



Colorado Measures of Academic Success



Grade 6 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.

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)

Which number is closest to zero on a number line?

☐ A. $-\frac{3}{5}$

☐ B. $-\frac{2}{5}$

☒ C. $\frac{1}{5}$

☐ D. $\frac{4}{5}$

Item Information

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.NS.C.7.c
 - Define the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of -30 dollars, write $|-30| = 30$ to describe the size of the debt in dollars.
- Evidence Statement – 6.NS.7c-1
 - Understand ordering and absolute value of rational numbers. c. Understand the absolute value of a rational number as its distance from 0 on the number line. i) Tasks do not have a context. ii) Tasks are not limited to integers.
- 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 – 0.868

Item Set 1 – Question 2 (Multiple Select)

The point $(-2, 6)$ is plotted on a coordinate plane.

Which statements are true?

Select the **two** statements that are true.

- ☒ A. The reflection point across the y -axis is $(2, 6)$.
- ☐ B. The reflection point across the y -axis is $(2, -6)$.
- ☐ C. The reflection point across the y -axis is $(-2, -6)$.
- ☐ D. The reflection point across the x -axis is $(2, 6)$.
- ☐ E. The reflection point across the x -axis is $(2, -6)$.
- ☒ F. The reflection point across the x -axis is $(-2, -6)$.

Item Information

- Answer – A, F
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.NS.C.6.b
 - Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; explain that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
- Evidence Statement – 6.NS.6b-2
 - Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. b. Recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. i) Tasks have "thin context" or no context. ii) Students need not recognize or use traditional notation for quadrants (such as I, II, III, IV). iii) Coordinates are not limited to integers.
- 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 – 0.196

Item Set 1 – Question 3 (Selected Response)

Which question is a statistical question?

- ☐ A. Which students in an elementary school class can speak another language?
- ☒ B. How many students in a middle school class like each type of food?
- ☐ C. Which elementary classes is the principal visiting this week?
- ☐ D. How many students are in a middle school?

Item Information

- Answer – B
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.SP.A.1
 - Identify a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.
- Evidence Statement – 6.SP.1
 - Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages. i) Tasks do not assess mode and range.
- 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 – 0.402

Item Set 1 – Question 4 (Selected Response)

What is the value of this expression?

$$1,224 \div 16$$

- ☐ A. 76.0
- ☐ B. 76.2
- ☒ C. 76.5
- ☐ D. 76.8

Item Information

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.NS.B.2
 - Fluently divide multi-digit numbers using the standard algorithm.
- Evidence Statement – 6.NS.2
 - Fluently divide multi-digit numbers using the standard algorithm. i) The given dividend and divisor are such as to require an efficient/standard algorithm (e.g., $40584 \div 76$). Numbers in the task do not suggest any obvious ad hoc or mental strategy (as would be present for example in a case such as $40064 \div 16$). ii) Tasks do not have a context. iii) Only the answer is required. iv) Tasks are not to exceed five-digit dividends and two-digit divisors, with or without remainder. v) Tasks may or may not have a remainder. Students understand that remainders can be written as fractions or decimals.
- 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 – 0.424

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

A baker mixes 42.68 grams of flour and 19.125 grams of sugar in a bowl. The baker then uses 52.76 grams of the mixture in a cake.

How many grams of the mixture does the baker still have?

Enter your answer in the box.

9.045

Item Information

- Answer – See image
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.NS.B.3
 - Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
- Evidence Statement – 6.Int.1
 - Solve two-step word problems requiring operations on multi-digit whole numbers or decimals. i) Operations are no more complex than those specified for 6.NS.2, 6.NS.3-1, 6.NS.3-2, 6.NS.3-3, and 6.NS.3-4. ii) 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, 2-digit x 5-digit, or 3-digit x 3-digit (For example, 7.68×15.3 or 0.35×18.241 .)
- 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 – 0.394

An expression is shown.

$$19 \times 19 \times 19 \times 19 \times 19 \times 19 \times 19$$

Using a base and an exponent, write an expression that is equivalent to the one shown.

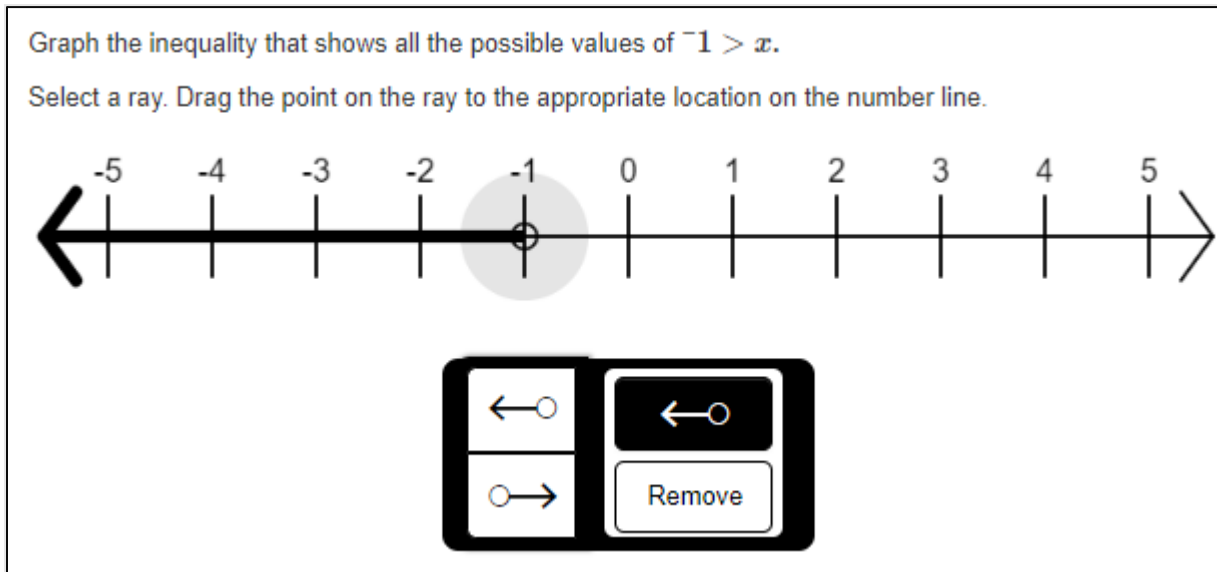
Enter your expression in the space provided. Enter **only** your expression.

19^7

Item Information

- Answer – See image
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.EE.A.1
 - Write and evaluate numerical expressions involving whole-number exponents.
- Evidence Statement – 6.EE.1-1
 - Write numerical expressions involving whole-number exponents. i) Tasks involve expressing b-fold products $a \times a \times \dots \times a$ in the form a^b , where a and b are non-zero whole numbers. ii) Tasks do not require use of the laws of exponents.
- 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 – 0.655

Item Set 1 – Question 7 (TEI Number Line)



Item Information

- Answer – See image
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.EE.B.8
 - Write an inequality of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ to represent a constraint or condition in a real-world or mathematical problem. Show that inequalities of the form $x > c$, $x \geq c$, $x < c$, or $x \leq c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
- Evidence Statement – 6.EE.8
 - Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. i) Constraint values (denoted c in standard 6.EE.8) are not limited to integers. ii) Tasks involve $<$ and $>$, not "less than or equal to" or "greater than or equal to."
- 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 – Scoring information unavailable for this item

Item Set 1 – Question 8 (Selected Response)

The width of a postage stamp is $1\frac{1}{5}$ inches and its area is $1\frac{1}{3}$ square inches.

What is the length of the postage stamp in inches?

- ☐ A. $\frac{2}{15}$
- ☐ B. $\frac{9}{10}$
- ☒ C. $1\frac{1}{9}$
- ☐ D. $1\frac{3}{5}$

Item Information

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.NS.A.1
 - Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $2/3 \div 3/4$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $2/3 \div 3/4 = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $a/b \div c/d = ad/bc$.) How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$ -cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?
- Evidence Statement – 6.NS.1-2
 - Solve word problems involving division of fractions by fractions. For example, How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$ -cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi? i) Only the answer is required; explanations and representations are not assessed here. For this part of standard 6.NS.1, see 6.C.2 and 6.C.3. ii) Note that the italicized examples correspond to three meanings/uses of division: (1) equal sharing; (2) measurement; (3) unknown factor. These meanings/uses of division should be sampled equally. iii) Tasks may involve fractions and mixed numbers but not decimals.
- 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 – 0.273

Item Set 1 – Question 9 (Multiple Select)

Which group of numbers is arranged from least to greatest?

Select **all** that apply.

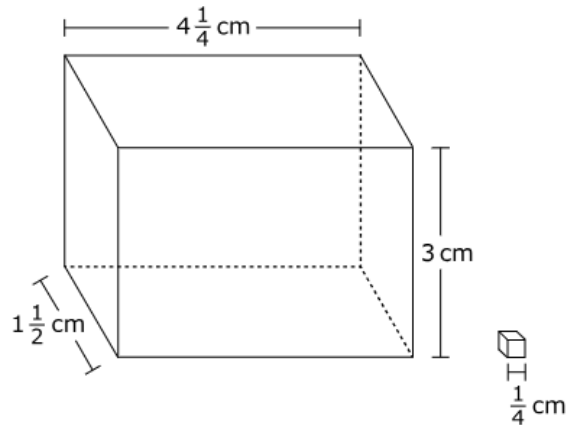
- ☒ A. $-7, -5, 1$
- ☐ B. $|-7|, |-5|, |1|$
- ☐ C. $-5, 7, 1$
- ☐ D. $|-5|, |7|, |1|$
- ☐ E. $-1, 5, -7$
- ☒ F. $|-1|, |5|, |-7|$

Item Information

- Answer – A, F
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.NS.C.7.d
 - Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.
- Evidence Statement – 6.NS.7d
 - Understand ordering and absolute value of rational numbers. d. Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars. i) Pool should contain tasks with and without context. ii) Tasks are not limited to integers. iii) Prompts do not present students with a number line diagram, but students may draw a number line diagram 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 – 0.238

Item Set 1 – Question 10 (Selected Response)

A right rectangular prism is made up of cubes. Each cube in the prism has an edge length of $\frac{1}{4}$ centimeter.



What is the number of cubes that fit inside the prism with no gaps?

- ☐ A. 77
- ☐ B. 102
- ☒ C. 1,224
- ☐ D. 2,240

Item Information

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.G.A.2
 - Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
- Evidence Statement – 6.G.2-1
 - Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. i) Tasks do not have a context. ii) Tasks focus on the connection between packing the solid figure and computing the volume.
- 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 – 0.388

Item Set 1 – Question 11 (Fill in the Blank)

What is the value of the expression $1,362 \div 12$?

Write your answer as a decimal.

Enter your answer in the box.

113.5

Item Information

- Answer – See image
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.NS.B.2
 - Fluently divide multi-digit numbers using the standard algorithm.
- Evidence Statement – 6.NS.2
 - Fluently divide multi-digit numbers using the standard algorithm. i) The given dividend and divisor are such as to require an efficient/standard algorithm (e.g., $40584 \div 76$). Numbers in the task do not suggest any obvious ad hoc or mental strategy (as would be present for example in a case such as $40064 \div 16$). ii) Tasks do not have a context. iii) Only the answer is required. iv) Tasks are not to exceed five-digit dividends and two-digit divisors, with or without remainder. v) Tasks may or may not have a remainder. Students understand that remainders can be written as fractions or decimals.
- 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 – 0.309

Item Set 1 – Question 12 (Selected Response)

Which expression uses the greatest common factor to show the sum of $48 + 64$?

- ☐ A. $4(12 + 16)$
- ☐ B. $8(6 + 8)$
- ☒ C. $16(3 + 4)$
- ☐ D. $24(2 + 3)$

Item Information

- Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.NS.B.4
 - Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express $36 + 8$ as $4(9 + 2)$.
- Evidence Statement – 6.NS.4-2
 - Use the distributive property to express a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express $36 + 8$ as $4(9 + 2)$. i) Tasks do not have a context. ii) Tasks require writing or finding the equivalent expression with the greatest common factor.
- 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 – 0.263

Item Set 1 – Question 13 (Fill in the Blank)

Evaluate the expression $4x + y^2$ when $x = 1.8$ and $y = 3$.

Write your answer as a decimal.

Enter your answer in the box.

16.2

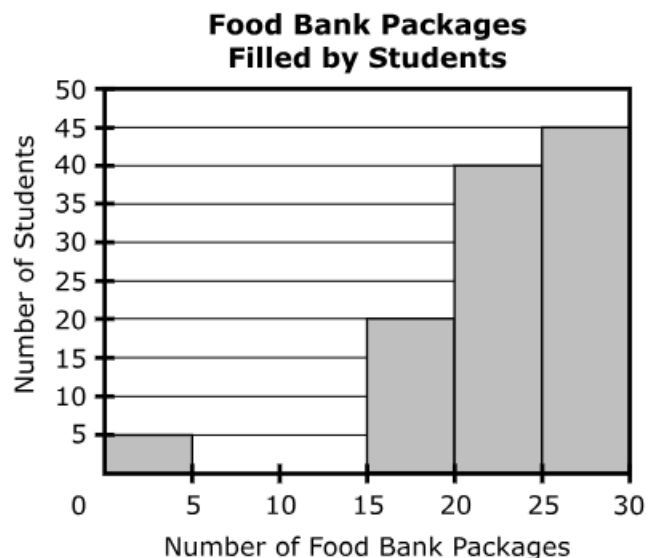
Item Information

- Answer – See image
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.EE.A.2.c
 - Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.
- Evidence Statement – 6.EE.2c-1
 - Write, read, and evaluate expressions in which letters stand for numbers. c. Evaluate expressions at specific values of their variables. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). i) Tasks do not have a context. ii) Numerical values in these expressions may include whole numbers, fractions, and decimals. iii) Task will not require operations on negative numbers.
- 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 – 0.289

ANSWER KEY: ITEM SET 2

Item Set 2 – Question 1 (Multiple Select)

Students volunteered to fill packages for a food bank. The manager recorded the number of packages filled by the students. The results are shown in this histogram.



Part A

Based on the histogram, how many students volunteered at the food bank?

- ☐ A. 30
- ☐ B. 45
- ☐ C. 105
- ☒ D. 110

Part B

Which statement about the data shown in the histogram is correct?

- ☒ A. The number of students who filled packages for the food bank in the interval 20–25 is twice the number of students who filled packages in the interval 15–20.
- ☐ B. The number of students who filled packages for the food bank in the interval 25–30 is greater than the number of students in all the other intervals combined.
- ☐ C. There are no outliers in the data set.
- ☐ D. The data is symmetrical.

Item Information

- Part A Answer – D
- Part B Answer – A
- Colorado Academic Standards (CAS) Evidence Outcomes
 - 6.SP.B.5.d – Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.
 - 6.SP.B.5.a – Reporting the number of observations
- Evidence Statement – 6.SP.5
 - Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. i) Tasks provide students with a text-based and graphics-based overview of a numerical data set. This overview includes the necessary information for (a) and (b). Students must extract this information from the overview and enter or identify/select it as part of the task. ii) With reference to the second clause in 6.SP.5c, tasks are technology-enhanced, e.g., to allow students to "tag" outliers, circle the bulk of the observations, etc. iii) With reference to 6.SP.6d, there is no wrong choice of measure of center--only a wrong interpretation of it. For example, students can choose the mean even for a distribution with outliers. However, tasks require students to identify/select from unambiguously true or false statements such as, "About half of the values are greater than the average"; "If this point were deleted from the data set, the median would not change"; etc. iv) Tasks do not assess mode and range.
- 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 – 0.582

Item Set 2 – Question 2 (Equation Editor)

A farmer plants tomatoes, carrots, and corn in a rectangular garden.

- The tomato section covers $\frac{2}{7}$ of the total area of the garden.
- The area of the tomato section is 68 square feet.
- The area of the entire garden is x square feet.

Write and solve an equation to determine the total area, in square feet, of the garden.

Enter your equation and your solution in the space provided. Enter **only** your equation and your solution.

Equation : $\frac{2}{7}x = 68$

Solution : $x = 238$

Item Information

- Answer – See Image, or an equivalent equation.
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.EE.B.7
 - Solve real-world and mathematical problems by writing and solving equations of the form $x \pm p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.
- Evidence Statement – 6.EE.7
 - Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers. i) Problem situations are of "algebraic" type, not "arithmetic" type. ii) 50% of tasks involve whole-number values of p , q , and/or x ; 50% of tasks involve fraction or decimal values of p , q , and/or x . Fractions and decimals should not appear together in the same problem. (Cf. 7.EE.3.) iii) These tasks only involve equations with addition and multiplication. iv) A valid equation and the correct answer are both required for full credit.
- 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 – 0.201

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

The table shows the number of words four students can type in a given amount of time.

Typing Speeds for Students

Student	Typing Speed
W	225 words in 5 minutes
X	246 words in 6 minutes
Y	266 words in 4 minutes
Z	303 words in 6 minutes

Part A

Which student can type the fewest number of words in 60 minutes?

- ☐ A. Student W
- ☒ B. Student X
- ☐ C. Student Y
- ☐ D. Student Z

Part B

How many words could students X and Y type together in 2 hours?

- ☒ A. 12,900
- ☐ B. 10,750
- ☐ C. 9,675
- ☐ D. 6,450

Part C

Student Z is typing a document with 5,454 words. How many minutes will it take this student to type this document?

Enter your answer in the box.

108

Part D

How many more words can Student Y type in 20 minutes compared to Student W?

Enter your answer in the box.

430

Item Information

- Part A Answer – B
- Part B Answer – A
- Part C Answer – See Image
- Part D Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.RP.A.3.b
 - Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?
- Evidence Statement – 6.RP.3b
 - Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? i) Expectations for unit rates in this grade are limited to non-complex fractions. The initial numerator and denominator should be whole numbers.
- 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 – 0.373

Item Set 2 – Question 4 (TEI Drag and Drop)

Which value of x makes each equation true?

Drag and drop each value of x into the appropriate box. Each value of x may be used once, more than once, or not at all.

$$20 = 5x$$

$$x = 4$$

$$\frac{12}{x} = 4$$

$$x = 3$$

$$27x = 3$$

$$x = \frac{1}{9}$$

$$x = \frac{1}{9}$$

$$x = \frac{1}{3}$$

$$x = 3$$

$$x = 4$$

$$x = 9$$

Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.EE.B.5
 - Describe solving an equation or inequality as a process of answering a question: Which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
- Evidence Statement – 6.EE.5-1
 - Understand solving an equation as a process of answering a question: which values from a specified set, if any, make the equation true?
- 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 – 0.227

Item Set 2 – Question 5 (Constructed Response)

There are x dollars in a cash register at the beginning of the day. By noon, there is an additional \$292.14 in the cash register. By the end of the day, \$186.95 more is added to the cash register. The total amount in the cash register at the end of the day is \$727.15. Use estimation to write an equation and your answers.

- Write an equation to estimate the amount of money in the cash register at the beginning of the day.
- Show your steps or explain how you found your equation.
- Determine an estimate of the original amount in the cash register. Round to the nearest hundred dollars in your estimation.

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

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.EE.B.7
 - Solve real-world and mathematical problems by writing and solving equations of the form $x \pm p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.
- Evidence Statement – 6.D.3
 - Reasoned estimates: Use reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity. Content Scope: Knowledge and skills articulated in Type I, Sub-Claim A Evidence Statements. i) Tasks may have scaffolding if necessary in order to yield a degree of difficulty appropriate to Grade 6.
- 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
 - 7.9% of students earned 3 points.
 - 23.6% of students earned 2 points.
 - 19.3% of students earned 1 point.
 - 48.3% of students earned 0 points.

Points	Attributes
3	<p>Student response includes the following 3 elements.</p> <ul style="list-style-type: none"> • Modeling component = 1 point: The student writes an equation to estimate the original amount in the cash register, such as $x + 500 = 700$. • Modeling component = 1 point: The student explains the answer or shows the work. • Computation component = 1 point: The student determines an estimate of the original amount in the cash register. <p>Sample Student Response: Since \$292.14 was in the cash register by noon, and by the end of the day there was an additional \$186.95 added to the cash register, I can add the rounded numbers \$300 and \$200 to find an estimate of how much was added to x for the entire day. The end-of-day balance in the cash register is \$727.15, which can be rounded to \$700. $x + 300 + 200 = 700$ The equation that estimates the original amount in the cash register is $x + 500 = 700$. To estimate the original amount in the cash register in the morning, I need to solve the equation for x. To do this, I need to subtract 500 from both sides, since subtraction is the opposite of addition. $x + 500 - 500 = 700 - 500$ $x = 200$ I estimate that there was originally \$200 in the cash register in the morning. Note: Students can explain their answer or show their work.</p>
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: $x \approx 700 - (200 + 300)$ First I found the sum of 300 and 200. After I found that, I subtracted the sum from 700. $300 + 200 = 500$ $700 - 500 = 200$ $x \approx 200$ There were about 200 dollars in the cash register at the beginning of the day.</p>
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>Modeling Component:</p> <ul style="list-style-type: none"> • Student Response: $x \approx 700 - (200 + 300)$ <ul style="list-style-type: none"> ○ Rationale for Score: Valid equation to estimate the amount of money in the cash register at the beginning of the day is provided ($x \approx 700 - (200 + 300)$). Note that all the dollar amounts have been rounded to the nearest hundred dollars. <p>Modeling Component:</p> <ul style="list-style-type: none"> • Student Response: $300 + 200 = 500$, $700 - 500 = 200$, $x \approx 200$ <ul style="list-style-type: none"> ○ Rationale for score: Valid work is provided for how the equation was determined (First, I found the sum of 300 and 200. After I found that, I subtracted the sum from 700. $300 + 200 = 500$, $700 - 500 = 200$, $x \approx 200$). Explanation for how the dollar amounts were rounded is not required. <p>Computation Component:</p> <ul style="list-style-type: none"> • Student Response: about 200 dollars <ul style="list-style-type: none"> ○ Rationale for score: Valid estimate of the original amount in the cash register, rounded to the nearest hundred dollars, is given (about 200 dollars in the cash register at the beginning of the day). <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 2 – Question 6 (Selected Response)

Part A

In right triangle RST , point T is graphed at $(2, -3)$, and point R is graphed at $(-1, 1)$.

Which coordinate pair describes the location of point S ?

- ☒ A. $(-1, -3)$
- ☐ B. $(-1, 3)$
- ☐ C. $(1, 2)$
- ☐ D. $(1, 3)$

Part B

Triangle MRT is graphed with point M at $(-4, -3)$.

What is the length, in units, of side \overline{MT} ?

- ☐ A. 3
- ☐ B. 4
- ☒ C. 6
- ☐ D. 7

Item Information

- Part A Answer – A
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.G.A.3
 - Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
- Evidence Statement – 6.G.3
 - Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
- 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 – 0.492

Item Set 2 – Question 7 (Fill in the Blank)

What is 45% of 320?

Enter your answer in the box.

144

Item Information

- Answer – See Image
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.RP.A.3.c
 - Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
- Evidence Statement – 6.RP.3c-1
 - Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity). i) Pool should contain tasks with and without context. ii) Expectations for ratios in this grade are limited to ratios of non-complex fractions. The initial numerator and denominator should be whole numbers.
- 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 – 0.228

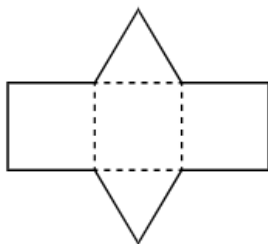
ANSWER KEY: ITEM SET 3

Item Set 3 – Question 1 (Selected Response)

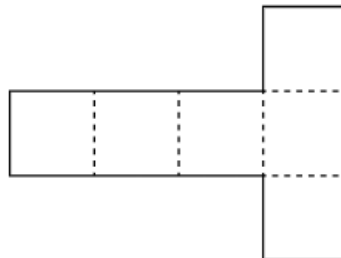
Part A

Which net represents a square pyramid?

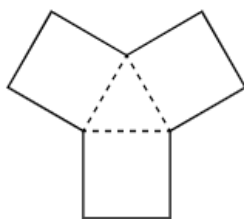
☐ A.



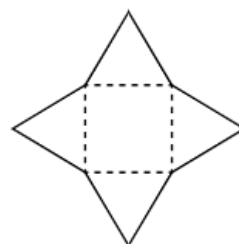
☐ B.



☐ C.

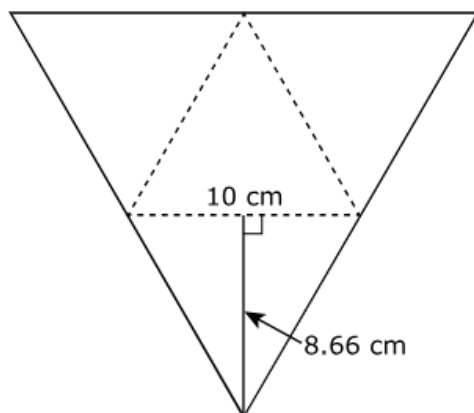


☒ D.



Part B

This net shows how to make a three-dimensional figure. Each triangular face of the net has an approximate height of 8.66 centimeters and a side length of 10 centimeters.



Which value **best** approximates the total surface area, in square centimeters, of the figure?

☐ A. 75

☐ B. 150

☒ C. 173

☐ D. 346

Item Information

- Part A Answer – D
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.G.A.4
 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
- Evidence Statement – 6.G.4
 - Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.
- 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 – 0.436

Item Set 3 – Question 2 (Constructed Response)

An expression that represents the perimeter of a quadrilateral is $x + x + x + 6$. A student claims that it is possible to write the expression for the perimeter in two more ways and still get the same perimeter.

- Show or explain why the expression $3(x + 2)$ is equivalent to the given expression.
- Write a different expression that represents the perimeter of the quadrilateral.
- Explain why the expression you wrote also represents the perimeter of the quadrilateral.
- Show or explain how to find the perimeter for all three expressions when $x = 13$.

Enter your answer and explanations in the space provided.

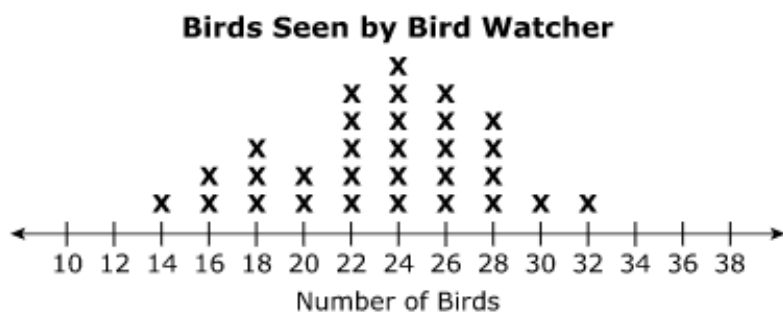
Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcomes – 6.EE.A.4
 - Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.
- Evidence Statement – 6.C.7
 - Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. Content Scope: Knowledge and skills articulated in 6.EE.4.
- 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
 - 2.8% of students earned 4 points.
 - 6.7% of students earned 3 points.
 - 6.4% of students earned 2 points.
 - 12.7% of students earned 1 point.
 - 68.7% of students earned 0 points.

Points	Attributes
4	<p>Student response includes the following 4 elements.</p> <ul style="list-style-type: none"> • Reasoning component = 1 point: The student shows or explains why the expression $3(x+2)$ is equivalent to the perimeter. • Computation component = 1 point: The student provides an expression that is equivalent to the perimeter. • Reasoning component = 1 point: The student explains why the provided expression is equivalent to the perimeter. • Reasoning component = 1 point: The student shows or explains how to find the perimeter for all three expressions when $x=13$. <p>Sample Student Response:</p> <p>"I know that the expression $3(x+2)$ is equivalent to the expression for the perimeter because $x + x + x + 6 = 3x + 6 = 3(x+2)$. I also know that the expression $3x + 6$ is equal to the perimeter because I get $3x$ when I combine like terms in $x + x + x$. When $x=13$, the perimeter using the expression $3(x+2)$ is $3(13+2) = 3(15) = 45$. I know that the perimeter equals 45 for the expressions $3x + 6$ and $x + x + x + 6$ because the two expressions are equivalent."</p> <p>Note: Various explanations are possible as long as the reasoning is valid. It is not necessary for the student to provide the expression $3x + 6$. Any expression that is equivalent to $3(x + 2)$ is valid.</p>
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>Sample Solution 1:</p> <p>$3(x + 2)$ is equivalent to the given expression because, if you distribute the 3 into the parentheses, 3 times 2 equals 6 and 3 times x equals $3x$.</p> <p>Another expression that could be used for this equation is $3x + 6$, this would work because the three x's in the equation given above represent $3x$.</p> <p>If x were to equal 13 then the solution for all the expressions is as follows:</p> <p>$x + x + x + 6 = 45$ $13 + 13 + 13 + 6 = 45$ $3(x + 2) = 45$ $3(13 + 2) = 45$ $3x + 6 = 45$ $3 \times 13 + 6 = 45$</p>
Annotation for Sample Student Response:	<p>Solution 1, Score Point 4</p> <p>The response receives full credit. It includes each of the 4 required elements.</p> <p>Reasoning Component:</p> <ul style="list-style-type: none"> Student Response: $3(x+2)$ is equivalent to the given expression because, if you distribute the 3 into the parentheses, 3 times 2 equals six and 3 times x equals $3x$. <ul style="list-style-type: none"> Rationale for Score: Valid explanation provided for why the expression $3(x+2)$ is equivalent to the given perimeter expression [$3(x+2)$ is equivalent to the given expression because, if you distribute the 3 into the parentheses, 3 times 2 equals six and 3 times x equals $3x$]. Using the distributive property to multiply the 3 and the x-variable, the product is $3x$ which is the result of combining the terms in $x + x + x$ as seen in the expression that represents the perimeter of a quadrilateral. 6 is then added, as shown in the given expression. <p>Computation Component:</p> <ul style="list-style-type: none"> Student Response: $3x + 6$ <ul style="list-style-type: none"> Rationale for score: Valid different expression that could represent the perimeter of the quadrilateral is provided (Another expression that could be used for this equation is $3x + 6$). Any expression that is equivalent to $3(x+2)$ is valid. <p>Reasoning Component:</p> <ul style="list-style-type: none"> Student Response: the three x's in the equation given above represent $3x$ <ul style="list-style-type: none"> Rationale for score: Valid explanation for why the provided expression also represents the perimeter of the quadrilateral is given (this would work because the three x's in the equation given above represent $3x$). The student explains how $3x+6$ is equivalent to the perimeter expression by indicating that the three x's in $x + x + x + 6$ represents $3x$ when combining like terms. <p>Reasoning Component:</p> <ul style="list-style-type: none"> Student Response: $x + x + x + 6 = 45$, $13 + 13 + 13 + 6 = 45$, $3(x + 2) = 45$, $3(13 + 2) = 45$, $3x + 6 = 45$, $3 \times 13 + 6 = 45$ <ul style="list-style-type: none"> Rationale for score: Valid work provided to find the perimeter for all three expressions when $x = 13$ [$x + x + x + 6 = 45$, $13 + 13 + 13 + 6 = 45$, $3(x + 2) = 45$, $3(13 + 2) = 45$, $3x + 6 = 45$, $3 \times 13 + 6 = 45$]. All three equations are equivalent, and the student's work correctly shows that the perimeter equals 45 for all three expressions when x is equal to 13. <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>

The number of birds seen by a bird watcher each day for 30 days is recorded in a line plot.



Part A

What is the mean number of birds seen by the bird watcher each day?

- ☐ A. 18
- ☐ B. 21.81
- ☒ C. 23.27
- ☐ D. 24

Part B

The bird watcher describes the center of the data set as the mean.

Which statement explains a reason the bird watcher would choose the mean to describe the center of the data set?

- ☐ A. More than half of the recorded number of birds seen by the bird watcher are less than the mean.
- ☐ B. The line plot showing the number of birds seen by the bird watcher is equally distributed.
- ☒ C. There are about the same number of data points above and below the mean.
- ☐ D. The mean is lower than all the data points.

Item Information

- Part A Answer – C
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.SP.B.5.c
 - Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
- Evidence Statement – 6.SP.5
 - Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. i) Tasks provide students with a text-based and graphics-based overview of a numerical data set. This overview includes the necessary information for (a) and (b). Students must extract this information from the overview and enter or identify/select it as part of the task. ii) With reference to the second clause in 6.SP.5c, tasks are technology-enhanced, e.g., to allow students to "tag" outliers, circle the bulk of the observations, etc. iii) With reference to 6.SP.6d, there is no wrong choice of measure of center--only a wrong interpretation of it. For example, students can choose the mean even for a distribution with outliers. However, tasks require students to identify/select from unambiguously true or false statements such as, "About half of the values are greater than the average"; "If this point were deleted from the data set, the median would not change"; etc. iv) Tasks do not assess mode and range.
- 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 – 0.273

Item Set 3 – Question 4 (Constructed Response)

An equation is shown.

$$x + 9.3 + 15 = 50$$

- Show the steps you can use to determine the value of x .
- Find the value of x in your last step.
- Explain or show how the value of x makes the equation true.

Enter your work, 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
 - 6.EE.B.5 – Describe solving an equation or inequality as a process of answering a question: Which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
 - 6.EE.B.6 – Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; recognize that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
- Evidence Statement – 6.C.6
 - Given an equation, present the solution steps as a logical argument that concludes with a solution. Content Scope: Knowledge and skills articulated in 6.EE.B i) Tasks do not require students to write an equation or inequality
- 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
 - 19.2% of students earned 3 points.
 - 29.2% of students earned 2 points.
 - 13.5% of students earned 1 point.
 - 37.1% of students earned 0 points.

Points	Attributes
3	<p>Student response includes the following 3 elements.</p> <ul style="list-style-type: none"> • Reasoning component = 1 point: The student shows all steps to determine the value of x. • Computation component = 1 point: The student determines the value of x. • Reasoning component = 1 point: The student explains why the value of x makes the equation true. <p>Sample Student Response: “The steps I took are shown below. $x + 9.3 + 15 = 50$ $x + 24.3 = 50$ $x + 24.3 - 24.3 = 50 - 24.3$ $x = 25.7$ “This value makes the equation true because when I place 25.7 back into the original equation, both sides are equal to 50.”</p> <p>Notes:</p> <ul style="list-style-type: none"> • A variety of explanations are possible. As long as it is clear that the student shows appropriate steps and explains why the value is a solution to the equation, credit should be given. • If a computation mistake is made, credit cannot be given for computation but can be given for a valid explanation. • Students can show a number sentence or explain how the value of x makes the equation true.
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> $x + 9.3 + 15 = 50$ subtract 15 from both sides. $x + 9.3 = 35$ subtract 9.3 from both sides $x = 25.7$ $(25.7) + 9.3 + 15 = 50$ $25.7 + 24.3 = 50$ $50 = 50$
Annotation for Sample Student Response:	<p>Solution 1, Score Point 3</p> <p>The response receives full credit. It includes each of the 3 required elements.</p> <p>Reasoning Component:</p> <ul style="list-style-type: none"> • Student Response: $x + 9.3 + 15 = 50$, subtract 15 from both sides, $x + 9.3 = 35$, subtract 9.3 from both sides, $x = 25.7$ <ul style="list-style-type: none"> ○ Rationale for Score: Valid work provided to determine the value of x ($x + 9.3 + 15 = 50$, subtract 15 from both sides, $x + 9.3 = 35$, subtract 9.3 from both sides, $x = 25.7$). <p>Computation Component:</p> <ul style="list-style-type: none"> • Student Response: 25.7 <ul style="list-style-type: none"> ○ Rationale for score: Correct value of x is provided ($x = 25.7$). <p>Reasoning Component:</p> <ul style="list-style-type: none"> • Student Response: $(25.7) + 9.3 + 15 = 50$, $25.7 + 24.3 = 50$, $50 = 50$ <ul style="list-style-type: none"> ○ Rationale for score: Valid explanation for how the value of x makes the equation true [$(25.7) + 9.3 + 15 = 50$, $25.7 + 24.3 = 50$, $50 = 50$]. The value of x is substituted into the equation to show that the value of the left side of the equation equals 50. <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>

A store sells cherries for \$3.70 per pound.

Part A

A person buys x pounds of cherries for \$7.56.

Which equation can be used to find the number of pounds of cherries the person buys?

- ☐ A. $3.70 + x = 7.56$
- ☐ B. $7.56 + x = 3.70$
- ☒ C. $3.70x = 7.56$
- ☐ D. $7.56x = 3.70$

Part B

The store changes the price of the cherries. The equation $3.70 + p = 4.66$ represents the relationship between the old and new prices of cherries, where p is the change in the price per pound of cherries.

What is the value of p in this equation?

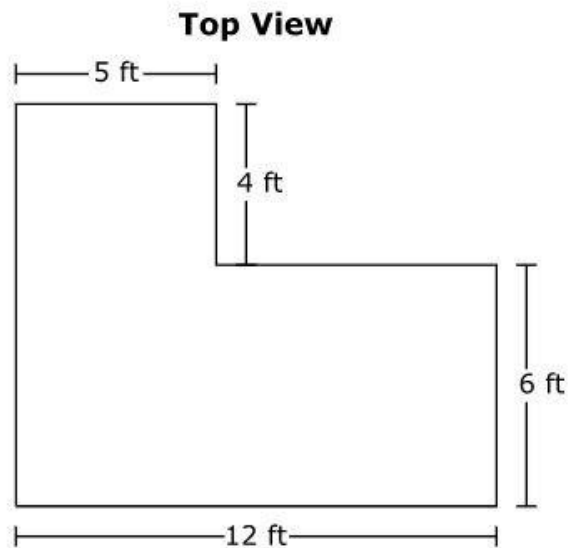
- ☐ A. 0.81
- ☐ B. 0.90
- ☒ C. 0.96
- ☐ D. 1.23

Item Information

- Part A Answer – C
- Part B Answer – C
- Colorado Academic Standards (CAS) Evidence Outcome(s) – 6.EE.B.7
 - Solve real-world and mathematical problems by writing and solving equations of the form $x \pm p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers.
- Evidence Statement – 6.EE.7
 - Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers. i) Problem situations are of "algebraic" type, not "arithmetic" type. ii) 50% of tasks involve whole-number values of p , q , and/or x ; 50% of tasks involve fraction or decimal values of p , q , and/or x . Fractions and decimals should not appear together in the same problem. (Cf. 7.EE.3.) iii) These tasks only involve equations with addition and multiplication. iv) A valid equation and the correct answer are both required for full credit.
- 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 – 0.684

Part A

An L-shaped pool is made of two right rectangular prisms. The figure shows a top view of this pool. The pool height is the same for the entire pool.



The pool is filled with water to a height of 4 feet.

- Create an equation or set of equations that can be used to find the volume, in cubic feet, of the pool.
- Explain how you created the equation or set of equations.
- Find the volume, in cubic feet, of the pool.

Enter your equation or set of equations, your explanation, and your answer in the space provided.

Part B

A different pool is in the shape of a right rectangular prism and has a volume of 192 cubic feet. The area of the base of the pool is 32 square feet.

- Create an equation to find the height, in feet, of the water in the pool.
- Find the height, in feet, of the water in the pool. Show your work.

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

Equation: $192 \div 32 = \text{height}$

Height of water: 6 feet

Your Work: $192 \div 32 = 6 \text{ ft}$

Item Information

- Answer – See Scoring Rubric and Sample Student Responses
- Colorado Academic Standards (CAS) Evidence Outcome(s)
 - 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.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 – 6.D.2
 - Solve multi-step contextual problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in 5.NBT.B, 5.NF, 5.MD, and 5.G.A. i) Tasks may have scaffolding if necessary in order to yield a degree of difficulty appropriate to Grade 6.
- 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
 - 7.0% of students earned 6 points.
 - 6.5% of students earned 5 points.
 - 4.0% of students earned 4 points.
 - 23.4% of students earned 3 points.
 - 6.1% of students earned 2 points.
 - 6.2% of students earned 1 point.
 - 46.7% 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"> • Modeling component: Valid equations or expressions to find the volume, in cubic feet, of the pool. • Modeling component: Valid explanation for how to create the equations or expressions to find the volume of the pool. • Computation component: Correct volume, in cubic feet, of the pool, 368.
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>$(4 \times 5 + 6 \times 12)4 = \text{volume}$. I made this equation by cutting the shape into 2 shapes. A 5 by 4 rectangle and a 6 by 12 rectangle. If you add those together, you get the area, and I know area times height equals volume so in my equation made it so you multiply the area times the height for volume.</p> <p> $4 \times 5 = 20$ $6 \times 12 = 72$ $20 + 72 = 92$ $92 \times 4 = 368$ $\text{volume} = 368$ </p> <p>The volume of the pool is 368 feet cubed.</p>
Annotation for Sample Student Response:	<p>Score Point 3</p> <p>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: $(4 \times 5 + 6 \times 12)4 = \text{volume}$. <ul style="list-style-type: none"> ○ Rationale for Score: The student provides a valid equation to find the volume of the pool $[(4 \times 5 + 6 \times 12)4 = \text{volume}]$. Expressions are provided for each rectangle that multiply the length times the width to find the area $(4 \times 5 + 6 \times 12)$, added together, and then multiplied by the height (4) to find the volume of the pool. <p>Modeling Component:</p> <ul style="list-style-type: none"> • Student Response: I made this equation by cutting the shape into 2 shapes. A 5 by 4 rectangle and a 6 by 12 rectangle. If you add those together, you get the area, and I know area times height equals volume so in my equation made it so you multiply the area times the height for volume. <ul style="list-style-type: none"> ○ Rationale for score: The student provides a detailed explanation of how the equation is created to find the volume of the pool (cutting the shape into 2 shapes. A 5 by 4 rectangle and a 6 by 12 rectangle . . . add those together, you get the area . . . area times height equals volume so in my equation made it so you multiply the area times the height for volume). <p>Computation Component:</p> <ul style="list-style-type: none"> • Student Response: The volume of the pool is 368 feet cubed. <ul style="list-style-type: none"> ○ Rationale for score: The correct volume of the pool, in cubic feet, is provided (368). <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>

Scoring Rubric – Part B

Points	Attributes
3	<p>Student response includes each of the following 3 elements.</p> <ul style="list-style-type: none"> • Modeling component: Valid equation to find the height, in feet, of the water in the pool. • Computation component: Correct height, in feet, of the water in the pool, 6 • Modeling component: Valid work to find the height of water in the pool.
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>Equation: $192 \div 32 = \text{height}$</p> <p>Height of water: 6 feet</p> <p>Your Work: $192 \div 32 = 6 \text{ ft}$</p>
Annotation for Sample Student Response:	<p>Score Point 3</p> <p>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: Equation: $192 \div 32 = \text{height}$ <ul style="list-style-type: none"> ○ Rationale for Score: The student provides a valid equation to find the height of the water in the pool ($192 \div 32 = \text{height}$). <p>Computation Component:</p> <ul style="list-style-type: none"> • Student Response: Height of water: 6 feet <ul style="list-style-type: none"> ○ Rationale for score: The correct height, in feet, of the water in the pool is provided (6). <p>Modeling Component:</p> <ul style="list-style-type: none"> • Student Response: Your Work: $192 \div 32 = 6 \text{ ft}$ <ul style="list-style-type: none"> ○ Rationale for score: The student provides valid work to find the height of the water in the pool ($192 \div 32 = 6 \text{ ft}$). <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>