NCSM 2014

Linking Formative Assessments, the Common Core, and Instructional Decisions

Marilyn Burns

Tuesday, April 8, 2014

Math Solutions
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First a math problem

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99 + 17

99+17

Lauren

99+10=109
109+7=116

99+17

Lauren/Alessandra

99+10=109
109+7=116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
6 is 1 less than the 7

The answer had to end in 6.
So I knew the answer had to be 116.

99+17

Lauren/Alessandra

99+10=109
109+7=116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
6 is 1 less than the 7

The answer had to end in 6.
So I knew the answer had to be 116.

Eliane

9+7=16
90+10=100
16+100=116

uren / Alessandra

- 10 = 109
l+7 = 116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
6 is 1 less than the 7

The answer had to end in 6.

So I knew the answer had to be 116.

Eliane

9+7=16
90+10=100
16+100=116

Lindsay

9+7=16
16+10=26
26+90=116

99+17

Lauren/Alessandra

99+10=109
109+7=116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
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The answer had to end in 6.
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Eliane

9+7=16
90+10=100
16+100=116

Lindsay

9+7=16
16+10=26
90+26=116

99+17

Lauren/Alessandra

99+10=109
109+7=116

Dylan

100+17=117
117-1=116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
6 is 1 less than the 7

The answer had to end in 6.
So I knew the answer had to be 116.

Eliane

9+7=16
90+10=100
16+100=116

Lindsay

① 9+7=16
16+10=26
90+26=116

② 90+17=107
107+9=116

99+17

Lauren/Alessandra

99+10=109
109+7=116

Dylan

100+17=117
117-1=116

Caleb

99 is 1 less than 100.
17-1=16
99+1=100
100+16=116

Jake

9 plus any number is 1 less than the number you had.
(9+7=16)
6 is 1 less than the 7

The answer had to end in 6.
So I knew the answer had to be 116.

Eliane

9+7=16
90+10=100
16+100=116

Lindsay

① 9+7=16
16+10=26
90+26=116

② 90+17=107
107+9=116

Common Core Connection

- Common Core Standards for Mathematical Practice
- Common Core Standards for Mathematical Content

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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."

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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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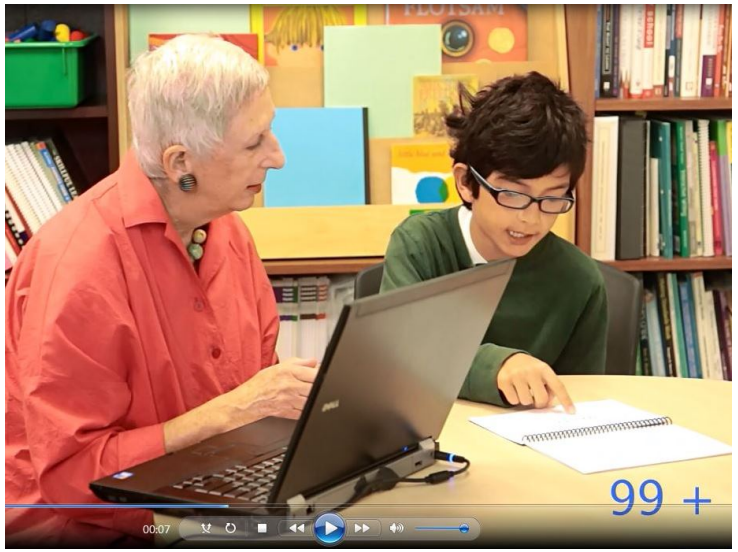
99 + 17

Alberto

Manuel

Dina



Amir

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MRI
Math Reasoning Inventory

Find out what students really understand about math

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Math Reasoning Inventory.

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Find out what your students really understand about math

- Focus on how students think and reason
- Uncover students' strategies, understandings, and misconceptions
- Learn how students respond to questions the Common Core expects all middle school students to answer successfully

Sign up for a **FREE** account and try it today!

SIGN UP FOR FREE | LEARN MORE

Why is Marilyn Burns so excited about MRI?

The Assessments

Math Reasoning Inventory (MRI) is an online formative assessment tool designed to make teachers' classroom instruction more effective.
Learn More

The Reports

MRI instant reports can be used to inform instruction, monitor progress, identify students who would benefit from intervention, and communicate with parents.
Learn More

Reasoning Strategies

The MRI Interview reveals the strategies students use to reason with whole numbers, decimals, and fractions.
Learn more

"In just a few minutes, I was able to gain valuable awareness about my math students and adjust my lessons accordingly."

— Diana Jones
Grade 6 Teacher
SLCUSD, California

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: Compare 3/8 and 5/6 Search by Student: Select one

Compare 3/8 and 5/6 and 3/6 00:24
Alberto

Compare 3/8 and 5/6 00:37
Amir

Compare 3/8 and 5/6 00:52
Dina

Compare 3/8 and 5/6 00:28
Ernesto

Compare 3/8 and 5/6 00:32
Malcolm

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

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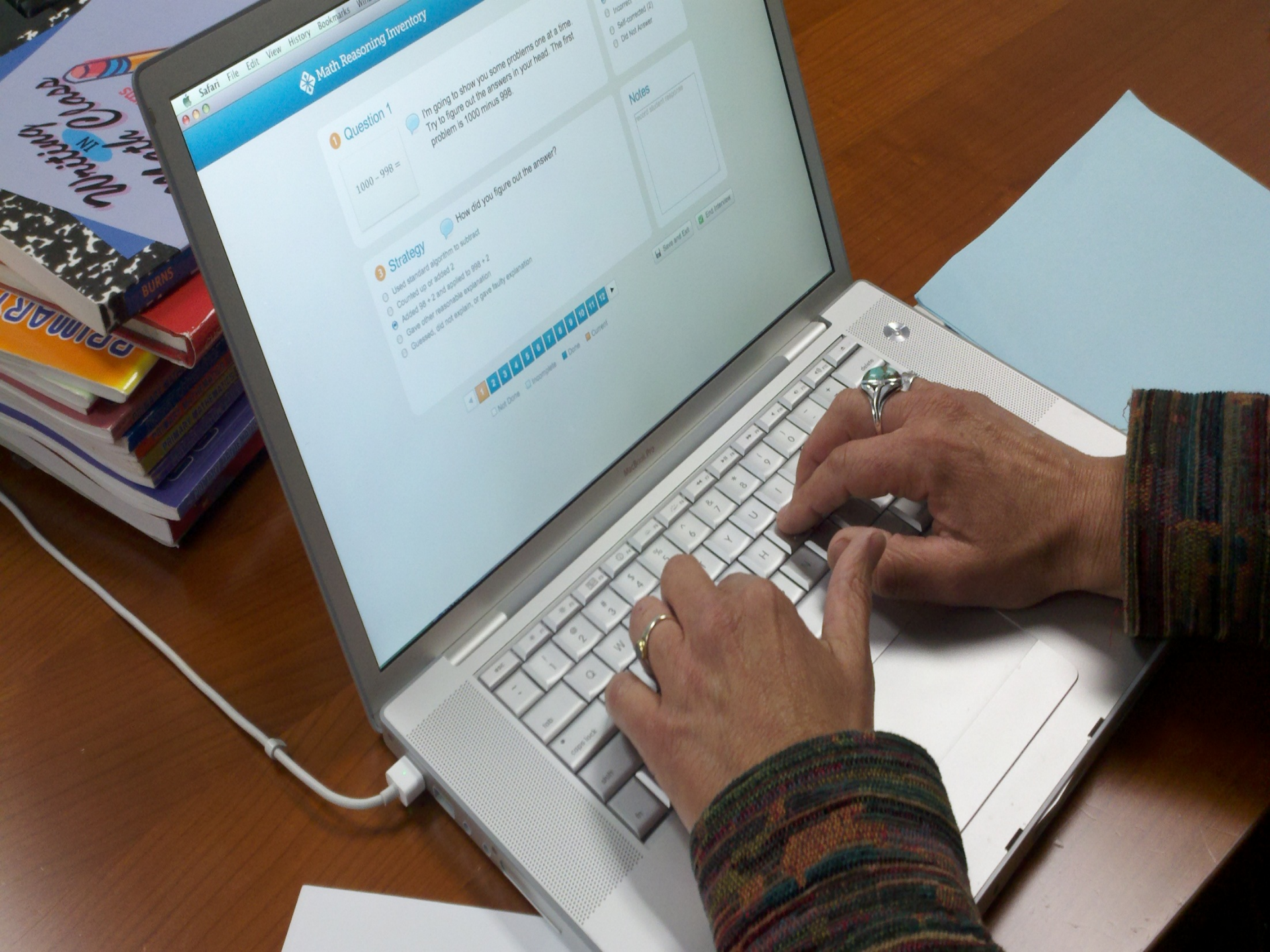
Math Reasoning Inventory
Question 1
I'm going to show you some problems one at a time. Try to figure out the answers in your head. The first problem is 1000 minus 998
1000 − 998 =
Notes
How did you figure out the answer?
Strategy
Used standard algorithm to subtract
Counted up or added 2
Added 98 + 2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

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 . . .

Practice Standard #3:
Construct viable arguments and critique the reasoning of others.

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Prompts for student writing. Grade 4:

It means . . .

Every students needs to learn . . .

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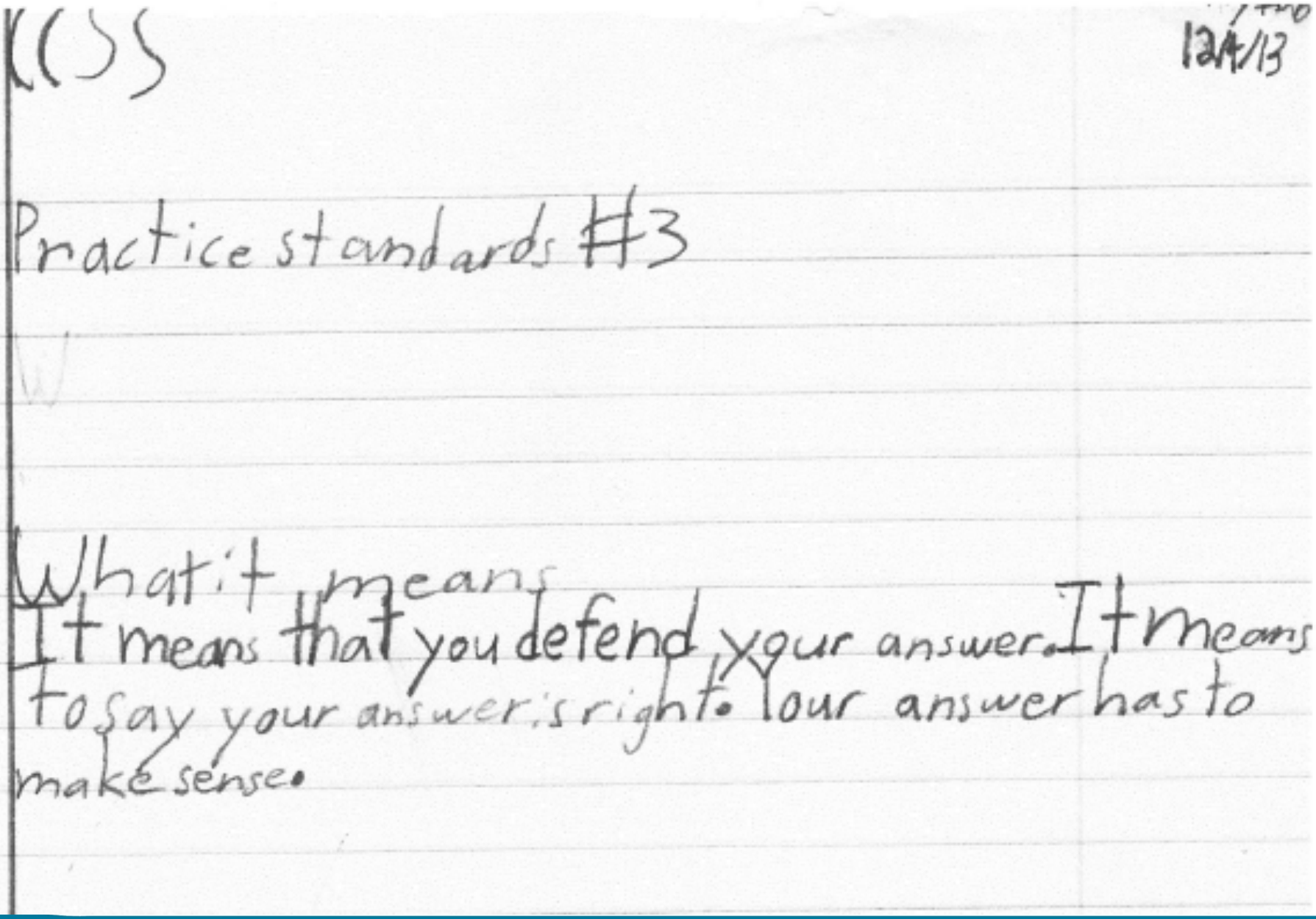
17 12\4\13

Common Core Practice Standard Number 3.

What it means:

Every student needs to learn how to explain their thinking. It is more important to be able to explain. If you didn't explain your thinking you would not learn that much, if all you needed were answers you would use calculators and your brain would not learn.

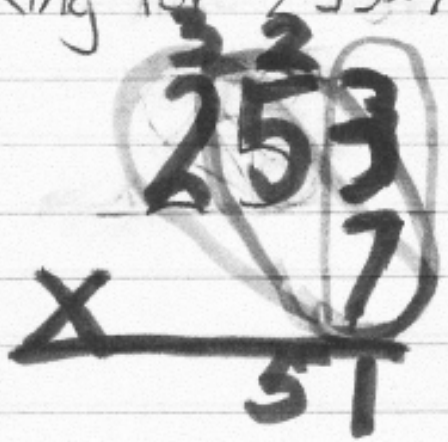


Practice Standard #3

12/4/13

Common Core (CCSS)

Every student needs to learn how to explain their thinking and have their answers make sense. Students also need to learn how to ask questions if something doesn't make sense to them. They need to learn how to be able to give other students feedback. I would explain my thinking for 253×7 by doing this:



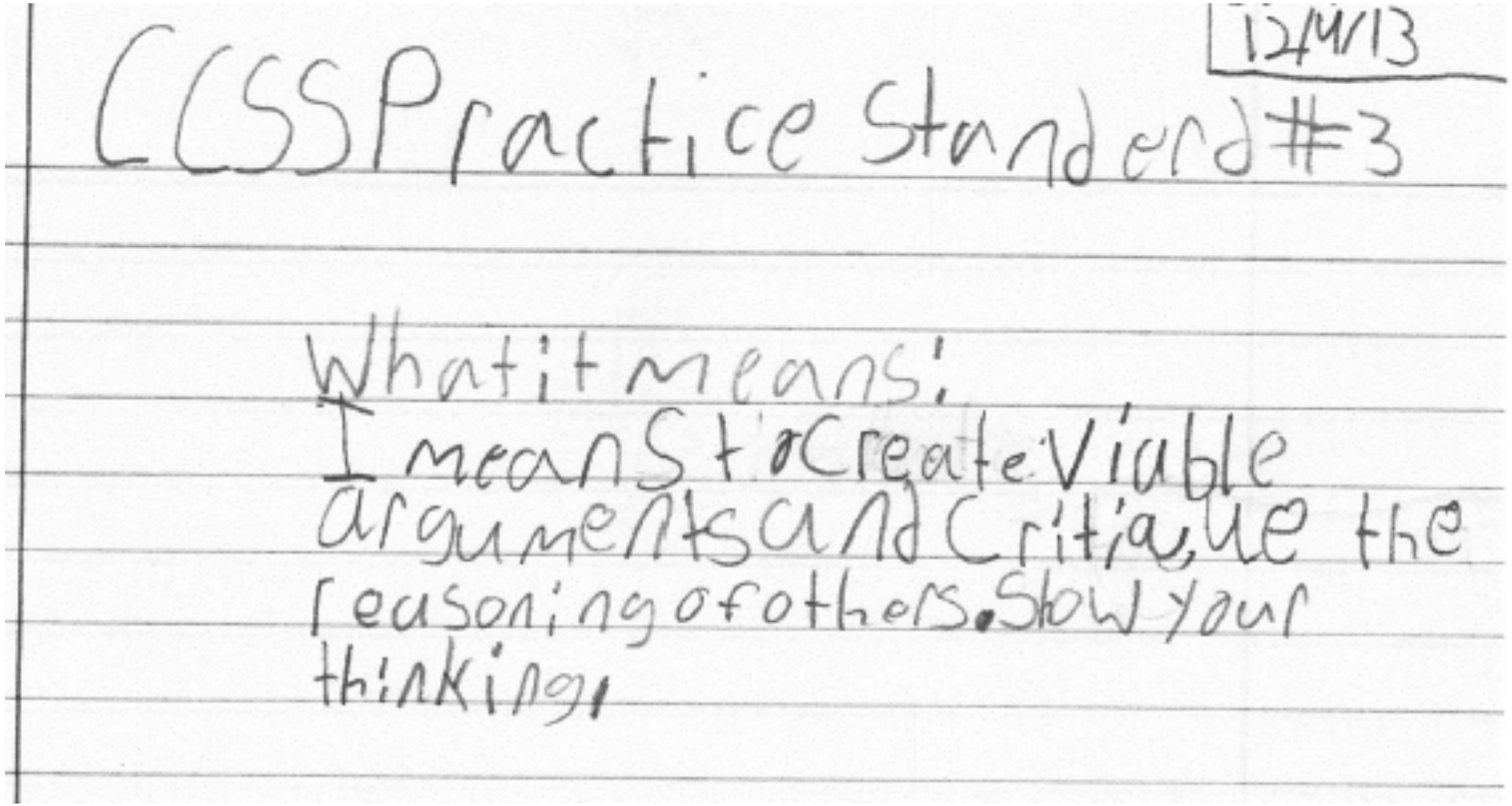
3×7=21
50×7=350 add 0
5×7=35
2×7=14
200×7=14,000 add 2 0s

12-4-13

Commen Core CCSS

Practice Standard. #3

It means that you should do something that makes sense and you should be able to critizize and question what the person is doing.



Common Core Connection

Grade 2

Number & Operations in Base Ten

Use place value understanding and properties of operations to add and subtract.

CCSS.Math.Content.2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

CCSS.Math.Content.2.NBT.9 Explain why addition and subtraction strategies work, using place value and the properties of operations.

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Common Core Connection

Grade 2

Operations & Algebraic Thinking

Represent and solve problems involving addition and subtraction.

CCSS.Math.Content.2.OA.A.1 Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.

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There are __ girls on the playground.
There are __ boys on the playground.
There are __ children in all.

There are **7** girls on the playground.

There are **15** boys on the playground.

There are __ children in all.

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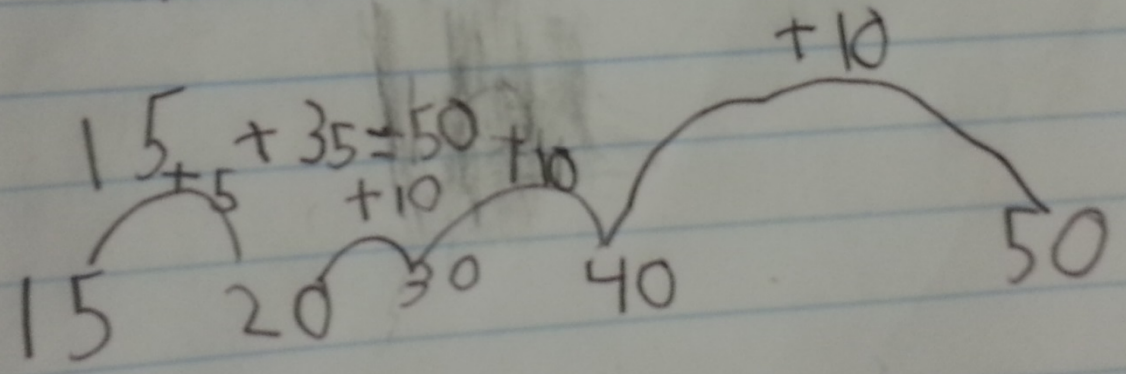
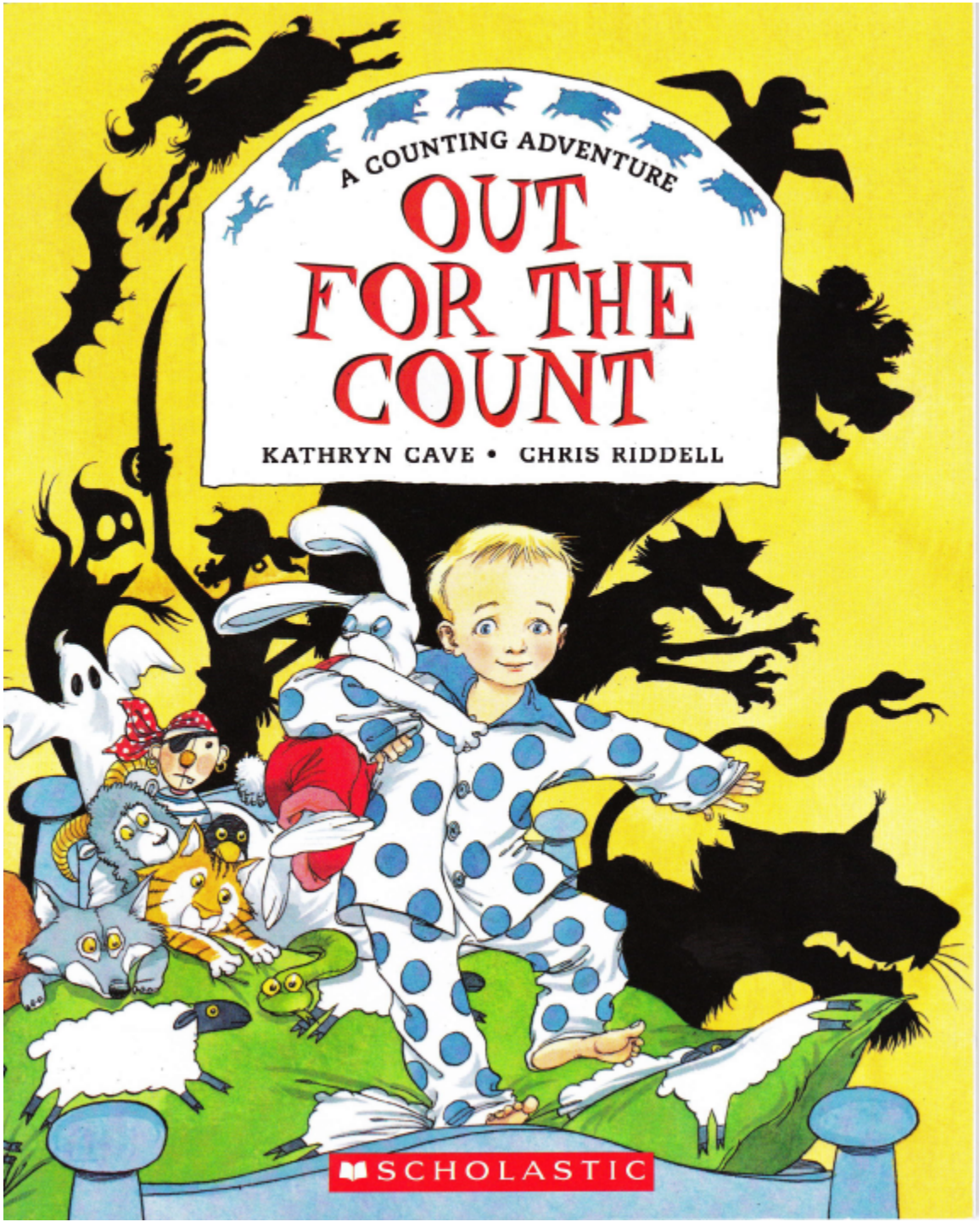
There are __ girls on the playground.
There are 15 boys on the playground.
There are 50 children in all.

$10 + \underline{50} = 60$

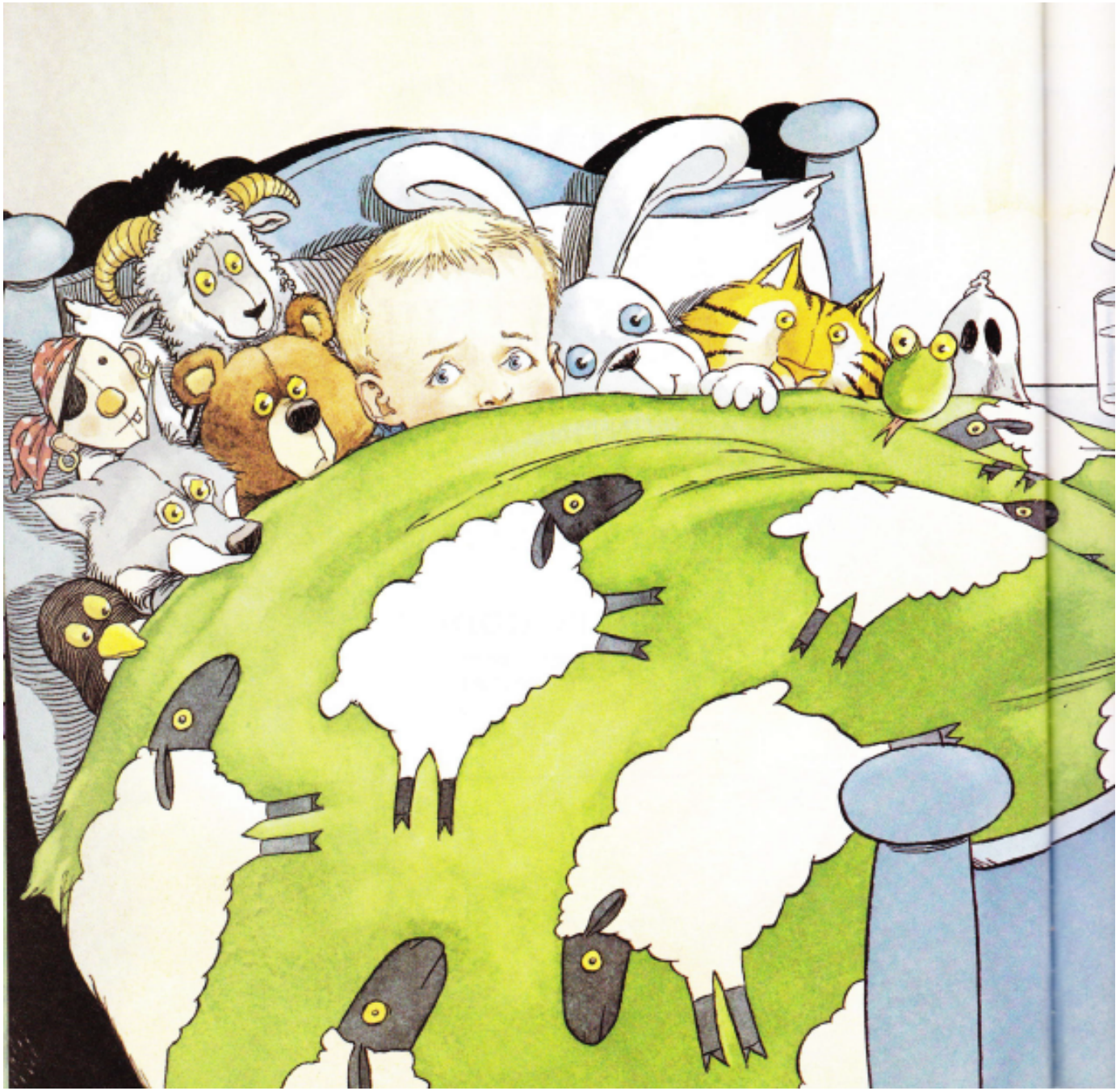
There are 35 girls
There are 15 boys
There are 50 in all.




A COUNTING ADVENTURE
OUT FOR THE COUNT
KATHRYN CAVE • CHRIS RIDDELL
SCHOLASTIC

Approaching from the east Tom saw
a band of pirates armed for war,
with pistols, cutlasses and axes,
looking for some target practice.

No time to hide, no place to run,
outnumbered 45 to one,
Tom ducked beneath the gangplank fast
and tripped them up as they went past.



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Buy Stuffed Animals

Isabella

DIRECTIONS

1	2	3	4
Penguin $13 and Sheep $18 13 + 18 Choose two stuffed animals. Write the problem.	10 + 10 = 20 3 + 8 = 11 20 + 11 = 31 13 + 18 = 31 Find the total price using equations.	13 +18 20 +11 31 Find the total price going down.	+10 +7 +1 13 → 23 → 30 → 31 Add with an open number line.

STUFFED ANIMALS

Penguin	$13	Bear	$35
Sheep	$18	Wolf	$38
Ghost	$26	Pirate	$39
Python	$29	Tiger	$47
Goat	$34	Rabbit	$49

① Stuffed animals: Ghost and Baer

Problem 25 + 26 = 61

Use equations.

35 + 26 =
20 + 30 = 50
6 + 6 = 11
50 + 11 = 61

Add going down.

2	5
+ 3	6
+ 5	0
1	1

Use an open number line.

+20 +10 -4

56 60 61

② Stuffed animals: Wolf and Pangwen

Problem 36 + 13 = 49

Use equations.

36 + 13 = 49
30 + 10 = 40
6 + 3 = 9
40 + 9 = 49

Add going down.

0	5
+ 3	6
3	6

+10 +3

Use an open number line.

36 + 46 = 49

③ Stuffed animals: Pirate and Sheep

Problem 39 + 18 = 57

Use equations.

39 + 18 = 57
30 + 10 = 40
9 + 8 = 17

Add going down.

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

+10 +7

Use an open number line.

+10 -2

39 49 57 59

Home Note: Your child uses splitting and going to the next ten to add two-digit numbers.

① Stuffed animals: Ghost and Bear

Problem 25 + 26 = 61

Use equations.

35 + 26 =

20 + 30 = 50

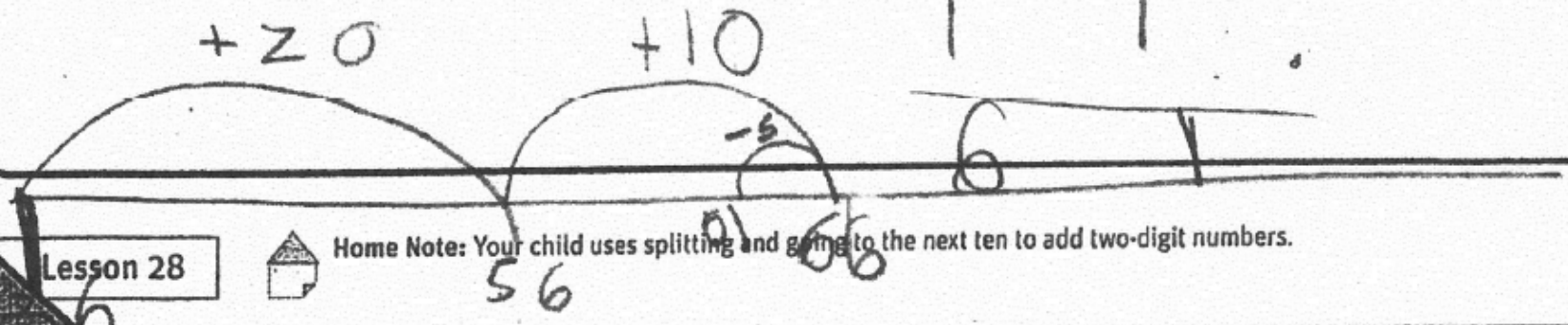
6 + 6 = 11

50 + 11 = 61

Add going down.

2	5
+ 3	6
5	0
+	
	1 1
6	1

Use an open number line.



Lesson 28

Home Note: Your child uses splitting and going to the next ten to add two-digit numbers.

Buy Stuffed Animals

Dean

DIRECTIONS

1. Penguin $13 and Sheep $18 — 13 + 18 — Choose two stuffed animals. Write the problem.
2. 10 + 10 = 20; 3 + 8 = 11; 20 + 11 = 31; 13 + 18 = 31 — Find the total price using equations.
3. 13 + 18 = 20; 20 + 11 = 31 — Find the total price going down.
4. 13 → +10 → 23 → +7 → 30 → +1 → 31 — Add with an open number line.

STUFFED ANIMALS

Penguin	$13	Bear	$35
Sheep	$18	Wolf	$38
Ghost	$26	Pirate	$39
Python	$29	Tiger	$47
Goat	$34	Rabbit	$49

① Stuffed animals: ghost and Bear

Problem $26 + $35

Use equations.

26 + 35 = ?
20 + 30 = 50
6 + 5 = 11
50 + 11 = 61

Add going down.

26
+35
50
+11
=61

Use an open number line.

Home Note: Your child uses splitting and going to the next ten to add two-digit numbers.

② Stuffed animals: rabbit and tiger

Problem 47 + 49

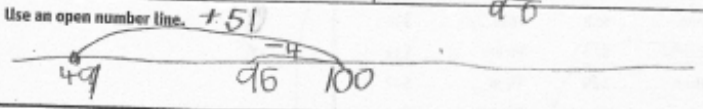
Use equations.

47 + 49 = ?
40 + 40 = 80
7 + 9 = 16
80 + 16 = 96

Add going down.

47
+49
80
16
96

Use an open number line. +51, +4



③ Stuffed animals: ~~tiger~~ and penguin and ~~ghost~~ and goat

Problem 47 + 13 + 26 + 34

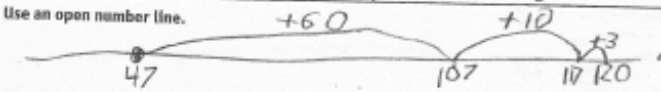
Use equations.

47 + 13 + 26 + 34
60 + 60 = 120

Add going down.

47
+26
+13
+34
100
20
120

Use an open number line. +60, +10, +3



Home Note: Your child uses splitting and going to the next ten to add two-digit numbers.

③ Stuffed animals: tiger and penguin and ghost and goat

Problem 47+13+26+34

Use equations.

47+13+26+34

60+60=120

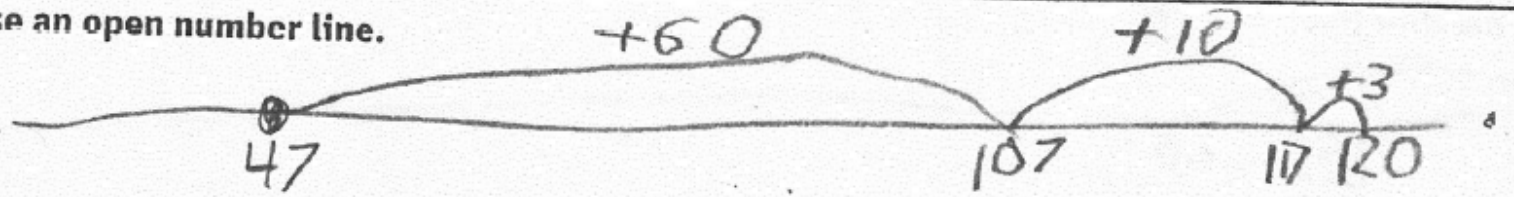
Add going down.

47
+26
+13
+34

100
20

120

Use an open number line.



SPECIAL SALE!

STUFFED ANIMALS

Penguin	~~$13~~ $6	Bear	~~$35~~ $8
Sheep	~~$18~~ $9	Wolf	~~$38~~ $10
Ghost	~~$26~~ $10	Pirate	~~$39~~ $6
Python	~~$29~~ $15	Tiger	~~$47~~ $5
Goat	~~$34~~ $12	Rabbit	~~$49~~ $20

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Grade 2 Benchmark Assessment

The teacher had 99 stickers. She gave ___ stickers away. Then the teacher had 50 stickers. How many stickers did she give away?

Solve with words, numbers, or pictures. Write an equation that represents the problem.

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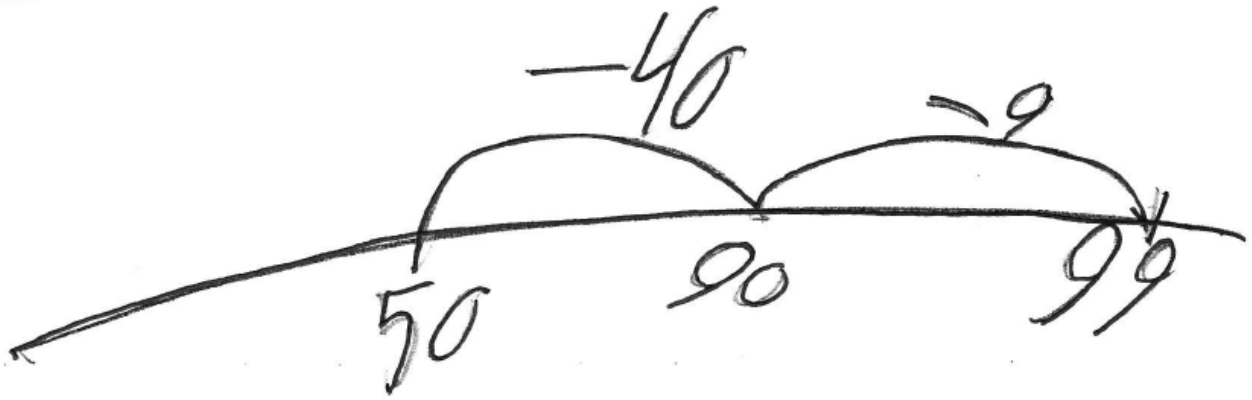
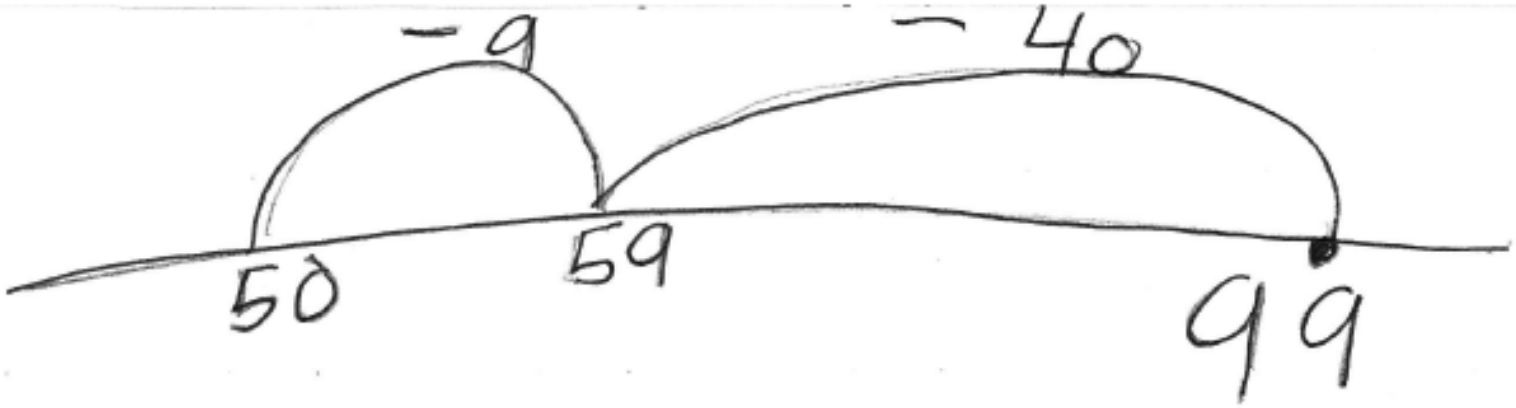


Write an equation that represents this problem.

99 - 49 = 50



Write an equation that represents this problem.

99 - 49 = 50

99 − 9 = 90

801

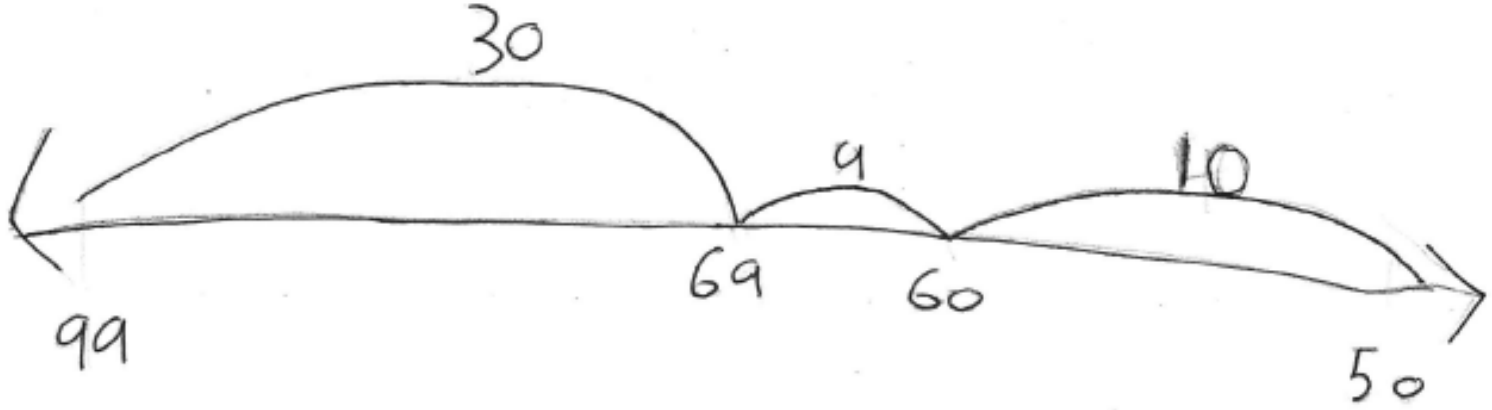
702

603

49 504

Write an equation that represents this problem.

99 − 49 = 50



Write an equation that represents this problem.

$99 - 30 = 69 - 9 = 60 - 10 = 50$

39

49

If it was

100 it would be 50. − 1 = 99 − 49

Write an equation that represents this problem.

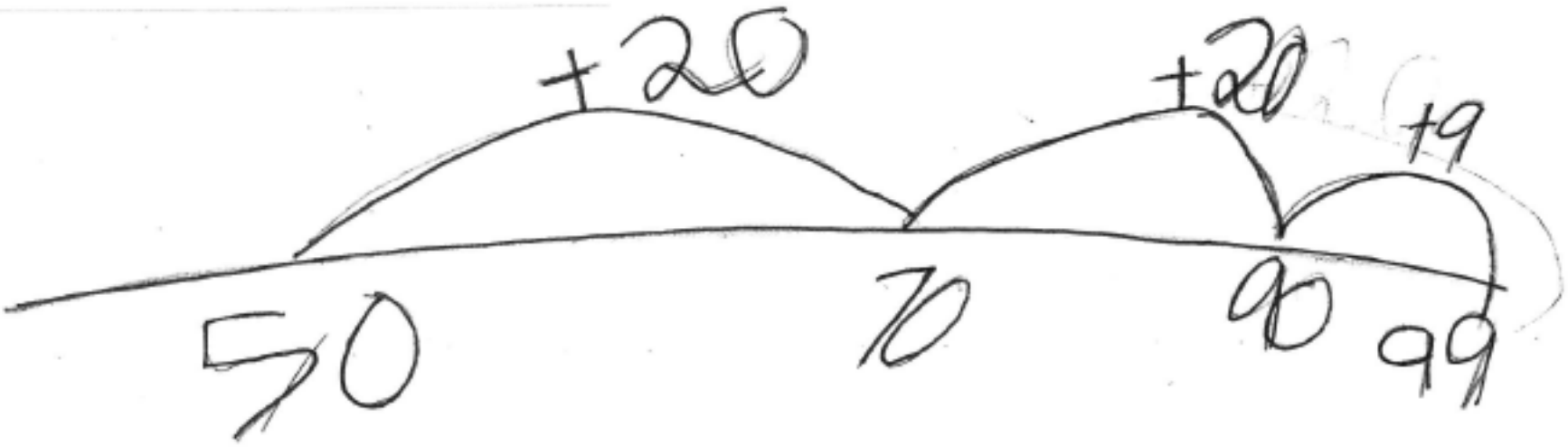
$99\overline{} - 49 = 50$

49

But 99 so one less than 50

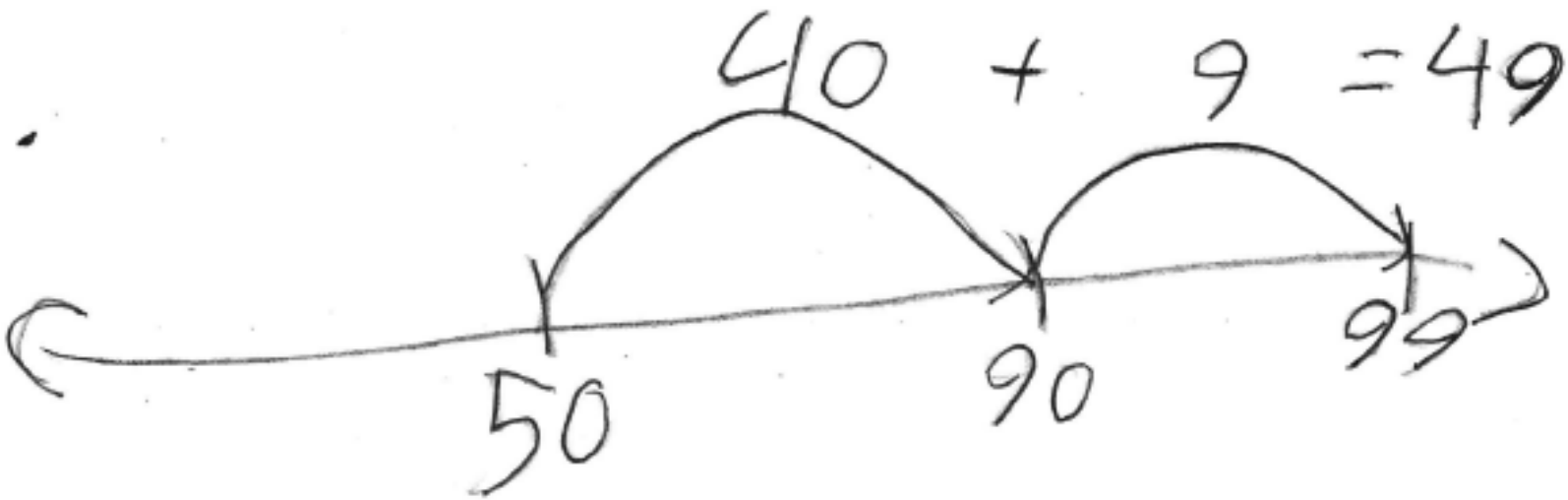
Write an equation that represents this problem.

$50 + \boxed{49} = 99$



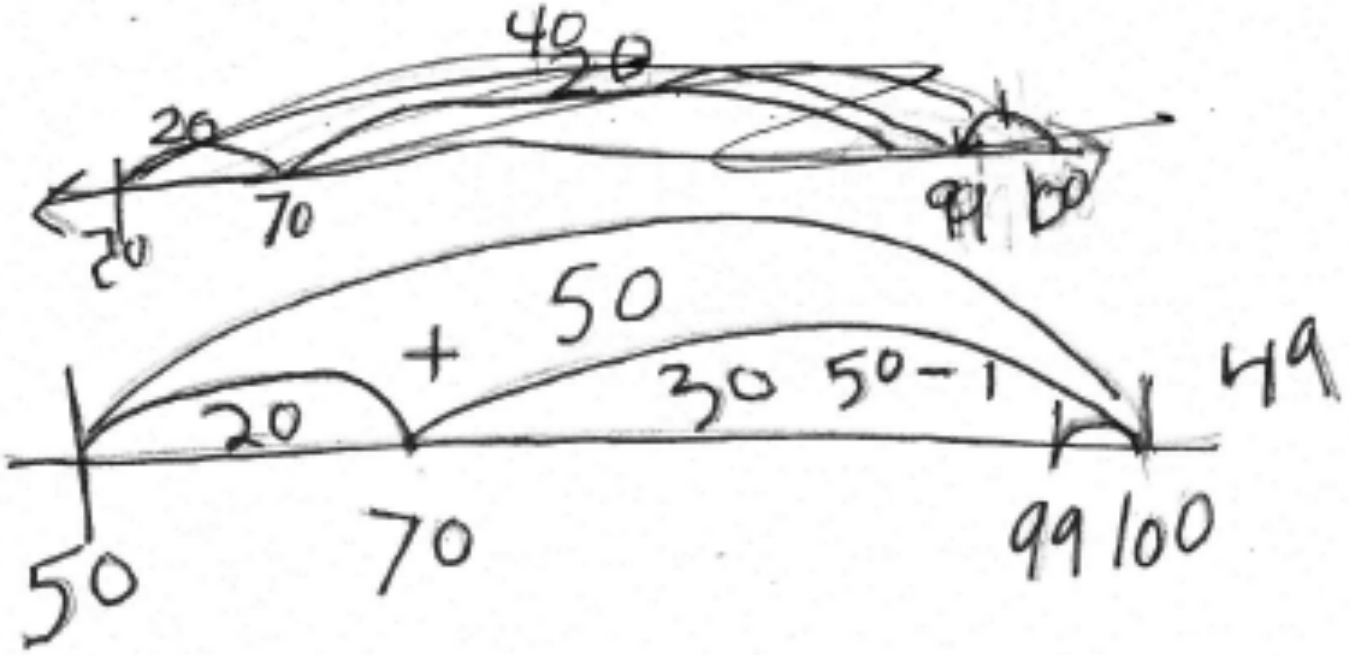
Write an equation that represents this problem.

50 + 49 = 99

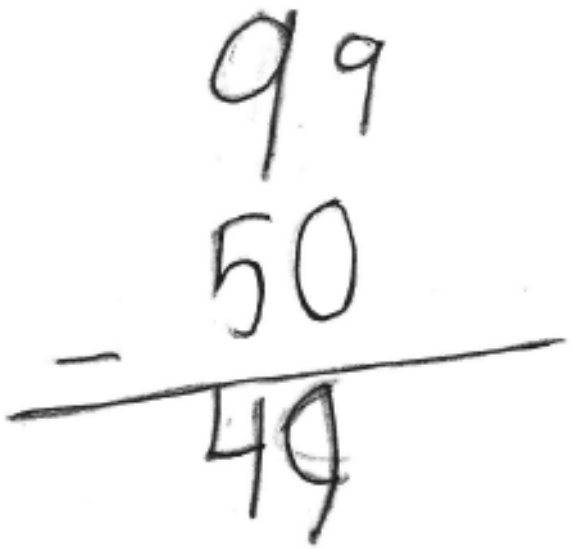


Write an equation that represents this problem.

$99 - \underline{49} = 50$

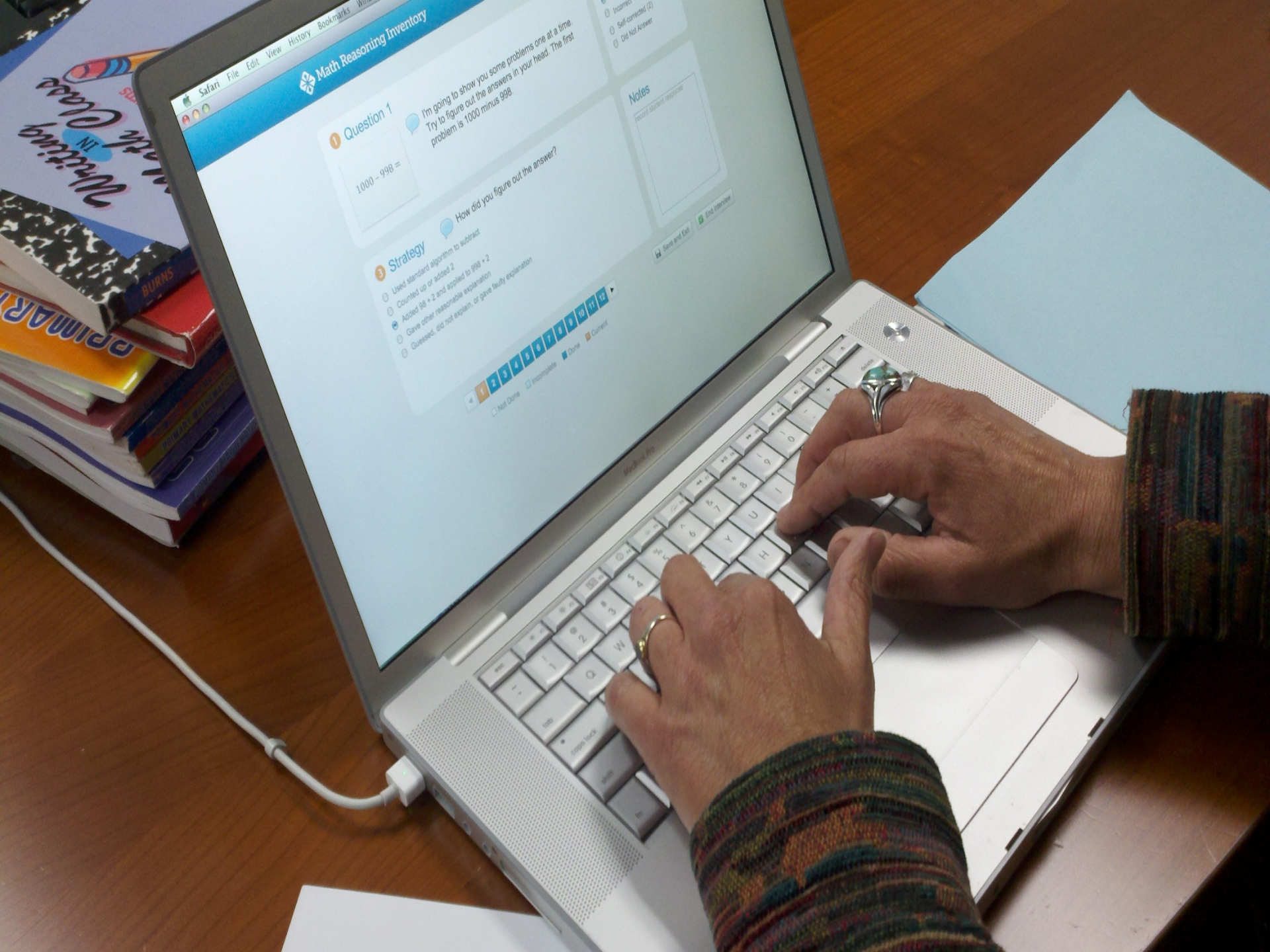


Write an equation that represents this problem.



Write an equation that represents this problem.

$99 - 50 = 49$


Math Reasoning Inventory
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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
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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
Save and Exit
End Interview
Not Done
Incomplete
Done
Current

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

15 x 12

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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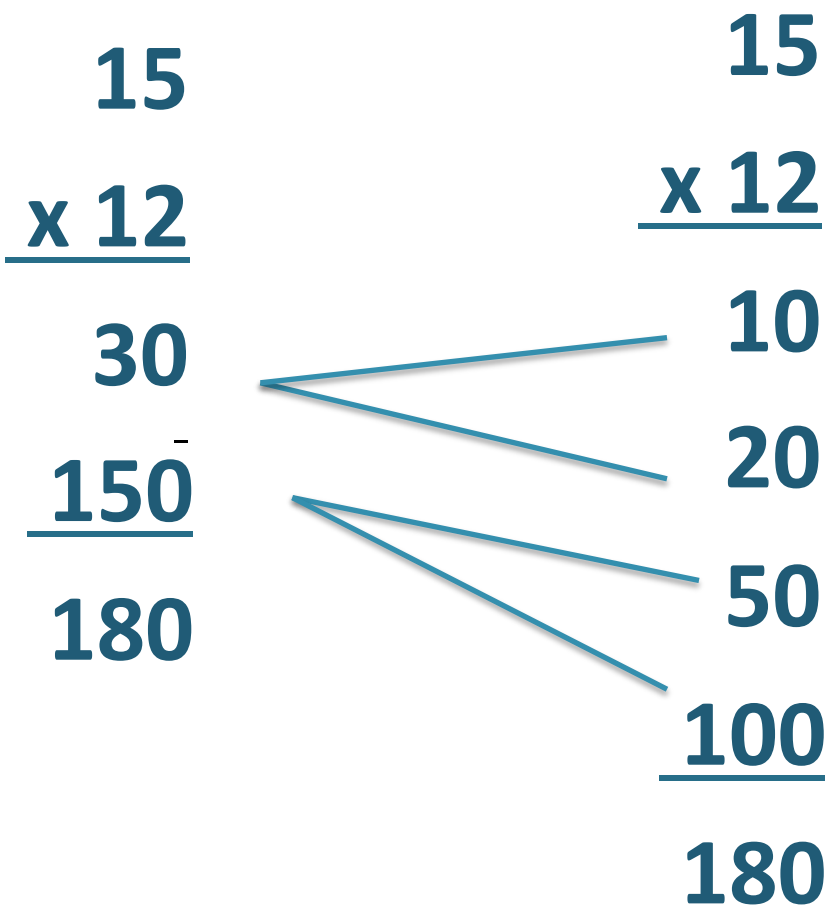
15 x 12



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Distributive Property of Multiplication over Addition

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15 x 12

Monica

Malcolm

Alberto

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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."

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."

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

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

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

Molly Problem

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

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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.

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Molly Problem

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

20 x 1.5 = ___

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Distributive Property of Multiplication over Addition

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Sergio: Molly problem, 20 x 1.5

(View at www.mathreasoninginventory.com)

"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

20 x 1.5 = (20 x 1) + (20 x .5)

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Common Core Connection

Grade 2

Measurement & Data

Measure and estimate lengths in standard units.

CCSS.Math.Content.2MD.A.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes .

Relate addition and subtraction to length.

CCSS.Math.Content.2MD.B.5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units,.

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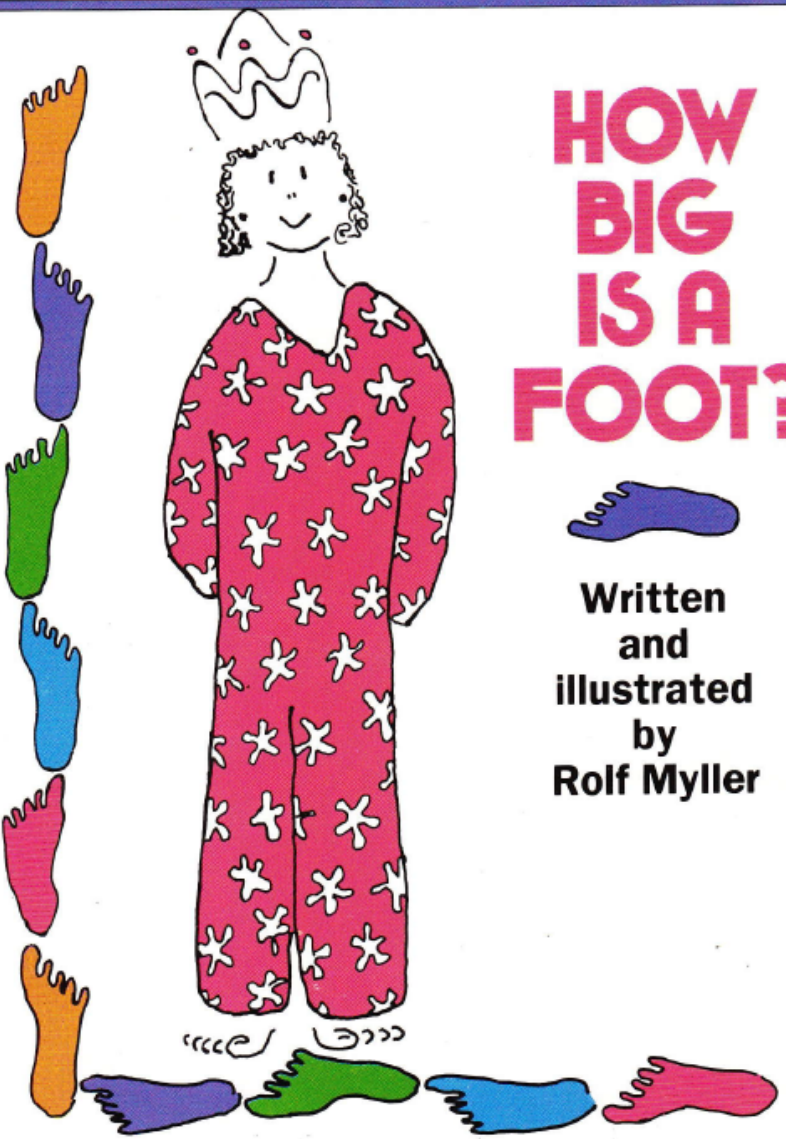
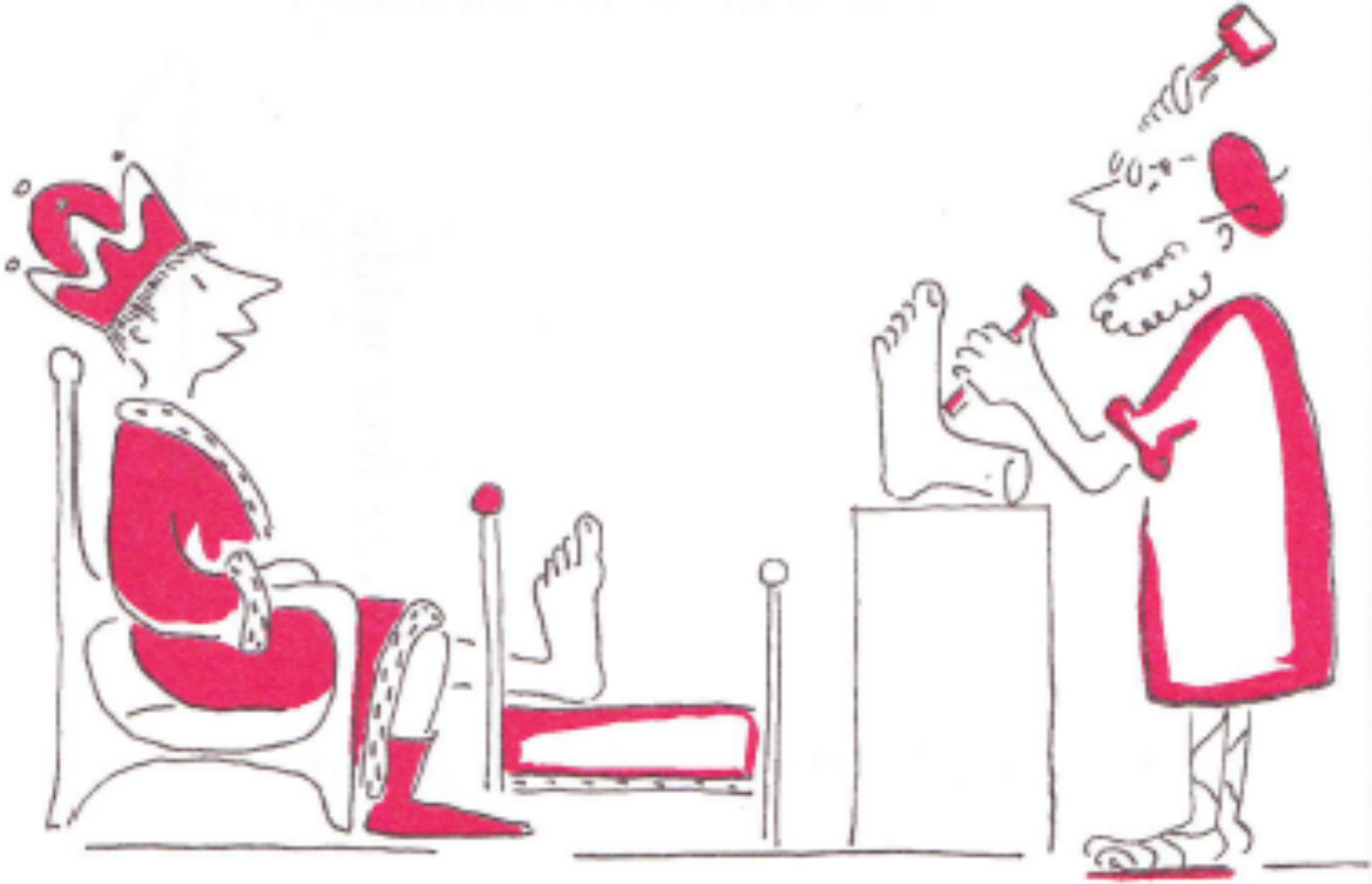
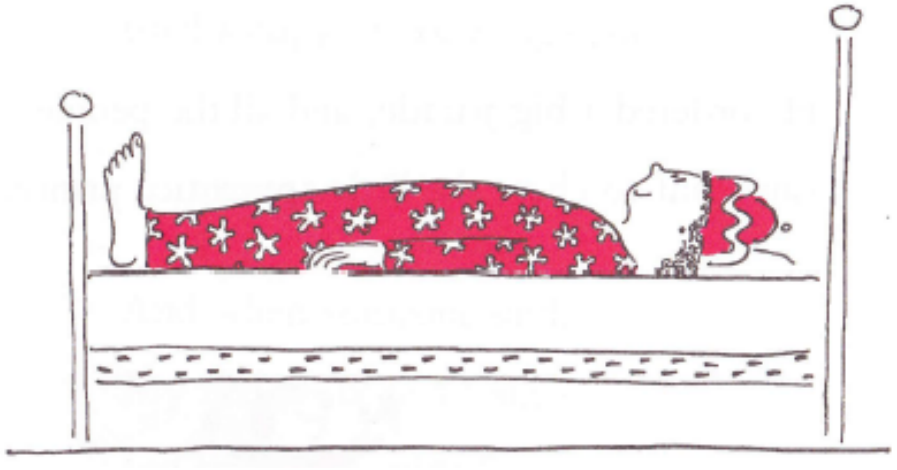
A DELL YOUNG YEARLING



HOW BIG IS A FOOT?

Written and illustrated by Rolf Myller



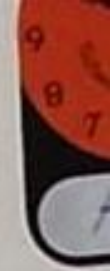


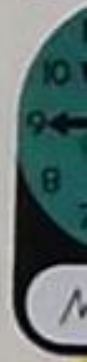
marker | 12 centimeters | $4\frac{1}{2}$ inches
12 cm | $4\frac{1}{2}$ in
$4\frac{1}{2}$ "

Name

Measuring Things

What I measure	inches	centimeters
1.		
2.		
3.		
4.		
5.		

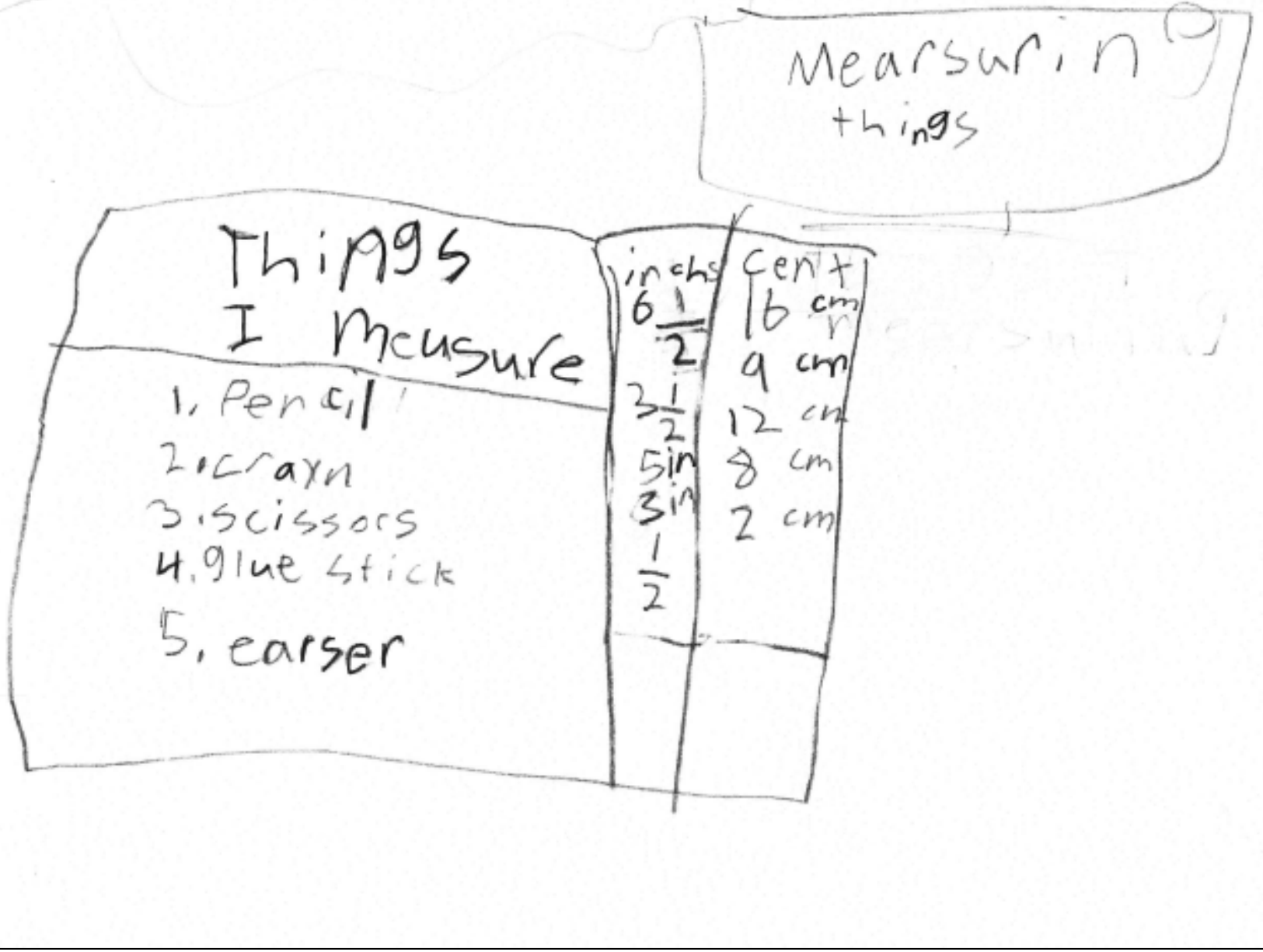


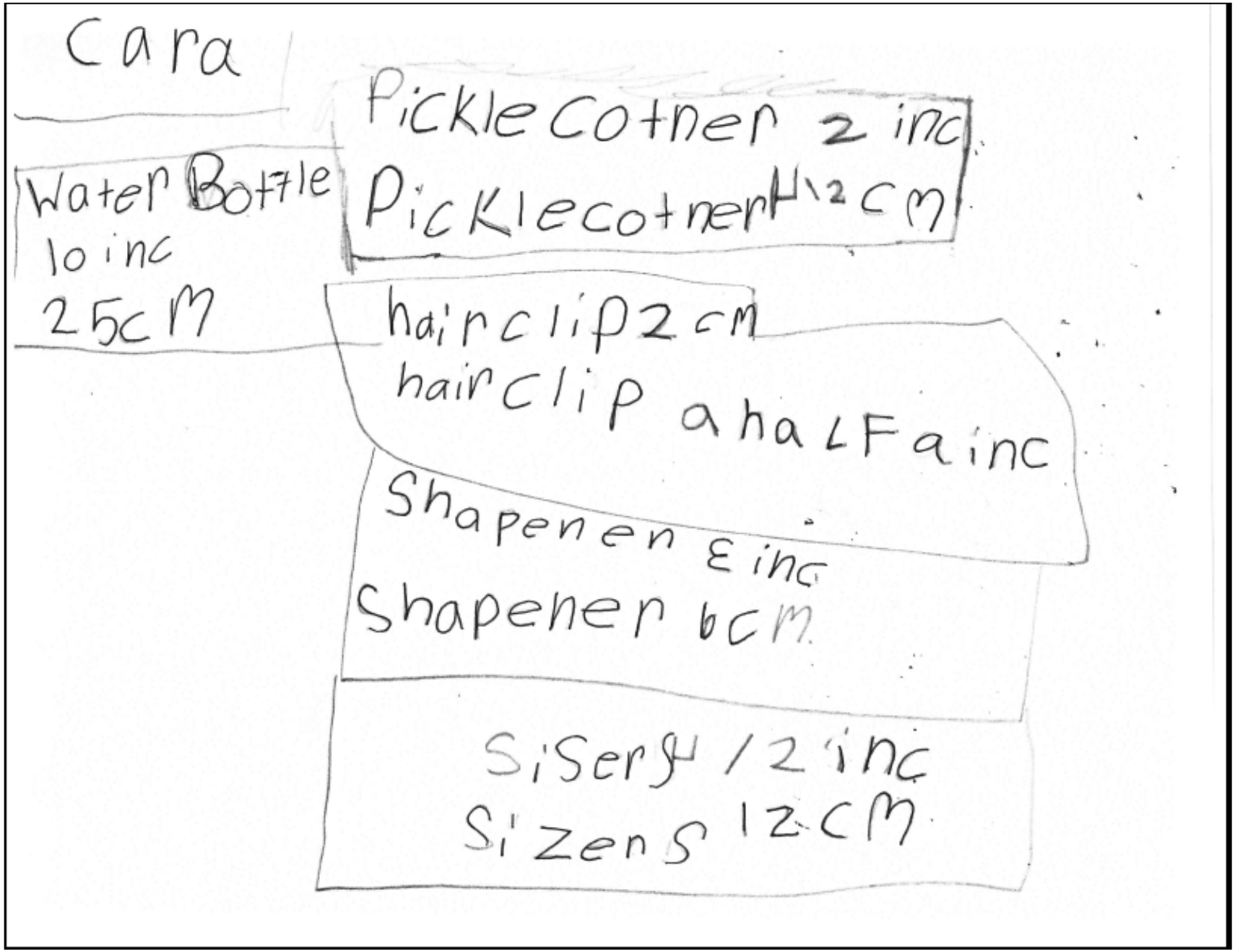


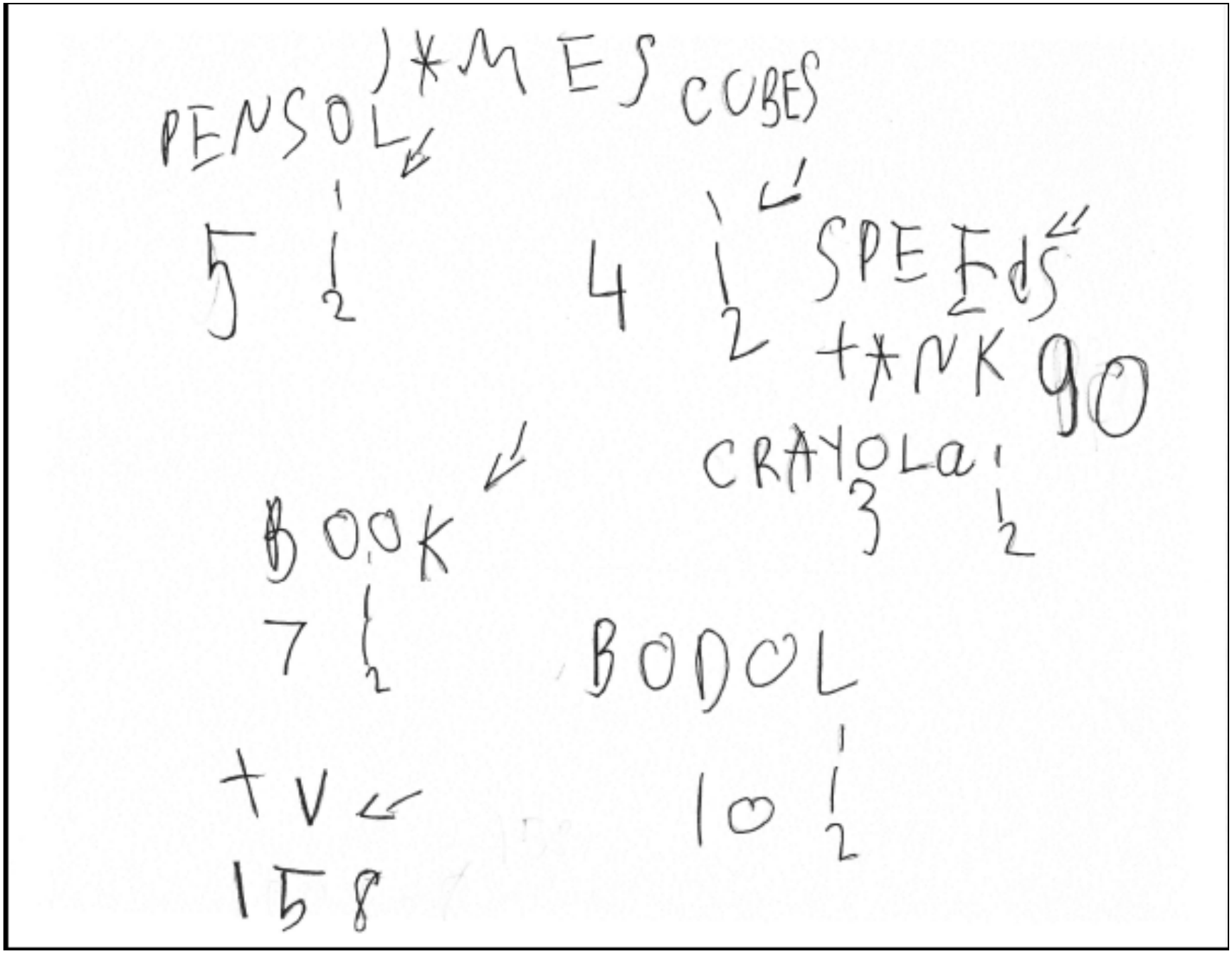
Maya

Measuring Things

What I measure	inches	centimeters
1. Scissors	1. $5\frac{1}{2}$"	1. 14 cm.
2. Crayon	2. $3\frac{1}{2}$"	2. 9 cm.
3. Pencil	3. 7"	3. 19 cm
4. Pencil sharpener	4. $2\frac{1}{2}$"	4.
5.	5.	5.


Mearsuring things
Things I Meusure
inchs
centi
1. Pencil
2. Crayn
3. Scissors
4. Glue Stick
5. earser
6 1/2
6 cm
9 cm
3 1/2
12 cm
5in
8 cm
3in
2 cm
1/2


Cara
Water Bottle
10 inc
25cM
Pickle Cotner 2 inc
Pic Klecotner 1\2 cM
hair clip 2 cM
hair clip a half a inc
Shapener 8 inc
Shapener 6cM
Siser 1/2 inc
Sizens 12 cM


JAMES
PENSOL
5 1/2
CUBES
4 1/2
SPEEDS
TANK
90
CRAYOLa
3 1/2
BOOK
7 1/2
BODOL
10 1/2
TV
158

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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