



# Colorado Measures of Academic Success



## Grade 5 Math

### Answer Key with Scoring Rubrics, Sample Responses & Annotations

Practice Resource for Students



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## ITEM INFORMATION

### *Colorado Academic Standard (CAS) Evidence Outcome*

Describes the evidence that demonstrates that a student is meeting the grade level expectation at a mastery level.

### *Evidence Statement*

Describes the knowledge or skills that an assessment item/task elicits from students. Full descriptions of Evidence Statements and their alignment to the Colorado Academic Standards are located at [http://cde.state.co.us/assessment/cmas\\_testdesign](http://cde.state.co.us/assessment/cmas_testdesign).

### *Subclaim*

The reporting category of the associated CAS.

- Math
  - Subclaim A – Major Content
  - Subclaim B – Supporting Content
  - Subclaim C – Expressing Mathematical Reasoning
  - Subclaim D – Modeling and Application

## ITEM TYPES

Items are questions that appear on the assessments. They are presented in three different ways.

### *Selected Response (Multiple Choice, Multiple Response, and Fill in the Blank)*

For multiple choice and multiple response items, students select a correct answer out of provided choices. For fill in the blank items, students type/write their answer in a blank box.

### *Technology-Enhanced (Bar Graph, Drag and Drop, Inline Choice, Hot Spot, and Match Table Grid)*

Students show their answer using technology, such as by creating a bar graph using a template provided by the online testing system or on the paper-based test. Drag and drop items require students to drag answer choices into correct answer bays (draw lines or write corresponding letters for paper-based testing). Inline choice items require students to select their answer from a drop-down menu (circle answer from a list of choices for paper-based testing) to complete a sentence or sentences. Hot spot items require students to select the correct response from its location in an image (write corresponding letters or circle answer for paper-based testing). Match table grid items require students to check checkboxes in cells to indicate a match between the column and row labels.

### *Constructed Response*

Students construct an open-ended response.

## STUDENT PERFORMANCE

### *P Value – Selected Response Only*

The P value represents the percentage of students who answered each selected response question correctly. For example, if the P value associated with a question is 0.64, then 64% of students responded to the question with the correct answer.

### *Score Point Distribution – Constructed Response Only*

The score point distribution provides the percentage of students who scored at each possible score point for constructed response questions.

In addition to score point distribution, the scoring guide, scoring rubric, and sample student responses at each score point are provided for constructed response items.

**Note:** P values and score point distributions are only available for released items (i.e., questions that previously appeared on CMAS assessments administered statewide). Items without this information were developed as sample items.

## ANSWER KEY: ITEM SET 1

### Item Set 1 - Question 1 (Selected Response)

What is the value of  $46.8 \div 6$ ?

☐ A. 7.1

☒ B. 7.8

☐ C. 71

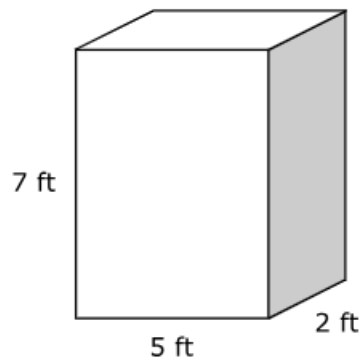
☐ D. 78

#### Item Information

- Answer – B
- Colorado Academic Standards (CAS) Evidence Outcomes – 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.
- Evidence Statement – 5.NBT.7-4
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.721

Item Set 1 – Question 2 (Selected Response)

The dimensions of a right rectangular prism are shown in the diagram.



What is the volume, in cubic feet, of the prism?

- ☐ A. 10
- ☐ B. 14
- ☐ C. 35
- ☒ D. 70

Item Information

- Answer – D
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.MD.C.5.b
  - Apply the formulas  $V = l \times w \times h$  and  $V = b \times h$  for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
- Evidence Statement – 5.MD.5b
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.718

Item Set 1 – Question 3 (Selected Response)

A store sells shoes.

**Part A**

One day, a delivery of shoes contains  $\frac{2}{3}$  dress shoes and  $\frac{1}{6}$  slippers.

Which equation can be used to find the fraction of shoes that are both dress shoes and slippers?

- ☐ A.  $\frac{2}{6} + \frac{1}{6} = \frac{3}{6}$
- ☐ B.  $\frac{4}{6} + \frac{2}{6} = \frac{6}{6}$
- ☐ C.  $\frac{1}{12} + \frac{2}{12} = \frac{3}{12}$
- ☒ D.  $\frac{8}{12} + \frac{2}{12} = \frac{10}{12}$

**Part B**

The next day, another delivery of shoes arrives. In the delivery,  $\frac{5}{12}$  are running shoes and  $\frac{1}{4}$  are sandals.

What is the difference between the fraction of running shoes and the fraction of sandals in the delivery?

- ☐ A.  $\frac{4}{8}$
- ☒ B.  $\frac{2}{12}$
- ☐ C.  $\frac{8}{12}$
- ☐ D.  $\frac{6}{16}$



### Item Information

- Part A Answer – D
- Part B Answer – B
- Colorado Academic Standards (CAS) Evidence Outcomes – 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  $2/5 + 1/2 = 3/7$ , by observing that  $3/7 < 1/2$
- Evidence Statement – 5.NF.2-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.436

### Item Set 1 – Question 4 (Constructed Response)

There are 4 pieces of carpet that are each  $\frac{3}{4}$  foot wide. A person multiplies the numerator and denominator of  $\frac{3}{4}$  by 4 and determines the total width of the 4 pieces of carpet is  $\frac{12}{16}$  foot.

$$4 \times \frac{3}{4} = \frac{4 \times 3}{4 \times 4} = \frac{12}{16}$$

- Explain the mistake the person made in finding the total width of the 4 pieces of carpet.
- Explain how to find the correct total width, in feet, of the 4 pieces of carpet.
- What is the total width, in feet, of 15 same-sized pieces of carpet? Show your work.

Enter your explanations, your answer, and your work in the space provided.

#### Item Information

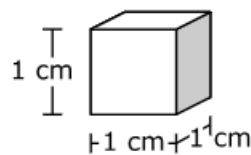
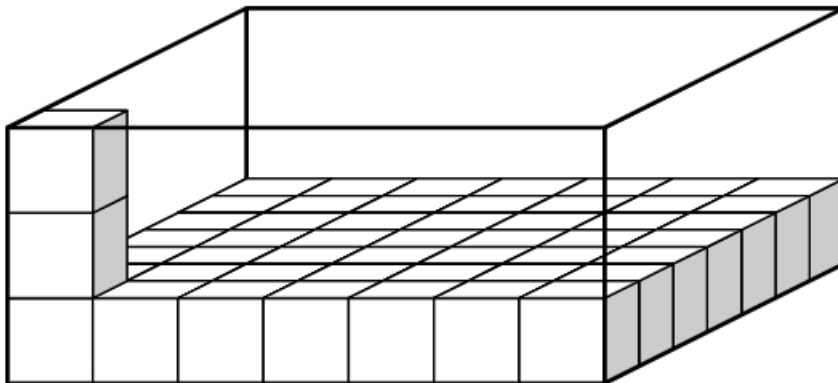
- Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcomes
  - 4.NF.B.4.a – Understand a fraction  $a/b$  as a multiple of  $1/b$ . For example, use a visual fraction model to represent  $5/4$  as the product  $5 \times 1/4$ , recording the conclusion by the equation  $5/4 = 5 \times 1/4$ .
  - 4.NF.B.4.c – 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  $3/8$  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?
  - 4.NF.B.4.b – Understand a multiple of  $a/b$  as a multiple of  $1/b$ , and use this understanding to multiply a fraction by a whole number. For example, use a visual fraction model to express  $3 \times 2/5$  as  $6 \times 1/5$ , recognizing this product as  $6/5$ . (In general,  $n \times a/b = n \times a/b$ .)
- Evidence Statement – 5.C.7-4
  - Distinguish correct explanation/reasoning from that which is flawed, and – if there is a flaw in the argument – present corrected reasoning. (For example, some flawed ‘student’ reasoning is presented and the task is to correct and improve it.) Content Scope: Knowledge and skills articulated in 4.NBT, 4.NF.A, 4.NF.B i) Tasks may have scaffolding 1, if necessary, in order to yield a degree of difficulty appropriate to Grade 5.
- Subclaim – C – Expressing Mathematical Reasoning
  - The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.
- Score Point Distribution
  - 8.6% of students earned 4 points.
  - 6.1% of students earned 3 points.
  - 14.6% of students earned 2 points.
  - 15.7% of students earned 1 point.
  - 55.0% of students earned 0 points.

Points	Attributes
4	<p>Student response includes the following 4 elements.</p> <ul style="list-style-type: none"> <li>• <b>Reasoning component</b> = 1 point. Valid explanation of the mistake made in finding the total width of the four pieces of carpet.</li> <li>• <b>Reasoning component</b> = 1 point. Valid explanation of how to find the correct total width of the 4 pieces of carpet.</li> <li>• <b>Computation component</b> = 1 point. Correct total width, in feet, of 15 same-sized pieces of carpet, 454454 or equivalent.</li> <li>• <b>Reasoning component</b> = 1 point. Valid work to find the total width of the 15 pieces of carpet.</li> </ul> <p>Sample Student Response:</p> <p>The person made the mistake of multiplying the numerator and the denominator by 4; 4 does not equal <math>\frac{4}{4}</math>.</p> <p><math>4 = \frac{4}{1}</math>, therefore the person should multiply the numerator by 4 and the denominator by 1 to get the correct answer.</p> <p>The total width of 15 pieces of carpet is <math>15 \times \frac{3}{4} = 45 \times \frac{1}{4} = \frac{45}{4}</math>.</p> <p>The width is <math>\frac{45}{4}</math> feet of carpet.</p> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>• Student responses may vary.</li> <li>• Students may share results in decimal form. This may be considered correct as long as the decimal and fractional forms are equivalent.</li> </ul>
3	Student response includes 3 of the 4 elements.
2	Student response includes 2 of the 4 elements.
1	Student response includes 1 of the 4 elements.
0	Student response is incorrect or irrelevant.

Sample Student Response:	<p><b>Sample Solution 1:</b></p> <p>The mistake the person made is that they multiplied the denominator of <math>\frac{3}{4}</math> by the wrong number. When multiplying a whole number by a fraction, you would only multiply the whole number by the numerator. What they should have done was multiply <math>\frac{3}{4}</math> by <math>\frac{4}{1}</math>, because <math>\frac{4}{1}</math> is equal to 4. The correct expression would be <math>\frac{4 \times 3}{1 \times 4}</math>.</p> <p><math>15 \times \frac{3}{4} = \frac{45}{4}</math>. The width of 15 pieces of carpet is <math>\frac{45}{4}</math>.</p>
Annotation for Sample Student Response:	<p><b>Solution 1, Score Point 4</b></p> <p>The response receives full credit. It includes each of the 4 required elements.</p> <p><b>Reasoning Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> multiplied the denominator of <math>\frac{3}{4}</math> by the wrong number, you would only multiply the whole number by the numerator. <ul style="list-style-type: none"> <li>○ <b>Rationale for Score:</b> Valid explanation of the mistake made in finding the total width of the four pieces of carpet is given (The mistake the person made is that they multiplied the denominator of <math>\frac{3}{4}</math> by the wrong number. When multiplying a whole number by a fraction, you would only multiply the whole number by the numerator). This explanation of the correct process sufficiently explains that the multiplication of the whole number and denominator is an error.</li> </ul> </li> </ul> <p><b>Reasoning Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> multiply <math>\frac{3}{4}</math> by <math>\frac{4}{1}</math>, because <math>\frac{4}{1}</math> is equal to 4, correct expression would be <math>\frac{4 \times 3}{1 \times 4}</math>. <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> Valid explanation of how to find the correct total width of the 4 pieces of carpet is given (What they should have done was multiply <math>\frac{3}{4}</math> by <math>\frac{4}{1}</math>, because <math>\frac{4}{1}</math> is equal to 4. The correct expression would be <math>\frac{4 \times 3}{1 \times 4}</math>). The conversion of 4 into an improper fraction and multiplying the numerators and denominators by each other respectively is sufficient for credit.</li> </ul> </li> </ul> <p><b>Computation Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>\frac{45}{4}</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> Correct total width of 15 same-sized pieces of carpet is provided (The width of 15 pieces of carpet is <math>\frac{45}{4}</math>).</li> </ul> </li> </ul> <p><b>Reasoning Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>15 \times \frac{3}{4} = \frac{45}{4}</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> Valid work to find the total width of the 15 same-sized pieces of carpet is provided (<math>15 \times \frac{3}{4} = \frac{45}{4}</math>).</li> </ul> </li> </ul> <p><b>Note:</b> Sample student responses are not representative of all correct answers for an item and are only provided as a guide to assist teachers with scoring.</p>

Item Set 1 – Question 5 (Fill in the Blank)

A right rectangular prism is being filled with unit cubes. Each unit cube measures 1 centimeter on each side.



What is the total volume, in cubic centimeters, of this right rectangular prism?

Enter your answer in the box.

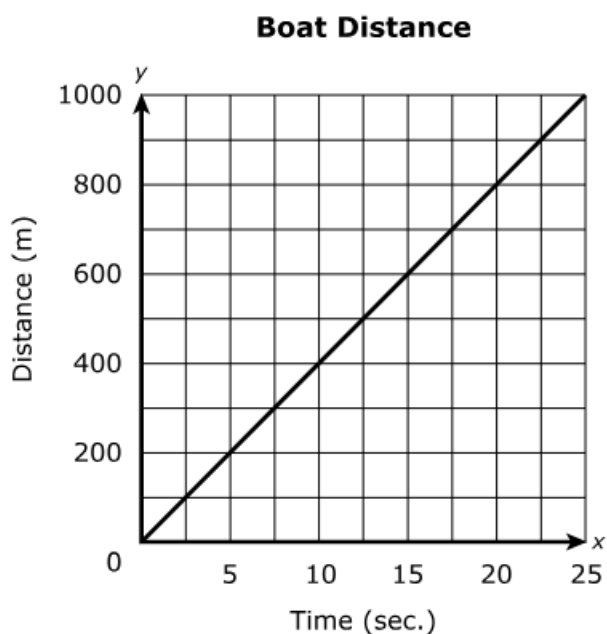
147

Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.MD.C.4
  - Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.
- Evidence Statement – 5.MD.4
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.369

Item Set 1 – Question 6 (Selected Response)

The line on the coordinate plane shows the time and distance of a boat race.



**Part A**

Which coordinate pairs represent points on the graph?

Select the **two** coordinate pairs.

- ☒ A. (5, 200)
- ☐ B. (8, 300)
- ☒ C. (10, 400)
- ☐ D. (12, 500)
- ☐ E. (25, 900)

**Part B**

Which statement could the coordinate pair (15, 600) represent on the coordinate plane?

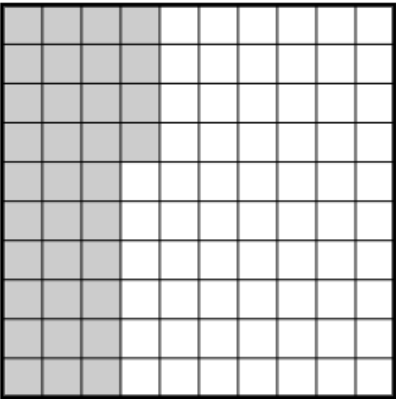
- ☐ A. The boat has been racing for 600 seconds since the beginning point of the race.
- ☐ B. The boat is 15 meters from the beginning point of the race after 600 seconds.
- ☒ C. The boat is 600 meters from the beginning point of the race after 15 seconds.
- ☐ D. The boat is 15 meters from the beginning point of the race.

**Item Information**

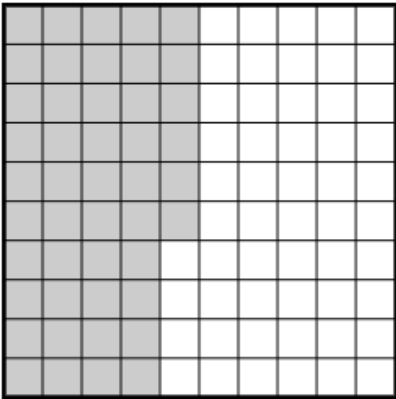
- Part A Answer – A, C
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.G.A.2
  - Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
- Evidence Statement – 5.G.2
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B – Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.526

Item Set 1 – Question 7 (Fill in the Blank)

The shaded parts of the models show 0.34 and 0.46.



0.34



0.46

What is the value of  $0.34 + 0.46$ ?

Enter your answer in the box.

Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 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.
- Evidence Statement – 5.NBT.7-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.833

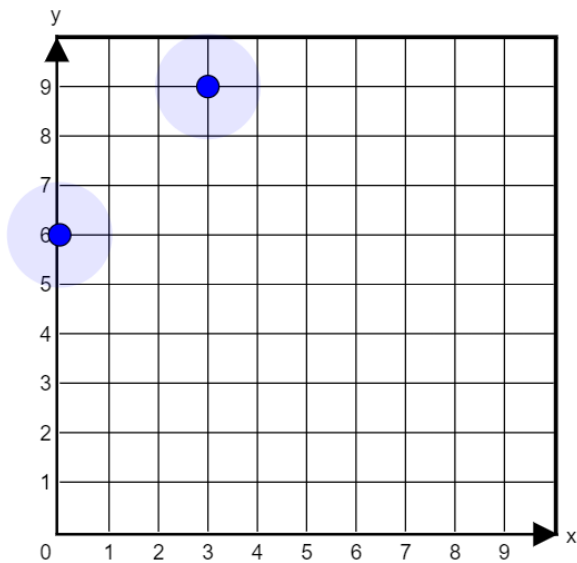


### Item Set 1 – Question 8 (TEI Graph)

Coordinates for two points on the coordinate plane are listed:

- Point  $P$  is 3 units to the right of the origin along the  $x$ -axis and 9 units up from the origin along the  $y$ -axis.
- Point  $R$  is located at  $(0, 6)$ .

Select the places on the coordinate plane to plot the points.



#### Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.G.A.1
  - Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g.,  $x$ -axis and  $x$ -coordinate,  $y$ -axis and  $y$ -coordinate).
- Evidence Statement – 5.G.1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B – Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.432

*Item Set 1 – Question 9 (Fill in the Blank, Constructed Response)*

A person built a sandbox in the shape of a rectangular prism.

**Part A**

The base of the sandbox has an area of 1,260 square inches. The height of the sandbox is 30 inches.

What is the volume, in cubic inches, of the sandbox?

37800

**Part B**

The person wants to fill the sandbox with 13 cubic feet of sand. She has 16 bags of sand that each contain  $\frac{3}{4}$  cubic foot of sand.

- Find the total amount of extra sand in the bags or the amount of additional sand needed to determine whether there is enough sand in the bags to fill the sandbox.
- Show your work.

Enter your answers and work in the space provided.

**Item Information**

- Part A Answer – See Image
- Part B Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcomes
  - 5.MD.C.5.b – Apply the formulas  $V = l \times w \times h$  and  $V = b \times h$  for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
  - 5.NF.B.6 – Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
- Evidence Statement – 5.D.1
  - Solve multi-step contextual word problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in Type I, Sub-Claim A Evidence Statements. i) Tasks may have scaffolding. ii) Multi-step problems must have at least 3 steps. iii) For purposes of assessment, the possibilities for multiplication are 1-digit x 2-digit, 1-digit x 3-digit, 2-digit x 3-digit, 2-digit x 4-digit, or 3-digit x 3-digit.
- Subclaim – D – Modeling and Application
  - The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP. 1), reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).
- Score Point Distribution
  - 9.8% of students earned 3 points.
  - 12.5% of students earned 2 points.
  - 27.1% of students earned 1 point.
  - 50.6% of students earned 0 points.

### Scoring Rubric – Part A

Points	Attributes
1	37,800 or equivalent number
0	The response is incorrect or irrelevant.

### Scoring Rubric – Part B

Points	Attributes
2	<p>Student response includes the following 2 elements:</p> <ul style="list-style-type: none"> <li>• <b>Modeling component</b> = 1 point. Valid work to find the amount of sand present.</li> <li>• <b>Computation component</b> = 1 point. States there is not enough sand and finds the extra amount of sand needed to fill the sandbox, 1 cubic foot or 2 bags of sand.</li> </ul> <p>Sample Student Response:</p> $16 \times \frac{3}{4} = 12$ <p>The total volume of sand in the bags is 12 cubic feet.</p> <p>There is not enough sand in the bags to fill the sandbox because 12 is less than 13.</p> $13 - 12 = 1$ <p>The person needs 1 cubic foot of sand.</p>
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.
Sample Student Response:	<p><b>Sample Solution 1:</b></p> $16 \times \frac{3}{4} = \frac{48}{4}, \frac{48}{4} = 12$ <p><math>12 &lt; 13</math>. There is not enough sand to fill the sandbox.</p> <p><math>13 - 12 = 1</math>. The person will need 1 additional cubic foot of sand in order to fill the sandbox.</p>
Annotation for Sample Student Response:	<p><b>Solution 1, Score Point 2</b></p> <p>The response receives full credit. It includes each of the two required elements.</p> <p><b>Modeling Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>16 \times \frac{3}{4} = \frac{48}{4}, \frac{48}{4} = 12, 13 - 12 = 1</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for Score:</b> Valid work to find the amount of sand present and the amount of additional sand needed is shown (<math>16 \times \frac{3}{4} = \frac{48}{4}, \frac{48}{4} = 12, 13 - 12 = 1</math>). A valid process is given that multiplies the bags of sand by the amount of sand in each bag, to find a total amount of sand she has, 12, and to then subtract that amount from the total needed, 13, to find how much additional sand, if any, is needed.</li> </ul> </li> </ul> <p><b>Computation Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> There is not enough sand, will need 1 additional cubic foot of sand. <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> A correct statement is provided that there is not enough sand (There is not enough sand to fill the sandbox), and includes the correct additional amount of sand needed to fill the sandbox (will need 1 additional cubic foot of sand).</li> </ul> </li> </ul> <p><b>Note:</b> Sample student responses are not representative of all correct answers for an item and are only provided as a guide to assist teachers with scoring.</p>

## ANSWER KEY: ITEM SET 2

### Item Set 2 – Question 1 (Selected Response)

A girl bought 1 pound of spinach. The following amounts were used.

- She used  $\frac{3}{8}$  pound of spinach in a chicken dish.
- She used  $\frac{2}{5}$  pound of spinach in a pasta dish.

How much spinach did she use for these two dishes?

- ☐ A.  $\frac{5}{13}$  pound
- ☐ B.  $\frac{6}{13}$  pound
- ☐ C.  $\frac{27}{40}$  pound
- ☒ D.  $\frac{31}{40}$  pound

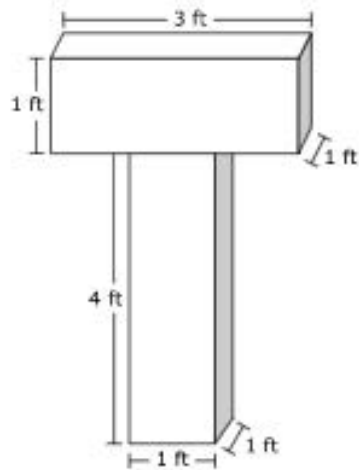
#### Item Information

- Answer – D
- Colorado Academic Standards (CAS) Evidence Outcomes – 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  $\frac{3}{7} < \frac{1}{2}$ .
- Evidence Statement – 5.NF.2-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.574

Item Set 2 – Question 2 (Fill in the Blank, Selected Response)

**Part A**

The school mascot is a tiger. Students build a "T" for their gym. The dimensions of the "T" are given in the diagram.



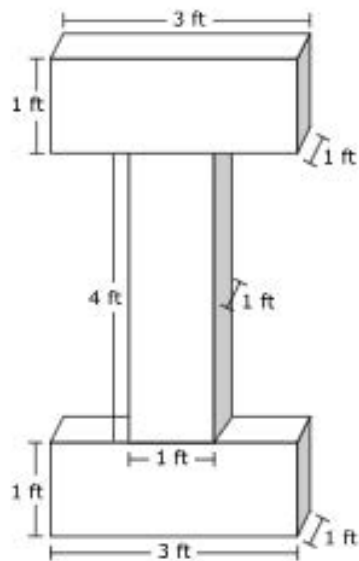
What is the volume, in cubic feet, of the "T"?

Enter your answer in the box.

7

**Part B**

The school mascot changes to an iguana. The students change the "T" into an "I."



Which statement describes the volume of the "I" compared to the volume of the "T"?

- ☐ A. The volume of the "I" is 1 cubic foot more than the volume of the "T."
- ☒ B. The volume of the "I" is 3 cubic feet more than the volume of the "T."
- ☐ C. The volume of the "I" is 5 cubic feet more than the volume of the "T."
- ☐ D. The volume of the "I" is 6 cubic feet more than the volume of the "T."

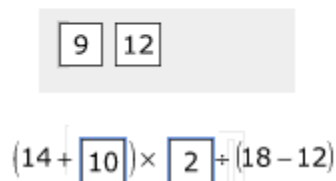
**Item Information**

- Part A Answer – See Image
- Part B Answer – B
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.MD.C.5.c
  - Use the additive nature of volume to find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.
- Evidence Statement – 5.MD.5c
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.423

Item Set 2 – Question 3 (Drag and Drop)

Which numbers are needed to complete the expression so that the expression has a value of 8?

Drag and drop a number into each box of the expression.


$$(14 + \boxed{9}) \times \boxed{12} + (18 - 12)$$

**Item Information**

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.OA.A.1
  - Use grouping symbols (parentheses, brackets, or braces) in numerical expressions, and evaluate expressions with these symbols.
- Evidence Statement – 5.OA.1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B - Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.405

*Item Set 2 – Question 4 (Selected Response)*

A bottle has  $\frac{3}{10}$  liter of tea. A second bottle has  $\frac{3}{5}$  of that amount of tea.

How many liters of tea are in the second bottle?

- ☐ A.  $\frac{3}{50}$
- ☐ B.  $\frac{3}{25}$
- ☒ C.  $\frac{9}{50}$
- ☐ D.  $\frac{9}{10}$

**Item Information**

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NF.B.6
  - Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
- Evidence Statement – 5.NF.6-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.38



*Item Set 2 – Question 5 (TEI Inline Choice)*

What is the value of each equation?

Select from the drop-down menus to correctly complete each equation.

$$8.29 + 1.71 = \text{10} \quad \text{v}$$

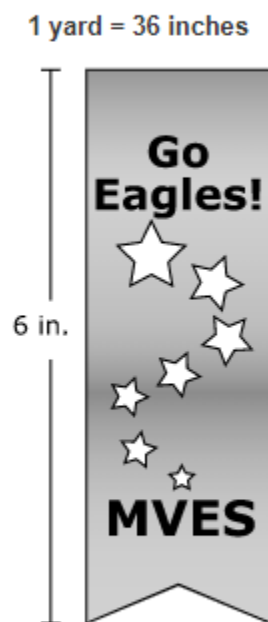
$$8.09 + 1.92 = \text{10.01} \quad \text{v}$$

**Item Information**

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 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.
- Evidence Statement – 5.NBT.7-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.784

**Part A**

A fifth-grade class at Middle Valley Elementary School is selling school ribbons to raise money for a field trip. The school ribbons will have a length of 6 inches. The cost of 5 yards of ribbon is \$6.



- Determine how many school ribbons can be made from the 5 yards of ribbon. Show your work.
- Show how to find the cost of each 6-inch school ribbon. Include your work.
- Write an equation that represents the cost of 5 school ribbons.

Enter your answers, your work, and your equation in the space provided.

**Part B**

The class wants to buy additional supplies and add an eagle sticker to each ribbon.

The additional supplies are shown.

- 30 yards of green ribbon that cost \$3 for each yard
- 40 yards of white ribbon that cost \$2 for each yard
- 10 packages of eagle stickers for \$2 a package

The parents contribute \$145 to help pay for the supplies.

- Write an equation that can be used to determine  $c$ , the total cost of the ribbons and stickers.
- Determine the value of  $c$  in your equation.
- Explain or show how to determine the money still needed to pay for the additional supplies.

Enter your equation, your answer, and your work or explanation in the space provided.

## Item Information

- Answer – See Scoring Rubric
- Colorado Academic Standards (CAS) Evidence Outcomes
  - 4.OA.A.3 – Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
  - 4.OA.A.2 – Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. (See Appendix, Table 2)
  - 4.NF.C.6 – Use decimal notation for fractions with denominators 10 or 100. For example, rewrite  $\frac{62}{100}$  as 0.62; describe a length as 0.62 meters; locate 0.62 on a number line diagram.
- Evidence Statement – 5.D.2
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – D - Modeling and Application
  - The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP. 1), reasoning abstractly and quantitatively (MP. 2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).
- Score Point Distribution
  - 2.7% of students earned 6 points.
  - 4.4% of students earned 5 points.
  - 9.7% of students earned 4 points.
  - 13.0% of students earned 3 points.
  - 12.5% of students earned 2 points.
  - 13.5% of students earned 1 point.
  - 44.1% of students earned 0 points.

## Scoring Rubric – Part A

Points	Attributes
3	<p>Student response includes each of the following 3 elements.</p> <ul style="list-style-type: none"> <li>• <b>Computation component:</b> Correct answer, 30, and valid work to find how many school ribbons can be made from 5 yards of ribbon.</li> <li>• <b>Modeling component:</b> Correct answer, \$0.20, and valid work to find the cost of each 6-inch school ribbon.</li> <li>• <b>Modeling component:</b> Valid equation that represents the cost of 5 school ribbons.</li> </ul>
2	Student response includes 2 of the 3 elements.
1	Student response includes 1 of the 3 elements.
0	Student response is incorrect or irrelevant.
Sample Student Response:	<p><math>36 \div 6 = 6</math>. That means that you can make 6 school ribbons with 1 yard of ribbon, so we need to multiply it by five to get the total ribbons. <math>6 \times 5 = 30</math>. You can make 30 school ribbons with 5 yards of ribbon. To find the cost of one ribbon you need to divide 6.00 by 30, <math>6.00 \div 30 = .20</math>. That means that each ribbon cost 20 cents. To find the cost of five school ribbons you need to multiply .20 by five. <math>.20 \times 5 = 1.00</math>. Five school ribbons cost one dollar.</p>
Annotation for Sample Student Response:	<p><b>Score Point 3</b> The response receives full credit. It includes each of the 3 required elements.</p> <p><b>Computation Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>36 \div 6 = 6</math>. That means that you can make 6 school ribbons with 1 yard of ribbon, so we need to multiply it by five to get the total ribbons. <math>6 \times 5 = 30</math>. You can make 30 school ribbons with 5 yards of ribbon. <ul style="list-style-type: none"> <li>○ <b>Rationale for Score:</b> The student provides the correct answer (30 school ribbons) and shows valid work to find how many school ribbons can be made from 5 yards of ribbon (<math>36 \div 6 = 6</math> . . . This means that you can make 6 school ribbons with 1 yard of ribbon, so we need to multiply it by five to get the total ribbons . . . <math>6 \times 5 = 30</math>). The response shows the work to find that 6 ribbons can be made from each yard and uses that to determine that 30 ribbons can be made from 5 yards.</li> </ul> </li> </ul> <p><b>Modeling Component:</b></p> <p><b>Student Response:</b> To find the cost of one ribbon you need to divide 6.00 by 30, <math>6.00 \div 30 = .20</math></p> <ul style="list-style-type: none"> <li>• That means that each ribbon cost 20 cents. <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> The student provides the correct answer (20 cents) and shows valid work to find the cost of each 6-inch school ribbon (To find the cost of one ribbon you need to divide . . . <math>6.00 \div 30 = .20</math>). The response finds the correct cost for each ribbon by dividing the cost of 5 yards of ribbon (\$6) given in the prompt with the number of ribbons (30).</li> </ul> </li> </ul> <p><b>Modeling Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> To find the cost of five school ribbons you need to multiply .20 by five. <math>.20 \times 5 = 1.00</math>. Five school ribbons cost one dollar. <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> A valid equation that represents the cost of 5 school ribbons is given (<math>.20 \times 5 = 1.00</math>).</li> </ul> </li> </ul> <p><b>Note:</b> Sample student responses are not representative of all correct answers for an item and are only provided as a guide to assist teachers with scoring.</p>

## Scoring Rubric – Part B

Points	Attributes
3	<p>Student response includes each of the following 3 elements.</p> <ul style="list-style-type: none"> <li>• <b>Modeling component:</b> Valid equation to determine the cost, <math>c</math>, of the ribbons and stickers.</li> <li>• <b>Computation component:</b> Valid explanation or work to determine the total cost of the supplies, \$190.</li> <li>• <b>Reasoning component:</b> Valid explanation or work to determine the amount still needed to pay for the supplies.</li> </ul>
2	Student response includes 2 of the 3 elements.
1	Student response includes 1 of the 3 elements.
0	Student response is incorrect or irrelevant.
Sample Student Response:	<p><b>Sample Solution 1:</b></p> $c = 30 \times \$3 + 40 \times \$2 + 10 \times \$2.$ $30 \times \$3 + 40 \times \$2 + 10 \times \$2 = \$190. \quad c = \$190.$ $\$190 - \$145 = \$45.$
Annotation for Sample Student Response:	<p><b>Solution 1, Score Point 3</b></p> <p>The response receives full credit. It includes each of the 3 required elements.</p> <p><b>Modeling Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>c = 30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2.</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for Score:</b> The student writes an equation to find the total cost, <math>c</math>, of the ribbons and stickers (<math>c = 30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2</math>). A valid equation is provided to find the total cost by multiplying the yards of each color of ribbon by the cost per yard, multiplying the number of packages of stickers by the cost of each package, and then adding the cost of all supplies together.</li> </ul> </li> </ul> <p>Note that use of a variable or symbol, to represent the total cost, is not required.</p> <p><b>Computation Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2 = \\$190. \quad c = \\$190.</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> The student determines the total cost of the supplies (<math>c = \\$190</math>).</li> </ul> </li> </ul> <p><b>Reasoning Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> <math>\\$190 - \\$145 = \\$45</math> <ul style="list-style-type: none"> <li>○ <b>Rationale for score:</b> The student explains or shows how to determine the amount still needed to pay for the supplies (<math>\\$190 - \\$145 = \\$45</math>). The response correctly subtracts the parent contribution from the total cost.</li> </ul> </li> </ul> <p><b>Note:</b> Sample student responses are not representative of all correct answers for an item and are only provided as a guide to assist teachers with scoring.</p>

*Item Set 2 – Question 7 (Selected Response)*

The rules for two different number patterns are given.

- Pattern A: Start with 0, and then add 2 to get the next number.
- Pattern B: Start with 2, and then multiply by 2 to get the next number.

How does the fourth number in Pattern B compare to the fourth number in Pattern A?

- ☒ A. The fourth number in Pattern B is 10 more than the fourth number in Pattern A.
- ☐ B. The fourth number in Pattern B is 2 more than the fourth number in Pattern A.
- ☐ C. The fourth number in Pattern B is 2 times the fourth number in Pattern A.
- ☐ D. The fourth number in Pattern B is 4 times the fourth number in Pattern A.

**Item Information**

- Answer – A
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.OA.B.3
  - Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.
- Evidence Statement – 5.OA.3
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B - Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.244

Item Set 2 – Question 8 (Selected Response)

How many  $\frac{1}{6}$ -cup servings are in 12 cups of juice?

- ☐ A.  $\frac{1}{72}$
- ☐ B.  $\frac{1}{2}$
- ☐ C. 2
- ☒ D. 72

**Item Information**

- Answer – D
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NF.B.7.c
  - Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share  $\frac{1}{2}$  lb. of chocolate equally? How many  $\frac{1}{3}$ -cup servings are in 2 cups of raisins?
- Evidence Statement – 5.NF.7c
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.408

*Item Set 2 – Question 9 (Selected Response)*

A fish tank is in the shape of a right rectangular prism. The fish tank has a length of 6 feet, a width of 2 feet, and a height of 3 feet.

What is the volume, in cubic feet, of the fish tank?

- ☐ A. 11
- ☐ B. 18
- ☐ C. 30
- ☒ D. 36

**Item Information**

- Answer – D
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.MD.C.5.b
  - Apply the formulas  $V = l \times w \times h$  and  $V = b \times h$  for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
- Evidence Statement – 5.MD.5b
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.795



## ANSWER KEY: ITEM SET 3

### Item Set 3 – Question 1 (Fill in the Blank)

A farmer has two different-sized rectangular gardens.

#### Part A

The smaller garden has a length of 24 feet and a width of 9 feet.

What is the area, in square feet, of the smaller garden?

Enter your answer in the box.

#### Part B

The larger garden has a length of 132 feet and a width of 24 feet.

What is the area, in square feet, of the larger garden?

Enter your answer in the box.

#### Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NBT.B.5
  - Fluently multiply multi-digit whole numbers using the standard algorithm.
- Evidence Statement – 5.Int.1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B - Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.453

*Item Set 3 – Question 2 (Selected Response, Fill in the Blank)*

**Part A**

Which amount is greater than four hundred forty-five and fifty-seven hundredths?

- ☐ A. Four hundred forty-five and five tenths
- ☒ B. Four hundred forty-five and seven tenths
- ☐ C. Four hundred forty-five and five thousandths
- ☐ D. Four hundred forty-five and fifty-seven thousandths

**Part B**

What is four hundred forty-five and fifty-seven hundredths rounded to the nearest tenth?

Enter your answer in the box.

445.6

**Item Information**

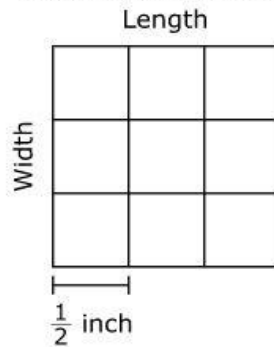
- Part A Answer – B
- Part B Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes
  - 5.NBT.A.3.a – Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g.,  $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$ .
  - 5.NBT.A.4 – Use place value understanding to round decimals to any place.
- Evidence Statement – 5.NBT.A.Int.1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.292

Item Set 3 – Question 3 (TEI Slider, Constructed Response)

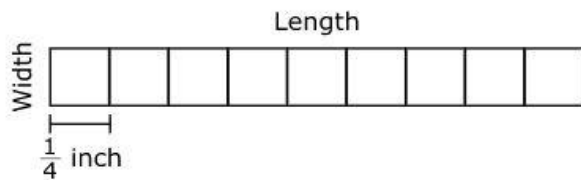
Student A and Student B created patterns using square tiles.

- The pattern created by each student is made up of 9 square tiles.
- Each tile in the pattern for Student A has a side length of  $\frac{1}{2}$  inch.
- Each tile in the pattern for Student B has a side length of  $\frac{1}{4}$  inch.

**Student A Pattern**



**Student B Pattern**

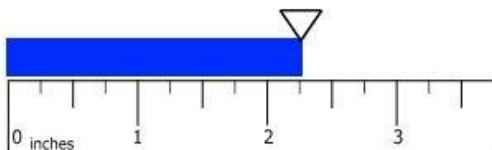


not to scale

**Part A**

What is the length, in inches, of the pattern for Student B?

Adjust the slider by dragging the end of the slider to the correct length.



**Part B**

- Find the area, in square inches, of the pattern for Student A.
- Explain how to find the area of the pattern for Student B using a different method than the one used to find the area of the pattern for Student A.

Enter your answer and your explanation in the space provided.

### Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NF.B.4.b
  - Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.
- Evidence Statement – 5.C.4-2
  - Base arithmetic explanations/reasoning on concrete referents such as diagrams (whether provided in the prompt or constructed by the student in her response), connecting the diagrams to a written (symbolic) method. Content Scope: Knowledge and skills articulated in 5.NF.4b
- Subclaim – C - Expressing Mathematical Reasoning
  - The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.
- Score Point Distribution
  - 1.8% of students earned 3 points.
  - 6.8% of students earned 2 points.
  - 32.5% of students earned 1 point.
  - 58.9% of students earned 0 points.

### Scoring Rubric – Part A

Points	Attributes
1	<b>Computation Component:</b> Correct length, in inches, of the pattern for Student B: Slider points to $2\frac{1}{4}$
0	Student response is incorrect or irrelevant.

## Scoring Rubric – Part B

Points	Attributes
2	<p>Student response includes each of the following 2 elements.</p> <ul style="list-style-type: none"> <li>• <b>Computation component:</b> Correct area, in square inches, of the pattern for Student A.</li> <li>• <b>Reasoning component:</b> Valid work or explanation of a different way to find the area of the pattern for Student B using a different method than the one used to find the area of the pattern for Student A.</li> </ul>
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.
Sample Student Response:	<p>For Pattern A to find the area I will just do the area of the tiny square first. It is <math>\frac{1}{4}</math> sq. in for each square since <math>\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}</math>. Since there are 9 tiny squares that make up the 1 big square, I am going to multiply <math>\frac{1}{4}</math> by 9. <math>\frac{1}{4} \times 9 = 2\frac{1}{4}</math>. The area for pattern A is 2. For pattern B there are 9 squares that make a rectangle. The length and width are <math>\frac{1}{4}</math> in. Since there are 9 squares and each have <math>\frac{1}{4}</math> in. for length I will do <math>\frac{1}{4}</math> times 9. This is <math>2\frac{1}{4}</math>. The width only has 1 square so it will stay as <math>\frac{1}{4}</math> so to find the area you have to multiply <math>\frac{1}{4} \times 2\frac{1}{4}</math>. The area is <math>\frac{9}{16}</math>.</p>
Annotation for Sample Student Response:	<p><b>Score Point 2</b></p> <p>The response receives full credit. It includes each of the 2 required elements.</p> <p><b>Computation Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> The area for pattern A is <math>2\frac{1}{4}</math> <ul style="list-style-type: none"> <li>o <b>Rationale for Score:</b> The student finds the correct area of the pattern for Student A (<math>2\frac{1}{4}</math>).</li> </ul> </li> </ul> <p><b>Reasoning Component:</b></p> <ul style="list-style-type: none"> <li>• <b>Student Response:</b> For Pattern A . . . It is <math>\frac{1}{4}</math> sq. in. for each square since <math>\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}</math>. Since there are 9 tiny squares that make up the 1 big square I am going to multiply <math>\frac{1}{4}</math> by 9. <math>\frac{1}{4} \times 9 = 2\frac{1}{4}</math> ... For pattern B... there are 9 squares and each have <math>\frac{1}{4}</math> in. for length I will do <math>\frac{1}{4}</math> times 9. This is <math>2\frac{1}{4}</math>. The width only has 1 square so it will stay as <math>\frac{1}{4}</math> so to find the area you have to multiply <math>\frac{1}{4} \times 2\frac{1}{4}</math>. The area is <math>\frac{9}{16}</math>. <ul style="list-style-type: none"> <li>o <b>Rationale for score:</b> The student explains a different way to find the area of the pattern for Student B using a different method than the one used to find the area of the pattern for Student A. The area of pattern A is determined by finding the area of each square in the pattern (<math>\frac{1}{4}</math> sq. in. for each square since <math>\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}</math>), then multiplying the total number of squares by the individual area of each square to find the total area of the pattern (<math>\frac{1}{4} \times 9 = 2\frac{1}{4}</math>). A different method to find the area of Pattern B is used. The student multiplies the length of the pattern by the width of the pattern to find the total area of pattern B (multiply <math>\frac{1}{4} \times 2\frac{1}{4}</math>. The area is <math>\frac{9}{16}</math>).</li> </ul> </li> </ul> <p><b>Note:</b> Sample student responses are not representative of all correct answers for an item and are only provided as a guide to assist teachers with scoring.</p>

Item Set 3 – Question 4 (Selected Response)

What is the value of the expression  $\frac{11}{8} + \frac{1}{5}$ ?

☐ A.  $\frac{3}{10}$

☐ B.  $\frac{12}{13}$

☒ C.  $\frac{63}{40}$

☐ D.  $\frac{15}{8}$

**Item Information**

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NF.A.1
  - Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example,  $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$ . (In general,  $\frac{a}{b} + \frac{c}{d} = \frac{(ad + bc)}{(bd)}$ .)
- Evidence Statement – 5.NF.1-1
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.503

*Item Set 3 – Question 5 (Selected Response)*

**Part A**

A frog wants to reach a pond that is 10 feet away. The frog hops 5 times. Each hop is 18 inches. How many more inches does the frog need to travel to reach the pond?

- ☒ A. 30
- ☐ B. 90
- ☐ C. 102
- ☐ D. 138

**Part B**

The frog has two ways to reach the pond. The frog could hop on grass for 10 feet or hop on the sidewalk for 4 yards and 1 foot to reach the pond.

Which statement is true?

- ☐ A. The grass route is 72 inches shorter than the sidewalk route.
- ☐ B. The sidewalk route is 5 feet shorter than the grass route.
- ☒ C. The sidewalk route is 1 yard longer than the grass route.
- ☐ D. The sidewalk route is 2 feet longer than the grass route.

**Item Information**

- Part A Answer – A
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.MD.A.1
  - Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.
- Evidence Statement – 5.MD.1-2
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – B - Supporting Content
  - The student solves problems involving the Additional and Supporting Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.376

Item Set 3 – Question 6 (Multiple Select)

Which inequalities are correct?

Select the **three** correct inequalities.

☐ A.  $12.012 > 12.12$

☒ B.  $12.071 < 12.12$

☒ C.  $12.07 > 12.054$

☐ D.  $12.076 > 12.54$

☒ E.  $12.012 < 12.076$

Item Information

- Answer – B, C, E
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NBT.A.3.b
  - Compare two decimals to thousandths based on meanings of the digits in each place, using  $>$ ,  $=$ , and  $<$ .
- Evidence Statement – 5.NBT.3b
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – 0.49



Item Set 3 – Question 7 (TEI Fraction Model)

Create a fraction model to show the answer to  $\frac{1}{2} \times \frac{3}{4}$ .

Divide the figure into the correct number of equal parts by using the More and Fewer buttons. Then shade by selecting the part or parts.

The fraction model consists of a vertical rectangle divided into 8 equal horizontal bars. The top 3 bars are shaded purple, representing  $\frac{3}{4}$ . Below them are 5 unshaded bars. At the bottom of the interface are three buttons: 'Fewer', 'More', and 'Reset'.

**Item Information**

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 5.NF.B.4.a
  - Interpret the product  $\frac{a}{b} \times q$  as a parts of a partition of  $q$  into  $b$  equal parts; equivalently, as the result of a sequence of operations  $a \times q \div b$ . For example, use a visual fraction model to show  $\frac{2}{3} \times 4 = \frac{8}{3}$ , and create a story context for this equation. Do the same with  $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ . (In general,  $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ .)
- Evidence Statement – 5.NF.4a-2
  - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 5, requiring application of knowledge and skills articulated in 4.OA, 4.NBT, 4.NF, 4.MD i) Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 5. ii) Multi-step problems must have at least 3 steps.
- Subclaim – A – Major Content
  - The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.
- P Value – Not Available