

Colorado Measures of Academic Success



Grade 5 Mathematics

Answer Key with Scoring Rubrics

Practice Resource for Students

Table of Contents

ITEM INFORMATION.....	2
Colorado Academic Standard (CAS) Evidence Outcome.....	2
Evidence Statement	2
Subclaim	2
The reporting category of the associated CAS.....	2
ITEM TYPES.....	2
Selected Response (Multiple Choice, Multiple Response, and Fill in the Blank):	2
Technology-Enhanced (Bar Graph, Drag and Drop, Inline Choice, Hot Spot, and Match Table Grid):.....	2
Constructed Response:.....	2
STUDENT PERFORMANCE.....	2
P Value – Selected Response Only.....	2
Score Point Distribution – Constructed Response Only.....	2
ANSWER KEY: ITEM SET 1	3
Item Set 1 – Question 1 (Selected Response)	3
Item Set 1 – Question 2 (Selected Response)	4
Item Set 1 – Question 3 (Fill in the Blank, Selected Response)	5
Item Set 1 – Question 4 (Constructed Response)	7
Item Set 1 – Question 5 (Drag and Drop)	9
Item Set 1 – Question 6 (Selected Response)	10
Item Set 1 – Question 7 (TEI Inline Choice)	11
Item Set 1 – Question 8 (Constructed Response)	12
Item Set 1 – Question 9 (Selected Response)	16
Item Set 1 – Question 10 (Selected Response)	17
Item Set 1 – Question 11 (Selected Response)	18
Item Set 1 – Question 12 (Selected Response)	19
ANSWER KEY: ITEM SET 2	20
Item Set 2 – Question 1 (Fill in the Blank).....	20
Item Set 2 – Question 2 (Selected Response, Fill in the Blank)	21
Item Set 2 – Question 3 (TEI Line Graph, Selected Response).....	22
Item Set 2 – Question 4 (TEI Slider, Constructed Response)	24
Item Set 2 – Question 5 (Selected Response)	27
Item Set 2 – Question 6 (Selected Response)	28
Item Set 2 – Question 7 (Multiple Select).....	29
Item Set 2 – Question 8 (TEI Fraction Model).....	30

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.

Subclaim

The reporting category of the associated CAS.

- Mathematics
 - 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.

ANSWER KEY: ITEM SET 1

Item Set 1 – Question 1 (Selected Response)

Which explanations are true or false?

Select the boxes to identify whether each explanation is true or false.

Explanation	True	False
All squares have four equal sides. Squares are parallelograms, so all parallelograms have four equal sides.	<input type="radio"/>	<input checked="" type="radio"/>
All quadrilaterals have 4 sides. Triangles have 3 sides, so no triangles are quadrilaterals.	<input checked="" type="radio"/>	<input type="radio"/>
All parallelograms have two pairs of parallel sides. Rectangles are parallelograms, so all rectangles have two pairs of parallel sides.	<input checked="" type="radio"/>	<input type="radio"/>

Item Information		
Answer:	See Image	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.G.B.3	Explain that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.
Evidence Statement:	5.G.3	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.
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:	0.482	

Item Set 1 – Question 2 (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?

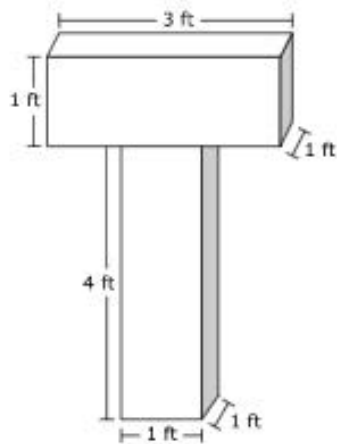
A. $\frac{5}{13}$ pound
 B. $\frac{6}{13}$ pound
 C. $\frac{27}{40}$ pound
 D. $\frac{31}{40}$ pound

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 word problems involving addition and subtraction of fractions referring to the same whole, in cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem.
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 1 – Question 3 (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.

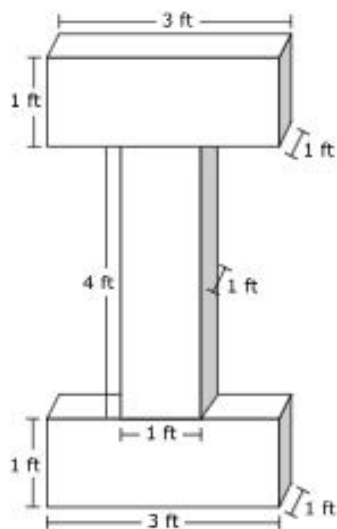


What is the volume, in cubic feet, of the "T"?

Enter your answer in the box.

Part B

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



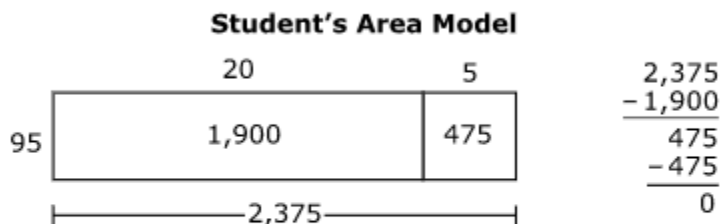
Which statement describes the volume of the "I" compared to the volume of the "T"?

- 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		
Answer:	Part A = See Image Part B = B	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.MD.C.5.c	Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume. (CCSS: 5.MD.C.5) 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	Relate the operations of multiplication and addition and solve real world and mathematical problems involving volume. c. Recognize volume as additive. 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.
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 1 – Question 4 (Constructed Response)

A student uses an area model to find the value of the expression 95×25 .



- Find the value of the expression $2,375 \div 95$.
- Explain how to use the area model to check your work.
- Explain how the area model shows both multiplication and division.

Enter your answer and your explanations in the space provided.

Item Information		
Answer:	See Scoring Rubric	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.NBT.B.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Evidence Statement:	5.C.2-1	Base explanations/reasoning on the relationship between multiplication and division. Content Scope: Knowledge and skills articulated in 5.NBT.6.
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.
P Value:	0.234	

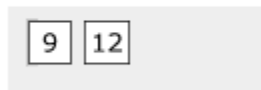
Scoring Rubric	
Points	Attributes
3	Student response includes each of the following 3 elements. <ul style="list-style-type: none"> • Computation component: Correct value of the expression $2,375 \div 95$, 25 • Reasoning component: Valid explanation of how to use the area model to check the work • Reasoning component: Valid explanation of how an area model shows both multiplication and division
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:	Sample Solution 1: $2,375 \div 95 = 25$. I can use the area model to check my work by adding $20 + 5$ then multiplying the total 25 by 95 to equal 2,375. The area model shows both multiplication by multiplying the side lengths of 95 by 20 and 95 by 5, to get 1,900 and 475. $1,900 + 475 = 2,375$. The model shows division by dividing 1,900 by 95 to equal 20 and 475 by 95 to equal 5, and 2,375 divided

	by 95 equals 25.
Annotation for Sample Student Response:	<p>Solution 1, Score Point 3 The response receives full credit. It includes each of the 3 required elements.</p> <p>Computation Component:</p> <ul style="list-style-type: none"> • Student Response: $2,375 \div 95 = 25$. <ul style="list-style-type: none"> ○ Rationale for Score: The student provides a correct value of the expression $2,375 \div 95$ (25). <p>Reasoning Component:</p> <ul style="list-style-type: none"> • Student Response: I can use the area model to check my work by adding $20 + 5$ then multiplying the total 25 by 95 to equal 2,375. <ul style="list-style-type: none"> ○ Rationale for score: The student provides a valid explanation of how to use the area model to check that the value of the expression is correct (I can use the area model to check my work by adding $20 + 5$ then multiplying the total 25 by 95 to equal 2,375). <p>Reasoning Component:</p> <ul style="list-style-type: none"> • Student Response: The area model shows both multiplication by multiplying the side lengths of 95 by 20 and 95 by 5, to get 1,900 and 475. $1,900 + 475 = 2,375$. The model shows division by dividing 1,900 by 95 to equal 20 and 475 by 95 to equal 5, and 2,375 divided by 95 equals 25. <ul style="list-style-type: none"> ○ Rationale for score: The student provides a valid explanation for how the area model shows both multiplication and division (The area model shows both multiplication by multiplying the side lengths of 95 by 20 and 95 by 5, to get 1,900 and 475. $1,900 + 475 = 2,375$. The model shows division by dividing 1,900 by 95 to equal 20 and 475 by 95 to equal 5, and 2,375 divided by 95 equals 25). <p>Note: 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 (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.



$$(14 + \boxed{10}) \times \boxed{2} + (18 - 12)$$

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	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
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 1 – Question 6 (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 real world problems involving multiplication of fractions, e.g., by using visual fraction models or equations to represent the problem. i) Tasks do not involve mixed numbers. ii) Situations include area and comparison/times as much, with product unknown. (See 2020 CAS, Appendix: Table 2). iii) Prompts do not provide visual fraction models; students may at their discretion draw visual fraction models as a strategy.
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 1 – Question 7 (TEI Inline Choice)

What is the value of each equation?

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

$8.29 + 1.71 =$ 

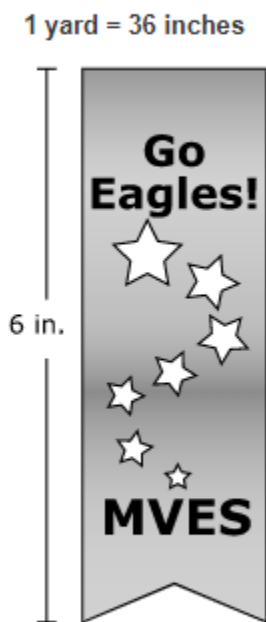
$8.09 + 1.92 =$ 

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	Add two 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.
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	

Item Set 1 – Question 8 (Constructed Response)

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).
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.
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).
P Value:	0.258	

Scoring Rubric – Part A	
Points	Attributes
3	<p>Student response includes each of the following 3 elements.</p> <ul style="list-style-type: none"> • Computation component: Correct answer, 30, and valid work to find how many school ribbons can be made from 5 yards of ribbon. • Modeling component: Correct answer, \$0.20, and valid work to find the cost of each 6-inch school ribbon. • Modeling component: Valid equation that represents the cost of 5 school ribbons.
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>$36 \div 6 = 6$. 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. $6 \times 5 = 30$. 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, $6.00 \div 30 = .20$. That means that each ribbon cost 20 cents. To find the cost of five school ribbons you need to multiply .20 by five. $.20 \times 5 = 1.00$. Five school ribbons cost one dollar.</p>

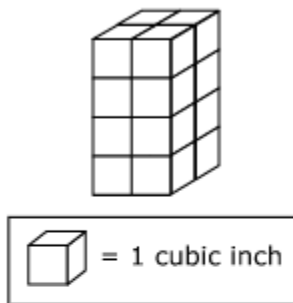
<p>Annotation for Sample Student Response:</p>	<p>Score Point 3 The response receives full credit. It includes each of the 3 required elements.</p> <p>Computation Component:</p> <ul style="list-style-type: none"> ● Student Response: $36 \div 6 = 6$. That means that you can make 6 school ribbons with 1 yard of ribbon, so we need to multiply it by five to get the total ribbons. $6 \times 5 = 30$. You can make 30 school ribbons with 5 yards of ribbon. <ul style="list-style-type: none"> ○ Rationale for Score: 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 ($36 \div 6 = 6$. . . 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 . . . $6 \times 5 = 30$). 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. <p>Modeling Component:</p> <p>Student Response: To find the cost of one ribbon you need to divide 6.00 by 30, $6.00 \div 30 = .20$</p> <ul style="list-style-type: none"> ● That means that each ribbon cost 20 cents. <ul style="list-style-type: none"> ○ Rationale for score: 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 . . . $6.00 \div 30 = .20$). 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). <p>Modeling Component:</p> <ul style="list-style-type: none"> ● Student Response: To find the cost of five school ribbons you need to multiply .20 by five. $.20 \times 5 = 1.00$. Five school ribbons cost one dollar. <ul style="list-style-type: none"> ○ Rationale for score: A valid equation that represents the cost of 5 school ribbons is given ($.20 \times 5 = 1.00$). <p>Note: 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>
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Scoring Rubric – Part B	
Points	Attributes
3	Student response includes each of the following 3 elements. <ul style="list-style-type: none"> ● Modeling component: Valid equation to determine the cost, c, of the ribbons and stickers. ● Computation component: Valid explanation or work to determine the total cost of the supplies, \$190. ● Reasoning component: Valid explanation or work to determine the amount still needed to pay for the supplies.
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>Sample Solution 1:</p> $c = 30 \times \$3 + 40 \times \$2 + 10 \times \$2$. $30 \times \$3 + 40 \times \$2 + 10 \times \$2 = \190 . $c = \$190$. $\$190 - \$145 = \$45$.

<p>Annotation for Sample Student Response:</p>	<p>Solution 1, Score Point 3 The response receives full credit. It includes each of the 3 required elements.</p> <p>Modeling Component:</p> <ul style="list-style-type: none"> ● Student Response: $c = 30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2$. <ul style="list-style-type: none"> ○ Rationale for Score: The student writes an equation to find the total cost, c, of the ribbons and stickers ($c = 30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2$). 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. Note that use of a variable or symbol, to represent the total cost, is not required. <p>Computation Component:</p> <ul style="list-style-type: none"> ● Student Response: $30 \times \\$3 + 40 \times \\$2 + 10 \times \\$2 = \\190. $c = \\$190$. <ul style="list-style-type: none"> ○ Rationale for score: The student determines the total cost of the supplies ($c = \\$190$). <p>Reasoning Component:</p> <ul style="list-style-type: none"> ● Student Response: $\\$190 - \\$145 = \\$45$ <ul style="list-style-type: none"> ○ Rationale for score: The student explains or shows how to determine the amount still needed to pay for the supplies ($\\$190 - \\$145 = \\$45$). The response correctly subtracts the parent contribution from the total cost. <p>Note: 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>
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Item Set 1 – Question 9 (Selected Response)

A right rectangular prism is shown.



What is the volume, in cubic inches, of the right rectangular prism?

- A. 8
- B. 13
- C. 16
- D. 20

Item Information		
Answer:	C	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.
Evidence Statement:	5.MD.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.
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:	0.745	

Item Set 1 – Question 10 (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	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.
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 1 – Question 11 (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	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.) (CCSS: 5.NF.B.7) 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	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. 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?
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 1 – Question 12 (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	Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume. (CCSS: 5.MD.C.5) 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. (CCSS: 5.MD.C.5.b)
Evidence Statement:	5.MD.5b	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. 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.
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 2

Item Set 2 – 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 one-step word problems involving multiplying multi-digit whole numbers. i) The given factors are such as to require an efficient/standard algorithm (e.g., $726 \times 4,871$). Factors in the task do not suggest any obvious ad hoc or mental strategy (as would be present for example in a case such as 7250×400). ii) The possibilities 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. iii) Word problems shall include a variety of grade-level appropriate applications and contexts.
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 2 – 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		
Answer:	Part A = B, Part B = 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	Demonstrate understanding of the place value system by combining or synthesizing knowledge and skills articulated in 5.NBT.A. i) Prompts do not provide visual fraction models; students may at their discretion draw visual fraction models as a strategy.
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	

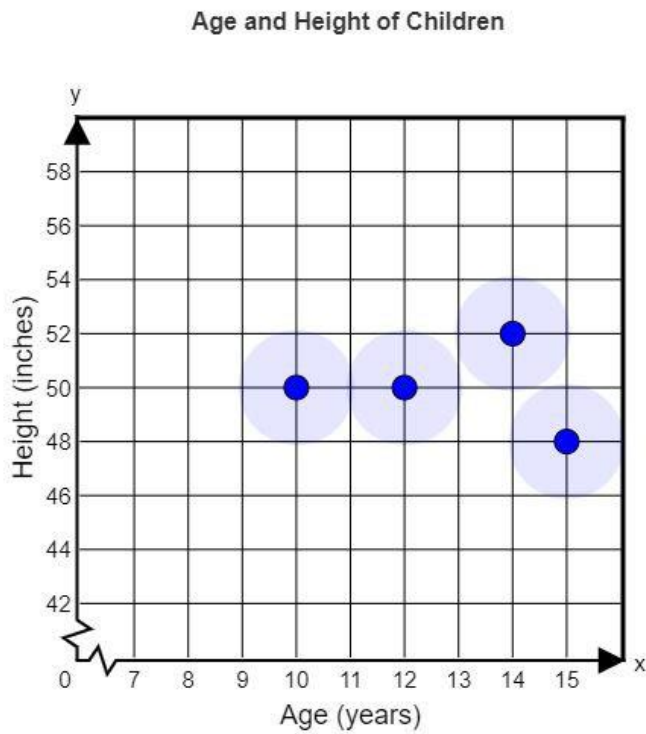
Item Set 2 – Question 3 (TEI Line Graph, Selected Response)

Four children are in line. Their age and height are shown in the table.

Child	Martha	Jason	Angie	Alex
Age (years)	12	15	10	14
Height (inches)	50	48	50	52

Part A

Graph the points for the age, x , in years, and height, y , in inches, of the four children.



Part B

The park rules allow children who are 12 years or older and at least 50 inches tall to go on the water ride.

Which coordinate pair could represent the age and height of a child that can go on the ride?

- A. (11, 54)
- B. (12, 44)
- C. (13, 51)
- D. (14, 49)

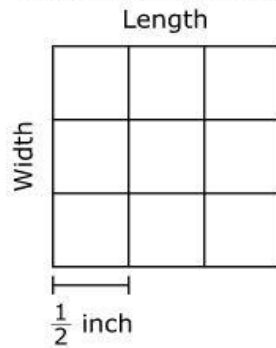
Item Information		
Answer:	Part A = See Image, Part B = C	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.G.A.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.
Evidence Statement:	5.G.2	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.
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:	0.793	

Item Set 2 – Question 4 (TEI Slider, Constructed Response)

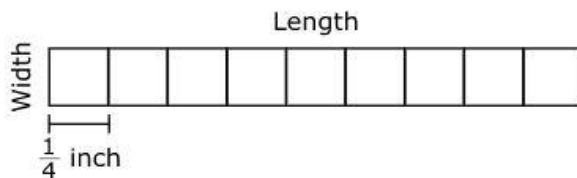
Student A and Student B created patterns using square tiles.

- 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

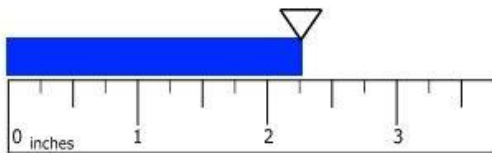


not to scale

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 (Machine Scored)	
Points	Attributes
1	Computation Component: 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	Student response includes each of the following 2 elements. <ul style="list-style-type: none"> • Computation component: Correct area, in square inches, of the pattern for Student A. • Reasoning component: 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.
1	Student response includes 1 of the 2 elements.
0	Student response is incorrect or irrelevant.
Sample Student Response	For Pattern A to find the area I will just do the area of the tiny square first. It is $\frac{1}{4}$ sq. in for each square since $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$. Since there are 9 tiny squares that make up the 1 big square, I am going to multiply $\frac{1}{4}$ by 9. $\frac{1}{4} \times 9 = 2\frac{1}{4}$. The area for pattern A is 2. For pattern B there are 9 squares that make a rectangle. The length and width are $\frac{1}{4}$ in. Since there are 9 squares and each have $\frac{1}{4}$ in. for length I will do $\frac{1}{4}$ times 9. This is $2\frac{1}{4}$. The width only has 1 square so it will stay as $\frac{1}{4}$ so to find the area you have to multiply $\frac{1}{4} \times 2\frac{1}{4}$. The area is $\frac{9}{16}$.

Annotation
for Sample
Student
Response

Score Point 2

The response receives full credit. It includes each of the 2 required elements.

Computation Component:

- **Student Response:** The area for pattern A is $2\frac{1}{4}$
 - **Rationale for Score:** The student finds the correct area of the pattern for Student A ($2\frac{1}{4}$).

Reasoning Component:

- **Student Response:** For Pattern A . . . It is $\frac{1}{4}$ sq. in. for each square since $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$. Since there are 9 tiny squares that make up the 1 big square I am going to multiply $\frac{1}{4}$ by 9. $\frac{1}{4} \times 9 = 2\frac{1}{4}$... For pattern B... there are 9 squares and each have $\frac{1}{4}$ in. for length I will do $\frac{1}{4}$ times 9. This is $2\frac{1}{4}$. The width only has 1 square so it will stay as $\frac{1}{4}$ so to find the area you have to multiply $\frac{1}{4} \times 2\frac{1}{4}$. The area is $\frac{9}{16}$.
 - **Rationale for score:** 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 ($\frac{1}{4}$ sq. in. for each square since $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$), then multiplying the total number of squares by the individual area of each square to find the total area of the pattern ($\frac{1}{4} \times 9 = 2\frac{1}{4}$). 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 $\frac{1}{4} \times 2\frac{1}{4}$. The area is $\frac{9}{16}$).

Note: 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.

Item Set 2 – Question 5 (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	Add two fractions with unlike denominators, or subtract two fractions with unlike denominators, 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, $\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$.) i) Tasks do not have a context. ii) Tasks ask for the answer or ask for an intermediate step that shows evidence of using equivalent fractions as a strategy. iii) Tasks do not include mixed numbers. iv) Tasks may involve fractions greater than 1 (including fractions equal to whole numbers). v) Prompts do not provide visual fraction models; students may at their discretion draw visual fraction models as a strategy.
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 2 – Question 6 (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		
Answer:	Part A = A, Part B = 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, real world problems requiring conversion among different-sized standard measurement units within a given measurement system. i) 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 2 – Question 7 (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. $12.076 > 12.54$

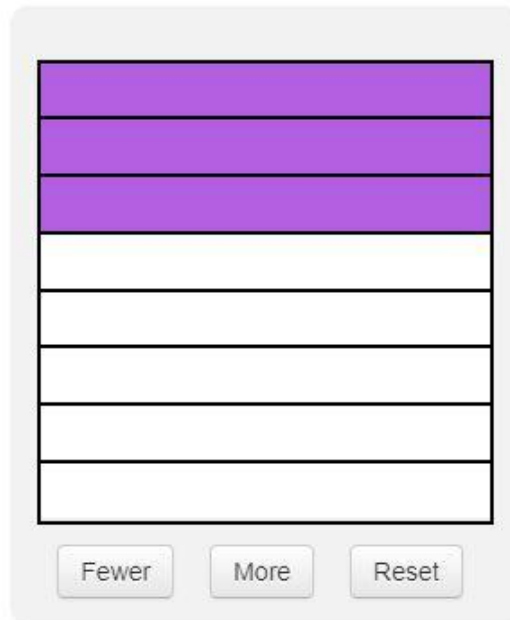
E. $12.012 < 12.076$

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 $<$ symbols to record the results of comparisons.
Evidence Statement:	5.NBT.3b	Read, write, and compare decimals to the thousandths. b. Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons. i) Tasks assess conceptual understanding, e.g., by including a mixture (both within and between items) of expanded form, number names, and base ten numerals. ii) Tasks have "thin context" or no context.
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 2 – Question 8 (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.



Item Information		
Answer:	See Image	
Colorado Academic Standards (CAS) Evidence Outcomes:	5.NF.B.4.a	Interpret the product $(a/b) \times q$ as a part 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 $(2/3) \times 4 = 8/3$, and create a story context for this equation. Do the same with $(2/3) \times (4/5) = 8/15$. (In general, $(a/b) \times (c/d) = ac/bd$.)
Evidence Statement:	5.NF.4a-2	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. For a fraction q , interpret the product $(a/b) \times q$ as a part 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 $(2/3) \times 4 = 8/3$, and create a story context for this equation. Do the same with $(2/3) \times (4/5) = 8/15$. (In general, $(a/b) \times (c/d) = ac/bd$.) i) Tasks require finding a product of two fractions (neither of the factors equal to a whole number). ii) The result is equal to a whole number in 20% of tasks; these are practice-forward for MP.7. iii) Tasks have "thin context" or no context.
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	