

**engage<sup>ny</sup>**

**Our Students. Their Moment.**

**DRAFT**

**New York State Testing Program  
Grade 7 Common Core  
Mathematics Test**

**Released Questions with Annotations**

**August 2013**



THE STATE EDUCATION DEPARTMENT / THE UNIVERSITY OF THE STATE OF NEW YORK /  
ALBANY, NY 12234

## **New York State Testing Program Grade 7 Common Core Mathematics Test**

### **Released Questions with Annotations**

With the adoption of the New York P-12 Common Core Learning Standards (CCLS) in ELA/Literacy and Mathematics, the Board of Regents signaled a shift in both instruction and assessment. In Spring 2013, New York State administered the first set of tests designed to assess student performance in accordance with the instructional shifts and the rigor demanded by the Common Core State Standards (CCSS). To aid in the transition to new tests, New York State released a number of resources during the 2012-2013 year, including test blueprints and specifications, and criteria for writing test questions. These resources can be found at <http://www.engageny.org/common-core-assessments>.

New York State administered the first ELA/Literacy and Mathematics Common Core tests in April 2013 and is now making a portion of the questions from those tests available for review and use. These released questions will help students, families, educators, and the public better understand how tests have changed to assess the instructional shifts demanded by the Common Core and to assess the rigor required to ensure that all students are on track to college and career readiness.

#### ***Annotated Questions Are Teaching Tools***

The released questions are intended to help students, families, educators, and the public understand how the Common Core is different. The annotated questions will demonstrate the way the Common Core should drive instruction and how tests have changed to better assess student performance in accordance with the instructional shifts demanded by the Common Core. They are also intended to help educators identify how the rigor of the State tests can inform classroom instruction and local assessment. The annotations will indicate common student misunderstandings related to content standards; educators should use these to help inform unit and lesson planning. In some cases, the annotations may offer insight into particular instructional elements (conceptual thinking, visual models) that align to the Common Core that may be used in curricular design. It should not be assumed, however, that a particular standard will be measured with an identical item in future assessments.

The annotated questions will include both multiple-choice and constructed-response questions. With each multiple-choice question released, a rationale will be available to demonstrate why the question measures the intended standards; why the correct answer is correct; and why each wrong answer is plausible but incorrect. The rationales describe why the wrong answer choices are plausible but incorrect and are based in common errors in computation. While these rationales will speak to a possible and likely reason for selection of the incorrect option by the student, these rationales do not contain definitive statements as to why the student chose the incorrect option or what we can infer about knowledge and skills of the student based on their selection of an incorrect response. These multiple-choice questions are designed to assess student proficiency, not to diagnose specific misconceptions/errors with each and every incorrect option.

Additionally, for each constructed-response question, there will be an explanation for why the question measures the intended standards and sample student responses representing each possible score point. Questions from the upper grades may feature more detailed annotations, as the items tend to be more complex.

### ***Understanding Math Annotated Questions***

#### **Multiple Choice**

Multiple-choice questions are designed to assess CCLS for Mathematics. Mathematics multiple-choice questions will mainly be used to assess standard algorithms and conceptual standards. Multiple-choice questions incorporate both Standards and Standards for Mathematical Practices, some in real-world applications. Many multiple-choice questions require students to complete multiple steps. Likewise, many of these questions are linked to more than one standard, drawing on the simultaneous application of multiple skills and concepts. Within answer choices, distractors will all be based on plausible missteps.

Short and extended constructed-response questions may refer to the scoring rubric, which can be found at [www.engageny.org/resource/test-guides-for-english-language-arts-and-mathematics](http://www.engageny.org/resource/test-guides-for-english-language-arts-and-mathematics).

#### **Short Response**

Short-response questions are similar to past 2-point questions, requiring students to complete a task and show their work. Like multiple-choice questions, short-response questions will often require multiple steps, the application of multiple mathematics skills, and real-world applications. Many of the short-response questions will cover conceptual and application Standards.

#### **Extended Response**

Extended-response questions are similar to past 3-point questions, asking students to show their work in completing two or more tasks or a more extensive problem. Extended-response questions allow students to show their understanding of mathematical procedures, conceptual understanding, and application. Extended-response questions may also assess student reasoning and the ability to critique the arguments of others.

### ***Released Questions Do Not Comprise a Mini Test***

This document is NOT intended to show how operational tests look or to provide information about how teachers should administer the test; rather, the purpose of the released questions is to provide an overview of how the new test reflects the demands of the Common Core.

The released questions do not represent the full spectrum of standards assessed on the State test, nor do they represent the full spectrum of how the Common Core should be taught and assessed in the classroom. Specific criteria for writing test questions as well as additional test information is available at [www.engageny.org/common-core-assessments](http://www.engageny.org/common-core-assessments).

Cassie rolls a fair number cube with 6 faces labeled 1 through 6. She rolls the number cube 300 times. Which result is **most** likely?

- A** Cassie will roll a 1 or a 2 about 50 times.
- B** Cassie will roll a 1 or a 2 exactly 50 times.
- C** Cassie will roll an even number about 150 times.
- D** Cassie will roll an even number exactly 150 times.

**Key: C**

**Measured CCLS: 7.SP.6; 7.SP.7a**

**Commentary:** The item measures 7.SP.7a, because it involves using a uniform probability model to determine probabilities of events. The item also measures 7.SP.6, because it requires predicting the approximate relative frequency given the probability.

**Answer Choice A:** "Cassie will roll a 1 or a 2 about 50 times." This response reflects the approximate number of times that any one side of the number cube will be rolled. The student may have found that the probability of rolling any one side was  $\frac{1}{6}$ , but did not include the probability of rolling the second side. A student who selects this response may not understand how to combine the probabilities of two events.

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

$$\frac{2}{6} \times 300 = 100$$

**Answer Choice B:** "Cassie will roll a 1 or a 2 exactly 50 times." This response reflects the approximate number of times that any one side of the number cube will be rolled. The student found that the probability of rolling any one side was  $\frac{1}{6}$ , but did not include the probability of rolling the second side. A student who selects this response may not understand how to combine the probabilities of two events. In addition, it is unlikely that experimental results will exactly match the prediction based on theoretical probability. It is more likely that a 1 will be rolled "about" 50 times, rather than "exactly" 50 times.

$$\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

$$\frac{2}{6} \times 300 = 100$$

**Answer Choice C:** "Cassie will roll an even number about 150 times." The student correctly determined the approximate number of times the sides of the number cube labeled 2, 4, or 6 will be rolled. The student who selects this response likely used the probability that the number cube will land on a side labeled 2, 4, or 6 on any given roll to predict the total number of times that these events would occur out of 300 rolls.

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6}$$

$$\frac{3}{6} \times 300 = 150$$

**Answer Choice D:** "Cassie will roll an even number exactly 150 times." This response reflects the approximate number of times the sides of the number cube labeled 2, 4, or 6 will be rolled. The student likely found that the

probability of rolling one of these three sides was  $\frac{3}{6}$ , but did not allow that experimental results would not exactly match the prediction based on theoretical probability. It is more likely that an even number will be rolled "about" 150 times, rather than "exactly" 150 times. A student who selects this response may not understand the relationship between theoretical probability and experimental results.

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when predicting the approximate relative frequency given the probability. Answer option C represents the approximate number of times the sides of the number cube labeled 2, 4, or 6 will be rolled out of 300 rolls.

What is the value of the expression below?

$$\frac{3}{8} + \left(-\frac{4}{5}\right) + \left(-\frac{3}{8}\right) + \frac{5}{4}$$

- A** 0
- B**  $\frac{1}{20}$
- C**  $\frac{9}{20}$
- D**  $2\frac{4}{5}$

**Key: C**

**Measured CCLS: 7.NS.1d**

**Commentary:** The item measures 7.NS.1d because it assesses applying properties of operations as strategies to add and subtract rational numbers.

**Answer Choice A:** 0. This response may reflect a misunderstanding of additive inverses. The student may have recognized that  $\frac{3}{8} + \left(-\frac{3}{8}\right) = 0$ , but did not recognize that  $-\frac{4}{5} + \frac{5}{4} = 0$  was a false statement.

$$\frac{3}{8} + \left(-\frac{4}{5}\right) + \left(-\frac{3}{8}\right) + \frac{5}{4} \rightarrow 0$$

**Answer Choice B:**  $\frac{1}{20}$ . This response may reflect a computational error when adding two fractions with unlike denominators. The student likely recognized that  $\frac{3}{8} + \left(-\frac{3}{8}\right) = 0$ , but incorrectly determined that  $-\frac{4}{5} + \frac{5}{4} = \frac{1}{20}$ .

$$\frac{3}{8} + \left(-\frac{4}{5}\right) + \left(-\frac{3}{8}\right) + \frac{5}{4} \rightarrow \frac{1}{20}$$

**Answer Choice C:**  $\frac{9}{20}$ . The student determined the correct value of the expression. Students who recognized the presence of additive inverses were rewarded with a simpler expression to calculate.

$$\frac{3}{8} + \left(-\frac{4}{5}\right) + \left(-\frac{3}{8}\right) + \frac{5}{4} = \frac{9}{20}$$

**Answer Choice D:**  $2\frac{4}{5}$ . This response reflects the value of the expression where the student disregarded all negative signs on the fractions,  $\frac{3}{8} + \frac{4}{5} + \frac{3}{8} + \frac{5}{4} = 2\frac{4}{5}$ . The student may not be correctly interpreting the notation of signs separated by parentheses in the expression. The student may only have a partial understanding of adding positive and negative fractions.

$$\frac{3}{8} + \left(-\frac{4}{5}\right) + \left(-\frac{3}{8}\right) + \frac{5}{4} \rightarrow 2\frac{4}{5}$$

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when applying properties of operations as strategies to add and subtract rational numbers. Answer option C represents the correct process used to find the value of the given expression.

Carmine paid an electrician  $x$  dollars per hour for a 5-hour job plus \$70 for parts. The total charge was \$320. Which equation can be used to determine how much the electrician charged per hour?

- A**  $5x = 320 + 70$
- B**  $5x = 320 - 70$
- C**  $(70 + 5)x = 320$
- D**  $(70 - 5)x = 320$

**Key: B**

**Measured CCLS: 7.EE.4a**

**Commentary:** The item measures 7.EE.4a because it measures solving word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. The item assesses if students can determine the equation that can be used to solve the given word problem. Compare with the item on page 10, which also assesses 7.EE.4a.

**Answer Choice A:**  $5x = 320 + 70$ . This response is equivalent to  $5x - 70 = 320$ , which reflects the cost per hour of work,  $x$ , when the cost of the parts is subtracted from  $5x$ . The choice of this response indicates that the student may not understand that 70 is added to the hourly charge to determine the total of 320. A student who selects this response may have partial understanding of how to write equations in the form  $px + q = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers, in the context of a word problem.

**Answer Choice B:**  $5x = 320 - 70$ . This response correctly shows that the cost of 5 hours of work is equal to the total cost excluding the cost associated with parts. This response may also be seen as equivalent to  $5x + 70 = 320$ , which reflects that the total cost of \$320 is the cost per hour,  $x$ , for 5 hours of work plus \$70 for parts. The student who selects this response determined an equation that can be used to solve the given word problem.

**Answer Choice C:**  $(70 + 5)x = 320$ . This response is equivalent to  $75x = 320$ , which reflects the cost per hour of work,  $x$ , for 75 hours of work with no parts included. A student who selects this response may have partial understanding of how the terms of an equation in the form of  $px + q = r$ , and  $p(x + q) = r$  contribute to the value of  $r$ .

**Answer Choice D:**  $(70 - 5)x = 320$ . This response is equivalent to  $65x = 320$ , which reflects the cost per hour of work,  $x$ , for 65 hours of work with no parts included. A student who selects this response may have partial understanding of how the terms of an equation in the form of  $px + q = r$ , and  $p(x + q) = r$  contribute to the value of  $r$ .

Answer options A, C, and D are plausible but incorrect. They represent common student errors made when determining an equation of the form  $px + q = r$ , and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers, that can be used to solve a word problem. Answer option B represents an equation in which \$320 is the cost per hour,  $x$ , for 5 hours of work plus \$70 for parts.

The relationship between the length of one side of a square,  $x$ , and the perimeter of the square,  $y$ , can be represented in an  $xy$ -plane by a straight line. Which of the points with coordinates  $(x, y)$  lie on the line?

- A** (2, 6)
- B** (2, 8)
- C** (6, 2)
- D** (8, 2)

**Key: B**

**Measured CCLS: 7.RP.2d**

**Commentary:** This item measures 7.RP.2d, because it assesses understanding of interpreting the meaning of point  $(x, y)$  on the graph of a proportional relationship. In this case, the proportional relationship is that the perimeter of a square is always four times the length of one of its sides.

**Answer Choice A:** (2, 6). This response reflects adding 4 to the  $x$ -coordinate instead of multiplying by 4. The student may have applied the 4 sides of the square to determine the  $y$ -coordinate, but chose an incorrect operation. A student who selects this response may have partial understanding of graphs of proportional relationships, but may not know how to apply a unit rate to determine an unknown point.

$$2 + 4 = 6 \rightarrow (2, 6)$$

**Answer Choice B:** (2, 8). The student determined a point that would lie on a graph where  $x$  represents the length of one side of a square and  $y$  represents the perimeter of the square. The student who selects this response may have determined that the unit rate of the graph would be 4 units of perimeter for each unit of side length, and then applied this unit rate to determine a point that would lie on the graph.

$$2 \times 4 = 8 \rightarrow (2, 8)$$

Students may have created a table of values and selected the correct solution choice by comparing them to their own table of values. Additionally, students may also have tested each coordinate according to the relationship above without directly calculating the unit rate (i.e., if the side length of the square is 2 the perimeter would be 8).

**Answer Choice C:** (6, 2). This response reflects adding 4 to the  $x$ -coordinate instead of multiplying by 4, and then reversing the order of the coordinates. The student may have applied the 4 sides of the square to determine the  $y$ -coordinate, but chose an incorrect operation, and then reversed the order of the coordinates. A student who selects this response may have partial understanding of graphs of proportional relationships, but may not know how to apply a unit rate to determine an unknown point, and may not understand the proportional relationship between the  $x$  and  $y$  on the coordinate plane.

$$2 + 4 = 6 \rightarrow (6, 2)$$

**Answer Choice D:** (8, 2). This response reflects a point that would lie on a graph, but with the order of the coordinates reversed. The student may have determined a point that would lie on a graph where  $x$  represents the perimeter of the square and  $y$  represents the length of one side of a square. The student who selects this response may have correctly determined that the unit rate of the graph would be 4 units of perimeter for each unit of side length and applied this unit rate to determine a point that would lie on the graph, but  $x$  and  $y$  were incorrectly defined.

$$2 \times 4 = 8 \rightarrow (8, 2)$$

Answer options A, C, and D are plausible but incorrect. They represent common student errors made when determining a point  $(x, y)$  on the graph of a proportional relationship in terms of a given situation. Answer option B represents determining that the unit rate of the graph would be 4 units of perimeter for each unit of side length, and then applying this unit rate to determine a point that would lie on the graph.

A crew of highway workers paved  $\frac{2}{15}$  mile in 20 minutes. If they work at the same rate, what portion of a mile will they pave in one hour?

**A**  $\frac{1}{150}$

**B**  $\frac{2}{45}$

**C**  $\frac{2}{5}$

**D**  $\frac{5}{2}$

**Key: C**

**Measured CCLS: 7.RP.1**

**Commentary:** The item measures 7.RP.1 because it requires computing unit rates associated with ratios of fractions, including quantities measured in like or different units.

**Answer Choice A:**  $\frac{1}{150}$ . This response reflects the number of miles of road that workers pave in one minute. The student may have divided the distance by time, but did not convert the time in minutes to time in hours. A student who selects this response may be able to find unit rates, but was not precise in their use of units or in providing an answer in the units demanded by the question.

$$\frac{\frac{2}{15}}{20} = \frac{2}{15} \times \frac{1}{20} = \frac{1}{150}$$

**Answer Choice B:**  $\frac{2}{45}$ . This response reflects the number of miles of road that workers pave multiplied by time in hours. The student may have converted 20 minutes to  $\frac{1}{3}$  hour, but multiplied, instead of dividing, the fractions to determine the unit rate. A student who selects this response may not understand how to use division of fractions to find unit rates associated with fractions.

$$\frac{2}{15} \times \frac{1}{3} = \frac{2}{45}$$

**Answer Choice C:**  $\frac{2}{5}$ . The student correctly determined the number of miles of road that workers pave in one hour. The student who selects this response computed the unit rate, in miles per hour, associated with paving  $\frac{2}{15}$  miles in 20 minutes, which is equivalent to  $\frac{1}{3}$  hour.

$$\frac{\frac{2}{15}}{\frac{1}{3}} = \frac{2}{15} \times 3 = \frac{2}{5}$$

Similarly, students may have used proportional reasoning to determine that if  $\frac{2}{15}$  of mile can be paved in 20 minutes, then in one hour or 60 minutes three times as much road could be paved.

$$\frac{2}{15} \times 3 = \frac{6}{15} = \frac{2}{5}$$

**Answer Choice D:**  $\frac{5}{2}$ . This response reflects the number of hours it will take workers to pave one mile. The student may have converted 20 minutes to  $\frac{1}{3}$  hour and used division of fractions to determine the unit rate, but reversed the position of the dividend and divisor in the equation. A student who selects this response may not understand how to create the expression needed to find the unit rate in miles per hour when the numerator and denominator are both fractions.

$$\frac{\frac{1}{3}}{\frac{2}{15}} = \frac{1}{3} \times \frac{15}{2} = \frac{5}{2}$$

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when computing a unit rate associated with fractions. Answer option C represents the correct process used to compute the unit rate, in miles per hour, associated with paving  $\frac{2}{15}$  miles in 20 minutes, which is equivalent to  $\frac{1}{3}$  hour.

Which expression represents the sum of  $(2x - 5y)$  and  $(x + y)$ ?

- A**  $3x - 4y$
- B**  $3x - 6y$
- C**  $x - 4y$
- D**  $x - 6y$

**Key: A**

**Measured CCLS: 7.EE.1**

**Commentary:** The item measures 7.EE.1 because it involves the application of properties of operations as strategies to add, subtract, factor, and expand linear expressions. These expressions are considered linear because each term is either a constant or the product of a constant and the first power of a variable.

**Answer Choice A:**  $3x - 4y$ . The student determined the correct sum of the two given expressions. The student who selects this response has applied properties of operations to add two expressions and combine like terms. Two methods that could have been used are:

$$\begin{array}{l} \text{Method 1: } \begin{array}{l} (2x - 5y) + (x + y) \\ 2x + x + (-5y) + y \\ 3x + (-4y) \end{array} \\ \text{Method 2: } \begin{array}{l} (2x - 5y) + (x + y) \\ 2x + x - 5y + y \\ 3x - 4y \end{array} \end{array}$$

**Answer Choice B:**  $3x - 6y$ . This response reflects the sum of  $(2x + x)$  and  $-(5y + y)$ . The student may have combined the coefficients of the  $y$  terms before applying the negative sign. A student who selects this response may not understand how to correctly apply the negative sign when rearranging expressions or combining terms with negative coefficients.

$$\begin{array}{l} (2x - 5y) + (x + y) \\ (2x + x) - (5y + y) \\ 3x - 6y \end{array}$$

**Answer Choice C:**  $x - 4y$ . This response reflects the sum of  $(2x - 5y)$  and  $(-x + y)$ . The student likely attempted to add the original expressions but lacked precision. A student who selects this response may also not understand how to apply the negative sign in the first expression or correctly translate the language of the problem into a mathematical expression.

**Answer Choice D:**  $x - 6y$ . This response reflects the difference of the two given expressions. The student likely subtracted the expressions instead of adding. A student who selects this response may not understand how to correctly translate the language of the problem into a mathematical expression.

Answer options B, C, and D are plausible but incorrect. They represent common student errors made when applying properties of operations as strategies to add linear expressions with rational coefficients. Answer option A represents the correct process used to determine the sum of the two given expressions.

Which steps can be used to solve for the value of  $y$ ?

$$\frac{2}{3}(y + 57) = 178$$

- A** divide both sides by  $\frac{2}{3}$ , then subtract 57 from both sides
- B** subtract 57 from both sides, then divide both sides by  $\frac{2}{3}$
- C** multiply both sides by  $\frac{2}{3}$ , then subtract 57 from both sides
- D** subtract  $\frac{2}{3}$  from both sides, then subtract 57 from both sides

**Key: A**

**Measured CCLS: 7.EE.4a**

**Commentary:** The item measures 7.EE.4a because it involves solving equations of the form  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. This item specifically assesses if students can identify the sequence of operations required to solve equations in the form  $p(x + q) = r$ . While there are many different ways to solve an equation of this type, A is the only choice that leads to a solution in two steps. Compare with the item on page 4, which also assesses 7.EE.4a.

**Answer Choice A:** "divide both sides by  $\frac{2}{3}$ , then subtract 57 from both sides". The student determined the correct process needed to solve the given equation for the variable,  $y$ . The student who selects this response used the order of operations to determine that both sides of the equation may be divided by the coefficient and then the constant subtracted from both sides in order to solve the equation efficiently for the variable,  $y$ .

$$\begin{aligned} \frac{2}{3}(y + 57) &= 178 \\ \frac{\frac{2}{3}}{\frac{2}{3}}(y + 57) &= \frac{178}{\frac{2}{3}} \\ y + 57 &= 267 \\ y + 57 - 57 &= 267 - 57 \\ y &= 210 \end{aligned}$$

**Answer Choice B:** "subtract 57 from both sides, then divide both sides by  $\frac{2}{3}$ ". This response does not lead to a solution in two steps; in fact, it reflects the opposite order of the usual solution method shown in A. A student who selects this response may not understand how to solve equations of the form  $p(x + q) = r$  for the variable.

**Answer Choice C:** "multiply both sides by  $\frac{2}{3}$ , then subtract 57 from both sides." The student selected multiplication (instead of division as in the usual method shown in A) as the first step in the process to solve this equation for the variable,  $y$ . This response does not lead to a solution in two steps. A student who selects this response may not understand the inverse relationship between multiplication and division as they relate to solving equations for a variable.

**Answer Choice D:** "subtract  $\frac{2}{3}$  from both sides, then subtract 57 from both sides." The student selected subtraction (instead of division as in the usual method shown in A) as the first step needed in the process to solve this equation for the variable. This response does not lead to a solution in two steps. A student who selects this response may not understand how to use inverse operations to solve equations of this form.

Answer options B, C, and D are all plausible but incorrect. They represent common student errors made when determining the process needed to solve an equation for the variable. Answer option A represents the correct process used to solve the given equation for the variable,  $y$ .

David bought a computer that was 20% off the regular price of \$1,080. If an 8% sales tax was added to the cost of the computer, what was the total price David paid for it?

- A** \$302.40
- B** \$864.00
- C** \$933.12
- D** \$1,382.40

**Key: C**

**Measured CCLS: 7.EE.3**

**Commentary:** The item measures 7.EE.3 because it measures solving a multi-step real-life problem posed with positive rational numbers in any form (whole numbers, fractions, and decimals). The solving process includes applying properties of operations to calculate with rational numbers and percents, and converting between forms as appropriate.

**Answer Choice A:** \$302.40. This response reflects 28% of the cost of the computer. The student may have multiplied the cost of the computer by the sum of the discount and tax. A student who selects this response may have a partial understanding of the relationship between discount and tax, and how these are related to the total cost of the computer.

$$1,080(0.20 + 0.08) = 302.40$$

**Answer Choice B:** \$864.00. This response reflects the cost of the computer after the discount. The student likely multiplied the cost of the computer by 0.8, but did not follow this step by applying the sales tax. A student who selects this response may not understand how a tax relates to the final cost of an item.

$$1,080 \times 0.8 = 864.00$$

**Answer Choice C:** \$933.12. The student determined the total amount paid for a computer, in dollars, including a discount and tax. The student who selects this response found the cost of the computer after the discount, and then the total cost after tax. Two methods that could have been used are:

<p>Method 1:</p> $1,080 \times 0.8 = 864.00$ $864.00 \times 1.08 = 933.12$	<p>Method 2:</p> $1,080 \times 0.2 = 216$ $1,080 - 216 = 864.00$ $864.00 \times 0.08 = 69.12$ $864.00 + 69.12 = 933.12$
--	---

**Answer Choice D:** \$1,382.40. This response reflects 128% of the cost of the computer. The student multiplied the cost of the computer by the sum of the discount, tax, and one. A student who selects this response may have a partial understanding of the relationship between discount and tax, and how these are related to the total cost of the computer.

$$1,080(0.20 + 0.08 + 1) = 1,382.40$$

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when solving multi-step real-life problems posed with positive rational numbers, represented by whole numbers and percents, using tools strategically. Answer option C represents the correct process used to find the total amount paid for a computer, in dollars, including a discount and tax.

Suzanne bought a sweater at the sale price of \$25. The original cost of the sweater was \$40. What percent represents the discount that Suzanne received when buying the sweater?

- A** 15%
- B** 37.5%
- C** 60%
- D** 62.5%

**Key: B**

**Measured CCLS: 7.RP.3**

**Commentary:** The item measures 7.RP.3 because it assesses the use of proportional relationships to solve multi-step ratio and percent problems.

**Answer Choice A:** 15%. This response reflects the difference between the original cost and the sale price. The student likely subtracted the sale price from the original cost to determine the difference in price, but did not follow this by dividing by 40 to determine the percent discount. A student who selects this response may not understand the relationship between a percent discount and the amount of a discount.

$$40 - 25 = 15$$

**Answer Choice B:** 37.5%. The student correctly determined the percent discount that was applied to a sweater when given the original cost and sale price. The student who selects this response computed the discount applied to the original cost of the sweater. Two methods that could have been used are:

$$\begin{array}{l} \text{Method 1:} \quad 40 - 25 = 15 \\ \quad \quad \quad (15 \div 40) \times 100 = 37.5 \end{array} \quad \begin{array}{l} 40x = 25 \\ \text{Method 2:} \quad x = \frac{25}{40} = 0.625 \\ \quad \quad \quad (1 - 0.625) \times 100 = 37.5 \end{array}$$

**Answer Choice C:** 60%. This response reflects the percent increase that can be applied to 25 to equal 40. The student may have subtracted the sale price from the original cost to determine the difference in price, but then divided by the sale price instead of the original cost. A student who selects this response may not understand the relationship between the percent discount and the original cost.

$$40 - 25 = 15$$

$$(15 \div 25) \times 100 = 60$$

**Answer Choice D:** 62.5%. This response reflects the percent of the original cost that is represented by the sale price. The student may have divided the sale price by the original cost to determine the percent of the original cost that is represented by the sale price, but did not follow this by subtracting this amount from one whole to determine the percent discount. A student who selects this response may not understand the relationship between the percentage of the original cost that is represented by the sale price and the percent discount.

$$\begin{array}{l} 40x = 25 \\ x = \frac{25}{40} = 0.625 \\ \frac{25}{40} \times 100 = 62.5 \end{array}$$

Answer options A, C, and D are plausible but incorrect. They represent common student errors made when using proportional relationships to solve multi-step ratio and percent problems. Answer option B represents the correct process used to determine the percent discount that was applied to a sweater when given the original cost and sale price.

Leo bought a used car for  $x$  dollars. One year later the value of the car was  $0.88x$ . Which expression is another way to describe the change in the value of the car?

- A** 0.12% decrease
- B** 0.88% decrease
- C** 12% decrease
- D** 88% decrease

**Key: C**

**Measured CCLS: 7.EE.2**

**Commentary:** The item measures 7.EE.2 because it requires students to rewrite an expression to shed light on how the quantities in the expression are related in a problem context. Students should recognize that  $0.88x$  represents 88% of the original value; rewriting  $0.88x$  as the equivalent  $x - 0.12x$  or  $(1 - 0.12)x$  reveals that the change in the value of the car could also be described as a 12% decrease in value.

**Answer Choice A:** 0.12% decrease. This response reflects  $\frac{1}{100}$  of the percent decrease. The student may have rewritten  $0.88x$  as the equivalent  $x - 0.12x$  or  $(1 - 0.12)x$  to reveal a decrease of 0.12 but did not multiply by 100 to convert to a percent. A student who selects this response may have partial understanding of how the quantities in the expression are related and how decimals relate to percents.

$$1 - 0.88 = 0.12$$

**Answer Choice B:** 0.88% decrease. This response reflects  $\frac{1}{100}$  of the percent of  $x$  remaining after the decrease. The student found the percent of  $x$  remaining after the decrease as a decimal, but did not multiply by 100 to convert to a percent. A student who selects this response may have partial understanding of how the quantities in the expression are related and how decimals relate to percents.

$$0.88x \rightarrow 0.88$$

**Answer Choice C:** 12% decrease. The student determined the percent decrease. The student who selects this response understands how the quantities in the given expression are related. The student may have been likely able to rewrite  $0.88x$  as the equivalent  $x - 0.12x$  or  $(1 - 0.12)x$  to reveal a decrease of 0.12 and also multiply by 100 to convert to a percent.

**Answer Choice D:** 88% decrease. This response reflects the percent of  $x$  remaining after the decrease. A student who selects this response may have partial understanding of how the quantities in the expression are related.

$$0.88x \rightarrow 0.88 \times 100 \rightarrow 88$$

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when relating the quantities in the given expression. Answer option C represents the correct explanation of the meaning of 0.88 in the given expression.

Last week Len spent \$18 to bowl 4 games. This week he spent \$27 to bowl 6 games. Len owns his bowling ball and shoes, so he only has to pay for each game that he bowls. If each of these bowling games costs the same amount of money, what is the constant of proportionality between the money spent and the number of games played?

- A** 1.5
- B** 2.0
- C** 4.5
- D** 9.0

**Key: C**

**Measured CCLS: 7.RP.2b**

**Commentary:** The item measures 7.RP.2b because it requires the student to identify the constant of proportionality (unit rate) from a verbal description of a proportional relationship.

**Answer Choice A:** 1.5. This response reflects the ratio of the number of games played this week to the number of games played last week. The student may have divided the 6 games played this week by the 4 games played last week. A student who selects this response may not understand that the “constant of proportionality” being found in this problem relates the amount of money spent with the number of games played.

$$\frac{6}{4} = 1.5$$

**Answer Choice B:** 2.0. This response reflects the difference between the number of games played this week and the number of games played last week. The student may have subtracted the 4 games played last week from the 6 games played this week. A student who selects this response may not understand that the “constant of proportionality” being found in this problem relates the amount of money spent with the number of games played.

$$6 - 4 = 2$$

**Answer Choice C:** 4.5. The student correctly determined the constant of proportionality between the total money spent and the number of games played. The student understood the meaning of the phrase “constant of proportionality,” and simply found the unit rate (price per game).

$$\frac{18}{4} = 4.5 \text{ or } \frac{27}{6} = 4.5$$

**Answer Choice D:** 9.0. This response is twice the value of the constant of proportionality. The student may determine the unit rate for each week and then found the sum of these. A student who selects this response may not understand that the constant of proportionality is one value that describes the proportional relationship.

$$\frac{18}{4} = 4.5$$

$$\frac{27}{6} = 4.5$$

$$4.5 + 4.5 = 9$$

Answer options A, B, and D are plausible but incorrect. They represent common student errors made when identifying the constant of proportionality (unit rate) in verbal descriptions of proportional relationships. Answer option C represents a correct process used to identify the constant of proportionality (unit rate) in verbal descriptions of proportional relationships.

Julia's service charge at a beauty salon was \$72.60, before tax. The sales tax rate was 8%. If she added 20% of the amount before tax as a tip, how much did she pay for the service at the salon?

- A \$87.12
- B \$92.93
- C \$100.60
- D \$145.20

**Key: B**

**Measured CCLS: 7.RP.3**

**Commentary:** The item measures 7.RP.3, because it measures the use of proportional relationships to solve multi-step ratio and percent problems.

**Answer Choice A:** \$87.12. This response reflects the cost of the services plus 20%. The student likely increased the cost of the services by the 20% tip, but did not apply the 8% tax. A student who selects this response may not understand the relationship between a tax and the original amount.

$$72.60(1 + 0.2) = 87.12$$

**Answer Choice B:** \$92.93. The student determined the total amount of a service at a salon, in dollars, including tax and tip. The student who selects this response applied a 20% tip and 8% tax to the original cost. Two methods that could have been used are:

$\begin{aligned} &72.60 \times 0.08 \approx 5.81 \\ \text{Method 1: } &72.60 \times 0.2 = 14.52 \\ &72.60 + 5.81 + 14.52 = 92.93 \end{aligned}$	$\begin{aligned} &72.60 \times 1.08 \approx 78.41 \\ \text{Method 2: } &78.41 + (72.60 \times 0.2) = 92.93 \end{aligned}$
---	---

**Answer Choice C:** \$100.60. This response reflects the cost of the services plus \$28. The student likely increased the cost of the services by the sum of a \$20 discount and an \$8 tax, with both values as a number of dollars instead of a percent of the original amount. A student who selects this response may not understand the relationship between a percent of the original amount and an amount in dollars.

$$72.60 + 28 = 100.60$$

**Answer Choice D:** \$145.20. This response reflects the cost of the services plus a 20% tip and 80% tax. The student likely increased the cost of the services by the 20% tip, but incorrectly converted the 8% tax to 0.8. A student who selects this response may not understand the relationship between a percent and the decimal representation of a percent or may lack precision when transforming from one form to another.

$$72.60(1 + 0.2) + 72.60(0.8) = 145.20$$

Answer options A, C, and D are plausible but incorrect. They represent common student errors made when using proportional relationships to solve multi-step ratio and percent problems. Answer option B represents the correct process used to determine the total amount of a service at a salon, in dollars, including tax and tip, where both the tax and tip are given as percents.

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

**Show your work.**

**Answer** \$ \_\_\_\_\_

What was the total amount the group paid, including tax and tip?

**Show your work.**

**Answer** \$ \_\_\_\_\_

**Measured CCLS: 7.RP.3**

**Commentary:** The item measures 7.RP.3 because it assesses using proportional relationships to solve multi-step ratio and percent problems.

**Extended Rationale:** This first question asks students to determine the tip amount, in dollars, and the second questions asks for the total amount of a restaurant bill, in dollars, including tax and tip. Students must include a set of computations that will lead to a correct response where work is provided to defend each step in the process. As indicated in the rubric, student responses will be rated on whether they show sufficient work to indicate a thorough understanding of using proportional relationships to solve multi-step ratio and percent problems. The determining factor in demonstrating a thorough understanding is using mathematically sound procedures to lead to a correct response.

The correct sales tax amount, in dollars, based on the amount of the restaurant bill may be arrived at by:

Sales tax amount, in dollars:

Method 1:  $37.50(0.08) = 3.00$

Method 2:  $\frac{x}{37.50} = \frac{8}{100}$ , where  $x$  is the amount of sales tax

$$100x = 37.50(8)$$

$$x = \frac{37.50(8)}{100}$$

$$x = 3.00$$

Two possible methods for determining the correct total amount of the bill, in dollars, including tax and tip are:

Method 1:  $37.50 + 3.00 = 40.50$   
 $40.50(0.18) = 7.29$   
 $40.50 + 7.29 = 47.79$

Method 2:  $37.50 + 3.00 = 40.50$   
 $40.50(1 + 0.18) = 47.79$

**SAMPLE STUDENT RESPONSES AND SCORES APPEAR ON THE FOLLOWING PAGES:**

## Additional

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

Show your work.

$$\begin{array}{r} 37.50 \\ \times 0.08 \\ \hline 30000 \\ 00000 \\ 00000 \\ \hline 30000 \end{array}$$

$$\begin{aligned} \text{sales tax} &= 8\% \\ 8\% &= 0.08 \end{aligned}$$

Answer \$ 3.00

What was the total amount the group paid, including tax and tip?

Show your work.

$$\begin{array}{r} 37.50 \\ + 3.00 \\ \hline 40.50 \end{array}$$

$$\begin{array}{r} 40.50 \\ \times .18 \\ \hline 32100 \\ 40500 \\ \hline 72900 \end{array}$$

$$\begin{array}{r} \text{amount w/sales tax} - 40.50 \\ \hline \text{amount w/sales tax} - 47.79 \\ \text{\& tip} \end{array}$$

$$\begin{array}{r} 40.50 \\ + 7.29 \\ \hline 47.79 \end{array}$$

Answer \$ 47.79

### Score Point 2 (out of 2 points)

This response is correct and demonstrates a thorough understanding of the mathematical concepts and procedures embodied in the task. The sales tax is converted to a decimal in order to multiply the tax rate by the cost of the lunch, which results in the correct answer. For the second part, the tax is added to the cost of the lunch and 18% of that is correctly calculated and added to the bill + tax total, resulting in the correct answer.

- A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

Show your work.

$$\frac{8}{100} = \frac{x}{37.50} \quad \frac{100x}{100} = \frac{300}{100}$$

$$x = 3$$

Answer \$ 3

What was the total amount the group paid, including tax and tip?

Show your work.

$$37.50 + 3 = 40.50$$

$$\frac{18}{100} = \frac{x}{40.50} \quad \frac{100x}{100} = \frac{729}{100}$$

$$7.29 = \text{tip} \quad 7.29 + 40.50$$

Answer \$ 47.79

### Score Point 2 (out of 2 points)

This response is correct and indicates that the student has completed the task correctly, using mathematically sound procedures. A proportion is used to calculate the amount of the tax. In the second part, the tax is added to the bill and then a second proportion is used to solve for the 18% tip. This is then added to the previous total (\$40.50). The resulting answer is correct.

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

Show your work.

$$37.50 \times 0.08 = 3$$

Answer \$ 3.00

What was the total amount the group paid, including tax and tip?

Show your work.

$$\begin{array}{r} 37.50 \\ + 3.00 \\ \hline 40.50 \end{array}$$

$$40.50 \times 0.18 = 7.29$$

$$40.50 + 7.29 = 47.79$$

Answer \$ 47.79

### Score Point 2 (out of 2 points)

This response is correct and demonstrates a thorough understanding of the mathematical concepts and procedures embodied in the task. The cost of the bill is multiplied by the percent in decimal form to correctly determine the tax. This is then added to the bill and 18% of the sum is calculated using a mathematically appropriate process, and the total is correctly determined. The answer is correct and the work shown is sufficient for full credit.

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

**Show your work.**

$$\begin{array}{r} 64 \\ 37.5 \\ \times 0.08 \\ \hline 3.000 \end{array}$$

**Answer \$** 3.00

What was the total amount the group paid, including tax and tip?

**Show your work.**

$$\begin{array}{r} 18 \\ + 8 \\ \hline 26\% \end{array}$$

$$37.5 \times 0.08 = 9.75$$
$$\begin{array}{r} 37.5 \\ + 9.75 \\ \hline 47.25 \end{array}$$

**Answer \$** 47.25

### Score Point 1 (out of 2 points)

This response is partially correct and indicates that the student has demonstrated only a partial understanding of the mathematical concepts embodied in the task. The response shows the correct amount for the tax on the lunch bill, which was calculated using a mathematically appropriate process. However, in the second part, the percentages for the tip and sales tax are added together ( $18 + 8 = 26\%$ ) before multiplying by the cost of the lunch.

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

**Show your work.**

$$\begin{aligned} 37.50 \times 8\% &= 3 \\ 37.50 + 3 &= 40.50 \\ 40.50 \times 18\% &= .0405 \\ 40.50 + 0.0405 &= 40.905 \end{aligned}$$

**Answer \$** 40.50

What was the total amount the group paid, including tax and tip?

**Show your work.**

$$\begin{aligned} 40.50 \times 18\% &= 0.0405 \\ 40.50 + 0.0405 &= 40.905 \end{aligned}$$

**Answer \$** 41.00

### Score Point 1 (out of 2 points)

This response is only partially correct and indicates that the student has demonstrated only a partial understanding of the mathematical concepts embodied in the task. The 8% tax is correctly calculated. However, the answer given for that part is the sum of the bill and the tax, which is not what is asked for in this section. In the second part, the work shows that total being multiplied by 18%, an appropriate process, but the answer shows a value of 0.1% ( $40.50 \times 18\% = 0.0405$ ). This is added incorrectly to 40.50, resulting in an incorrect answer (41.00).

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

**Show your work.** bill before tax = 37.50 sales tax?  
sales tax = 8% = .08  
tipped = 18%

$$\begin{array}{r} 37.50 \\ + .08 \\ \hline \$37.58 \end{array}$$

**Answer \$** 0.08

What was the total amount the group paid, including tax and tip?

**Show your work.**

$$\begin{array}{r} \$37.58 \\ + 18 \\ \hline \$45.58 \end{array}$$

**Answer \$** 45.58

**Score Point 0 (out of 2 points)**

This response is incorrect. The sales tax percentage is converted to a decimal. This value (.08) is then incorrectly added to the bill as 8 cents, which is incorrectly given as the total tax. In the second part, a similar process is used to determine the 18%; however, that is added to the total bill as \$18, which is incorrect.

## Additional

A group of friends went to lunch. The bill, before sales tax and tip, was \$37.50. A sales tax of 8% was added. The group then tipped 18% on the amount after the sales tax was added. What was the amount, in dollars, of the sales tax?

Show your work.

$$\begin{array}{r} 37.50 \\ \times .80 \\ \hline 46.88 \end{array}$$

$$\begin{array}{r} 46.88 \\ - 37.50 \\ \hline 9.38 \end{array}$$

Answer \$ 9.38

What was the total amount the group paid, including tax and tip?

Show your work.

$$\begin{array}{r} \$46.88 \\ + \$ 0.18 \\ \hline \$8.44 \end{array}$$

$$\begin{array}{r} \$8.44 \\ + \$9.38 \\ \hline 17.82 \end{array}$$

Answer \$ 17.82

### Score Point 0 (out of 2 points)

This response is incorrect. The response incorrectly uses 80 percent (.80) instead of 8 percent when calculating the dollar amount for the sales tax. The cost of the bill is then subtracted from the calculated value for the tax (46.88), resulting in an incorrect answer (9.38). The 18% sales tax is calculated using the previously determined value for the tax. While this procedure is completed correctly, the resulting amount (8.44) is added to the value given above for the tip (9.38), and the sum is given as the total. Although some parts of this response contain correct mathematical procedures, holistically they are not sufficient to demonstrate a limited understanding of the mathematical concepts embodied in the task.

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

**Show your work.**

**Answer** \_\_\_\_\_ feet per year

**Measured CCLS: 7.RP.1**

**Commentary:** The item measures 7.RP.1 because it involves computing unit rates associated with ratios of fractions.

**Extended Rationale:** This question asks students to determine the average growth of a tree, in feet, per year. Students must include a set of computations that will lead to a correct response where work is provided to defend each step in the process. As indicated in the rubric, student responses will be rated on whether they show sufficient work to indicate a thorough understanding of computing unit rates associated with fractions. The determining factor in demonstrating a thorough understanding is using mathematically sound procedures to lead to a correct response.

The correct answer may be arrived at by determining the total growth of the tree, in feet, and then dividing that amount by the number of years:

$$\text{Total tree growth, in feet: } 57 - 40\frac{1}{2} = 16\frac{1}{2}$$

$$\text{Average tree growth, in feet per year: } \frac{16\frac{1}{2}}{7\frac{1}{2}} = \frac{33}{2} \times \frac{2}{15} = \frac{11}{5} \text{ or } 2\frac{1}{5}$$

**SAMPLE STUDENT RESPONSES AND SCORES APPEAR ON THE FOLLOWING PAGES:**

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

**Show your work.**

$$\begin{array}{r} 40\frac{1}{2} + 7\frac{1}{2}r = 57 \\ -40.5 \quad -40.5 \\ \hline 7\frac{1}{2}r = 16.5 \quad \text{calc.} \\ \frac{7.5}{7.5} \quad \frac{16.5}{7.5} \\ \hline r = 2.2 \end{array}$$

**Answer** 2.2 feet per year

**Score Point 2 (out of 2 points)**

This response is correct and demonstrates a thorough understanding of the mathematical concepts and procedures embodied in the task. An equation is set up to find the rate of growth,  $r$ . The values given in the prompt are converted into their decimal equivalents and  $r$  is calculated correctly.

**Additional**

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

**Show your work.**

$$\begin{array}{r} 57 \\ -40.5 \\ \hline 16.5 \end{array}$$
$$7.5 \overline{) 16.5} \quad \begin{array}{l} 2.2 \\ \hline \end{array}$$

2.2 feet

**Answer** 2.2 feet per year

**Score Point 2 (out of 2 points)**

This response is correct and demonstrates a thorough understanding of the mathematical concepts and procedures embodied in the task. The values in the prompt are converted into their decimal equivalents. The number of feet the tree grew in  $7\frac{1}{2}$  years is determined by calculating the difference between the two height measurements and then dividing that value by the number of years, resulting in the correct growth rate.

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

**Show your work.**

$$57 - 40.5 = 16.5 \div 7.5 = 2.2 \text{ ft per}$$

**Answer** 2.2 feet per year

**Score Point 2 (out of 2 points)**

This response is correct and demonstrates a thorough understanding of the mathematical concepts and procedures embodied in the task. The values in the prompt are converted into their decimal equivalents. The number of feet the tree grew in  $7\frac{1}{2}$  years is determined by calculating the difference between the two height measurements and then dividing that value by the number of years, resulting in the correct growth rate. While there is a run-on equation error in the work, this is considered to be part of the student's work process and does not detract from the demonstration of understanding.

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

Show your work.

$$\begin{array}{ccc}
 \underline{2005} & \xrightarrow{+7\frac{1}{2} \text{ years}} & \underline{2012\frac{1}{2}} \\
 40\frac{1}{2} \text{ ft} & \xrightarrow{+17 \text{ ft}} & 57 \text{ ft}
 \end{array}$$

$$17 \div 7\frac{1}{2} = 2.\bar{26}$$

Answer 2.26 feet per year

**Score Point 1 (out of 2 points)**

This response is partially correct and contains an incorrect solution but applies a mathematically appropriate process. The number of feet the tree grew in  $7\frac{1}{2}$  years is incorrectly determined to be (17 ft). This incorrect height is then correctly divided by the number of years to determine the average yearly growth rate.

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

**Show your work.**

$$\begin{array}{r} 57.0 \\ -40.5 \\ \hline 17.5 \end{array}$$
$$\begin{array}{r} \sqrt{17.5} \\ 2 \overline{)35} \\ \underline{35} \\ 0 \end{array}$$

**Answer** 2.33 feet per year

**Score Point 1 (out of 2 points)**

This response is partially correct and contains an incorrect solution but applies a mathematically appropriate process. While determining the number of feet the tree grew in  $7\frac{1}{2}$  years, a subtraction error is made ( $57.0 - 40.5 = 17.5$ ) resulting in an incorrect height difference. This error results in the incorrect answer for the average yearly growth rate; which is calculated using a mathematically appropriate process.

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

*Show your work.*

$(5.4 \text{ feet per year})$   
 $7.5 \overline{)40.5}$

*Answer* \_\_\_\_\_ feet per year

**Score Point 0 (out of 2 points)**

This response is incorrect. The response divides the height of the tree measured in the year 2005 by the number of years between the two measurements. This strategy is incorrect.

## Additional

A pine tree measured  $40\frac{1}{2}$  feet tall. Over the next  $7\frac{1}{2}$  years, it grew to a height of 57 feet. During the  $7\frac{1}{2}$  years, what was the average yearly growth rate of the height of the tree?

*Show your work.*

$$\begin{array}{r} 40.5 \\ 7.5 \\ + 57 \\ \hline 53.7 \end{array}$$

**Answer** 53.7 feet per year

### Score Point 0 (out of 2 points)

This response is incorrect. The incorrect procedure of adding all of the numbers given in the prompt is used. An addition error is made, as well.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

**Show your work.**

**Answer** \$ \_\_\_\_\_

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

**Show your work.**

**Answer** \_\_\_\_\_ weeks

### Measured CCLS: 7.EE.3

**Commentary:** The item measures 7.EE.3, because it involves solving multi-step real-life problems posed with positive rational numbers in any form (whole numbers, fractions, and decimals). This item also includes applying properties of operations to calculate with numbers in any form and converting between forms as appropriate.

**Extended Rationale:** This question asks students to determine the total amount paid for a model rocket kit, in dollars, including tax and shipping cost, and the number of weeks of allowance that will be needed to purchase the model rocket. Students must include a set of computations that will lead to a correct response where work is provided to defend each step in the process. As indicated in the rubric, student responses will be rated on whether they show sufficient work to indicate a thorough understanding of solving multi-step real-life problems posed with positive rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. The determining factor in demonstrating a thorough understanding is using mathematically sound procedures to lead to a correct response.

Two possible methods for determining the correct total amount paid for a model rocket kit, in dollars, including tax and shipping cost, are:

$$\begin{array}{l} \text{Method 1:} \quad 124.95 \times 0.07 \approx 8.75 \\ \quad \quad \quad 124.95 + 8.75 + 10.00 = 143.70 \end{array} \qquad \begin{array}{l} \text{Method 2:} \quad 124.95(1 + 0.07) \approx 133.70 \\ \quad \quad \quad 133.70 + 10.00 = 143.70 \end{array}$$

The correct number of weeks of allowance that will be needed to purchase the model rocket may be arrived at by:

Number of weeks of allowance that will be needed to purchase the model rocket:

$$143.70 \div 15 \approx 9.6 \rightarrow 10$$

A student should recognize that even though the division results in approximately 9.6, in interpreting this solution, since the allowance is given once a week, it will take 10 full weeks to acquire enough to purchase the kit.

**SAMPLE STUDENT RESPONSES AND SCORES APPEAR ON THE FOLLOWING PAGES:**

## Additional

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

*Show your work.*

$$\begin{array}{l} 124.95 \cdot 1.07 + 10 \\ 133.70 + 10 \\ 143.70 \end{array}$$

*Answer* \$ 143.70

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

*Show your work.*

$$\begin{array}{l} 143.70 \div 15 \\ 9.58 \end{array}$$

*Answer* 10 weeks

### Score Point 3 (out of 3 points)

This response answers the question correctly and demonstrates a thorough understanding of the mathematical concepts. The total taxed cost is determined and then correctly added to the shipping cost to solve for the total amount paid for the kit. The number of allowance weeks required to purchase the kit is also correct.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$\frac{x}{124.95} = \frac{7}{100}$$
$$874.65 = 100x$$
$$x = 8.75$$

Answer \$ 143.70

$$\begin{array}{r} 135.70 \\ + 10.00 \\ \hline 143.70 \end{array}$$

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

$$\frac{15w}{15} = \frac{143.70}{15}$$
$$w = 10$$

Answer 10 weeks

### Score Point 3 (out of 3 points)

This response answers the question correctly and demonstrates a thorough understanding of the mathematical concepts. A proportion is used to find the tax and then the appropriate values are added to correctly solve for the total amount paid for the kit. The number of allowance weeks required to purchase the kit is also correct.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$124.95 \cdot 7\% = 8.7465$$

$$\begin{array}{r} 124.95 \\ + 8.7465 \\ \hline 133.7005 \\ + 10.00 \\ \hline 143.7005 \\ 143.70 \end{array}$$

Answer \$ 143.70

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

w = weeks  
\$ = money

w	\$
1	15
2	30
3	45
4	60
5	75
6	90
7	105
8	120
9	135
10	150

Answer 10 weeks

**Score Point 3 (out of 3 points)**

This response answers the question correctly and demonstrates a thorough understanding of the mathematical concepts. The tax is determined, added to the original price of the kit, and then that sum is added to the shipping cost to correctly solve for the total amount paid for the kit. The number of allowance weeks required to purchase the kit is also correct. The process used is acceptable for full credit.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

*Show your work.*

$$\begin{array}{r} 124.95 \\ 8.75 \\ + 10.00 \\ \hline 143.70 \end{array}$$

*Answer* \$ 143.70

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

*Show your work.*

$$\begin{array}{r} 143.70 \\ \hline 15 \end{array}$$

*Answer* 9 weeks

### Score Point 2 (out of 3 points)

This response is only partially correct. This response shows the correct solutions for the total amount paid for the kit. The work shown, the addition of the three parts of the total cost, is sufficient work for full credit on this part of the question. On the second part, the response shows an incorrect solution (9), but applies a mathematically appropriate process when solving for the number of allowance weeks required, demonstrating partial understanding of the mathematical concepts and procedures embodied in the task.

## Additional

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

*Show your work.*

$$\begin{array}{r} 133.70 \\ + 10.00 \\ \hline 143.70 \end{array}$$

$$\begin{array}{r} 124.95 \\ + 8.75 \\ \hline 133.70 \\ 124.95 \\ \hline 8.75 \end{array}$$

**Answer** \$ 143.70

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

*Show your work.*

$$\begin{array}{r} 124.95 \\ \hline 15 \\ \hline 8.33 \end{array}$$

**Answer** 9 weeks

### Score Point 2 (out of 3 points)

This response is only partially correct. This response shows the correct solution for the total amount paid for the kit. In the second part, the cost of the kit without shipping and tax (124.95) is used to calculate the number of weeks of allowance needed. The process used and the answer are correct for this incorrect value.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$\begin{array}{r} 124.95 \\ 7.00 \\ + 10.00 \\ \hline 141.95 \end{array}$$

Answer \$ 141.95

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

$$\frac{141.95}{15} = 9\frac{1}{2} \text{ weeks}$$

Answer 10 weeks

### Score Point 1 (out of 3 points)

This response is incomplete and exhibits many flaws but is not completely incorrect. In the first part, the three parts of the total cost are added, but 7 dollars is added rather than 7% of 124.95. This results in an incorrect answer and reflects a misunderstanding of an important aspect of the task. However, the final answer is correct and the work is acceptable.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$x = 17.85$$

$$\begin{aligned} \frac{\$124.95}{7} &= x \\ \$124.95 + x + \$10 &= \\ \$124.95 + \$17.85 + \$10 &= \\ \$152.80 & \end{aligned}$$

Answer \$ 152.80

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

$$\begin{aligned} \frac{\$15x}{15} &= \frac{\$152.80}{15} \\ x &= 10 \end{aligned}$$

Answer 10 weeks

### Score Point 1 (out of 3 points)

This response is incomplete and exhibits many flaws but is not completely incorrect. In the first part, the three parts of the total cost are added, but  $\frac{1}{7}$  of 124.95 is added rather than 7% of 124.95. This results in an incorrect answer and reflects a misunderstanding of an important aspect of the task. The final answer is correct for the actual cost, but is not correct for the calculated cost:  $152.80 \div 15 = 10.19$ , which would result in 11 weeks worth of allowance.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$\begin{array}{r}
 124.95 \text{ kit} \\
 + 8.68 \text{ tax} \\
 + 10.00 \text{ shipping} \\
 \hline
 143.63
 \end{array}$$

Answer \$ 143.63

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

$$\begin{array}{r}
 15 \overline{) 229.6} \\
 \underline{15} \phantom{.6} \\
 79 \phantom{.6} \\
 \underline{75} \phantom{.6} \\
 4 \phantom{.6} \\
 \underline{0} \phantom{.6} \\
 00.6 \\
 \underline{00.6} \\
 0
 \end{array}$$

Answer 10 weeks

### Score Point 1 (out of 3 points)

This response is incomplete and exhibits many flaws but is not completely incorrect. In the first part, the three parts of the total cost are added, but the calculation of the tax is not shown and an incorrect value is added for the tax. This results in an incorrect answer and reflects a misunderstanding of an important aspect of the task. This response also contains a correct answer for the number of allowance weeks required; however, the answer from the first part is rounded prior to use in the second part, which is not appropriate.

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

*Show your work.*

$$\begin{array}{l} 124.95 + 8\% + 10 \\ 124.95 + .7 + 10 \\ 125.65 + 10 \\ 135.65 \end{array}$$

**Answer** \$ 135.65

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

*Show your work.*

$$15 \overline{) 135.65} \begin{array}{r} 9.04 \end{array}$$

**Answer** 9 weeks

### Score Point 0 (out of 3 points)

This response is incorrect. In the first part, the three parts of the total cost are added, but 0.70 dollars is added rather than 7% of 124.95. This results in an incorrect answer and reflects a misunderstanding of an important aspect of the task. In the second part, the correct process is used to determine the number of weeks; however, this will yield a value of 10 weeks, rather than the (9) given as the answer. Although some parts contain correct mathematical procedures, holistically they are not sufficient to demonstrate even a limited understanding of the mathematical concepts embodied in the task.

## Additional

Patel bought a model rocket kit from a catalog. The price of the kit was \$124.95. The state sales tax of 7% was added, and then a \$10 charge for shipping was added after the sales tax. What was the total amount Patel paid, including tax and shipping cost?

Show your work.

$$\begin{array}{r} 124.95 \\ + 7\% \\ \hline 133.95 \\ + 10.00 \\ \hline 141.95 \end{array}$$

Answer \$ 141.95

Patel received an allowance of \$15 per week. How many weeks will it take him to purchase the kit?

Show your work.

$$\begin{array}{r} 9.4 \\ 15 \overline{)141} \end{array}$$

Answer 9.4 weeks

### Score Point 0 (out of 3 points)

This response is incorrect. In the first part, faulty mathematical reasoning is used ( $124.95 + 7\% = 131.95$ ), resulting in an incorrect total cost. This response also contains an incorrect solution (9.4) for the number of allowance weeks required; the work shown utilizes a mathematically appropriate process, but includes an error, rounding the answer from part 1 (141.95 rounded to 141), as well as showing a lack of understanding of the parameters of the problem (the allowance is paid in a lump sum each week and not in partial weeks).