



Oregon Mathematics Assessment

Clay Pottery Performance Task
Grade 5 Mathematics Sample Test
Scoring Guide
January 2017

Clay Pottery

Lizzie and Zela are interested in making pottery. The following chart shows how much clay is needed to make different projects.

Project	Pounds of Clay Needed
 Small Plate	$2\frac{1}{2}$
 Small Bowl	$1\frac{1}{2}$
 Large Bowl	$3\frac{1}{4}$
 Dinner Plate	$4\frac{1}{2}$
 Mug	$\frac{3}{4}$

1

Which project needs the most clay?

- A. Small Plate
- B. Small Bowl
- C. Large Bowl
- D. Dinner Plate
- E. Mug

2

How much more clay, in pounds, is needed to make a large bowl than a small bowl?

pounds

3

Zela wants to make a set of 6 mugs. The clay **only** comes in 1-pound blocks.



What is the **least** number of blocks of clay Zela will need to make 6 mugs?

Explain how you figured out your answer.

Note: Zela knows that leftover clay from each block can be squished together and used.

4

Lizzie has 12 pounds of clay and wants to use all of it. She does not need to make all of the projects, and may make more than one of any project.

Describe a plan for Lizzie to use 12 pounds of clay making projects from the chart.

Show how you know she will use **exactly** 12 pounds of clay with this plan.

5

Zela is making a plan to use her 12 pounds of clay. She still wants to make 6 mugs. She also wants to make 6 small bowls.

Lizzie says:

“12 pounds is not enough to make 6 mugs and 6 small bowls. I know because I did the math.”

Zela says:

“It is enough if I make the bowls smaller!”

Make a plan for Zela to use no more than 12 pounds of clay to make 6 mugs and 6 bowls that are **smaller** than the bowls in the chart.

In the plan, state how much clay she should use for each of her smaller bowls. Her bowls should all be the same size.

Zela does **not** care about using **exactly** 12 pounds, but she does want to use as much of the clay as possible.

1

Which project needs the most clay?

- A. Small Plate
- B. Small Bowl
- C. Large Bowl
- D. Dinner Plate
- E. Mug

#1 Multiple choice – 1 point

Item	Claim	Domain	Target	DOK	MP	Key
#1	2	NF	2A	1	1	D - Dinner plate

Key (1 point): The student selects option D - Dinner plate.

Commentary: The first two questions are entry level questions to ramp into the work of the task. The purpose of these questions are primarily to assess whether the student (1) understands the context and the representation (a table) and (2) can identify and infer relevant quantities and perform typical calculations (compare magnitudes).

The context is reasonably authentic. Many students have taken an art class or have interacted with clay in other settings. Understanding that different projects require different quantities of clay can be applied to many contexts besides art. These questions are about understanding which projects use more or less clay.

Rationale for Content:

The content is securely held, as this question assesses a 4th-grade standard. Students are asked to determine how much more clay is needed to make the large bowl compared to the small bowl, which in essence is asking them to compare two fractions. This is why the content standard is 4.NF.A.2.

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 $\frac{1}{2}$. 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.

Rationale for Claim:

The fact that the student must extract the quantities and compare them is what makes this a Claim 2, Target D.

Claim 2, Target D: Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas).

Rationale for DOK:

This is a straightforward DOK 1. From the *Depth of Thinking* chart:

ANALYZE (DOK 1):

-Retrieve information from a table or graph to answer a question.

2

How much more clay, in pounds, is needed to make a large bowl than a small bowl?

pounds

#2 Equation numeric – 1 point

Item	Claim	Domain	Target	DOK	Content	MP	Key
#2	2	NF	2A, 2D	2	5.NF.A.2; 4.NF.A.2	1	$1\frac{3}{4}$ or 1.75 or equivalent

Key (1 point): $1\frac{3}{4}$ or 1.75 or equivalent

Rationale for Content:

The content is part of the progression of standards in the NF domain that leads to understanding how to use equivalent fractions as a strategy to subtract fractions. This is why the primary content standard is 5.NF.A.2. However, the problem can be solved using the strategies linked to 4.NF.A.2 as well.

5.NF.A.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$, by observing that $\frac{3}{7} < \frac{1}{2}$.

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 $\frac{1}{2}$. 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.

Rationale for Claim:

The fact that the student must extract the quantities, choose the procedure, and calculate the answer to solve this problem is what makes this a Target 2A (primary target) and Target 2D (secondary target).

Claim 2, Target A: Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace.

Claim 2, Target D: Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas).

Rationale for DOK:

Since the student needs to retrieve information from the context and select a procedure (in this case, subtraction), it meets the requirement for DOK 2.

From the *Depth of Thinking* chart:

APPLY (DOK 2):

- Select a procedure and perform it
- Solve a routine problem applying multiple concepts or decision points
- Retrieve information to solve a problem

3

Zela wants to make a set of 6 mugs. The clay **only** comes in 1-pound blocks.



What is the **least** number of blocks of clay Zela will need to make 6 mugs?

Explain how you figured out your answer.

Note: Zela knows that leftover clay from each block can be squished together and used.

#3 Short answer – 2 points

Item	Claim	Domain	Target	DOK	Content	MP	Key
#3	4	NF	4D	2	4.NF.A.4c	2, 3, 4	See sample responses

Rubric:

2 points: Student **develops** an approach to determine the number of pounds of clay needed to make 6 mugs AND provides an **explanation** as to why 5 blocks are needed.

1 point: Student correctly calculates the amount of clay needed, but does not provide an explanation why. Or, student provides the correct answer but with a flawed justification.

0 points: All other responses

Commentary: Although the purpose of this question is to have students solve a problem in a real-life context, it has been designed to focus on *interpreting results* in such a context. This is achieved by making the amount of clay needed to be 4.5 pounds and requiring clay to be sold in 1-pound increments only. If the amount needed had been, for example, 4 pounds of clay, then this would not have necessitated the same degree of interpretation.

Rationale for Content:

This content is securely held, being essentially 4th grade.

4.NF.B.4c Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat $\frac{3}{8}$ of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*

Rationale for Claim:

There are a variety of approaches. Students may create a list or make a table showing the amount of clay needed for a set of 6 mugs. This requires understanding of the context, correctly calculating the amount of clay, and interpreting the result in context. Because clay only comes in 1-pound increments, students must correctly explain what to do with the 4.5 pounds of clay needed. This is what makes this a Claim 4, as is explicitly called out in the specifications:

Claim 4, Target D: Interpret results in the context of a situation. Tasks used to assess this target should ask students to link their answer(s) back to the problem's context. In early grades, this might include a judgment by the student of whether to express an answer to a division problem using a remainder or not based on the problem's context. In later grades, this might include a rationalization for the domain of a function being limited to positive integers based on a problem's context (e.g., understanding that the number of buses required for a given situation cannot be $32\frac{1}{2}$, or that the negative values for the independent variable in a quadratic function modeling a basketball shot have no meaning in this context).

Rationale for DOK:

This question has two parts that qualify as DOK 2. From the *Depth of Thinking* chart:

APPLY DOK 2: Select a procedure and perform it

And from the item specifications:

ANALYZE DOK 2: Interpret results in the context of a situation

What follows are sample responses and scoring annotations for Item 3.



Sample Response 3a



$$3/4 + 3/4 + 3/4 + 3/4 + 3/4 + 3/4 = 4 \frac{1}{2}$$

Zela will need 5 blocks of clay to make a set of 6 mugs. Since the clay blocks only come in one pound blocks you need to round $4 \frac{1}{2}$ up.

SCORE

2

The student correctly calculated that $4 \frac{1}{2}$ pounds of clay would be needed to create a set of 6 mugs. The student then explained that because clay only comes in one-pound blocks, Zela would need to buy 5 blocks of clay. The response contains evidence of the student's competence in problem solving to the full extent that these processes apply to this item.

Sample Response 3b



Each mug takes $3/4$ pounds of clay. And 6 times $3/4$ is $18/4$ which is $4 \frac{2}{4}$.

So Zela needs more than 4 pounds of clay, but less than 5 pounds.

She will need to squish together the left over pieces of each block, but she should be able to make all 6 cups with 5 1-pound blocks.

SCORE

2

The student correctly calculated that to make 6 mugs, Zela needs $4 \frac{2}{4}$ pounds of clay. He/she states that Zela needs more than 4 pounds, but less than 5 pounds, implying that he/she understands the clay only comes in 1-pound blocks. The student also understands that leftover pieces of each block will need to be combined to make all 6 mugs with 5 blocks of clay. The response contains evidence of the student's competence in problem solving to the full extent that these processes apply to this item.

Sample Response 3c



$$.75 \times 6 \text{ mugs} = 4.5$$

She needs 5 blocks.

SCORE

1

The student correctly calculated that 6 mugs times 0.75 is 4.5 and even stated that Zela needs 5 blocks of clay. However, he/she did not provide an explanation as to why 5 blocks are needed. The student has demonstrated only a **partial** understanding of the mathematical content and practices essential to this item.

Sample Response 3d



$$3/4 + 3/4 + 3/4 + 3/4 + 3/4 + 3/4 = 18/4$$

Zela needs 18/4 of clay to make 6 mugs.

SCORE

1

The student correctly calculated that Zela needs 18/4 pounds of clay to make 6 mugs. However, he/she didn't take into account the fact that the clay only comes in 1-pound blocks. The student has demonstrated only a **partial** understanding of the mathematical content and practices essential to this item.

Sample Response 3e

B I U I_x           

1 mug = $\frac{3}{4}$

$\frac{3}{4} \times 6 = \frac{18}{24}$

I multiplied $\frac{3}{4} \times 6$ and then it equaled $\frac{18}{24}$.

SCORE

0

The student showed initial understanding of the mathematics required, but he/she did not execute the multiplication correctly, nor provide an adequate explanation. The explanation given is not a justification for the amount of clay, rather it is a description of the process used. No evidence is present that demonstrates the student's competence in problem solving related to the specified task.

Sample Response 3f

B I U I_x           

I think Zela will need 6 blocks of clay.

SCORE

0

The student has demonstrated merely an acquaintance with the topic in that he/she at least attempted to answer the question. However, the response contains no support for the answer of 6 blocks by way of work or explanation. No evidence is present that demonstrates the student's competence in problem solving related to the specified task.

4

Lizzie has 12 pounds of clay and wants to use all of it. She does not need to make all of the projects, and may make more than one of any project.

Describe a plan for Lizzie to use 12 pounds of clay making projects from the chart.

Show how you know she will use **exactly** 12 pounds of clay with this plan.

#4 Short answer – 2 points

Item	Claim	Domain	Target	DOK	Content	MP	Key
#4	3	NF	B	3	4.NF.A.4c	2, 3, 4	See sample responses

Rubric:

2 points: Student describes a plan by which Lizzie uses all 12 pounds of clay making projects from the chart. A valid explanation is one that connects to the context. Numeric computations with no explanation are not considered valid.

1 point: Student provides either a correct explanation with incorrect calculations or has incorrect calculations that total 12, but has a valid explanation.

0 points: All other responses

Commentary:

This question is about planning which combinations of projects can be made that require exactly 12 pounds of clay (which, mathematically, reduces to finding certain combinations of given fractions that add up to 12) and justifying the solution.

Rationale for Content:

This content is securely held, being essentially 4th grade.

4.NF.4c: Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat $\frac{3}{8}$ of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed?*

Between what two whole numbers does your answer lie?

Rationale for Claim:

Because the problem is asking for an explanation, the expectation is that students connect the meaning of the context to suitable operations and show, mathematically, that conditions are met. Providing numeric calculations with no connections to the context does not comprise an explanation and is therefore not sufficient. It is this aspect that pushes it into Claim 3 from Claim 2.

Rationale for DOK:

This is a straightforward DOK 3 problem. From the *Depth of Thinking* chart:

DOK 3, UNDERSTAND:

- Use concepts to solve non-routine problems
- Explain reasoning when more than one response is possible

What follows are sample responses and scoring annotations for Item 4.

Sample Response 4a

B I U I_x

 $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{8}$ $\frac{7}{8}$

Lizzie could make 2 dinner plates and 2 small bowls

$4 \frac{1}{2} + 4 \frac{1}{2} = 9$ and $1 \frac{1}{2} + 1 \frac{1}{2} = 3$ $3 + 9 = 12$ pounds

SCORE

2

The student described a correct combination of projects and showed the appropriate computation to support the total is 12 pounds. The student demonstrated a full and complete understanding of all mathematical content and practices essential to this task.

Sample Response 4b

B I U T_x          **ABC** 

If she makes all of the projects it would take $2.5+1.5+3.25+.75+4.5=12.5$.

That doesn't work. So she should make 2 sm plats and 2 sm bowls instead of the dinner plate. That takes exactly 12 pounds of clay.

SCORE

2

The student added up what it would take to make one of each project (even though he/she did not include the names of the projects, it is clear that the numbers match the projects in the same order given in the table). The student then realized that taking away the dinner plate (4.5) and making 2 small plates and 2 small bowls (instead of 1 each) would take exactly 12 pounds of clay. The student did not explicitly restate the calculations; however, the student demonstrated enough understanding of the mathematical content and practices essential to this task in order to earn full credit.

Sample Response 4c

B I U T_x          **ABC** 

2 large bowls = 6 1/2 lb

2 small bowls = 3 lb

2 mugs = 1 1/2 lb

This means Lizzie has used all 12 lbs of clay.

SCORE

1

The student correctly indicated what it would take to make 2 each of the large bowls, small bowls, and mugs. However, the student incorrectly stated that all 12 pounds of clay was used (it adds to only 11 pounds). This computational error prevents the response from receiving full credit.

Sample Response 4d

B I U I_x           

small plate + small bowl = 4 x 3 = 12

SCORE

1

The student appears to have indicated that Lizzie can make 3 small plates and 3 small bowls and it would total 12 pounds. However, the response doesn't actually contain enough information for scorers to make this determination. The item specifically states "Describe a plan..." and the student failed to provide a description of the plan. Therefore, the response can only earn partial credit.

Sample Response 4e

B I U I_x           

Lizzie would use all 12 pounds of clay if she makes all five projects.

SCORE

0

The student has demonstrated merely an acquaintance with the topic in that he/she at least attempted to answer the question. However, the response contains no support for the answer of using all 12 pounds of clay if Lizzie makes all five projects by way of work or explanation. No evidence is present that demonstrates the student's competence in problem solving, reasoning, and/or modeling related to the specified task.

5

Zela is making a plan to use her 12 pounds of clay. She still wants to make 6 mugs. She also wants to make 6 small bowls.

Lizzie says:

“12 pounds is not enough to make 6 mugs and 6 small bowls. I know because I did the math.”

Zela says:

“It is enough if I make the bowls smaller!”

Make a plan for Zela to use no more than 12 pounds of clay to make 6 mugs and 6 bowls that are **smaller** than the bowls in the chart.

In the plan, state how much clay she should use for each of her smaller bowls. Her bowls should all be the same size.

Zela does **not** care about using **exactly** 12 pounds, but she does want to use as much of the clay as possible.

#5 Short answer – 2 points

Item	Claim	Domain	Target	DOK	Content	MP	Key
#5	4	NF	F	3	3.NF.A.3, 4.NF.B.4c	2, 3, 4	See sample responses

Rubric:

2 points: The student describes an amount of clay that meets the criteria (6 mugs $\times \frac{3}{4}$ and 6 bowls times a value between 1 and $1\frac{1}{2}$) AND gives a valid explanation for how this value meets the criteria.

1 point: The student’s response contains some of the attributes of an appropriate response but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits may include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and/or lack of explanation or clarity in the response.

0 points: All other responses

Note: If the student uses an incorrect amount of clay from item #3 in the response to determine the amount of clay needed, the response can still earn full credit.

Commentary:

The purpose of the question is to provide a "design under constraint" type problem. This entails multiple steps: (1) Students must make sense of the constraints, (2) determine a value that satisfies the constraints, and (3) explain why this value works. We view this a modeling task, hence Claim 4. There is also, by design, a non-routine quality to mathematical work expected of the students in that 5th-grade students will not have algebraic tools to tackle this in generality, hence must devise their own strategy. In addition, there is no scaffolding, so even though the numbers involved are (by design) not too messy, the depth of knowledge is increased to level 3.

Rationale for Content:

The content is securely held; the numeric comparisons of fractions are a Grade 3 content standard.

3.NF.3: Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

Rationale for Claim:

This question aligns with Claim 4, Target F because this problem asks students to design under constraints. This particular question is asking students to design bowls by (1) specifying values of essential parameters given, and (2) giving an explanation of how these values satisfy the constraint.

Claim 4, Target F: Identify important quantities in a practical situation and map their relationships.

Rationale for DOK:

This question is DOK 3 for the following reasons. From the *Depth of Thinking* chart:

UNDERSTAND (DOK 3):

- Use concepts to solve non-routine problems
- Explain reasoning when more than one response is possible

What follows are sample responses and scoring annotations for Item 5.

Sample Response 5a

B I U I_x           

I alredy know it takes 4 1/2 pounds of clay to make 6 mugs so i have 7 1/2 pounds left to make the bowls. 6 bowls x 1 1/2 is 9. I don't have enough. zela can make them smaller. I think if she just takes 7 pounds and divides by 6, it will work. So 7/6 pounds per bowl. She'll have some left over, but not much.

SCORE **2**

The student used the exact amount of clay needed to make 6 mugs (which could have been taken from his/her work on item #3). The student correctly indicated how much clay was available to make the small bowls (7½ lbs) and knew that 9 pounds would be needed if using the amount from the table. Although the student didn't divide 7½ by 6 to determine the amount needed for each bowl, he/she did recognize that he/she only needed to be close to 12 pounds without going over. The student demonstrated a full and complete understanding of all mathematical content and practices essential to this task.

Sample Response 5b

B I U I_x           

Since I need 5 blocks of clay to make 6 mugs, I have 7 blocks left to make 6 bowls. If I use 1 block for each bowl, instead of 1 1/2 blocks it will work. I know it means I have 1 block left over, so I could make another small bowl or maybe another mug to use as much clay as possible.

SCORE **2**

The student refers to blocks rather than pounds, but they essentially reflect the same amount. The indication that 5 blocks of clay was needed for 6 mugs is likely a comment back to item #3, so it is taken as a correct amount amount (even though it could be considered a minor flaw that the student didn't mention the amount of clay that would be left over – ½ pound). The student correctly indicated how much clay was available to make the small bowls (7 blocks) and knew that the bowls would need less than 1½ blocks each in order to work. The student recommended 1 block per bowl and even declared there would be enough left over to make another mug or bowl. The student demonstrated enough understanding of the mathematical content and practices essential to this task to receive full credit.

Sample Response 5c

B I U I_x **☰ ☷ ☹ ☺** ✂ 📄 📁 ⬅ ➡ ABC Ω

12 - 4 1/2 (mugs) = 7 1/2

1 1/2 + 1 1/2 + 1 1/2 + 1 1/2 + 1 1/2 + 1 1/2 = 6 wholes and 6 1/2s

6 1/2s = 3

Zela needs 6 + 3 = 9 lbs to make the bowls and only has 7 1/2. So she can't make the bowls without making them smaller.

SCORE

1

The student clearly shows that it will take 4½ pounds of clay for the mugs and when subtracting from 12 it leaves 7½ pounds to make the bowls. Furthermore, the student shows that by using the amount for each bowl given in the table (1 ½), it will take a total of 9 pounds of clay. While the student recognizes that Zela doesn't have enough clay, he/she does not attend to the part of the problem that required the students to address the amount of clay that Zela could use if she made the bowls smaller. The student demonstrated only a **partial** understanding of the mathematical content and practices essential to this task.

Sample Response 5d

B I U I_x **☰ ☷ ☹ ☺** ✂ 📄 📁 ⬅ ➡ ABC Ω

Zela does not need to make smaller bowls. She only needs 9 clay to make 6 bowls. 6 times 1 1/2 = 9 So I have 3 pounds left from the 12.

SCORE

1

The student seems to have missed one of the constraints of the problem, in that Zela still wants to make 6 mugs as well as 6 small bowls. While it is clear that a major component of the problem was overlooked, the student demonstrated enough understanding of the mathematical content and practices essential to this task to receive partial credit.

Sample Response 5e

B I U I_x **☰ ☲ ☱ ☴** **✂** **📄** **📋** **↶** **↷** **ABC** **Ω**

she could use 11 1/2 pounds to make the mugs and bowls

SCORE

0

The student has demonstrated merely an acquaintance with the topic in that he/she at least attempted to answer the question. However, no evidence is present that demonstrates the student's competence in problem solving, reasoning, and/or modeling related to the specified task.

Sample Response 5f

B I U I_x **☰ ☲ ☱ ☴** **✂** **📄** **📋** **↶** **↷** **ABC** **Ω**

Lizzie is correct because she did the math. Zela doesn't have enough clay to make 6 mugs and 6 bowls.

SCORE

0

The student has merely restated what was in the prompt. No evidence is present that demonstrates the student's competence in problem solving, reasoning, and/or modeling related to the specified task.

The handscored items in this guide are both 2-point short-text items. The general rubric that is used as a basis for scoring all 2-point short-text items is shown below. Although item-specific rubrics are also provided to scorers to facilitate the handscored of short-text items, every response should be able to map back to this general rubric in a consistent and reliable manner.

General Rubric for 2-Point Items

Score	Description
2	The student has demonstrated a full and complete understanding of all mathematical content and practices essential to this task. The student has addressed the task in a mathematically sound manner. The response contains evidence of the student's competence in problem solving, reasoning, and/or modeling to the full extent that these processes apply to the specified task. The response may, however, contain minor flaws that do not detract from a demonstration of full understanding.
1	The student has demonstrated a partial understanding of the mathematical content and practices essential to this task. The student's response contains some of the attributes of an appropriate response but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and other omissions or irregularities that bring into question the student's competence in problem solving, reasoning, and/or modeling related to the specified task.
0	The student has demonstrated merely an acquaintance with the topic, or provided a completely incorrect or uninterpretable response. The student's response may be associated with the task, but contains few attributes of an appropriate response. There are significant omissions or irregularities that indicate a lack of comprehension in regard to the mathematical content and practices essential to this task. No evidence is present that demonstrates the student's competence in problem solving, reasoning, and/or modeling related to the specified task.