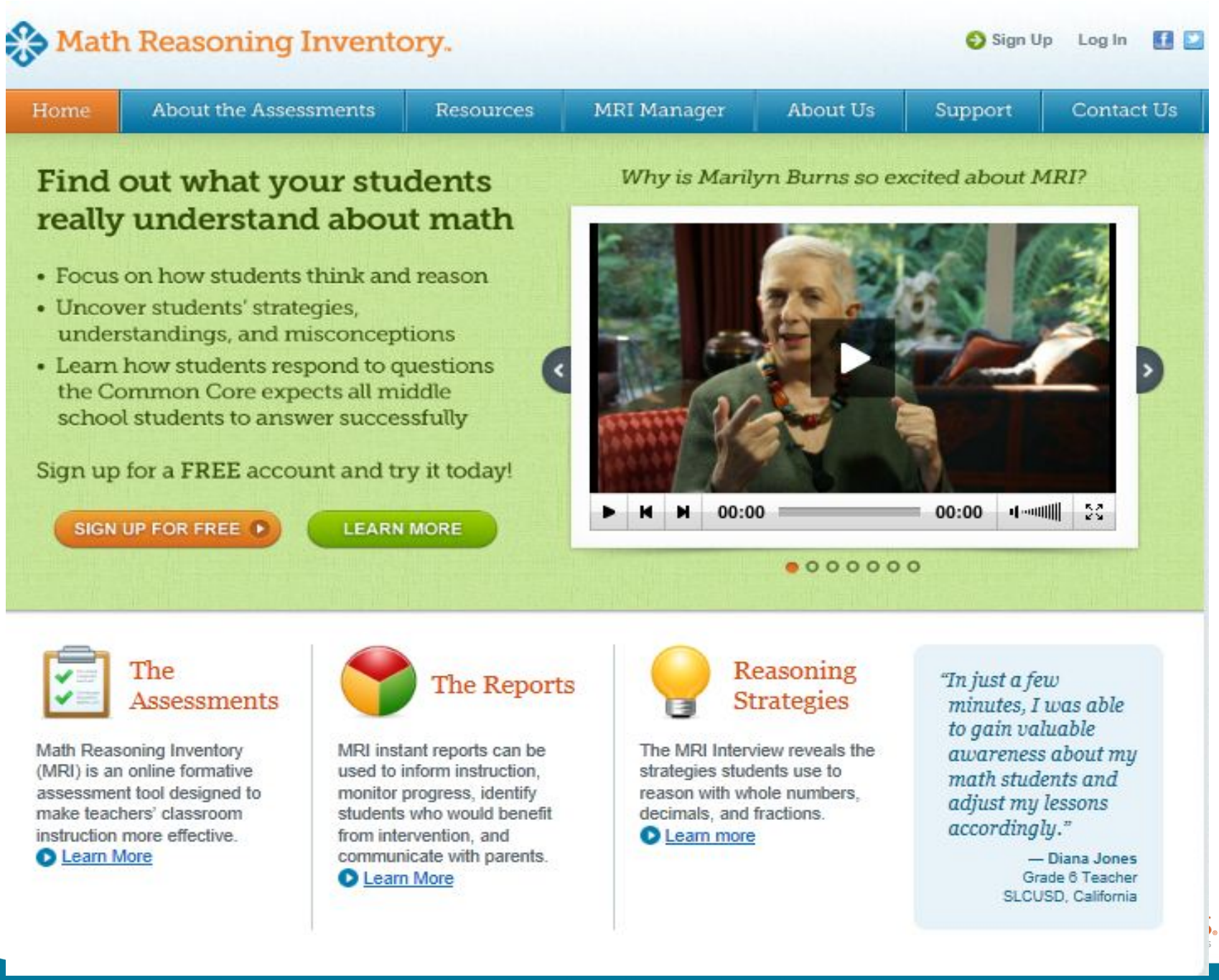

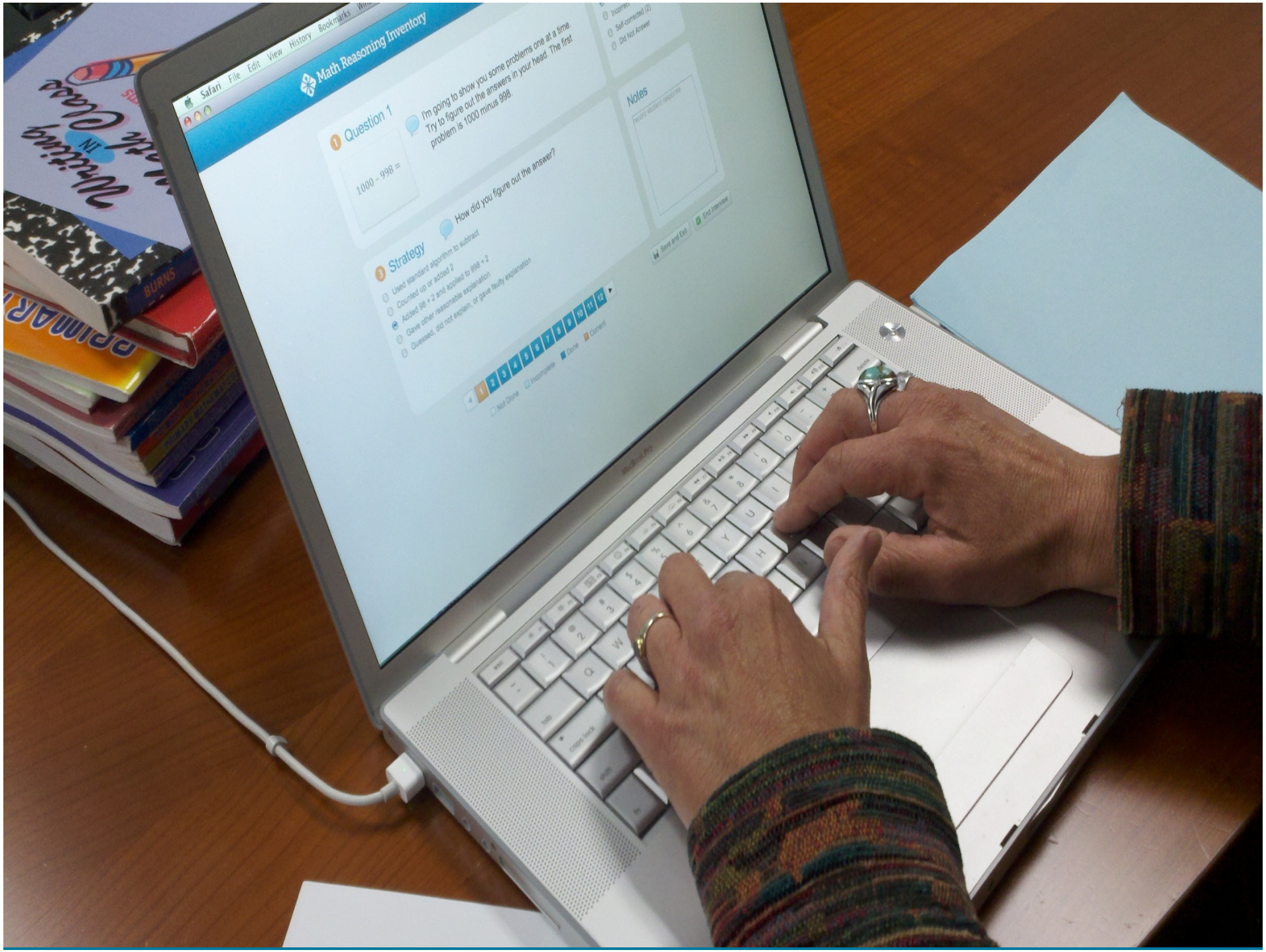
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Question 1
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Added 98 + 2 and applied to 998 + 2
Gave other reasonable explanation
Guessed, did not explain, or gave faulty explanation
Not Done
Incomplete
Done
Current
Save and Exit
End Interview

MRI asks questions that the Common Core expects all students entering middle school to be able to answer successfully.

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Reasoning is the heart of MRI.

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The ***Interview*** is the core of MRI.

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- We ask . . .
- We listen . . .
- We learn . . .

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Using MRI to support professional learning

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Math Reasoning Inventory.

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Resources ▸ Video Library

Video Library

The Video Library includes more than 80 video clips of students answering MRI Interview questions. These are placed throughout the website to provide examples of various MRI features. To locate specific video clips, search by Interview Question or by Student .

SEARCH VIDEOS Search by Interview Question: Select one Search by Student: Natasha

Natasha 06:49
Excerpt of Interview

Natasha 00:22
Compare 4/5, 0.503, and 0.7

Natasha 00:28
12.6 × 10

Natasha 01:43
20 days, 1.5 miles each day

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1. Embed video clips into classroom instruction.
2. Help teachers explore properties of operations.
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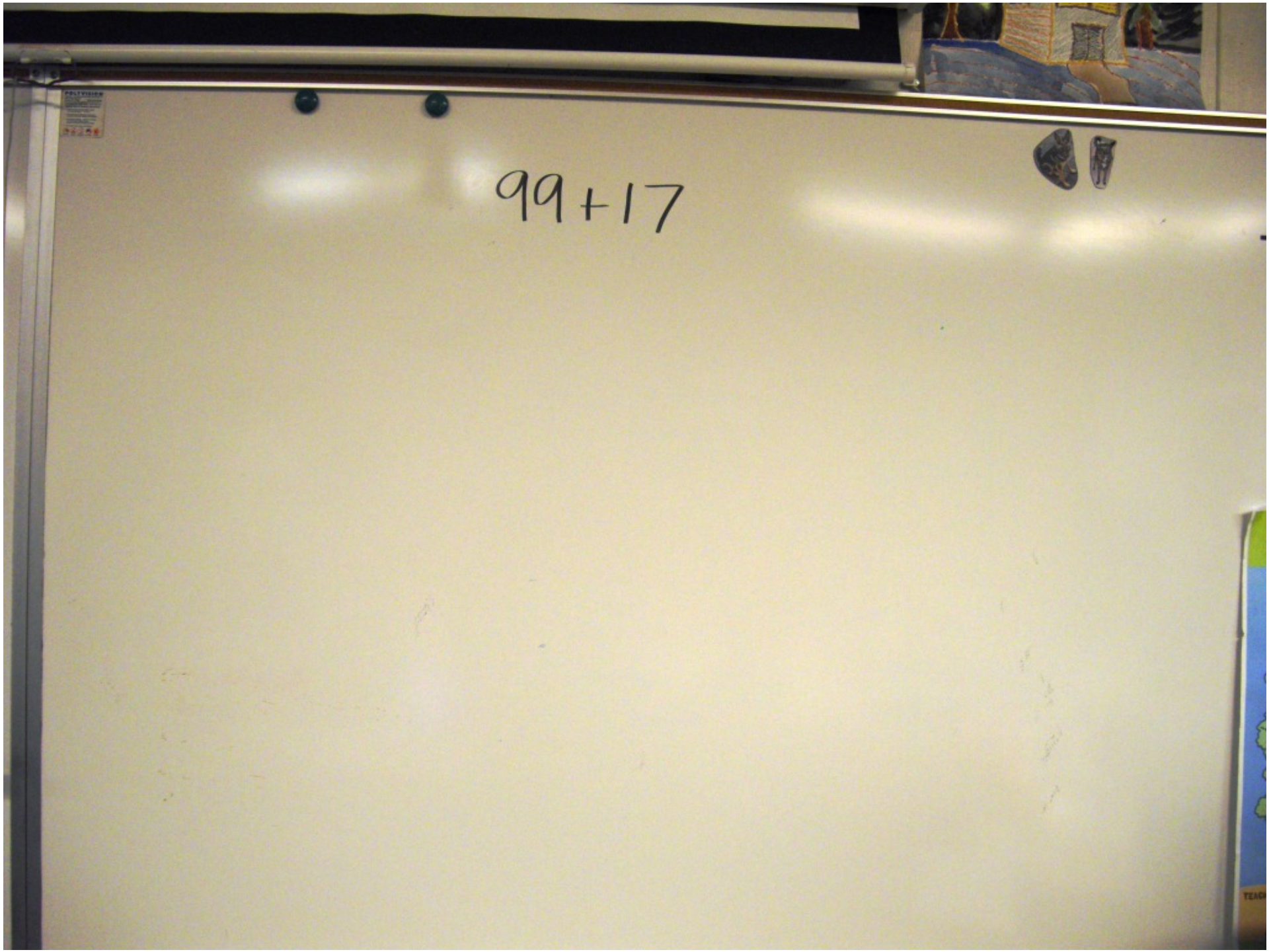
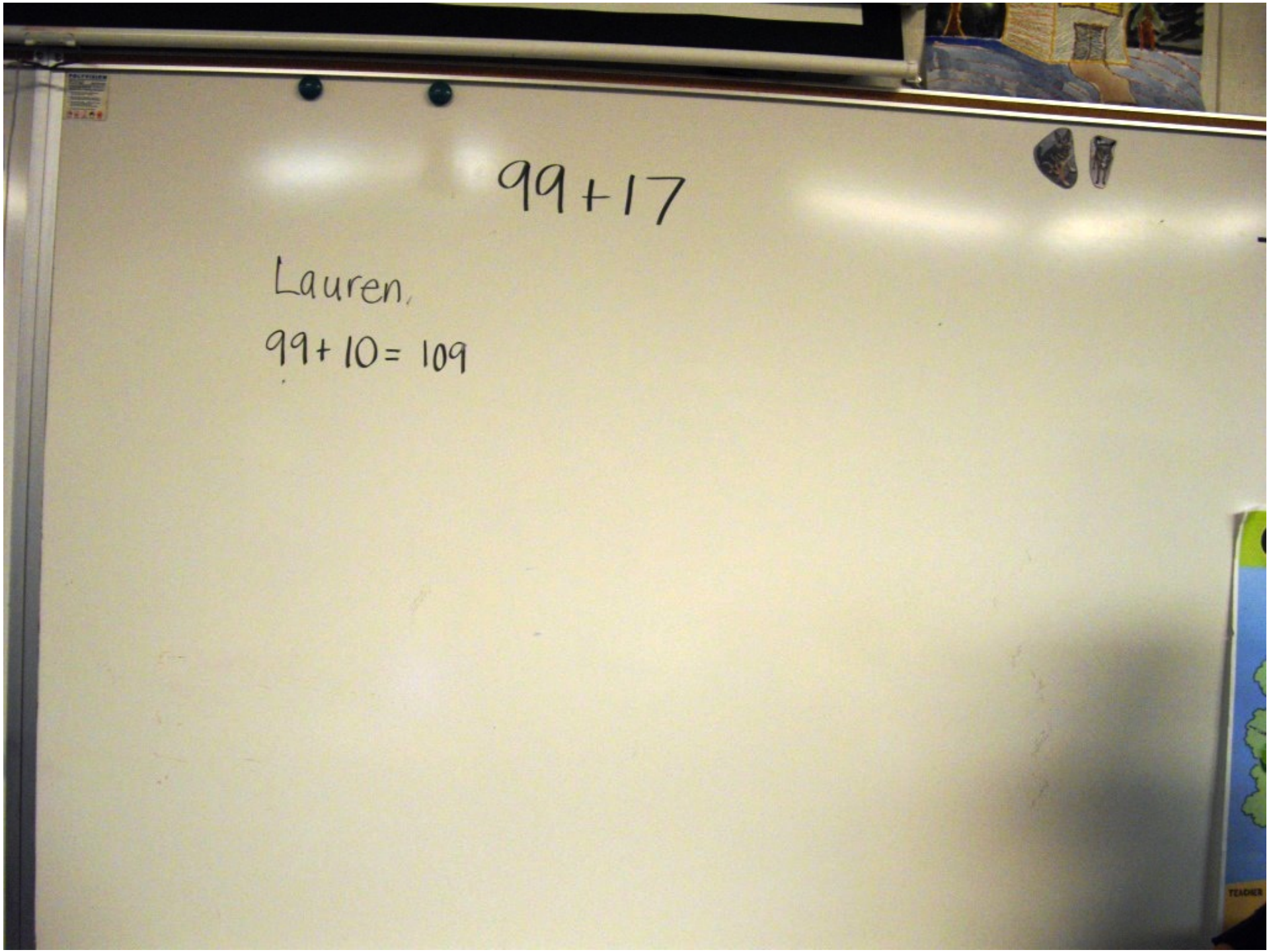

99+17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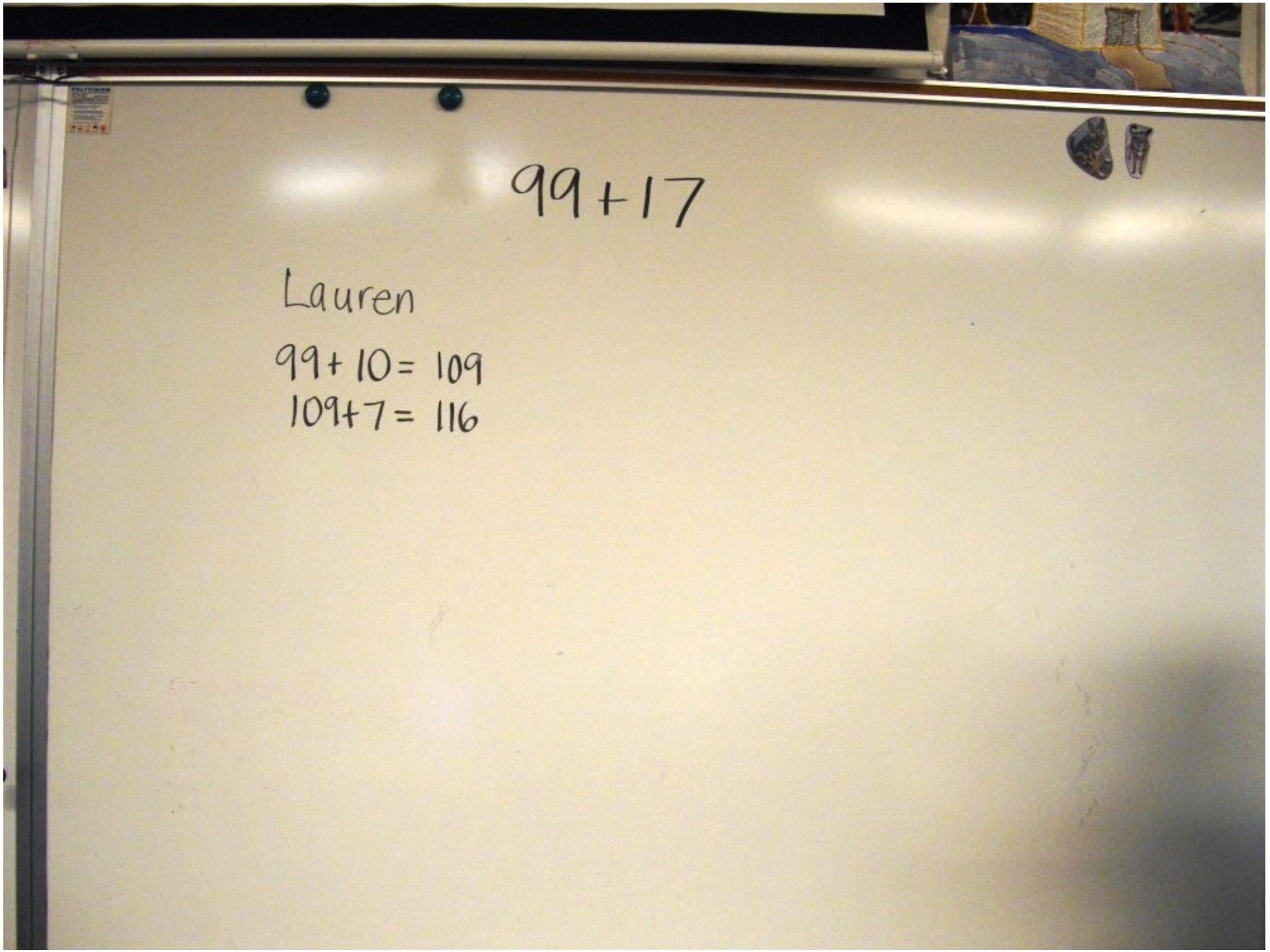
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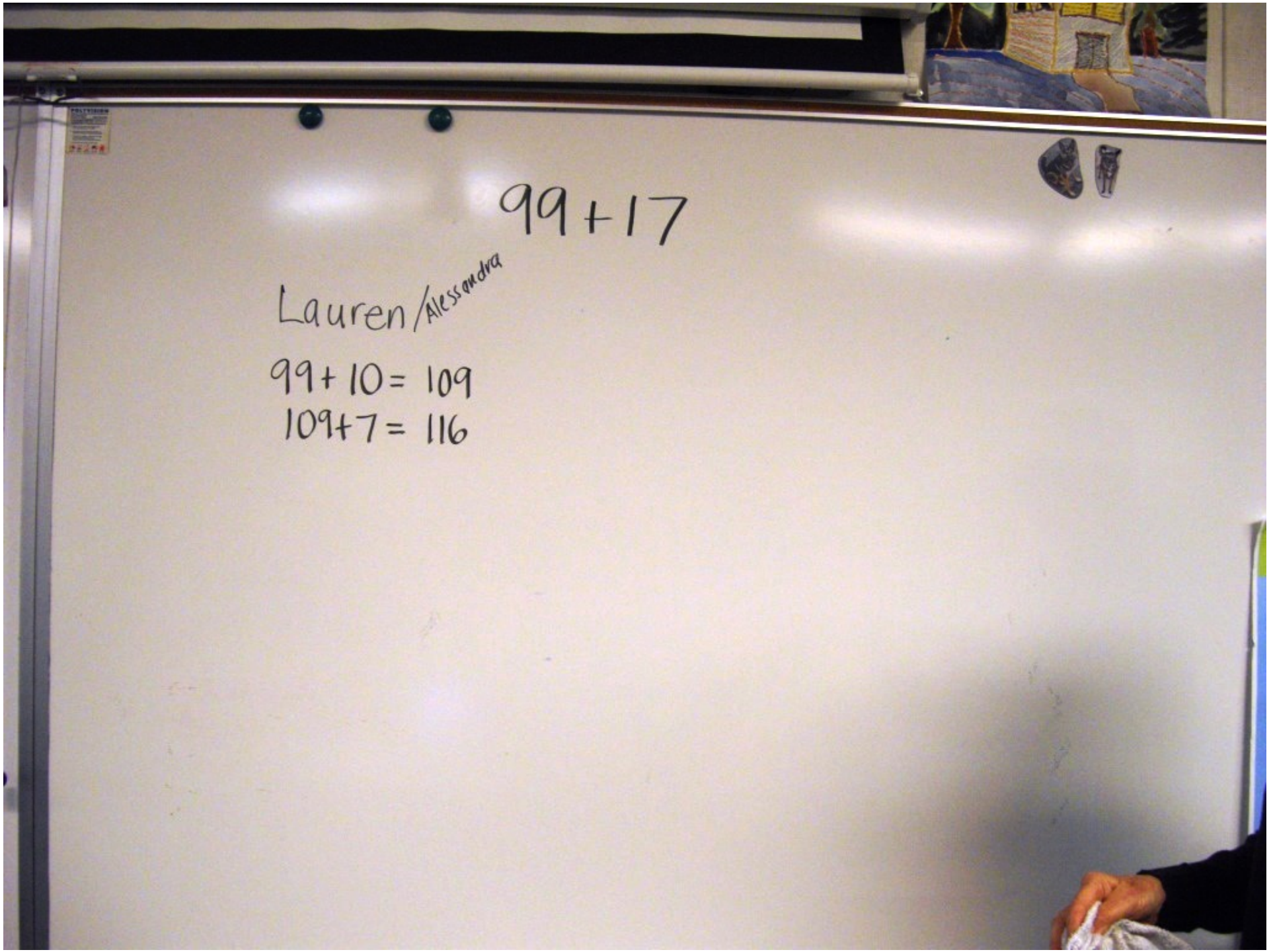
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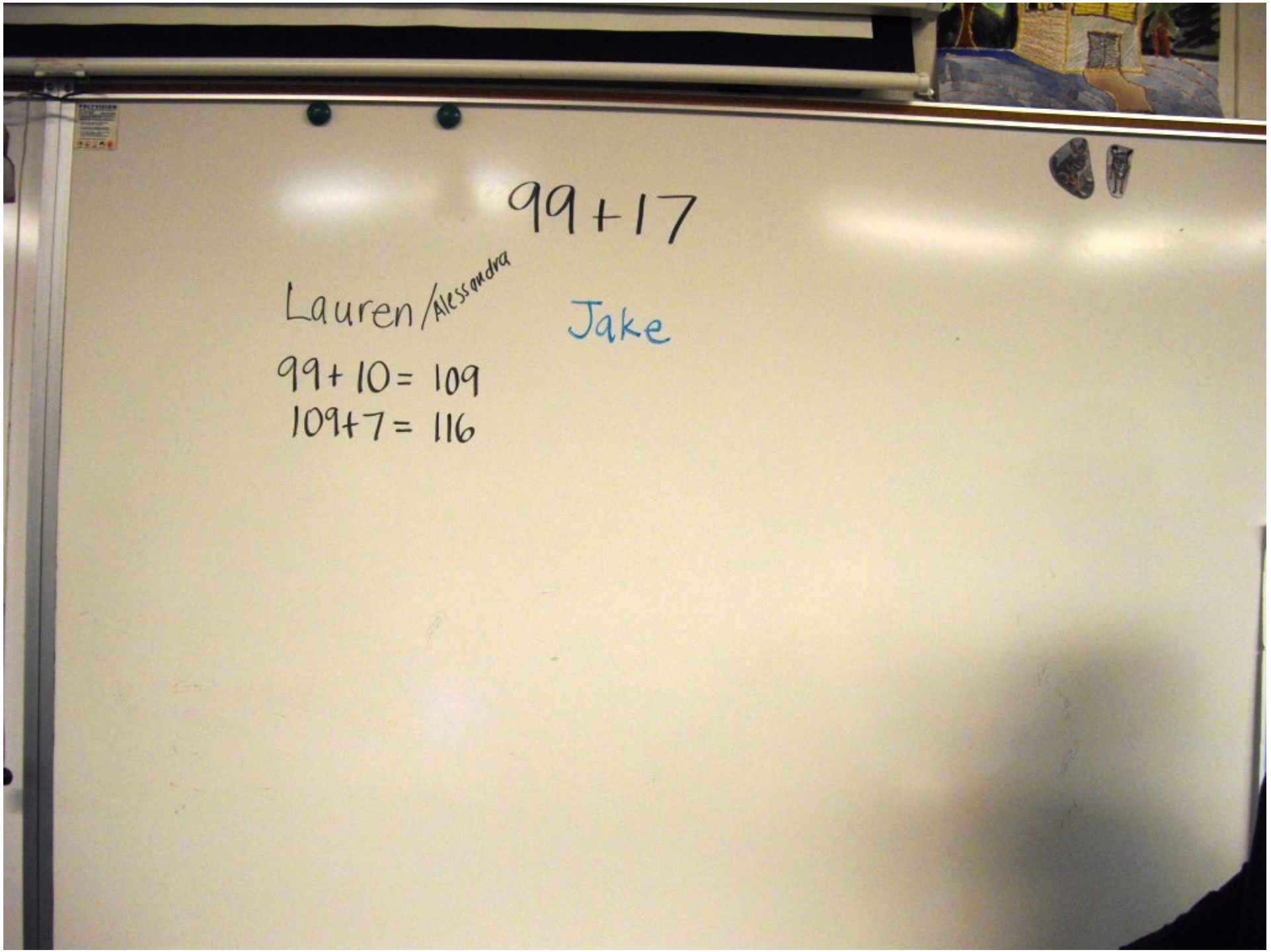
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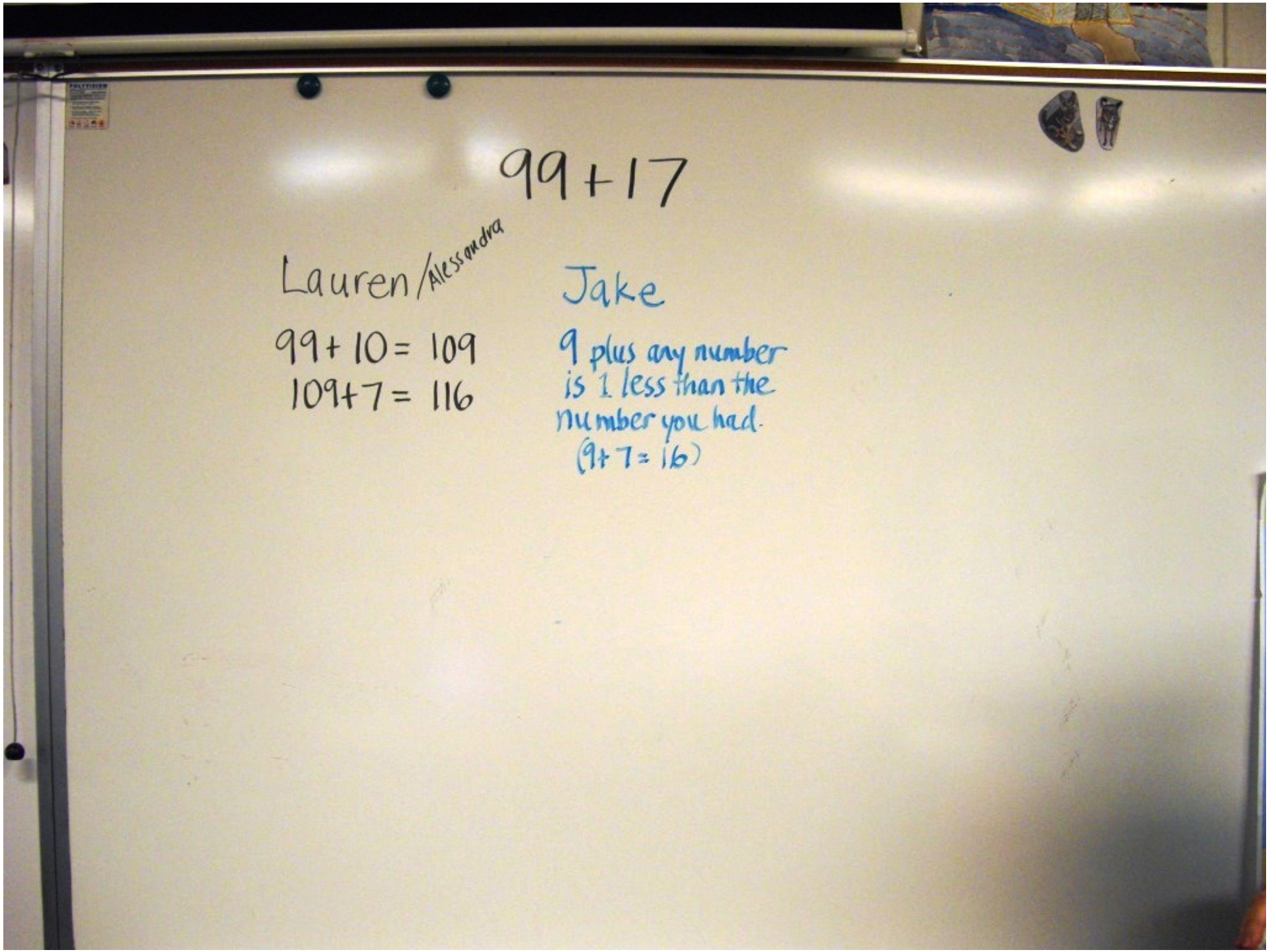
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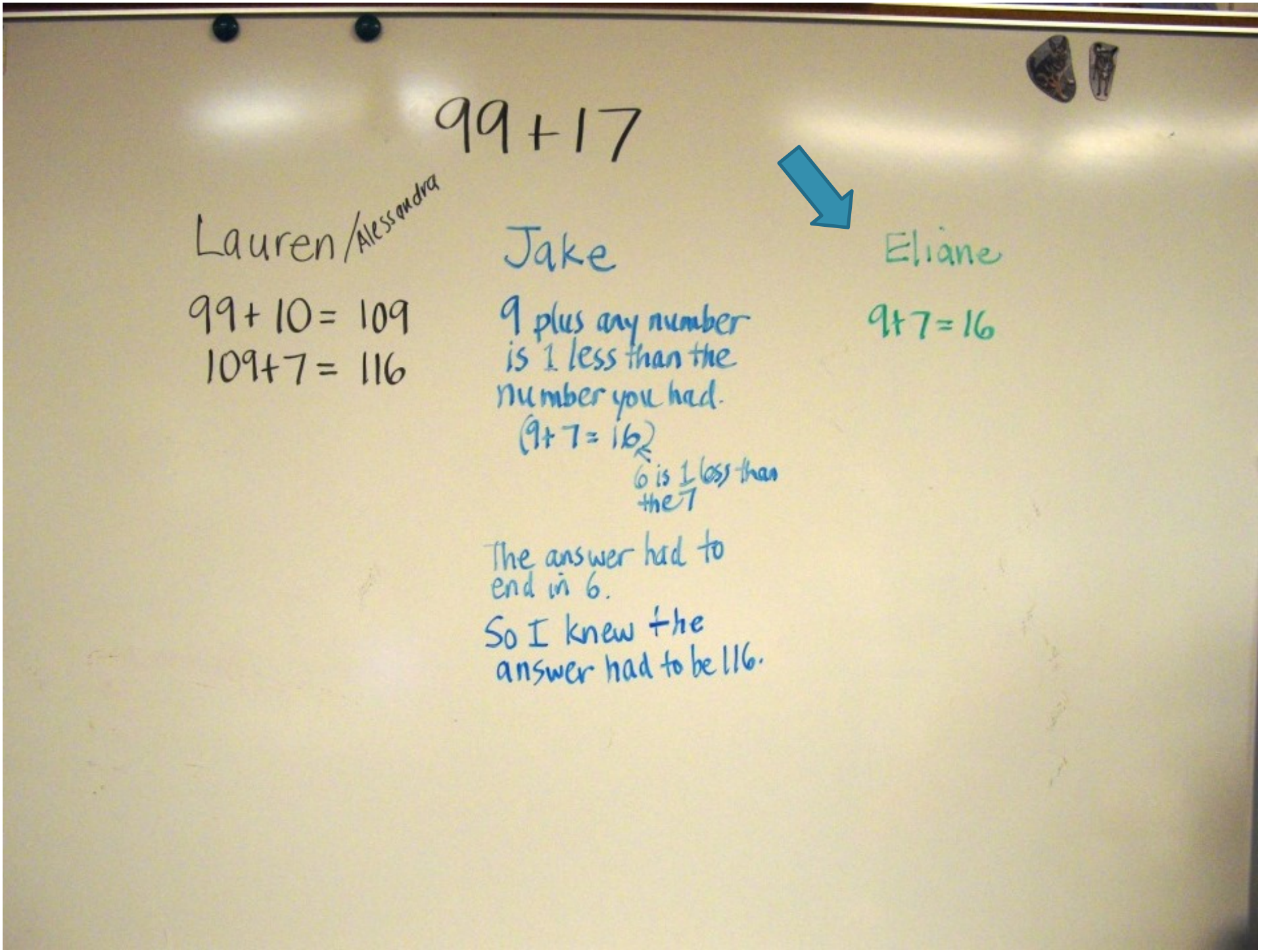
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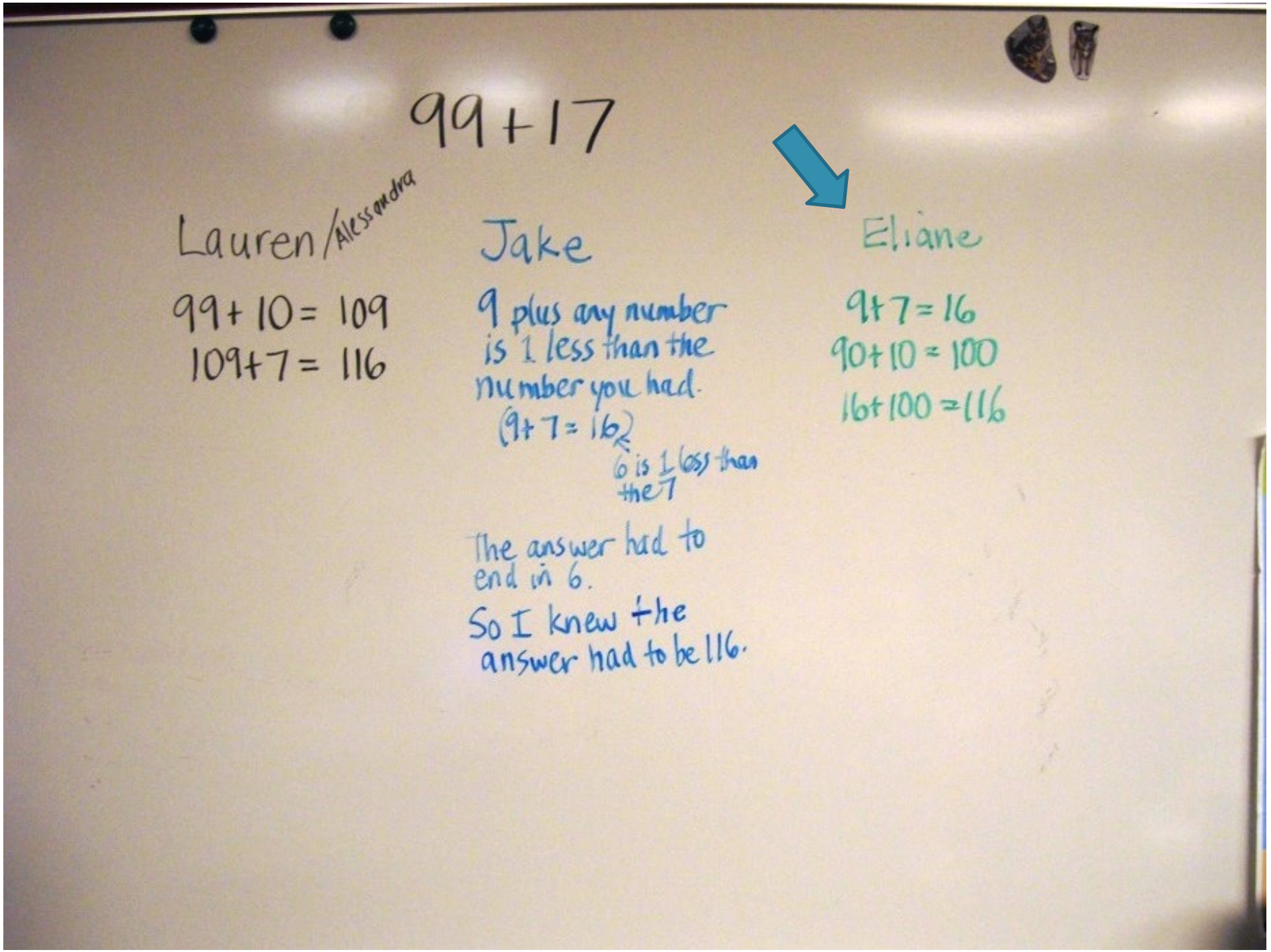
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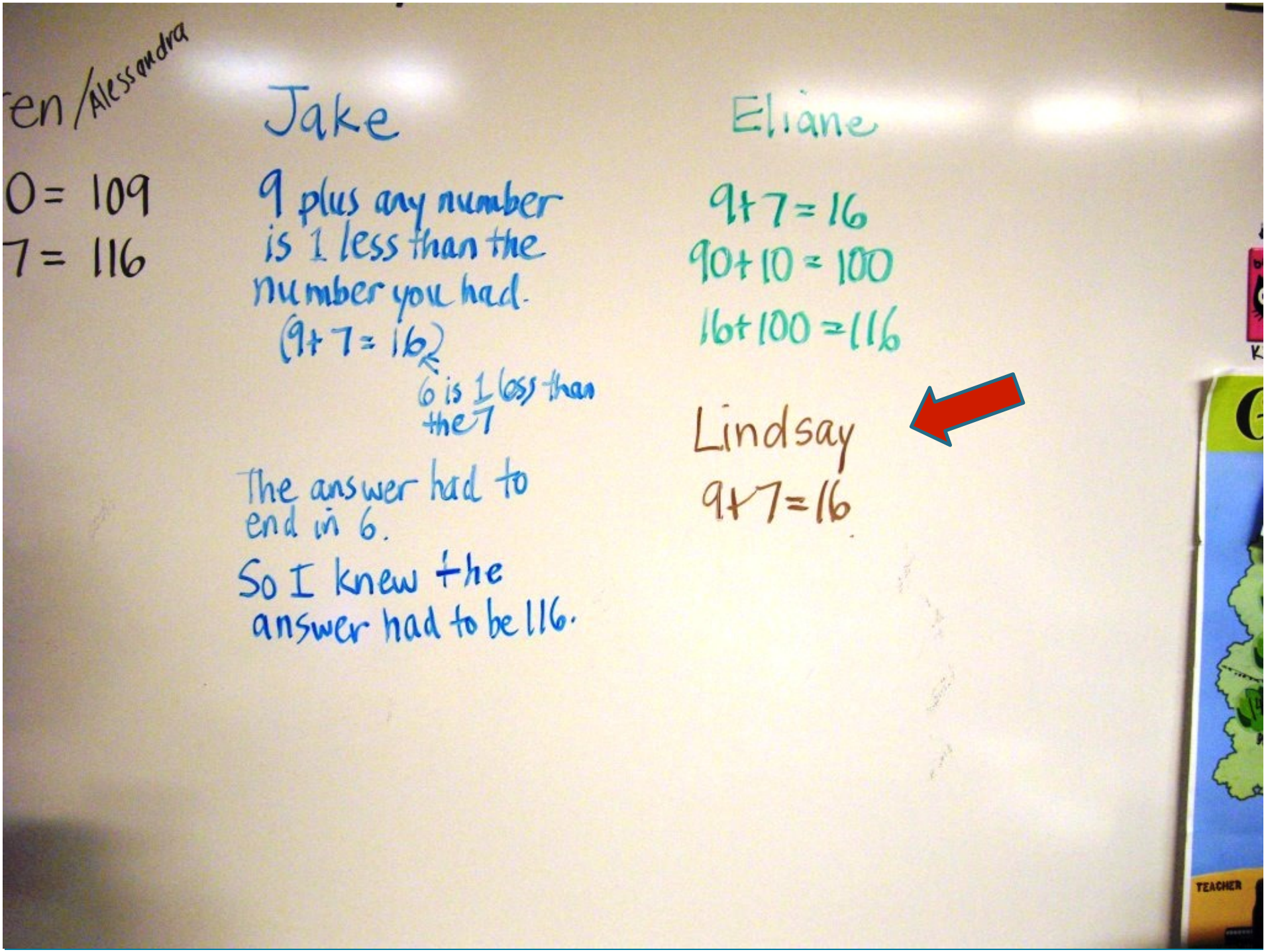
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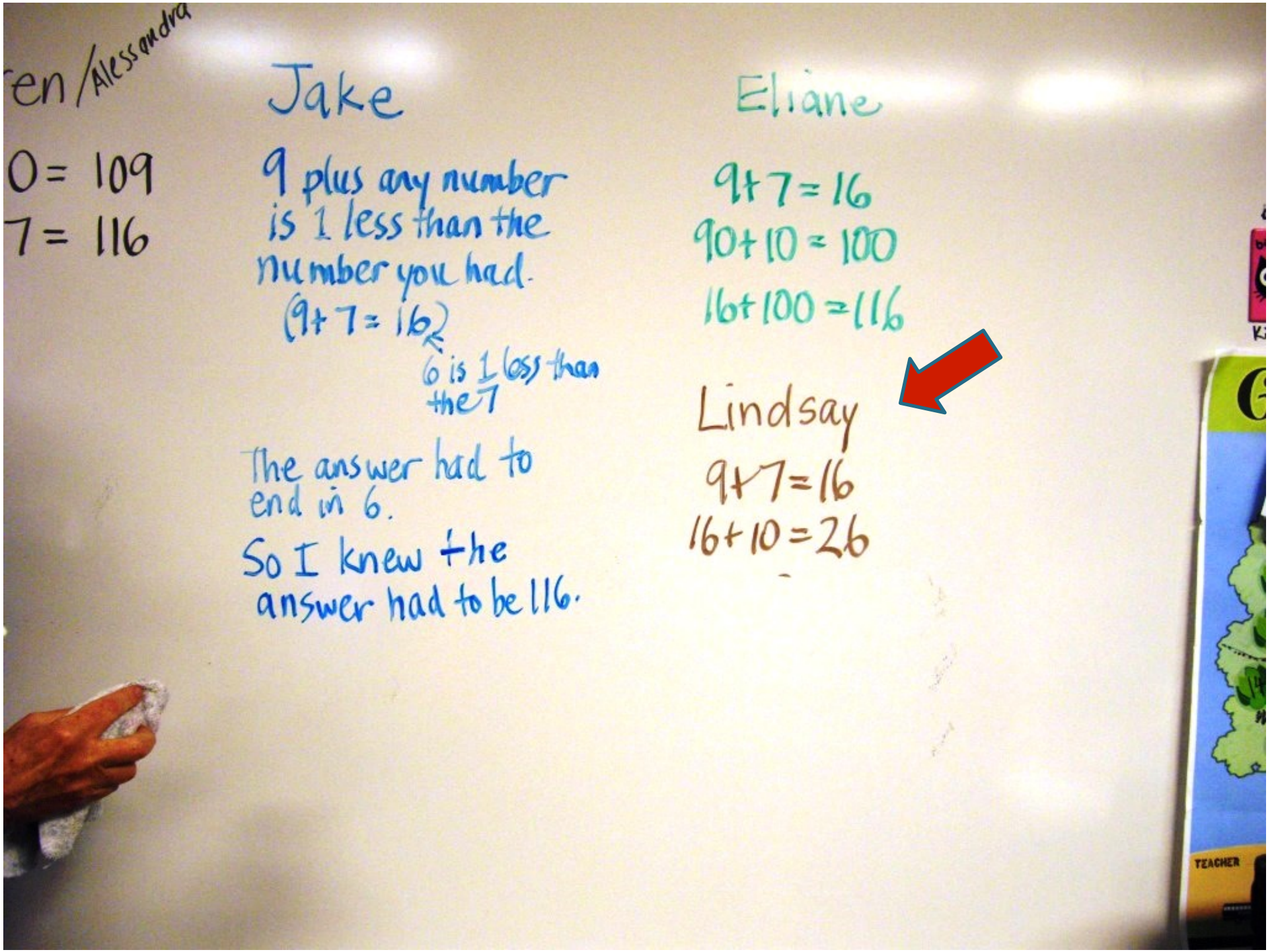
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uren / Alessandra

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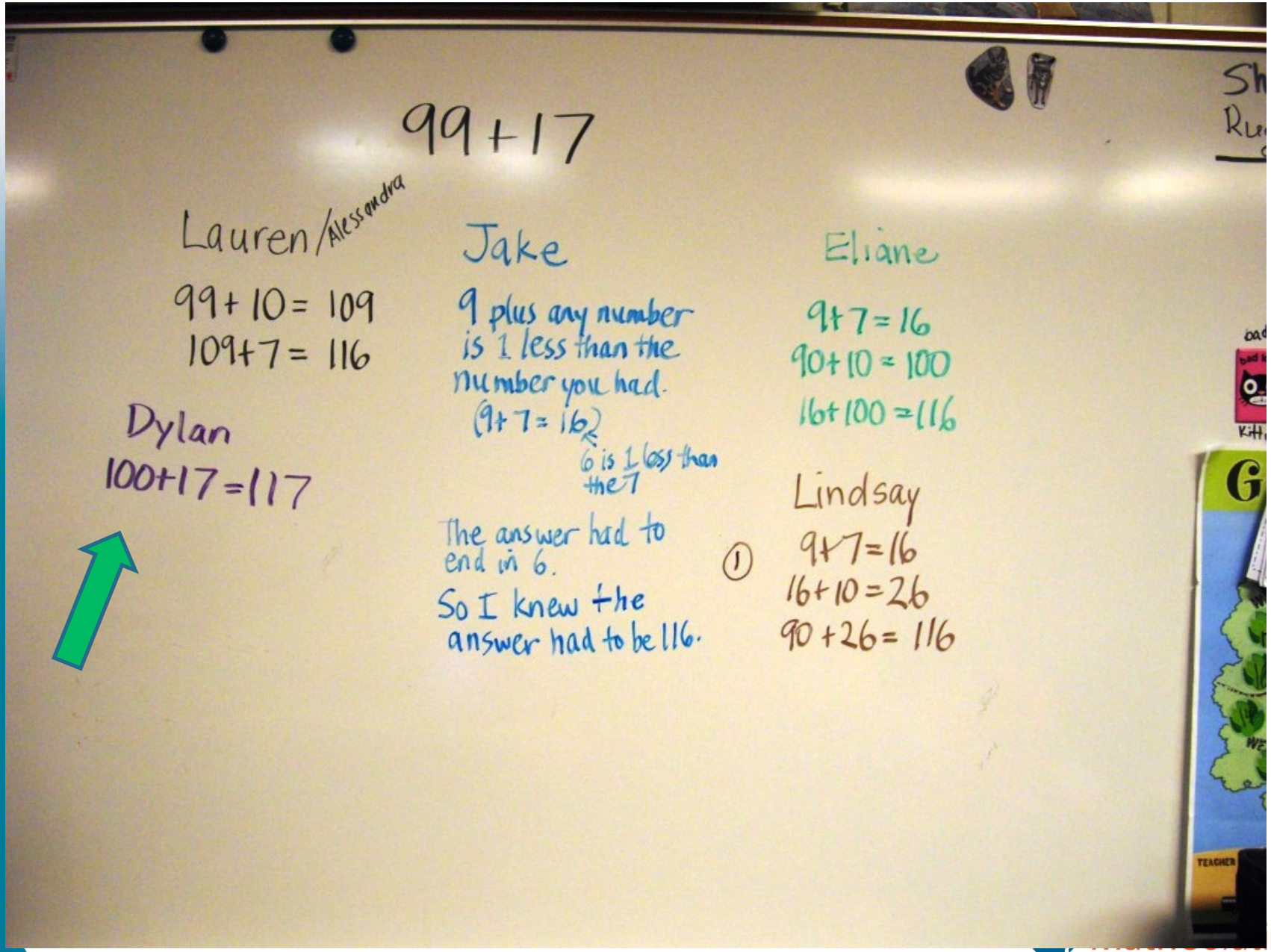

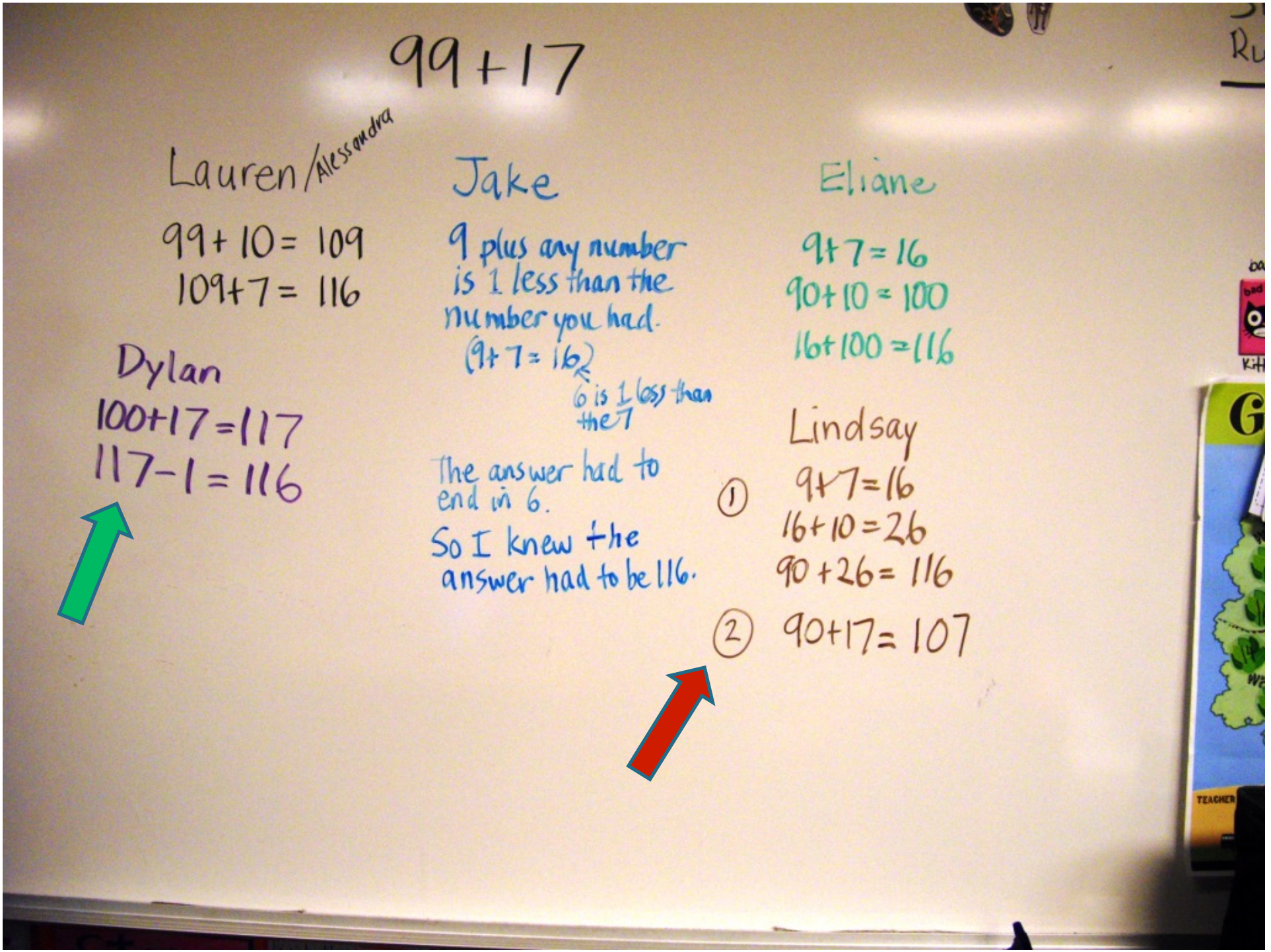
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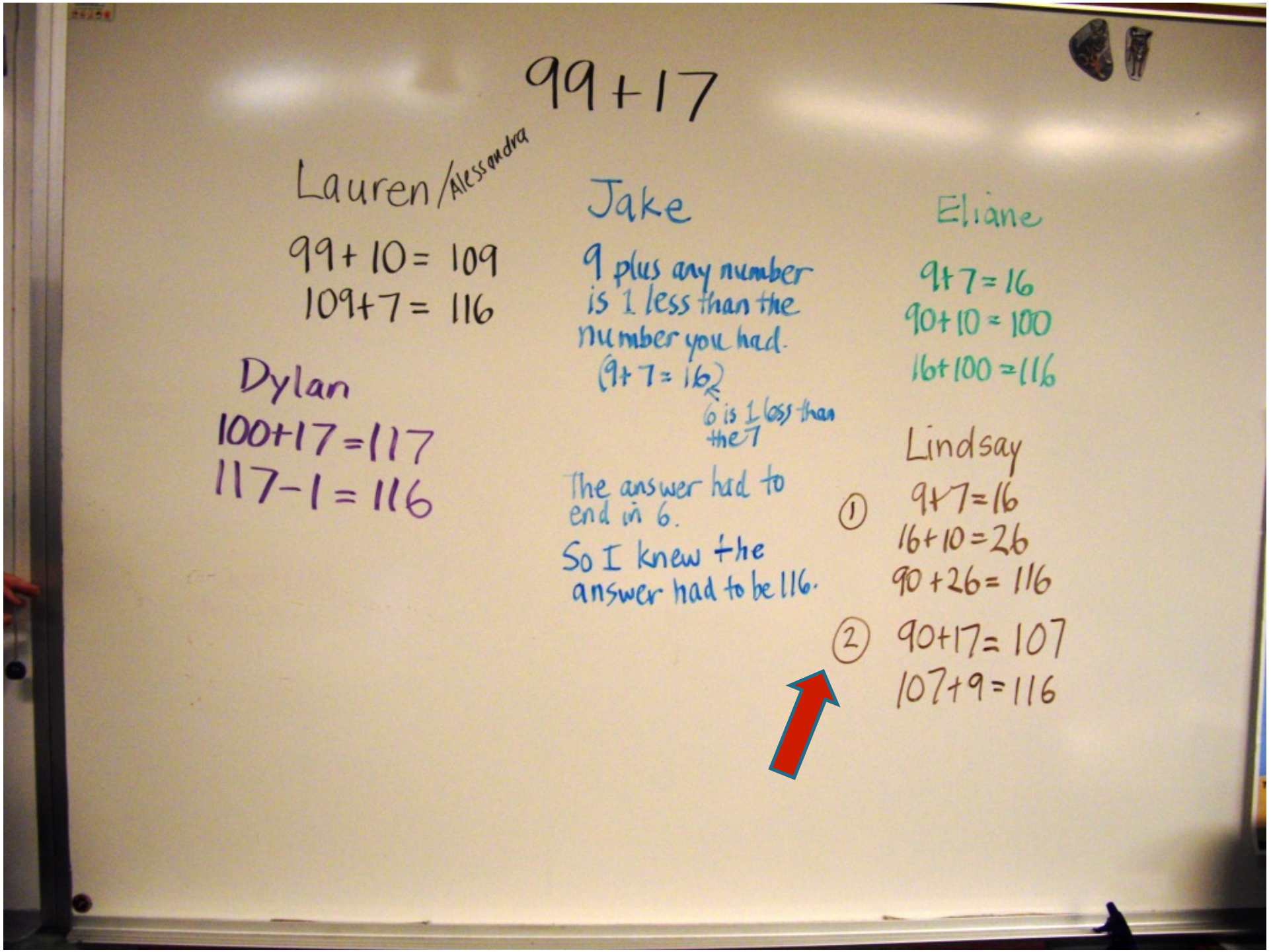
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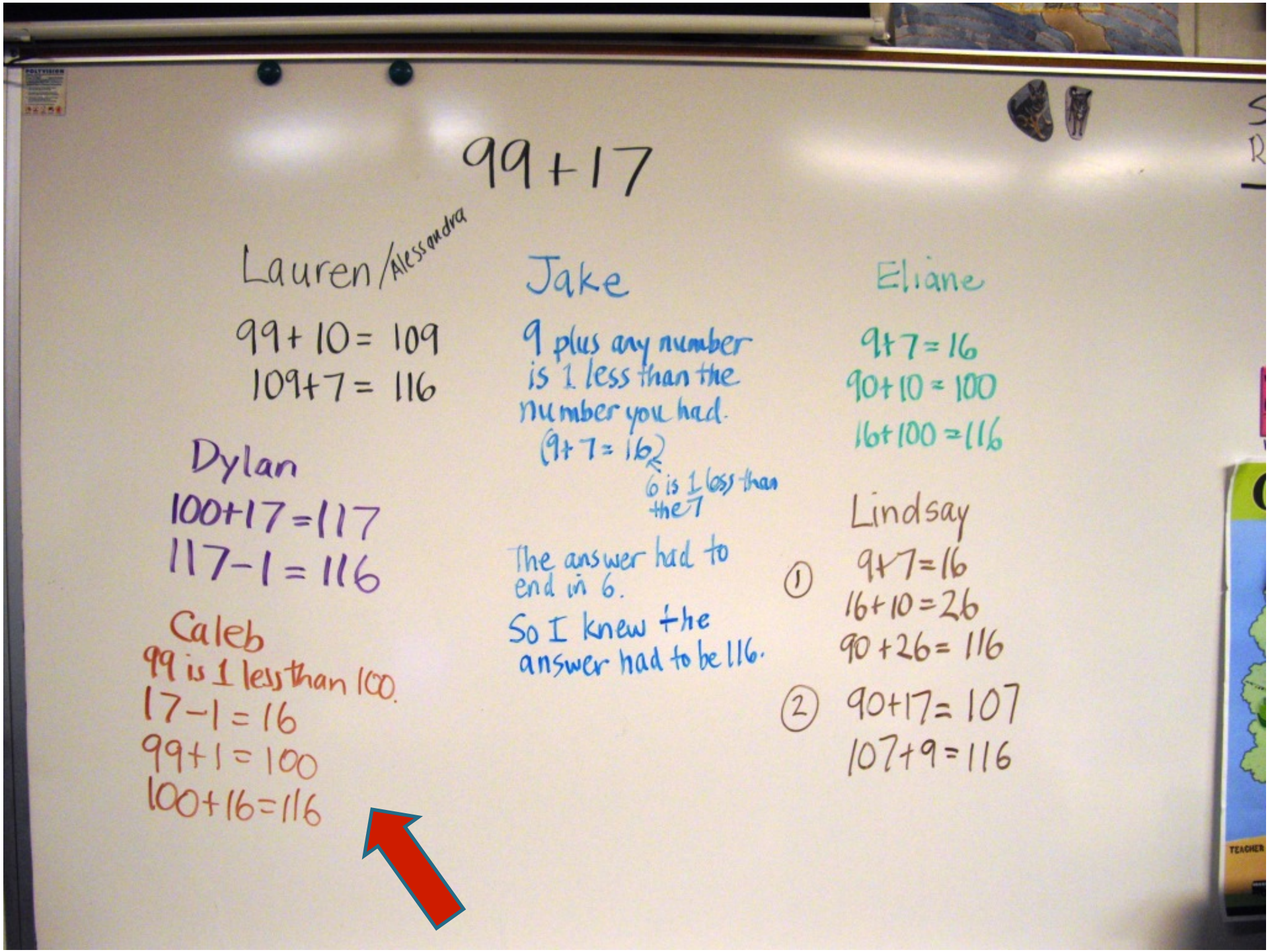
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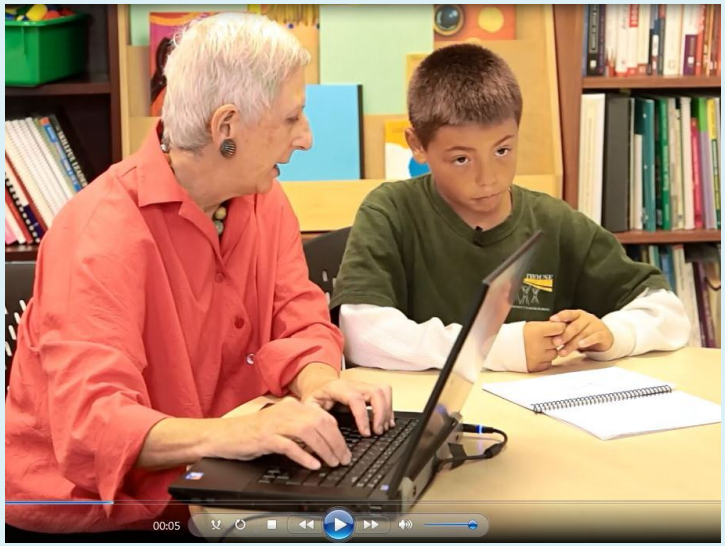
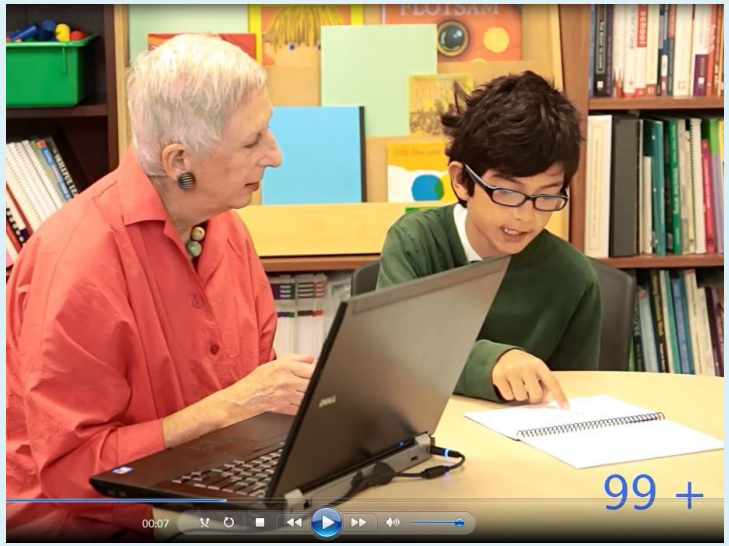
99 + 17



Alberto

Manuel

Dina



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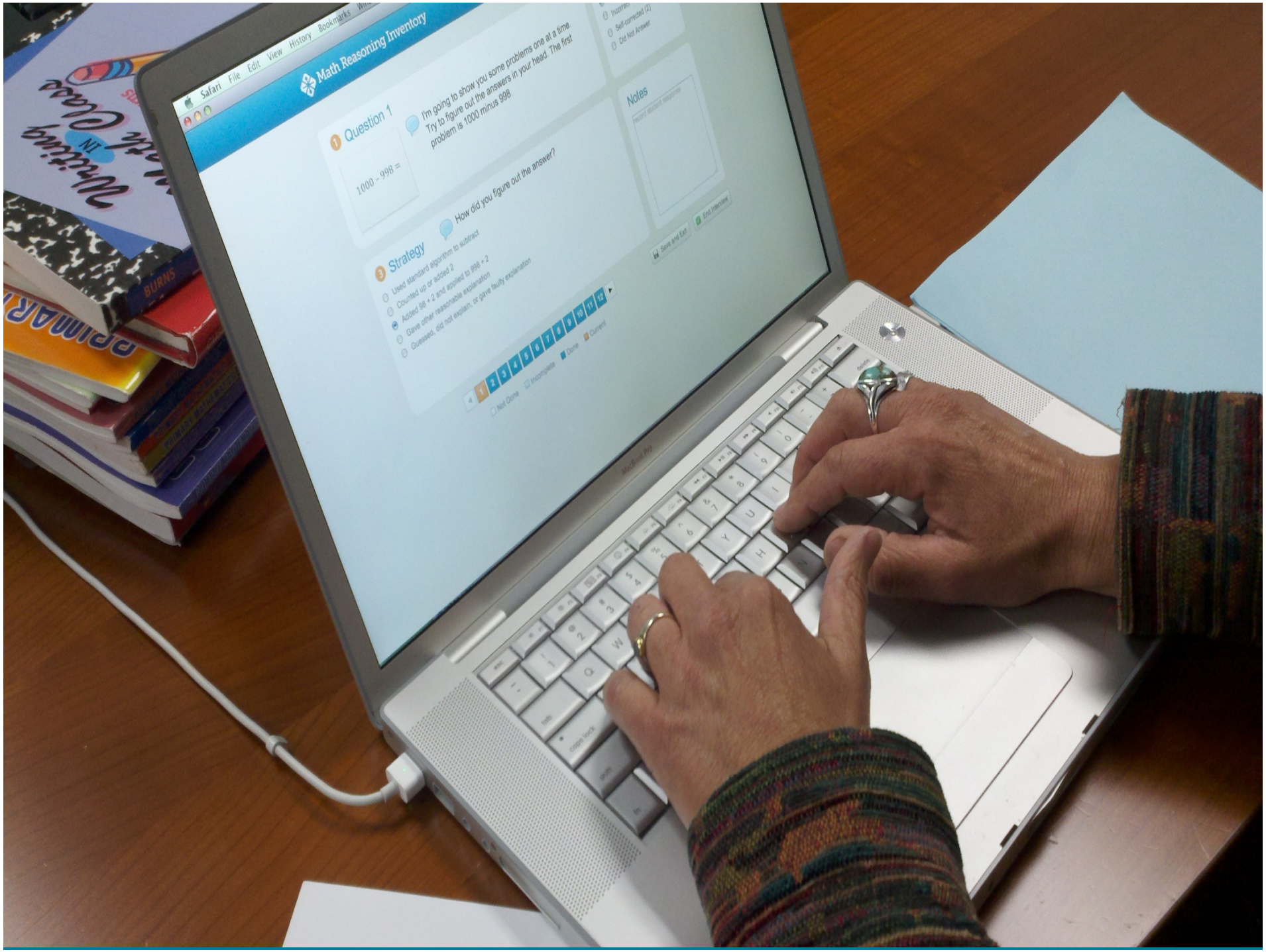
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Math Reasoning Inventory | Doe, Jane | Whole Numbers Interview

1 Question 7

$15 \times 12 =$

What is 15 times 12?

2 Answer

- ○ Correct (180)
- ○ Incorrect
- ○ Self-corrected (180)
- ○ Did Not Answer

3 Explanation

How did you figure out the answer?

- ○ Used standard algorithm to multiply
- ○ Broke 15 and/or 12 into parts and then multiplied (e.g., 15 x 10 and then 15 x 2)
- ○ Changed to an easier problem, 30 x 6, by doubling and halving
- ○ Gave other reasonable explanation
- ○ Guessed, did not explain, or gave faulty explanation

Notes

record student response

◄ 1 2 3 4 5 6 7 8 9 10 ►

Save and Exit | End Interview

☐ Not Done ☐ Incomplete ■ Done ■ Current

15 x 12

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Common Core Connection

Grade 4

Number and Operations in Base Ten

Use place value understanding and properties of operations to perform multi-digit arithmetic.

CCSS.Math.Content.4.NBT.B.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations.

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Common Core Connection

Grade 5

Operations & Algebraic Thinking

Write and interpret numerical expressions.

CCSS.Math.Content.5.OA.A.1 Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

CCSS.Math.Content.5.OA.A.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.*

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Common Core Connection

Grade 6

Expressions & Equations

Apply and extend previous understandings of arithmetic to algebraic expressions.

CCSS.Math.Content.6.EE.A.3 Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*

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Distributive Property of Multiplication over Addition

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15 x 12

Monica

Malcolm

Alberto

Monica: 15 x 12

"I did 15 times 10 and it was 150.

And then I did 15 times 2 which is 30.

And it was . . . um . . . 180."

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Monica: 15 x 12

"I did 15 times 10 and it was 150.

And then I did 15 times 2 which is 30.

And it was . . . um . . . 180."

12 = 10 + 2

15 x 10 = 150

15 x 2 = 30

150 + 30 = 180

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Malcolm: 15 x 12

"I broke apart the 15 and did 10 plus 5.

And then I did 10 times 12 which equals 120.

And then I did 12 times 5 which equals 60

And then I added it all together and I got 180."

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Malcolm: 15 x 12

"I broke apart the 15 and did 10 plus 5.

And then I did 10 times 12 which equals 120.

And then I did 12 times 5 which equals 60

And then I added it all together and I got 180."

15 = 10 + 5

10 x 12 = 120

12 x 5 = 60

120 + 60 = 180

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Alberto: 15 x 12

"I did 12 times 12 is 144

And then I did 3 times 12 and I got 36

And then I did 144 plus 36."

Math Solutions
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Alberto: 15 x 12

"I did 12 times 12 is 144

And then I did 3 times 12 and I got 36

And then I did 144 plus 36."

15 = 12 + 3

12 x 12 = 144

3 x 12 = 36

144 + 36 = 180

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15 x 12

Monica

$(15 \times 10) + (15 \times 2) = 180$

Malcolm

$(10 \times 12) + (12 \times 5) = 180$

Alberto

$(12 \times 12) + (3 \times 12) = 180$

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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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.

Math Solutions
FOUNDED BY MARILYN BURNS

15 x 12

Monica

Malcolm

Alberto

Cecilia

Cecilia: 15 x 12

"First I'm breaking it into steps and I'm doing 5 times 2. I leave the zero here and I bring the 1 up here.

Then 2 times 1 is 2, plus 1 is 3, so that's 30.

Put a zero. Five times 1 is 5, and then 1 x 1 is 1.

So then the answer is 180."

Math Solutions
FOUNDED BY MARILYN BURNS

Cecilia: 15 x 12

"First I'm breaking it into steps and I'm doing 5 times 2. I leave the zero here and I bring the 1 up here.

Then 2 times 1 is 2, plus 1 is 3, so that's 30.

Put a zero. Five times 1 is 5, and then 1 x 1 is 1.

So then the answer is 180."

15
x 12
30
150
180

Math Solutions
FOUNDED BY MARILYN BURNS

Common Core Connection

Grade 5

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and with decimals to hundredths.

CCSS.Math.Content.5.NBT.B.5 Fluently multiply multi-digit whole numbers using the standard algorithm.

Math Solutions
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Common Core Recommendation:

. . . a "balanced combination of procedures and understanding."

Common Core Caution:

. . . "students who lack understanding of a topic may rely on procedures too heavily."

Math Solutions
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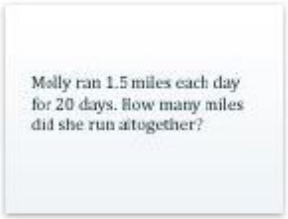
Math Reasoning Inventory | J, MB | Decimals Interview

1 Question 11



Molly ran 1.5 miles each day for 20 days. How many miles did she run altogether?

2 Answer

- Correct (30)
- Incorrect
- Self-corrected (30)
- Did Not Answer

3 Explanation

How did you figure out the answer?

- Used standard algorithm to multiply
- Multiplied 20 x 1 and then 20 x 0.5
- Multiplied 1.5 x 2 and then 3 x 10
- Multiplied 1.5 x 10 and then 15 x 2
- Multiplied 15 x 2 and then adjusted the decimal point
- Gave other reasonable explanation
- Guessed, did not explain, or gave faulty explanation

Notes

record student response

◄ 1 2 3 4 5 6 7 8 9 10 11 ►

Save and Exit | End Interview

Not Done | Incomplete | Done | Current

Molly Problem

Molly ran 1.5 miles each day for 20 days. How many miles did she run altogether?

Math Solutions
FOUNDED BY MARILYN BURNS

Common Core Connection

Grade 5

Number and Operations in Base Ten

Perform operations with multi-digit whole numbers and with decimals to hundredths.

CCSS.Math.Content.5.NBT.B.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.

Math Solutions
FOUNDED BY MARILYN BURNS

Molly Problem

Molly ran 1.5 miles each day for 20 days. How many miles did she run altogether?

$20 \times 1.5 = \_\_\_$

Math Solutions
FOUNDED BY MARILYN BURNS

Distributive Property of Multiplication over Addition

Math Solutions
FOUNDED BY MARILYN BURNS

Sergio: Molly problem, 20 x 1.5

- Video clip from MRI

Sergio: Molly problem, 20 x 1.5

"I know that 20 times 1 is 20, so I put the 20 aside. And 20 times 5 is 100, and bloop it by one is just zero … 10.0. So 20 plus 10 is 30."

Math Solutions
FOUNDED BY MARILYN BURNS

Sergio: Molly problem, 20 x 1.5

"I know that 20 times 1 is 20, so I put the 20 aside. And 20 times 5 is 100, and bloop it by one is just zero . . . 10.0. So 20 plus 10 is 30."

20 x 1 = 20

20 x 5 = 100, so 20 x .5 is 10.0

20 + 10 = 30

Math Solutions
FOUNDED BY MARILYN BURNS

Dina: Molly Problem, 20 x 1.5

- Video clip from MRI

Math Solutions
FOUNDED BY MARILYN BURNS

Dina: Molly Problem, 20 x 1.5

"She would run 30 miles altogether. So I wouldn't get confused, I did 10 days first. So it would be 15 miles for the 10 days. And then 15 miles times 2, for the other 10 days, would be 30."

Math Solutions
FOUNDED BY MARILYN BURNS

Dina: Molly Problem, 20 x 1.5

"She would run 30 miles altogether. So I wouldn't get confused, I did 10 days first. So it would be 15 miles for the 10 days. And then 15 miles times 2, for the other 10 days, would be 30."

10 x 1.5 = 15

15 x 2 = 30

Math Solutions
FOUNDED BY MARILYN BURNS

Molly Problem, 20 x 1.5

Sergio	Dina

Molly Problem, 20 x 1.5

Sergio	**Dina**
20 x 1 = 20 20 x .5 = 10 20 + 10 = 30 **1.5 = 1 + .5** **20 x 1.5 = (20 x 1) + (20 x .5)**	

Math Solutions
FOUNDED BY MARILYN BURNS

Molly Problem, 20 x 1.5

Sergio	Dina
20 x 1 = 20	10 x 1.5 = 15
20 x .5 = 10	15 x 2 = 30
20 + 10 = 30	
1.5 = 1 + .5	**20 = 2 x 10**
20 x 1.5 = (20 x 1) + (20 x .5)	**20 x 1.5 = 2 x (10 x 1.5)**

Math Solutions
FOUNDED BY MARILYN BURNS

Molly Problem, 20 x 1.5

Sergio	Dina
20 x 1.5 = (20 x 1) + (20 x .5)	20 x 1.5 = 2 x (10 x 1.5)
Distributive Property of Multiplication over Addition	???

Math Solutions
FOUNDED BY MARILYN BURNS

Molly Problem, 20 x 1.5

Sergio	Dina
20 x 1.5 = (20 x 1) + (20 x .5)	20 x 1.5 = 2 x (10 x 1.5)
Distributive Property of Multiplication over Addition	Associative Property

Math Solutions
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Using MRI for Professional Learning

1. Embed video clips into classroom instruction.
2. Help teachers explore properties of numbers.
3. **Analyze student errors.**
4. Use video clips to inform classroom instruction.

Math Solutions
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15 x 12

What were the two most common wrong answers?

??

Math Solutions
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15 x 12

What were the two most common wrong answers?

110 and 30

Math Solutions
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15 x 12

What were the two most common wrong answers?

110 and 30

(24% of all wrong answers)

Math Solutions
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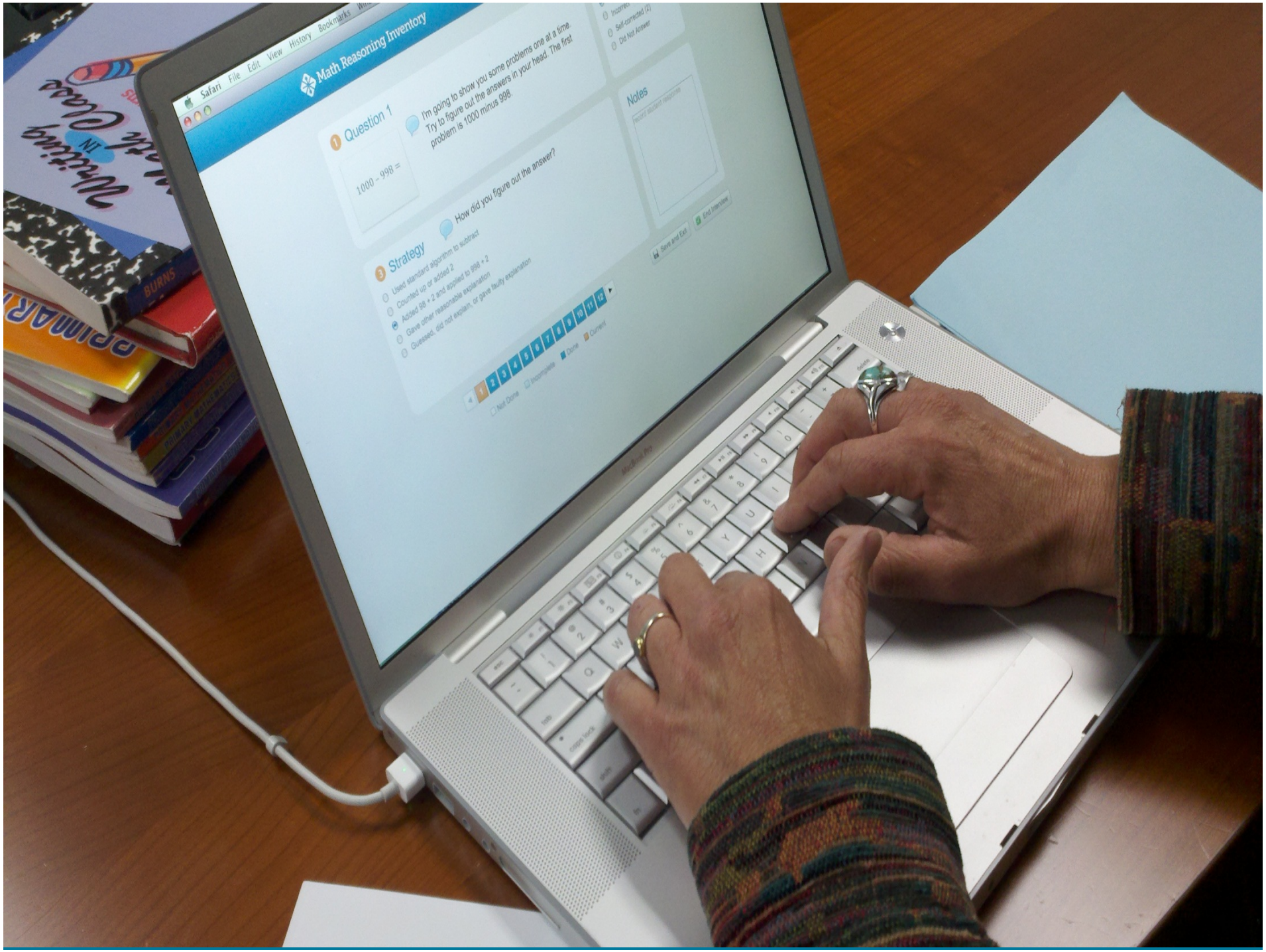
Math Reasoning Inventory
Question 1
I'm going to show you some problems one at a time. Try to figure out the answers in your head. The first problem is 1000 minus 998.
1000 – 998 =
Notes
How did you figure out the answer?
Strategy
Used standard algorithm to subtract
Counted up or added 2
Added 98 + 2 and applied to 998 + 2
Gave other reasonable explanation
Guessed, did not explain, or gave faulty explanation
Not Done
Incomplete
Done
Current
Save and Exit
End Interview

12.6 x 10

Math Solutions
FOUNDED BY MARILYN BURNS

12.6 x 10

What were the two most common wrong answers?

Math Solutions
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12.6 x 10

Jennifer

Craig

Luisa

Natasha

12.6 x 10

What were the two most common wrong answers?

120.6 and 12.60

(39% of all wrong answers)

Math Solutions
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12.6 x 10

“The answer is 120 and 30 fifths.”

Grade 5 student
March 21, 2013
Malcolm X Elementary School
Berkeley, CA

Math Solutions
FOUNDED BY MARILYN BURNS

12.6 x 10

"The answer is 120 and 30 fifths."

12 x 10 = 120

I changed .6 to 3/5

10 x 3/5 = 30/5

So the answer is 120 and 30/5.

Math Solutions
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Most common wrong answers

- 100 – 18
- 99 + 17
- 3 – 1.9

Math Solutions
FOUNDED BY MARILYN BURNS

Most common wrong answers

- 100 – 18 [92, 81]
- 99 + 17 [106, 117]
- 3 – 1.9 [1.6 and 2.9]

Math Solutions
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Andres: 3 – 1.9

- Video from MRI

Andres: 3 – 1.9

"I figured it out because I put the 3 under the 9 and then I subtracted and that would give me 1 and 6 tenths."

$$\begin{array}{r} 1.9 \\ -\ \ 3 \\ \hline 1.6 \end{array}$$

Math Solutions
FOUNDED BY MARILYN BURNS

Using MRI for Professional Learning

1. Embed video clips into classroom instruction.
2. Help teachers explore properties of numbers.
3. Analyze student errors.
4. **Use video clips to inform classroom instruction.**

Math Solutions
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Common Core Connection

Grade 3

Number and Operations—Fractions

Develop understanding of fractions as numbers.

CCSS.Math.Content.3.NF.A.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size

Math Solutions
FOUNDED BY MARILYN BURNS

Common Core Connection

Grade 4

Number and Operations—Fractions

Extend understanding of fraction equivalence and ordering.

CCSS.Math.Content.4.NF.A.2 Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Math Solutions
FOUNDED BY MARILYN BURNS

Which is greater, 3/8 or 9/16?

Lesson from *Teaching Arithmetic: Introducing Fractions*

Math Solutions
FOUNDED BY MARILYN BURNS

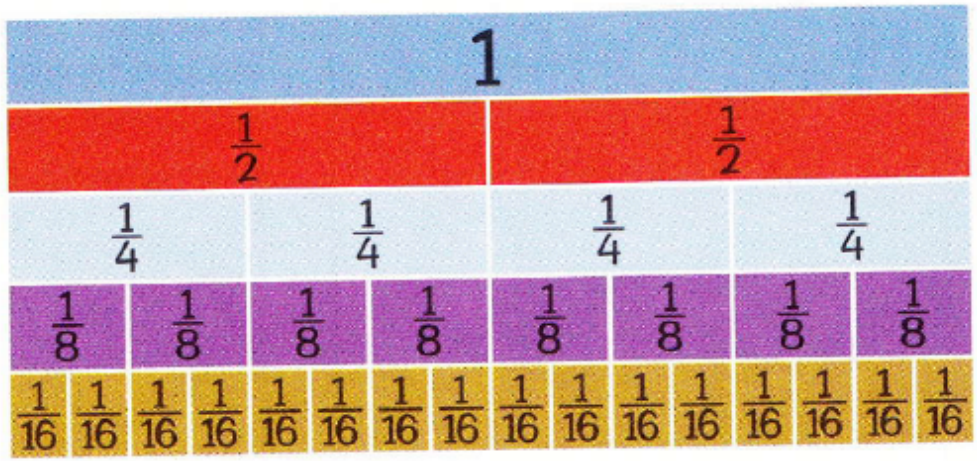
Comparing Fractions

Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$

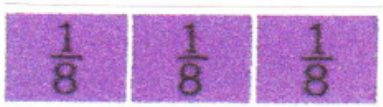
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$



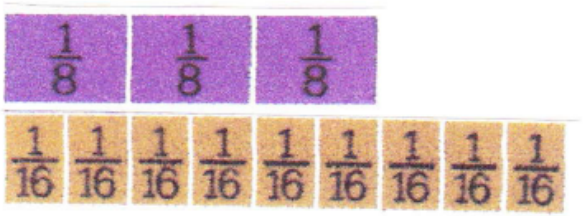
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$



Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$



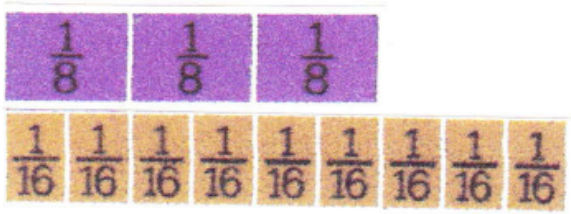
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$

$=$

$>$

$<$



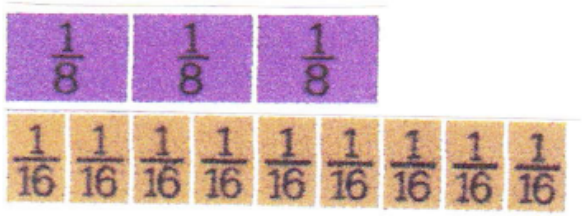
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$

$=$ is equal to

$>$

$<$



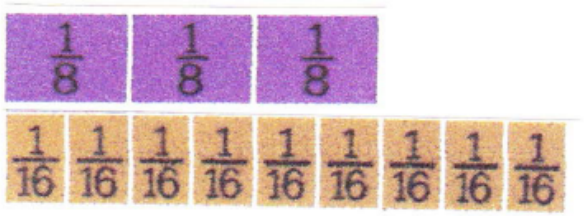
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$

$=$ is equal to

$>$ is greater than

$<$



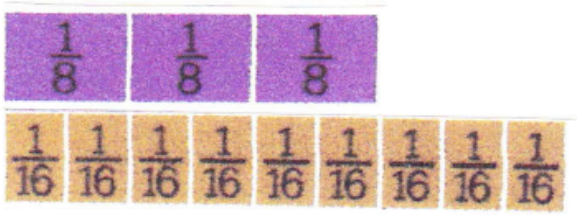
Comparing Fractions

$\frac{3}{8}$ $\frac{9}{16}$

$=$ is equal to

$>$ is greater than

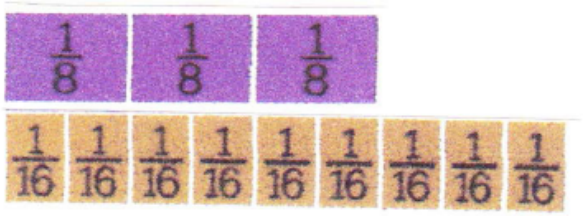
$<$ is less than



Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

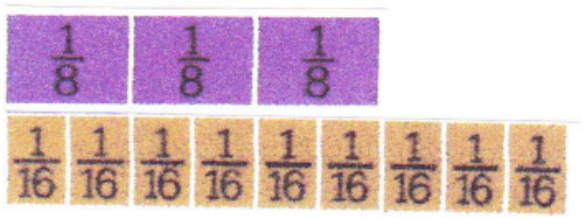
$=$	is equal to
$>$	is greater than
$<$	is less than



Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



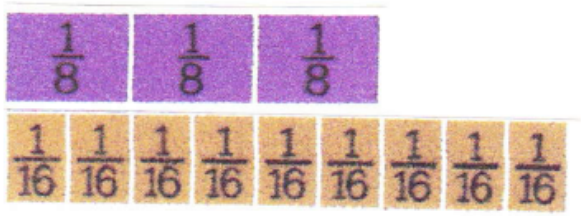
Sam

$\frac{2}{16} = \frac{1}{8}$

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



Sam

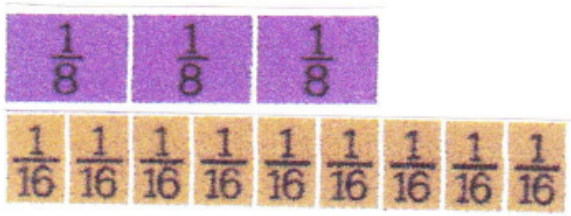
$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

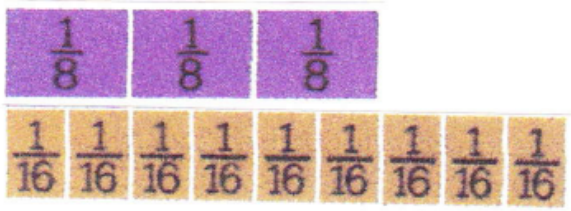
$\frac{4}{16} = \frac{2}{8}$

4 more 16ths make $\frac{3}{8}$

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

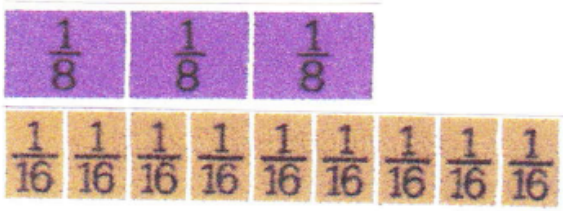
Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$ is equal to

$>$ is greater than

$<$ is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

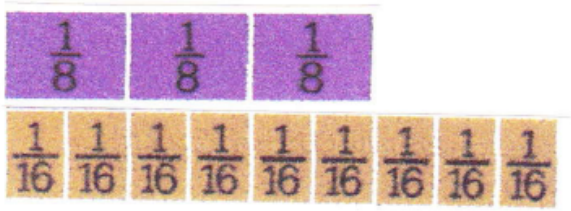
$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more.

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$\frac{1}{8}$			$\frac{1}{8}$			$\frac{1}{8}$					
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$			

$=$ is equal to

$>$ is greater than

$<$ is less than

Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

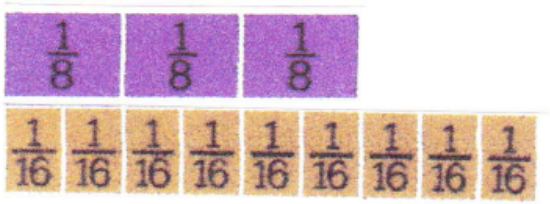
$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more. It takes $\frac{2}{16}$ to make $\frac{1}{8}$,

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$	is equal to
$>$	is greater than
$<$	is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more. It takes $\frac{2}{16}$ to make $\frac{1}{8}$, so you need $\frac{4}{16}$ for $\frac{2}{8}$ and $\frac{6}{16}$ for $\frac{3}{8}$.

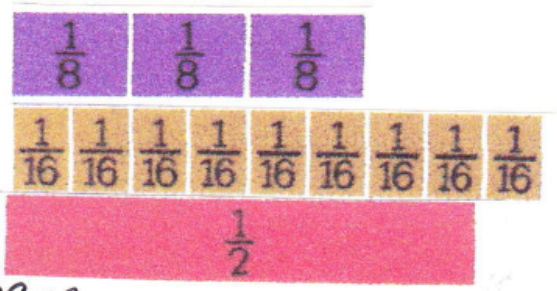
Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$ is equal to

$>$ is greater than

$<$ is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more. It takes $\frac{2}{16}$ to make $\frac{1}{8}$, so you need $\frac{4}{16}$ for $\frac{2}{8}$ and $\frac{6}{16}$ for $\frac{3}{8}$.

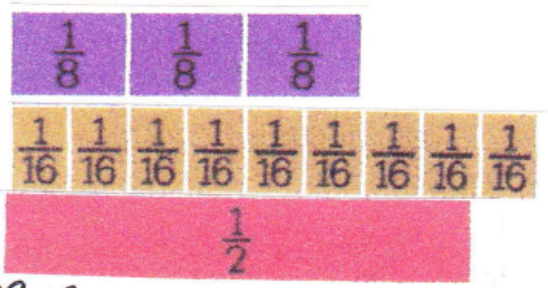
Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$=$ is equal to

$>$ is greater than

$<$ is less than



Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more. It takes $\frac{2}{16}$ to make $\frac{1}{8}$, so you need $\frac{4}{16}$ for $\frac{2}{8}$ and $\frac{6}{16}$ for $\frac{3}{8}$.

Jennifer

$\frac{3}{8} < \frac{9}{16}$ because

Comparing Fractions

$\frac{3}{8} < \frac{9}{16}$

$\frac{1}{8}$			$\frac{1}{8}$			$\frac{1}{8}$					
$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{16}$			
$\frac{1}{2}$											

$=$ is equal to

$>$ is greater than

$<$ is less than

Sam

$\frac{2}{16} = \frac{1}{8}$

$\frac{4}{16} = \frac{2}{8}$

$\frac{6}{16} = \frac{3}{8}$

$\frac{3}{8} < \frac{9}{16}$ because $\frac{3}{8} = \frac{6}{16}$ and $\frac{9}{16}$ is more. It takes $\frac{2}{16}$ to make $\frac{1}{8}$, so you need $\frac{4}{16}$ for $\frac{2}{8}$ and $\frac{6}{16}$ for $\frac{3}{8}$.

Jennifer

$\frac{3}{8} < \frac{9}{16}$ because $\frac{9}{16} > \frac{1}{2}$ and $\frac{3}{8} < \frac{1}{2}$.

Comparing Pairs

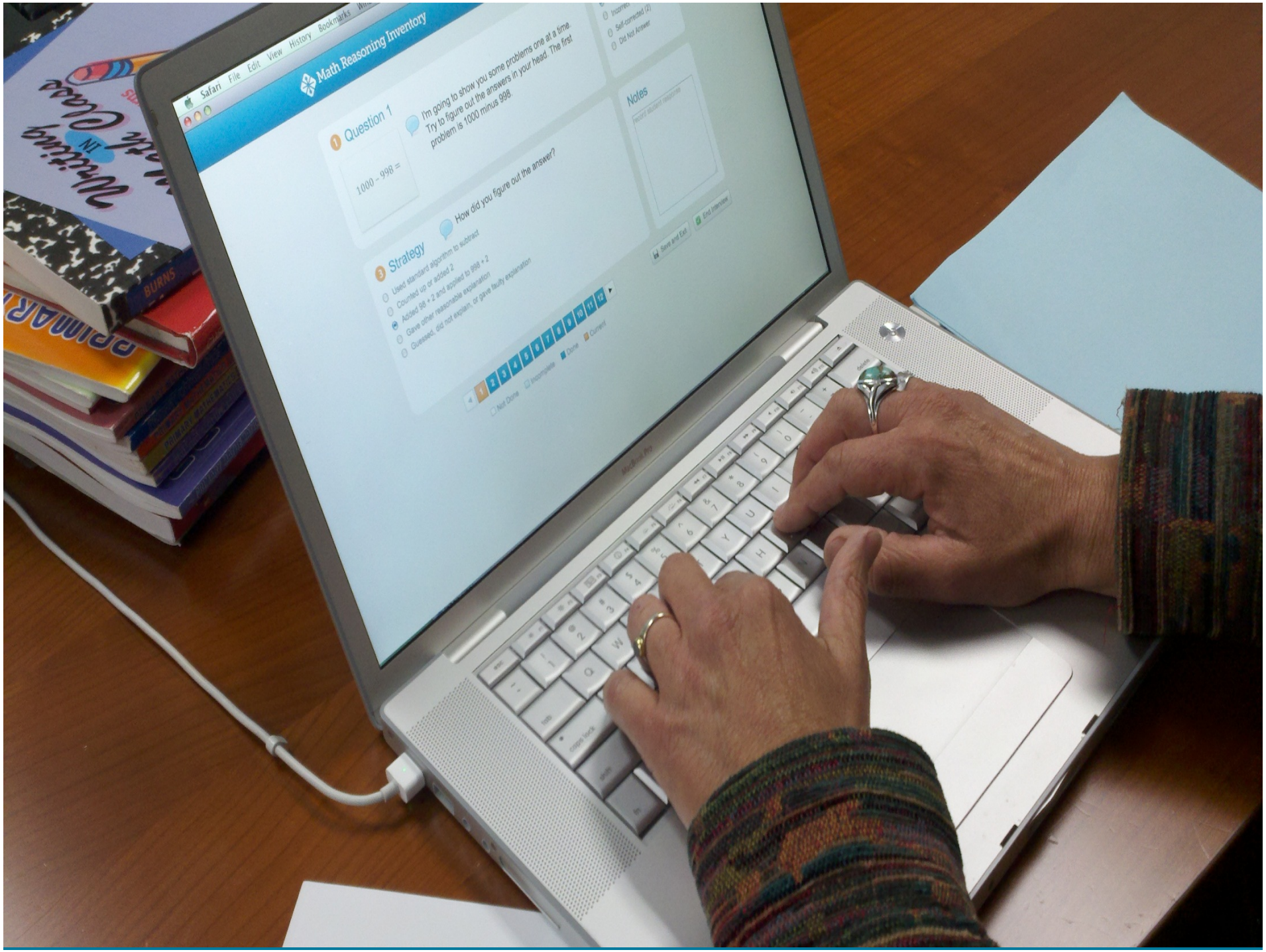
Write ">", "<", or "=" in between each pair to make a true statement.

1. 1/2 > 3/8 Because $\frac{4}{8}$ is is $\frac{1}{2}$ but since you only have $\frac{3}{8}$ $\frac{1}{2}$ is more
2. 3/4 > 5/8
3. 3/16 < 1/2
4. 1/4 = 2/8
5. 7/8 > 12/16
6. 1/2 = 2/4
7. 5/16 > 1/4 because $\frac{4}{16}$ is = to $\frac{1}{4}$ so you have $\frac{1}{16}$ left so $\frac{5}{16}$ is more than $\frac{1}{4}$
8. 8/16 = 2/4
9. 1/4 > 1/8 you need $\frac{2}{8}$ to make $\frac{1}{4}$ but you only have $\frac{1}{8}$ $\frac{1}{8}$ then $\frac{1}{4}$ is more than
10. 3/4 > 11/16 $\frac{1}{8}$
11. $\frac{4}{16}$ = $\frac{2}{8}$
12. $\frac{8}{16}$ > $\frac{3}{8}$ $\frac{4}{16}$ is = $\frac{8}{16}$ but you only have $\frac{3}{8}$ then $\frac{8}{16}$ is more the $\frac{3}{8}$

Comparing Pairs

Write ">", "<", or "=" in between each pair to make a true statement.

1. 1/2 > 3/8 because 4/8 = 1/2 so 3/8 is an $\frac{1}{8}$ less.
2. 3/4 > 5/8
3. 3/16 < 1/2
4. 1/4 = 2/8
5. 7/8 > 12/16
6. 1/2 = 2/4 because 1/2 is = with 2/4 because 2 is half of 4.
7. 5/16 > 1/4
8. 8/16 = 2/4
9. 1/4 > 1/8 because it takes 2/8 to be = to 1/4.
10. 3/4 > 11/16
11. 8/16 < 3/4
12. 1/4 = 2/8 see number 9.


Math Reasoning Inventory
Question 1
I'm going to show you some problems one at a time. Try to figure out the answers in your head. The first problem is 1000 minus 998.
1000 – 998 =
Notes
How did you figure out the answer?
Strategy
Used standard algorithm to subtract
Counted up or added 2
Added 98 + 2 and applied to 998 + 2
Gave other reasonable explanation
Guessed, did not explain, or gave faulty explanation
Not Done
Incomplete
Done
Current
Save and Exit
End Interview

Math Reasoning Inventory | J, MB | Fractions Interview

1 Question 1

$\frac{3}{8}$ $\frac{5}{6}$

Which is greater, 3/8 or 5/6?

2 Answer

- Correct (5/6)
- Incorrect
- Self-corrected (5/6)
- Did Not Answer

3 Explanation

How did you decide?

- Converted to common denominators
- Compared to 1/2 or 50%, or 1 or 100% (e.g., 5/6 is more than 1/2 and 3/8 is less than 1/2)
- Explained that eighths are smaller than sixths and there are fewer eighths
- Converted to decimals or percents
- Gave other reasonable explanation
- Guessed, did not explain, or gave faulty explanation

Notes

record student response

◄ 1 2 3 4 5 6 7 8 9 10 11 12 ►

Save and Exit | End Interview

Not Done | Incomplete | Done | Current

Which is greater, 3/8 or 5/6?

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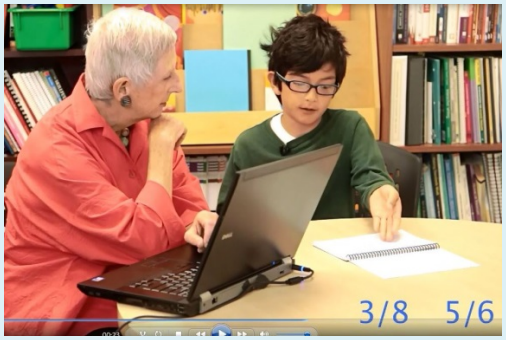
Which is greater, 3/8 or 5/6?

Amir



Ernesto

Alberto

Amir: Which is greater, 3/8 or 5/6?

- Video from MRI

Math Solutions
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Amir: Which is greater, 3/8 or 5/6?

"I know that … um … well,1/8 is 12 ½ percent and 1/6 is around 15 and 4/6 percent, it's around there. So 3/8 is around 37 ½ percent. And I know that 4/6 is 66 2/3 percent. So 5/6 must be greater than 3/8."

Math Solutions
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Ernesto: Which is greater, 3/8 or 5/6?

- Video from MRI

Math Solutions
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Ernesto: Which is greater, 3/8 or 5/6?

"Because 5/6 is almost a whole, if you add one more piece. And 3/8 needs a lot of pieces to get 1 whole."

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Alberto: Which is greater, 3/8 or 5/6?

- Video from MRI

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Alberto: Which is greater, 3/8 or 5/6?

"'Cause you just need 1 more to get to 6, and in this one you need 5 more."

[Repeat after prompting] *"You need 1 more sixth to get to 6, and 5 more eighths to get to 8 eighths."*

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What Does the Data Tell?

- MRI K–5

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Common Core Connection

Kindergarten

Number and Operations in Base Ten

Work with numbers 11–19 to gain foundations for place value.

CCSS.Math.Content.K.NBT.A.1 Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (such as 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

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Common Core Connection

Grade 1

Number and Operations in Base Ten

Understand place value.

CCSS.Math.Content.1.NBT.B.2 Understand that the two digits of a two-digit number represent amounts of tens and ones.

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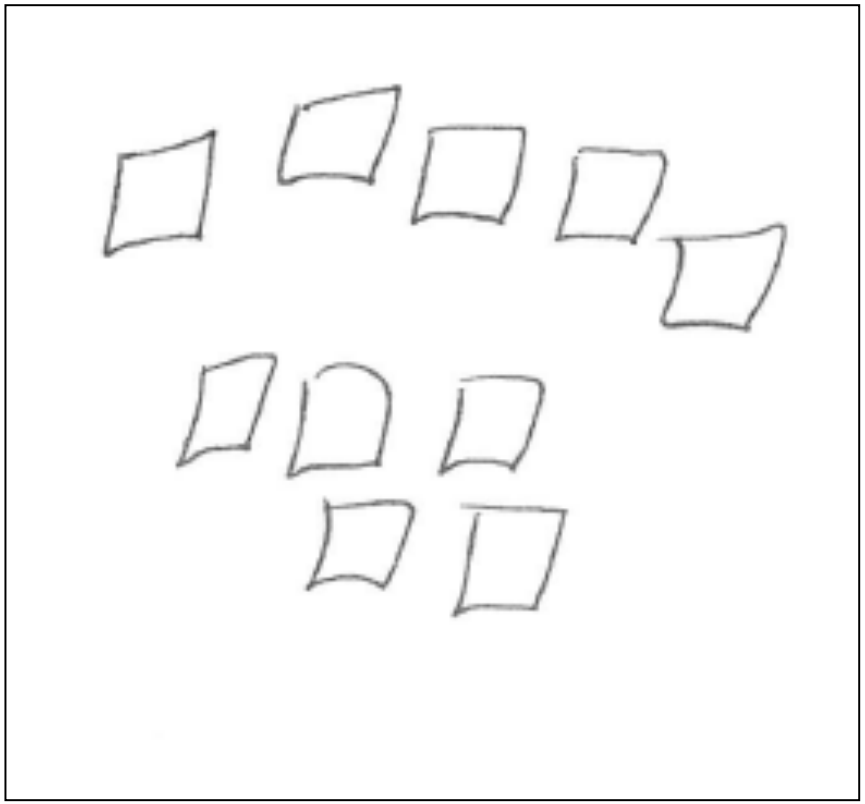
Place Value



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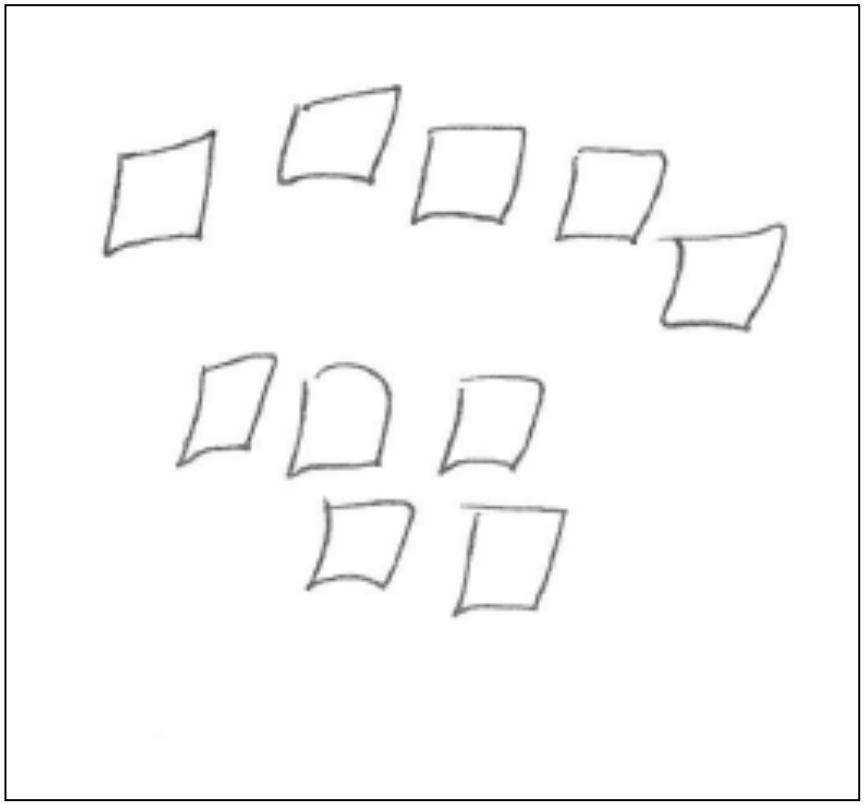
Place Value



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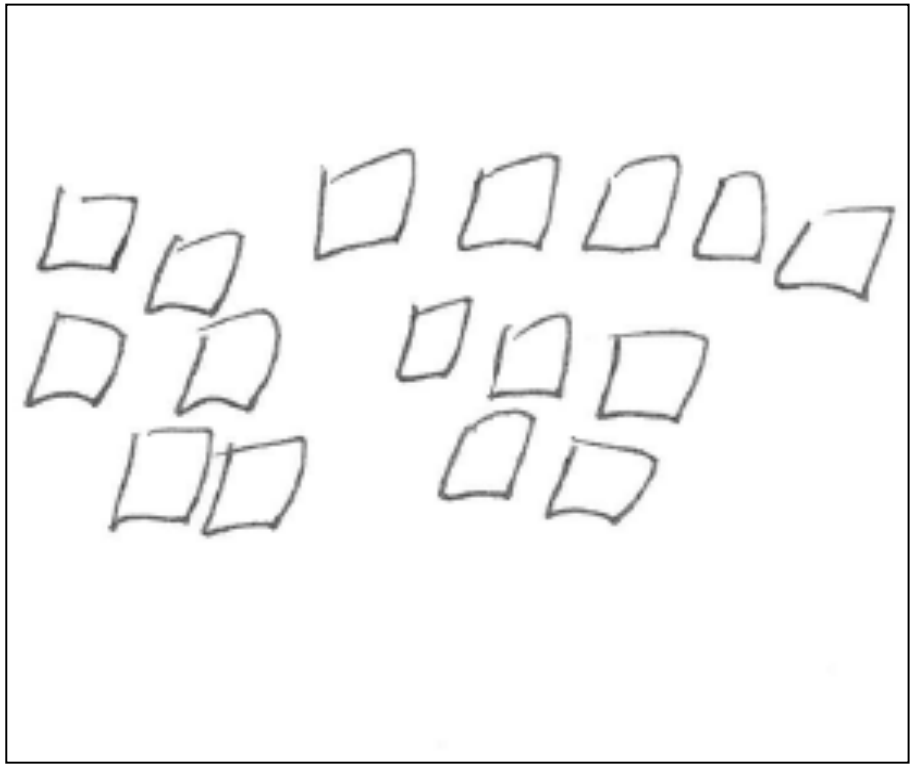
Place Value



Math Solutions
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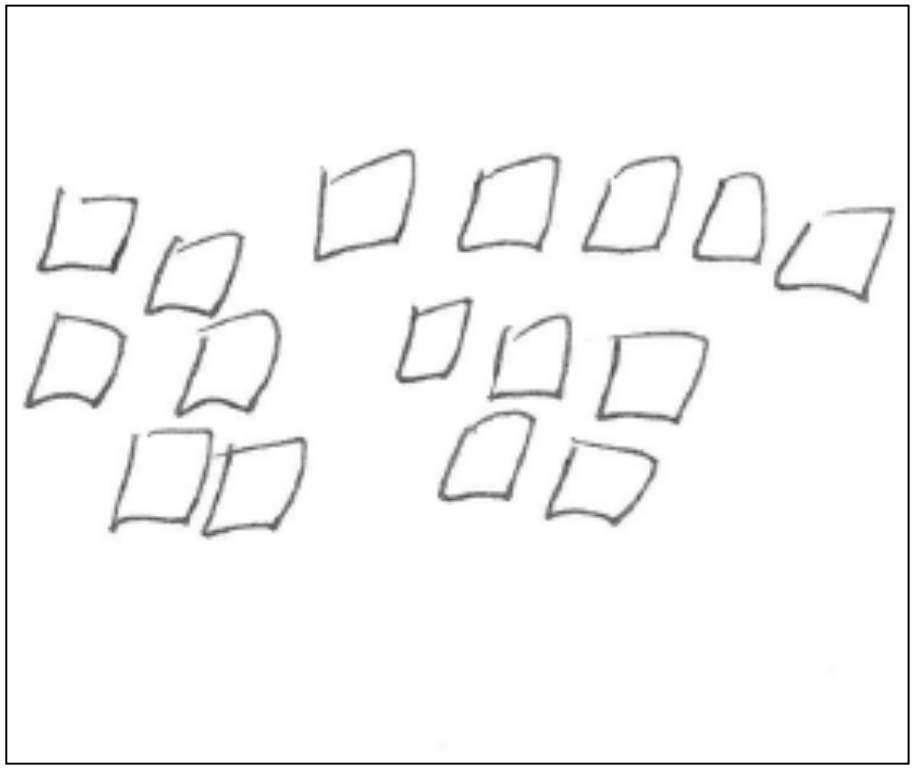
Place Value

- How many cubes are there altogether?



Math Solutions
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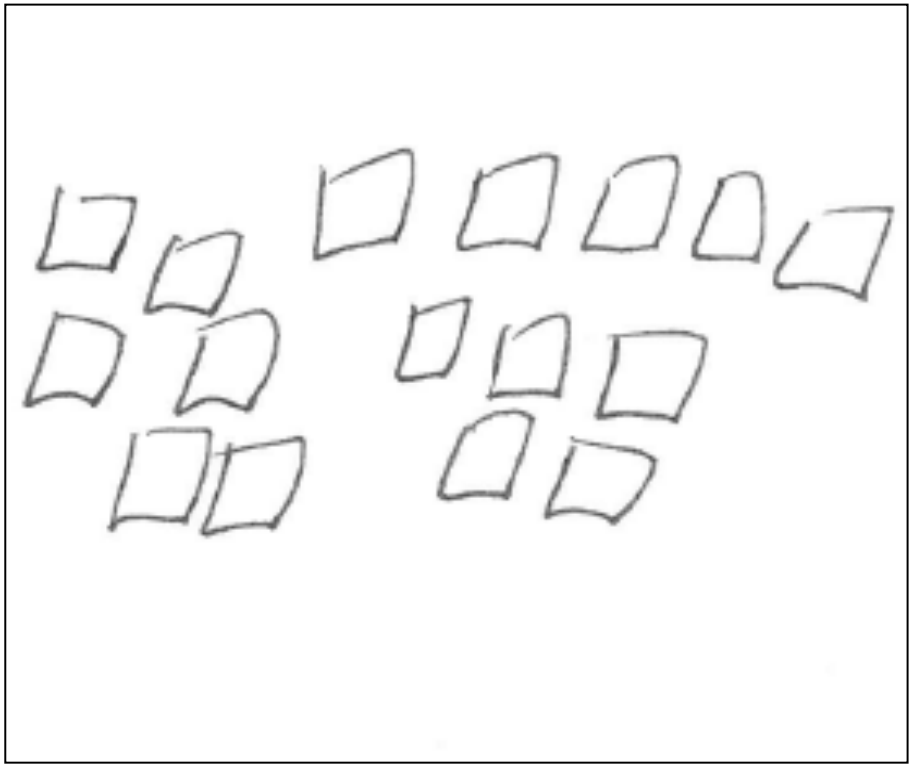
Place Value

- How many cubes are there altogether?
- If I take 6 cubes away, how many cubes will be left on the paper?



Math Solutions
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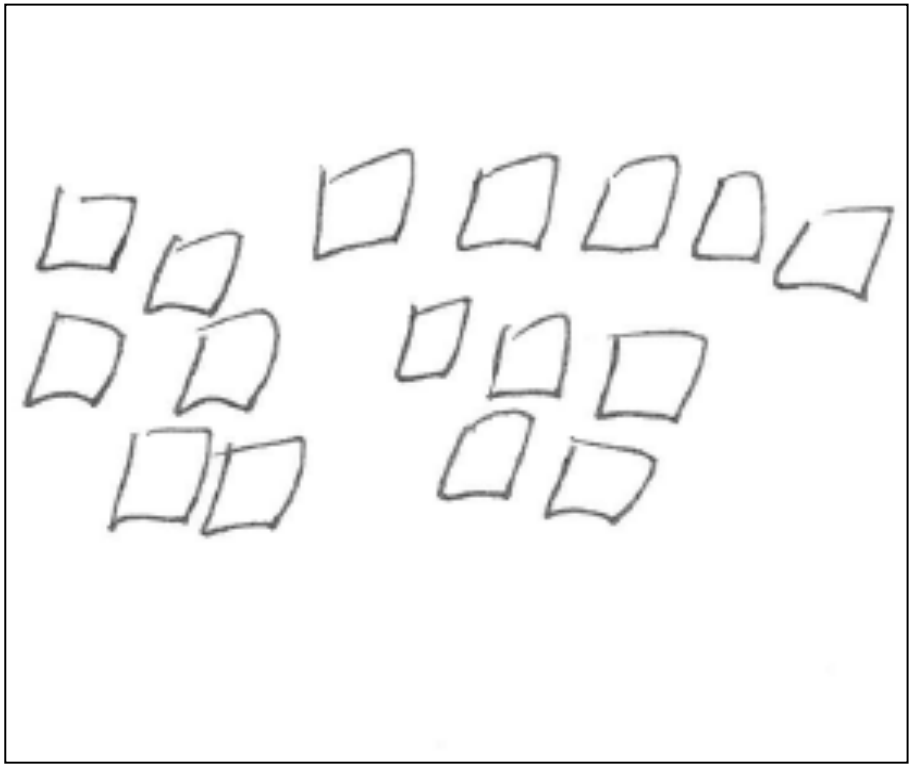
Place Value

- How many cubes are there altogether?
- If I take 6 cubes away, how many cubes will be left on the paper?
- If I take 10 cubes away, how many cubes will be left on the paper?



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Individual Report: Whole Numbers

MR, E

Legend

- Appropriate for the numbers at hand
- Not Appropriate for the numbers at hand

Interview

Date Completed: 17-Nov-2011

Category	Strategies or Understandings Demonstrated	Appropriate Strategies or Understandings Not Demonstrated
Adding and Subtracting Mentally	Breaks numbers apart to add or subtract 100 – 18 Gives other reasonable explanation 1000 – 998 Uses standard algorithm to add or subtract 99 + 17	• Uses addition to solve subtraction problems • Uses benchmark numbers to add or subtract
Multiplying and Dividing Mentally	Uses known facts and place value to multiply or divide 7000 ÷ 70 Breaks numbers apart to multiply or divide 15 × 12 Gives other reasonable explanation 60 × 40 Guesses, does not explain, or gives faulty explanation Estimate 18 × 21	• Uses benchmark numbers to make estimates
Applying Understanding	Uses distributive property 15 × 12 20 × 15 = 300, 21 × 15 = ___	• Models with mathematics to solve problems in context • Uses inverse relationship of addition and subtraction

Written Computation

Date Completed: 17-Nov-2011

Category	Demonstrated	Not Demonstrated
Computing Accurately with Paper and Pencil	5000 – 328 842 × 35 3423 ÷ 6 275 ÷ 22	

Group Report: Whole Numbers

All Students

Start Date: 24-Feb-2013
End Date: 24-Mar-2013

Legend

- Appropriate for the numbers at hand
- Not appropriate for the numbers at hand

Interview

Students: 25

Category	Consistently Demonstrated (75–100% of Students)	Often Demonstrated (50–74% of Students)	Sometimes Demonstrated (25–49% of Students)	Rarely Demonstrated (0–24% of Students)
Adding and Subtracting Mentally		Breaks numbers apart to add or subtract (72%)	Uses benchmark numbers to add or subtract (36%) Uses addition to solve subtraction problems (44%) Uses standard algorithm to add or subtract (32%)	Counts by 1s (8%)
Multiplying and Dividing Mentally	Uses known facts and place value to multiply or divide (80%)		Breaks numbers apart to multiply or divide (36%) Uses benchmark numbers to make estimates (44%)	Uses standard algorithm to multiply or divide (12%) Figures exact answer when asked to estimate (4%)
Applying Understanding	Uses inverse relationship of addition and subtraction (88%)	Uses distributive property (68%)	Models with mathematics to solve problems in context (36%)	

Written Computation

Students: 25

Category	75–100% of Students	50–74% of Students	25–49% of Students	0–24% of Students
Computing Accurately with Paper and Pencil	5000 − 328 (80%) 842 × 35 (84%)	3423 ÷ 6 (60%) 275 ÷ 22 (52%)		

Item Analysis: Whole Numbers

Period 1

Start Date: 30-Sep-2011
End Date: 28-Oct-2011

Legend

- ⊕ Appropriate for the numbers at hand
- ⊖ Not Appropriate for the numbers at hand

Interview

Students: 7

	Question	Correct / Self-corrected	Incorrect	Did Not Answer	Strategies Used by Students Who Gave Correct Answers
1	1000 – 998	100%	0%	0%	⊕ Uses addition to solve subtraction problems (6/7) ⊖ Guesses, does not explain, or gives faulty explanation (1/7)
2	99 + 17	43%	57%	0%	⊕ Breaks numbers apart to add or subtract (1/3) ⊖ Uses standard algorithm to add or subtract (2/3)
3	100 – 18	57%	29%	14%	⊕ Breaks numbers apart to add or subtract (2/4) ⊖ Uses standard algorithm to add or subtract (1/4) ⊖ Counts by 1s (1/4)
4	15 + ___ = 200	71%	14%	14%	⊕ Breaks numbers into parts to add or subtract (4/5) ⊖ Uses standard algorithm to add or subtract (1/5)
5	20 × 15 = 300, 21 × 15 = ____	0%	43%	57%	No correct answers given
6	60 × 40	43%	57%	0%	⊕ Uses known facts and place value to multiply or divide (3/3)
7	15 × 12	29%	43%	29%	⊖ Uses standard algorithm to multiply or divide (2/2)
8	7000 ÷ 70	57%	14%	29%	⊕ Uses known facts and place value to multiply or divide (4/4)
9	Estimate 18 × 21	57%	43%	0%	⊕ Relates to benchmark number to make estimates (1/4) ⊖ Figures exact answer when asked to estimate (1/4) ⊖ Guesses, does not explain, or gives faulty explanation (2/4)
10	295 students, 25 on each bus	0%	43%	57%	No correct answers given

Written Computation

Students: 7

	Question	Correct / Self-corrected	Incorrect	Did Not Answer
1	5000 – 328	100%	0%	0%
2	842 × 35	57%	29%	14%
3	3423 ÷ 6	71%	14%	14%
4	275 ÷ 22	0%	43%	57%

What Does the Data Tell?

- MRI K–5
- Mental reasoning should be integral to math instruction

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What Does the Data Tell?

- MRI K–5
- Mental reasoning should be integral to math instruction
- Intervention is needed for students who need to catch up

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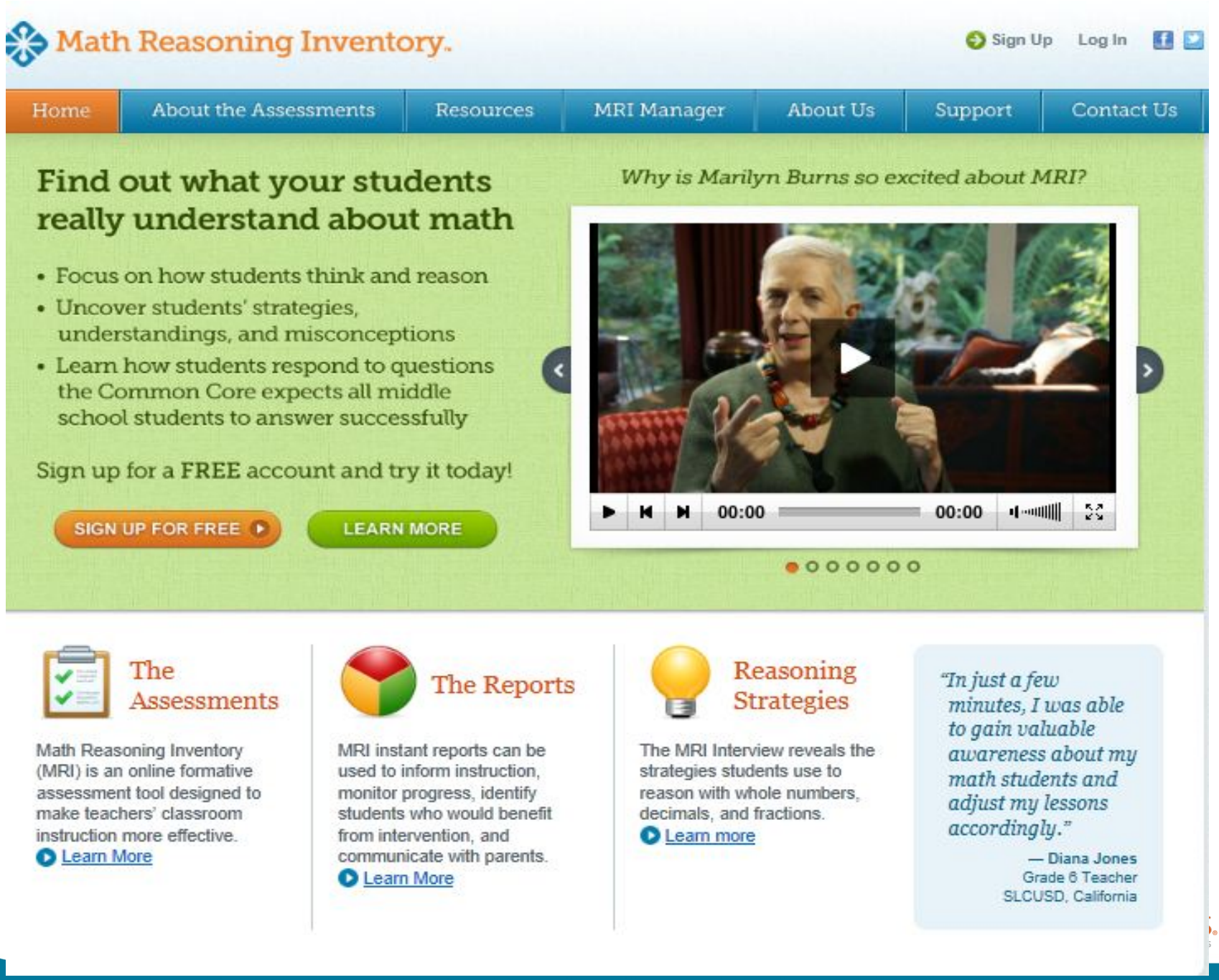

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