



Oregon Mathematics Assessment

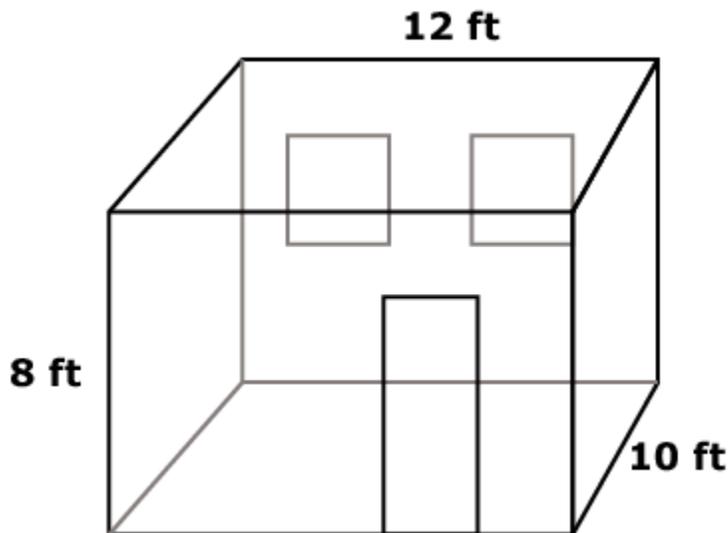
Let's Paint a Room Performance Task
Grade 7 Mathematics Sample Test
Scoring Guide
January 2017

Let's Paint a Room

Your friend Sam wants to paint her room. She wants to paint the ceiling white and the four walls purple.

You are helping Sam determine the cost and the amount of time needed to paint her room.

The room is shaped like a rectangular prism with a height of 8 feet, length of 12 feet, and width of 10 feet as shown.



Additional information about Sam's room:

- The door has an area of 22 square feet.
- The room has 2 square windows.
- Each window opening is 2 feet by 2 feet.

1

What is the area, in square feet, of the ceiling?

2

Sam needs to figure out how much purple paint to buy.

Calculate for her the total area, in square feet, of the four **walls**.

She will **not** paint the door or windows.

3

Part way through painting her room, Sam runs out of paint.

- She estimates that there are about 125 square feet left to paint.
- The purple paint that Sam is using is **only** available in 1-quart cans. (Assume she must buy whole cans of paint.)
- Each can of paint covers 40 square feet.

How many cans of paint does Sam **need** to buy to finish painting her room?
Explain to Sam why she needs this many cans of paint.

4

You decide to paint your room, too.

Your room has 300 square feet of wall space to paint.

Sam says it took her 10 minutes to paint 25 square feet.

At this rate, how many **hours** would it take Sam to paint your room?

5

Sam and you are going to paint your room together.

Sam takes 10 minutes to paint 25 square feet.

It takes you 5 minutes to paint 25 square feet.

Sam says, "If we paint together, then it will take 15 minutes for us to cover 50 square feet."

Give an explanation to convince Sam that she is **incorrect**.

1

What is the area, in square feet, of the ceiling?



#1 Equation/Numeric – 1 point

Item	Claim	Domain	Target	DOK	Content	MP	Key
#1	4	G, MD	4F	2	6.G.A, 4.MD.A.3	1,5	120

Rubric:

1 point: Correct response – 120

0 points: All other responses

Commentary: The purpose of the question is primarily to assess whether the student (1) understands the context and the representation and (2) can identify and infer relevant quantities and perform typical calculations. In this question, the student is given a fairly typical 2-dimensional diagram representing a 3-dimensional room. The context is reasonably authentic. Many students have had experience with painting. The context is also a natural place for important mathematics of proportional relationships, rates, and geometry.

Rationale for Content:

The content is essentially the Grade 6 Geometry Domain header:

6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.

Additionally, this content builds on Grade 4 Measurement:

4.MD.A.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*

Grade 7 Mathematics

Let's Paint a Room Performance Task

Since this question is intended to be accessible for most students, the numbers have been kept simple so as not to create arithmetic computational obstacles in obtaining evidence of Claims 2, 3, or 4.

The mathematical work of this question involves identifying the quantities (lengths of relevant edges). The ceiling is a rectangle. One side is *directly labeled* (12 ft). The other side length must be inferred from the parallel side of the wall (10 ft).

The next step for the student is choosing the relevant mathematical tool or procedure. For this question, the formula for the area of a rectangle is $A = l \times w$. So the solution is $12 \times 10 = 120$ square feet.

Rationale for Claim:

The fact that the student must extract the quantities, choose the procedure, and calculate the answer is what makes this a Target 4F.

Claim 4, Target F: Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas).

By design, the representation does not label all of the edge lengths making it unlikely that students could guess (e.g., select random numbers and perform a computation) and get the correct answer.

Rationale for DOK:

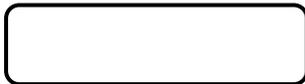
The fact that this question requires a couple of steps and inferences and is not a direct recall or single-step application of a known and identified procedure makes this a DOK 2. Recall that difficulty is not the same as depth of knowledge. This is not intended to be a particular difficult question, but it involves more than one-step recall or rote procedures. This is not a DOK 3 since the representation is fairly standard, the formulas are applied in a typical way, and there is not really a choice of strategies.

2

Sam needs to figure out how much purple paint to buy.

Calculate for her the total area, in square feet, of the four **walls**.

She will **not** paint the door or windows.



#2 Equation/Numeric – 1 point

Item	Claim	Domain	Target	DOK	Content	MP	Key
#2	2	G	2A	2	6.G.A	1,5	322

Rubric:

1 point: Correct response – 322

0 points: All other responses

Commentary: This question continues with the same context and representation as question #1. The mathematical work now is focused on problem solving in the sense that students need to "find a solution path" using readily available tools. The expectation is that students know the area of a rectangle, can infer the relevant quantities from the diagram, as in question #1, but this time they have to combine several steps and have several options.

Students can calculate the area of each wall and subtract the areas of the door and windows, or add up the area of all the walls and then subtract the total area of the door and windows. Students may even do more complex decomposition of the figure. Regardless, the primary mathematics involve applying a known tool multiple times after choosing a particular solution path.

Rationale for Content:

The content is essentially the Grade 6 Geometry Domain header:

6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.

Additionally, this content builds on Grade 5 Measurement:

5.MD.C.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

Rationale for Claim:

The question is completely formulated. There are a variety of solution paths that involve readily available mathematical tools (area of a rectangle, concept of area, strategy of decomposing figures). This work qualifies as evidence for Target 2A.

Claim 2, Target A: Apply mathematics to solve well-posed problems arising in everyday life, society, and the workplace. Under Claim 2, the problems should be completely formulated, and students should be asked to find a solution path from among their readily available tools.

Rationale for DOK:

Because this question requires organizing or managing several pieces of information, this qualifies for DOK 2. It does not cross the threshold for DOK 3 since the mathematical tools are expected to be known (area of a rectangle) and the combination is fairly typical. Students are expected to know how to find areas of figures by decomposing or subtracting areas.

3

Part way through painting her room, Sam runs out of paint.

- She estimates that there are about 125 square feet left to paint.
- The purple paint that Sam is using is **only** available in 1-quart cans. (Assume she must buy whole cans of paint.)
- Each can of paint covers 40 square feet.

How many cans of paint does Sam **need** to buy to finish painting her room? Explain to Sam why she needs this many cans of paint.

#3 Short-answer – 2 points

Item	Claim	Domain	Target	DOK	Content	MP	Key
#3	4	RP	4D	2	6.RP.A	1,6	See sample responses

Rubric:

2 points: Correct response – 4 cans AND correct explanation

1 point: Correct response, 4 cans, BUT no correct explanation OR 3.15 or equivalent with an acceptable explanation that clearly leaves out the fact that only whole cans can be bought

0 points: All other responses; including 3, 3.15 cans, or $3 \frac{5}{40}$ cans without an explanation

Note: Due to the fact that 3.15 is very close to 3 cans, a student might successfully argue for just 3 cans if he/she acknowledges that Sam's estimate may in fact be too high (it could be just 120 feet) or that she could possibly stretch the paint to finish the job. The key is that the explanation is thorough enough to show understanding that 3 cans is not enough unless some other factor is considered.

Commentary: This question is a fairly typical ratio reasoning problem. The key is that it is asking for an interpretation of the division in the context AND asking for an explanation. Students do not get full credit for merely indicating the correct number of cans. The explanation has to in some way state that cans must be bought in whole numbers of cans. The division of $125/40$ results in 3.125 cans.

Rationale for Content:

The content is securely held, being essentially about ratio reasoning in the Grade 6 Domain header:

6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.

The numbers are kept simple so as not to create arithmetic computational obstacles in obtaining evidence of Claim 4. The purpose is to provide evidence for students to show proficiency in Claim 4.

Rationale for Claim:

There are a variety of approaches. Students may list or make a table showing the amount of paint covered for a given number of cans: 1 can covers 40 sq ft, 2 cans 80 sq ft, 3 cans 120 sq ft, 4 cans 160 sq ft, hence because you must buy a whole number of cans, 4 cans are needed. Or they can do the division: $125/40$ and interpret accordingly. The student must interpret the remainder in the context as requiring an additional can, hence 4 cans are needed. This 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:

As described in the text for Claim 4 Target D, interpreting the results in the context of a situation qualifies as a DOK 2.

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

Sample Response 3a

B I U I_x    **ABC** 

$$125/40 = 3.125$$

She needs to buy 4 cans of paint because although the exact amount she needs is 3.125, she can't buy partial cans of paint and she should buy more to cover all of the walls in purple paint.

SCORE POINT

2

The student accurately calculated the exact amount of paint that Sam would need (3.125 cans) and then explained why Sam would actually need to purchase whole cans of paint. The response contains evidence of the student's competence in problem solving and/or modeling to the full extent that these processes apply to this item.

Sample Response 3b

B I U I_x    **ABC** 

$$125/40 = 3+$$

$$160/40 = 4$$

Sam, you should buy 4 quarts though you need 3 and a little bit, you can't buy a part of the can so you would have to buy 4 cans of paint.

SCORE POINT

2

The student accurately calculated that Sam would need a little more than 3 cans of paint and provided an explanation as to why 4 cans of paint would be needed. The response contains evidence of the student's competence in problem solving and/or modeling to the full extent that these processes apply to this item.

Sample Response 3c



If I divide 125 by 40 I get $3 \frac{1}{8}$. So Sam needs a little more than 3 cans of paint to finish painting her room. However, if Sam uses the paint sparingly, she might be able to just buy 3 quarts. Otherwise, she'd need 4 quarts.

SCORE POINT

2

The student accurately calculated that Sam would need a little more than 3 cans of paint and provided an explanation as to why 3 cans of paint might be enough (...uses the paint sparingly). The student completely understands that 4 cans might still be needed, but adding this extra statement wasn't necessary to receive full credit. The response contains evidence of the student's competence in problem solving and/or modeling to the full extent that these processes apply to this item.

Sample Response 3d



$$40 \cdot 2 = 80$$

$$40 \cdot 3 = 120$$

$$40 \cdot 4 = 160$$

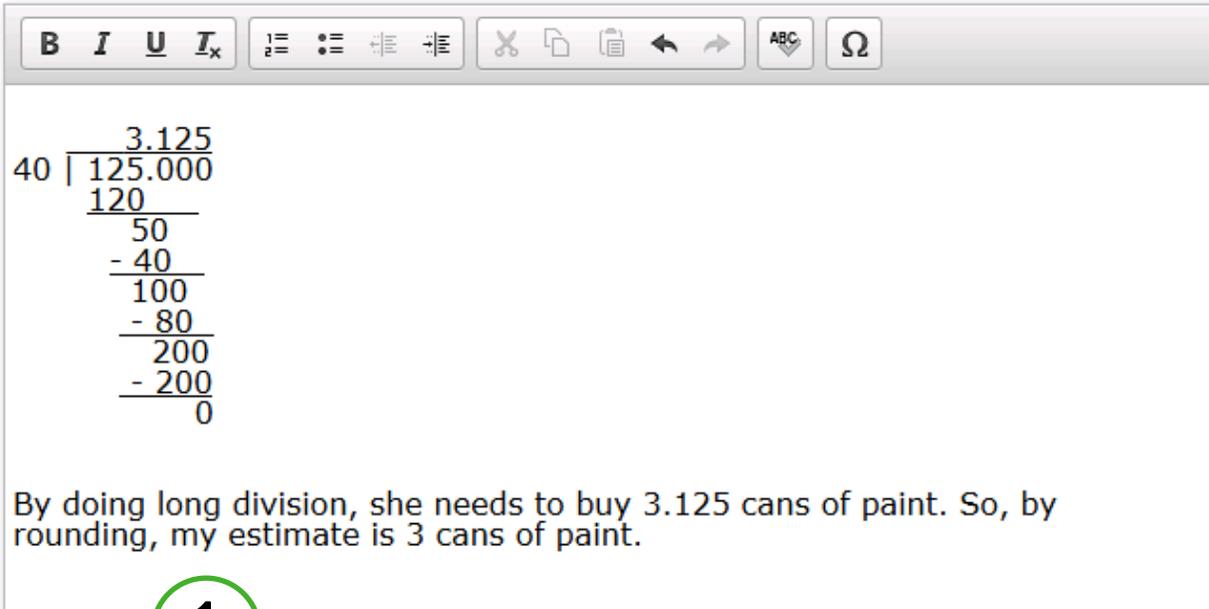
Sadly she will need to buy 4 cans. She will have a lot left over, but that's good because she can have some left for touch-ups.

SCORE POINT

1

The student arrived at the correct answer; however, he/she did not adequately explain why 4 cans was needed (i.e., 3 cans is not enough because I have to cover 125 sq ft). The response contains some of the attributes of an appropriate response but lacks convincing evidence that the student fully comprehends the essential ideas addressed by this task.

Sample Response 3e



$$\begin{array}{r}
 3.125 \\
 40 \overline{) 125.000} \\
 \underline{120} \\
 50 \\
 \underline{-40} \\
 100 \\
 \underline{-80} \\
 200 \\
 \underline{-200} \\
 0
 \end{array}$$

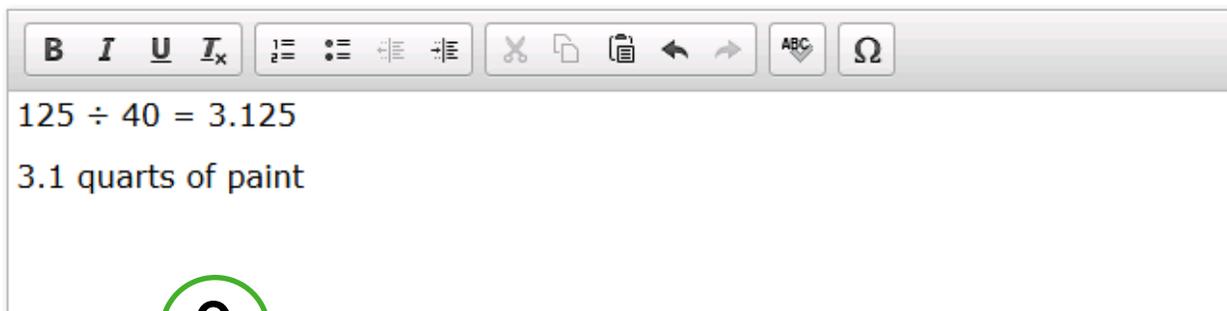
By doing long division, she needs to buy 3.125 cans of paint. So, by rounding, my estimate is 3 cans of paint.

SCORE POINT

1

The student explained his/her process (long division), which is an appropriate tool; however, he/she failed to realize Sam needs 4 cans because partial cans cannot be bought. The response contains some of the attributes of an appropriate response but lacks convincing evidence the student fully comprehends the essential ideas addressed by this task.

Sample Response 3f



$$125 \div 40 = 3.125$$

3.1 quarts of paint

SCORE POINT

0

The student does an appropriate calculation ($125 \div 40 = 3.125$), but there is no connection to the context, nor an explanation provided. There are significant omissions that indicate a lack of comprehension in regard to the essential ideas addressed by this task.

4

You decide to paint your room, too.

Your room has 300 square feet of wall space to paint.

Sam says it took her 10 minutes to paint 25 square feet.

At this rate, how many **hours** would it take Sam to paint your room?

#4 Equation/Numeric – 1 point

Item	Claim	Domain	Target	DOK	Content	MP	Key
#4	2	RP	2A	2	6.RP.A.3b	1	2

Rubric:

1 point: Correct response – 2

0 points: All other responses

Commentary: The purpose is to provide an opportunity for students to solve a problem that requires coordinating several quantities (area, time, rate) and track change of units (minutes to hours). By design, the numbers are kept simple to avoid arithmetic computational obstacles.

Rationale for Content:

The content in this question is grounded in Grade 6 Ratios and Proportional Relationships, namely:

- 6.RP.A.3.b Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
- b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

Rationale for Claim:

This question is fully formulated, asking how long it would take to paint the room and the student is provided with the quantities. The student must select how to relate these quantities and how to combine them to find the solution. This qualifies the question for Claim 2, Target A.

Claim 2, Target A: Apply mathematics to solve well-posed problems arising in everyday life, society, and the workplace. Under Claim 2, the problems should be completely formulated, and students should be asked to find a solution path from among their readily available tools.

Rationale for DOK:

The problem is formulated and the relevant quantities are given (and no extraneous quantities are given). So this does *not* cross the threshold of DOK 3. The student is required to select how the quantities relate and how to combine them. This coordination, including the unit conversion, makes this more than a rote one-step computation, so it does cross the threshold into DOK 2.

5

Sam and you are going to paint your room together.

Sam takes 10 minutes to paint 25 square feet.
It takes you 5 minutes to paint 25 square feet.

Sam says, "If we paint together, then it will take 15 minutes for us to cover 50 square feet."

Give an explanation to convince Sam that she is **incorrect**.

#5 Short text – 2 points

Item	Claim	Domain	Target	DOK	Content	MP	Key
#5	3	RP	3B	3	6.RP.A	3	See sample responses

Rubric:

2 points: Correct explanation

1 point: Elements of the explanation are correct, but the logic of the argument is fragmented or flawed.

0 points: All other responses

Commentary: This question requires students to confront and refute a common misconception about combining rates. Part of the design is that students are not required to actually solve the problem of figuring out how much time it would take to paint a room together. Rather, the purpose is to give Sam a convincing explanation that her reasoning is incorrect. This design allows for multiple logical approaches for refuting a claim.

Rationale for Content:

The content in this question is grounded in Grade 6 Ratios and Proportional Relationships, namely:

- 6.RP.3.b Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
 - b. Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?*

However, by asking about the combination of rates (i.e., two people who paint at different rates, what is their rate if they paint together?), this provides an opportunity for more sophisticated reasoning. By design, the numbers are selected to be simple and easy to work with so as to avoid arithmetic computational obstacles. Furthermore, although some students will opt to calculate the combined rate, others can choose to refute the claim more directly by providing a logical counterargument (see the student responses for examples).

Rationale for Claim:

This question is directly asking students to "refute a proposition" posed by another person. This squarely lands in the descriptor for Claim 3, Target B. Claim 3, Target B: Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. By "autonomous" we mean that the student responds to a single prompt, without further guidance within the task. Tasks used to assess this target should ask students to develop a chain of reasoning to justify or refute a conjecture. Tasks for Target B might include the types of examples called for in Target A as part of this reasoning, but they should do so with a lesser degree of scaffolding than tasks that assess Target A alone.

Rationale for DOK:

There is very little scaffolding and many possible methods of refuting the claim. Although the content is technically Grade 6 rates, the combining of rates is typically challenging for Grade 7 students. Again, noting that the student does not need to determine the actual combined rate, so there are methods that only use securely held content available, including the use of counterexample. All these reasons qualify this question as DOK 3.

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

Sample Response 5a

B I U I_x **1= 2= 3= 4=** **✂** **📄** **📁** **↶** **↷** **ABC** **Ω**

No, because by the time 5 minutes passes, Sam will only have painted 12.5 ft and I will paint 25. So if you calculate my amount to paint 25 ft in 5 min by 3, I'll paint 75 ft in 15 min. For Sam, you'd add the amount for 10 min (25 ft) to the 12.5 ft in 5 min to get 37.5 ft. If you add 75 + 37.5, you'll get 112.5 ft. We'll have painted 112.5 ft in 15 minutes.

Sam's thinking of the ft we'll paint together is if we did it at different times like if I painted for 5 minutes and Sam painted 10 minutes after I painted 5 minutes.

SCORE POINT

2

The student is able to refute Sam's claim by correctly calculating the amount painted together in 15 minutes (112.5) and also describes the problem with Sam's reasoning – making the assumption that Sam must think they *took turns* painting rather than painting at the same time. Note that the minor flaw in units (using ft instead of sq ft throughout the explanation) does not detract from receiving full credit. The response contains evidence of the student's competence in reasoning to the full extent that these processes relate to the specified task.

Sample Response 5b

Sam is incorrect because you can work w/Sam at the same time and in 15 minutes you will do 75 ($25 \cdot 3$) square feet and Sam will do 37.5 ($25 \cdot 1.5$) which adds up to 112.5 ($75 + 37.5$) ft^2 in 15 minutes.

SCORE POINT

2

The student is able to provide an argument as to why Sam's claim is incorrect and supports it with calculations. The response contains adequate evidence of the student's competence in reasoning to the extent that these processes relate to the specified task.

Sample Response 5c

Different rates of painting does not necessarily mean separate times to paint. Both Sam and I are not one entity. Due to the different rates, I would paint 50 sq ft in 10 minutes while Sam would still paint 25 sq ft in 10 minutes.

SCORE POINT

1

The student seems to understand the nature of Sam's error; however, he/she does not provide a clear argument as to why Sam's claim is incorrect. The response contains only partial evidence of the student's competence in reasoning to the extent that these processes relate to the specified task.

Sample Response 5d

B I U I_x **☰ ☷ ☹ ☺** ✂ 📄 📂 ↶ ↷ ABC Ω

Since I work 2 times faster than Sam, I would paint 50 square feet alone! And Sam would paint only 25 square feet in the same time. The total would end up being 75 square feet painted.

SCORE POINT

1

The student correctly indicates that more square feet would be painted (75) but fails to indicate the amount of time he/she and Sam painted and does not address how that makes Sam's claim incorrect. The response contains only partial evidence of the student's competence in reasoning to the extent that these processes relate to the specified task.

Sample Response 5e

B I U I_x **☰ ☷ ☹ ☺** ✂ 📄 📂 ↶ ↷ ABC Ω

Sam is incorrect because if we both paint together it wouldn't take us more time, it would take us less time to paint.

SCORE POINT

0

The student seems to indicate an initial understanding as to why Sam is incorrect; however, he/she did not disprove Sam's claim with any evidence or logical explanation. Since the prompt already stated that Sam's claim was incorrect, the student must provide convincing evidence as to why Sam is incorrect . . . not just restate the given information. The response lacks sufficient evidence of the reasoning required of this task and earns no credit.

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 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.