Tennessee Comprehensive Assessment Program / Mathematics

TCAP/CRA PILOT 2012

5

Task 4 : Ellen's Math

Scoring Guide

Task 4. Ellen's Math Task

Ellen says:

Multiplying any number will always give you an answer bigger than the number you started with.
Look, I can show you.

Start with 9.
Multiply by 5. $9 \times 5 = 45$
The answer is 45, and
45 is bigger than 9. $45 > 9$

It even works for fractions.
Start with $\frac{1}{2}$.
Multiply by 4. $\frac{1}{2} \times 4 = 2$
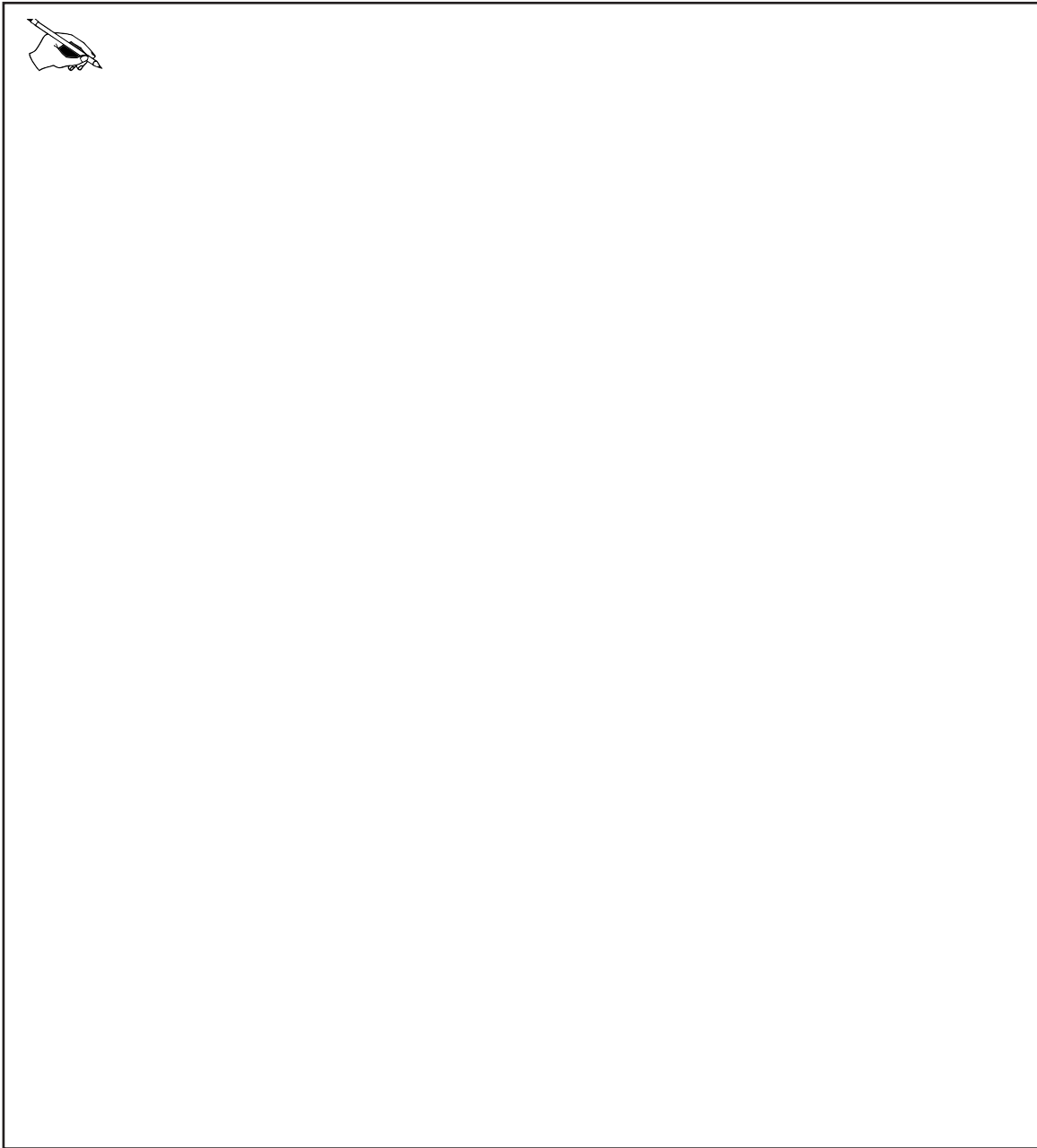The answer is 2, and
2 is bigger than $\frac{1}{2}$. $2 > \frac{1}{2}$

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

STOP

**REVIEW YOUR
WORK IF YOU
HAVE TIME.**

4. Ellen's Math Task Scoring Guide

The CCSS for Mathematical Content (1 point)

5.NF.5b   Student provides examples that show that, when one of two factors is a number   _____
between 0 and 1, the product will be smaller than the other factor.

<div align="center">OR</div>

5.OA.2*   Student provides an example to show that, when one of two factors in a   _____
multiplication equation is 0 or less, the product of the equation will be less than
the factor that is a positive number.

<div align="right">**Total Content Points** _____</div>

The CCSS for Mathematical Practices (3 points)

MP4   Student provides words, diagrams, or equations that indicate the relationship   _____
between the factors and the product.

    (MP4: Model with mathematics.)

MP6   Student uses accurate equations and provides correct calculations.   _____

    (MP6: Attend to precision.)

MP7   Student indicates the conditions under which the product will be smaller than the first   _____
or both factors.

    (MP7: Look for and make use of structure.)

<div align="right">**Total Practice Points** _____</div>

<div align="right">**Total Awarded Points** _____</div>

*5.OA.2 has been included to allow students to receive content credit for appropriate solution paths that do not include fractions, since the task does not specify that fractions are required in the response. Please note that 5.OA.2 is not one of the TNCore Focus Standards. In future CRA administrations students will be responsible for demonstrating their knowledge and abilities related to the TNCore Focus Standards on all tasks.

The CCSS for Mathematical Content Addressed in This Task

Apply and extend previous understanding of multiplication and division to multiply and divide fractions.

Interpret multiplication as scaling (resizing), by:

5.NF.5b   Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $a/b = (n × a)/(n × b)$ to the effect of multiplying a/b by 1.

Write and interpret numerical expressions.

5.OA.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.*

The CCSS for Mathematical Practices*

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.

*Gray text indicates Mathematical Practices not addressed in this task.

Students' responses to a mathematical task provide evidence of what they understand and are able to do in relation to the standards and practices. Across tasks, this cumulative evidence shows students' understanding and abilities within a domain. When students do not respond completely to all parts of a task, they provide insufficient evidence of their mathematical understanding and abilities and therefore do not fully demonstrate the expectations of the standards and practices aligned with that task.

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

Because her rule isn't always true, you can multiply $36 \times \frac{1}{4} = 9$

$36 > 9$ When you multiply something by a fraction less than a half, it is below the number you started with.
(unless the fraction comes before a whole)

STOP

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Litho#: 50014

50014   *Page 5*

Guide 1   Litho 50014

Total Content Points: 1   (5.NF.5b)
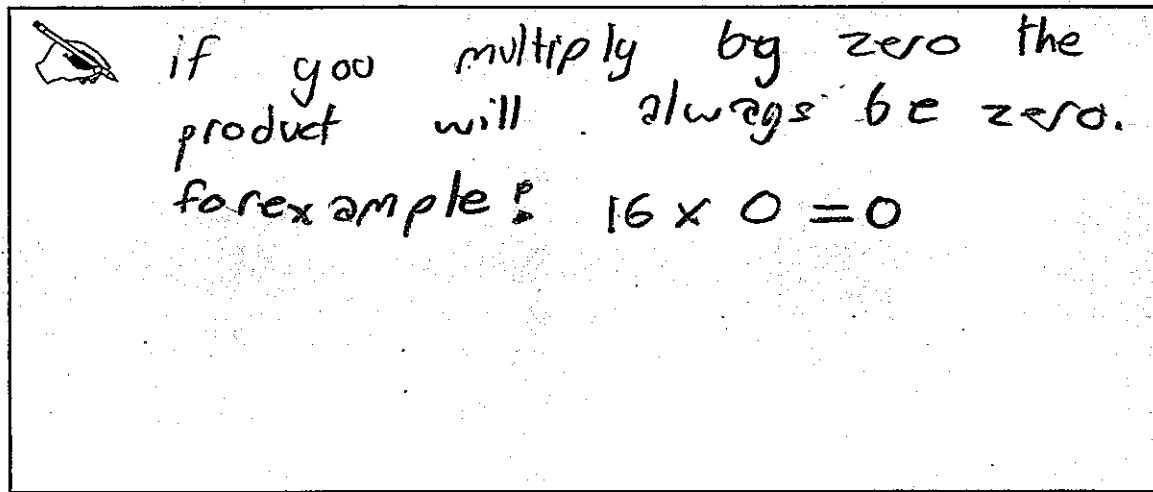
Total Practice Points: 3   (MP4, MP6, MP7)

The student provides a multiplication example that shows that when one of the factors is between 0 and 1, the product will be smaller than the other factor (5.NF.5b). The student uses an equation to demonstrate this relationship between factors and the product (MP4). The equation is correctly performed, and is correct in that the product is smaller than the number started with (MP6). Also, the student indicates a general condition under which the product will be smaller than the first factor (MP7).

Total Awarded Points: 4 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with*.

Explain when this is true, and give an example using words, diagrams and equations.

✎ if you multiply by zero the product will always be zero. forexample: 16 × 0 = 0

Guide 2   Litho 50009

Total Content Points: 1   (5.OA.2)

Total Practice Points: 3   (MP4, MP6, MP7)

The student provides a multiplication example that shows that when one of two factors in an equation is a positive number and the other factor is 0, the product will be smaller than the other factor (5.OA.2). The student uses an equation to demonstrate her thinking and to show the relationship of the product of the equation to the two factors (MP4). The equation is correctly chosen and correctly calculated (MP6). The student indicates a general condition under which the product will be less than the first factor (MP7).

Total Awarded Points: 4 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

If you multiply a number by 1 or 0 it will be the same number or 0. If you multiply with negatives, the number will be less. For example! For Example 5×0=0

$5 \times -5 = -25$

because
Start with 5
multiply by -5
The answer is -25
and -25 is less than 5.

Guide 3   Litho 50022

Total Content Points: 1   (5.OA.2)

Total Practice Points: 3   (MP4, MP6, MP7)

The student provides two multiplication examples, showing that when one of the two factors in an equation is 0 or is less than 0 the product will be smaller than the other factor (5.OA.2). The student uses equations ($5 \times 0 = 0$ and $5 \times -5 = -25$) to demonstrate this relationship between factors and the product (MP4). The equations are correctly calculated (MP6). In addition, the student provides statements of general conditions under which the product will be less than the first factor (MP7).

Total Awarded Points: 4 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

Multiplying by any number will not always give you an answer bigger than what you started with.

start with $\frac{2}{3}$ or $\frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$ or ⊕ x ⊕ ⊕
multiply it by $\frac{1}{3}$
you get $\frac{2}{9}$

STOP

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Guide 4   Litho 50029

Total Content Points: 1   (5.NF.5b)

Total Practice Points: 2   (MP4, MP6)

The student provides an example showing that when one of the factors of a multiplication equation is between 0 and 1, the product will be smaller than the other factor (5.NF.5b). The student provides an equation and a diagram to indicate this relationship between factors and product (MP4). The equation is correctly calculated (MP6). However, despite the student providing an example that fits the task, she makes no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 3 of 4

Ellen's calculations are correct, but her rule does *not* always work.

Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

Start with 20
multiply by 0
the answer is 0
0 is smaller than 20

"not bigger"
$20 \times 0 = 0$
$0 < 20$

start with 30
multply by 1
answer is 30

$30 \times 1 = 30$
$30 = 30$
30 is equal to 30

Guide 5   Litho 50033

Total Content Points: 1   (5.OA.2)

Total Practice Points: 2   (MP4, MP6)

The student provides one correct example showing that when one of two factors of a multiplication equation is 0, the product will be smaller than the other factor (5.OA.2). The student provides one correct equation and reiterates it in words to indicate this relationship between factors and product (MP4). The student also notes that when a factor is multiplied by 1, the result will be equal to the first factor, but he specifically states that multiplying by 0 gives the smaller result. The equation is correctly chosen and correctly calculated (MP6). However, there is no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 3 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

A. $56 \times \frac{1}{4} = 14$ → $56 > 14$
bigger — smaller

B. $66 \times \frac{2}{3} = 44$ → $66 > 44$
bigger — smaller

C. $112 \times \frac{1}{8} = 14$ → $112 > 14$
bigger — smaller

STOP

REVIEW YOUR WORK IF YOU HAVE TIME.

Guide 6   Litho 50008

Total Content Points: 1   (5.NF.5b)

Total Practice Points: 2   (MP4, MP6)

The student provides several examples of multiplication that show that when one of the factors in a multiplication equation is between 0 and 1, the product will be smaller than the other factor (5.NF.5b). The student uses three equations to demonstrate this relationship between factors and the product (MP4). All of the equations are appropriate and are correctly calculated (MP6). However, there is no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 3 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

You can multiply: $\frac{1}{2} \times 10 = 5$
five is smaller than ten

STOP

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Litho#: 50080

Guide 7   Litho 50080

Total Content Points: 1   (5.NF.5b)

Total Practice Points: 2   (MP4, MP6)

The student provides an example of a multiplication equation that show that when one of the factors is between 0 and 1, the product will be smaller than the other factor (5.NF.5b). The student uses an equation to demonstrate this relationship between factors and the product (MP4). The student's equation is calculated correctly, and although it is presented with the fraction before the whole number, the student is clear and precise in stating that the product is being compared to the larger whole-number factor (MP6). There is no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 3 of 4
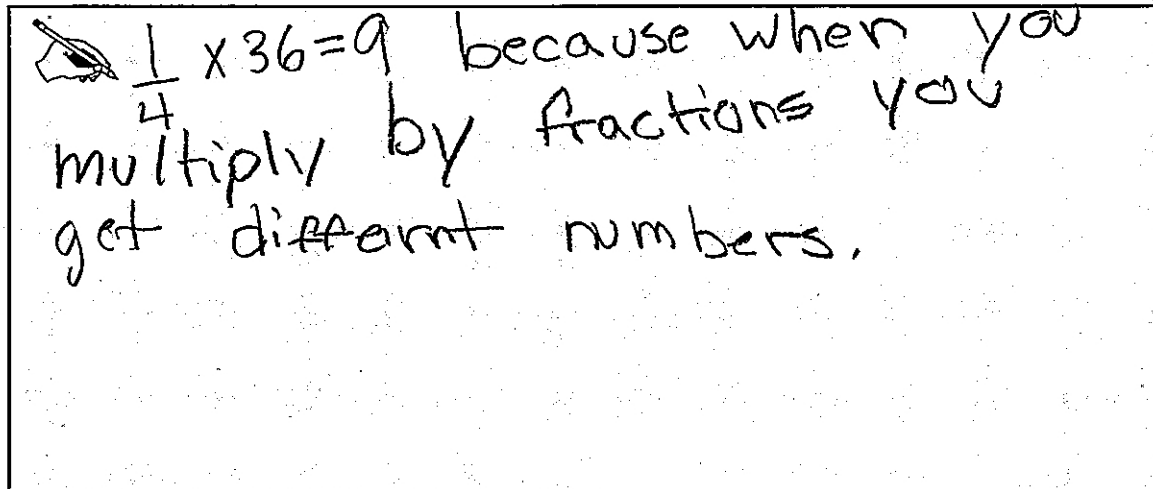
Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

$\frac{1}{4} \times 36 = 9$ because when you multiply by fractions you get different numbers.

STOP

REVIEW YOUR WORK IF YOU HAVE TIME.

Guide 8   Litho 50134

Total Content Points: 1   (5.NF.5b)

Total Practice Points: 1   (MP4)

The student provides an example of multiplication that shows that when one of the factors is between 0 and 1, the product will be smaller than the other factor (5.NF.5b). The student uses an equation to demonstrate this relationship between factors and the product (MP4). Although calculated correctly, the equation does not conform to the requirements of the task in that the product is not smaller than the initial number, and the student does not clearly explain the relationship of the product to the factors (no credit for MP6). Also, the student's explanation does not provide a general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 2 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

You can get a smaller number
by multiplying a number by a
Fraction.

STOP

REVIEW YOUR
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Page 11

Guide 9   Litho 50140

Total Content Points: 0

Total Practice Points: 1   (MP7)

The student makes a general statement indicating a condition under which the product will be smaller than the first or both factors (MP7) but fails to provide an example in words, in a diagram, or as an equation (no credit for 5.NF.5b, no credit for MP4). As the student has not stated an equation as an example, he has not demonstrated the precision necessary to adequately respond to the task (no credit for MP6).

Total Awarded Points: 1 of 4

Ellen's calculations are correct, but her rule does *not* always work.

Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

She was right and wrong because not all multiplication problems will have a bigger numbers.

STOP

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Page 11

Guide 10   Litho 50231

Total Content Points: 0

Total Practice Points: 0

The student does not give an example demonstrating a case where a multiplication equation results in a product less than one or both factors in words, in a diagram, or as an equation (no credit for 5.NF.5b, no credit for MP4). As the student has not stated an equation as an example, she has not demonstrated the precision necessary to adequately respond to the task (no credit for MP6). There is no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 0 of 4

Ellen's calculations are correct, but her rule does *not* always work.
Sometimes multiplication gives a product *smaller than the number you started with.*

Explain when this is true, and give an example using words, diagrams and equations.

This is Mainly true when you multiply whole numbers by whole numbers. Like when you multiply 12 times 12, you get 144. which is bigger than 12.
(12 × 12)   (144 > 12)

STOP

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Guide 11   Litho 50119

Total Content Points: 0

Total Practice Points: 0

The student has misunderstood the task, and does not give an example demonstrating a case where a multiplication equation results in a product less than one or both factors in words, in a diagram, or as an equation (no credit for 5.NF.5b, no credit for MP4). The student has not demonstrated the precision required to successfully respond to the task (no credit for MP6). In addition, there is no general statement indicating the conditions under which the product will be smaller than the first or both factors (no credit for MP7).

Total Awarded Points: 0 of 4