Colorado Measures of Academic Success

Grade 8 Mathematics

Answer Key with Scoring Rubrics

Practice Resource for Students

ANSWER KEY: ITEM SET 1

Item Set 1 - Question 1 (Selected Response)

Which decimal is equivalent to $\frac{11}{15}$?

- ○ A. $0.\overline{733}$

- ○ B. 0.73

- ● C. $0.7\overline{3}$

- ○ D. 0.733

Item Information		
Answer:	C	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.NS.A.1	Demonstrate informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. Define irrational numbers as numbers that are not rational.
Evidence Statement:	8.NS.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion, which repeats eventually into a rational number. i) Tasks do not have a context. ii) 50% of tasks require students to write a fraction a/b as a repeating decimal by showing, filling in, or otherwise producing the steps of a long division a ÷ b. iii) 50% of tasks require students to write a given repeating decimal as a fraction. iv) For tasks that involve writing a repeating decimal as a fraction, the given decimal should include no more than two repeating decimals without non-repeating digits after the decimal point. (i.e. 2.16666"..., 0.23232323"...).
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:	0.627	

Which expression is equivalent to $4^5 \times 4^{-3}$?

○ A. 4^8

◉ B. 4^2

○ C. 4^{-2}

○ D. 4^{-8}

Item Information		
Answer:	B	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 × 3^-5 = 3^-3 = 1/3^3 = 1/27.
Evidence Statement:	8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 x 3-5 = (1/3)3 = 1/27 i) Tasks do not have a context. ii) Tasks center on the properties and equivalence, not on simplification. For example, a task might ask a student to classify expressions according to whether or not they are equivalent to a given expression. iii) 50% of expressions should involve one property. iv) 30% of expressions should involve two properties. v) 20% of expressions should involve three properties. vi) Tasks should involve a single common base or a potential common base, such as a task that includes 3, 9 and 27.
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:	0.641	

The table shows a function composed of the given input and output values.

Function

Input	Output
2	1
3	3
4.5	6
?	?

Which sets of values could be included in the function?

Select **all** possible sets of values.

☑ A.

Input	Output
1	2

☐ B.

Input	Output
2	3

☐ C.

Input	Output
3	2

☑ D.

Input	Output
⁻3	3

☑ E.

Input	Output
⁻4.5	6

Item Information		
Answer:	A, D, E	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.F.A.1	Define a function as a rule that assigns to each input exactly one output. Show that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required for Grade 8.)
Evidence Statement:	8.F.1-1	Understand that a function is a rule that assigns to each input exactly one output. i) Tasks do not involve the coordinate plane or the "vertical line test." ii) Tasks do not require knowledge of the concepts or terms domain and range. iii) 20% of functions in tasks are non-numerical, e.g., the input could be a person and the output could be his or her month of birth. iv) Tasks should involve clearly defined inputs and outputs.
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:	0.108	

Item Set 1 - Question 4 (TEI Hot Spot)

Item Information		
Answer:	See Image	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
Evidence Statement:	8.NS.2	Use rational approximations of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g. pi2). For example, by truncating the decimal expansion of sq root 2, show that sq root 2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations. i) Tasks do not have a context.
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:	Not Available	

A right triangle is shown.
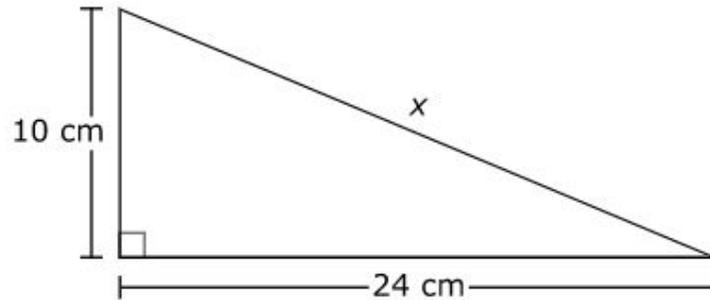
What is the value of x, in centimeters?

○ A. 17

○ B. 22

● C. 26

○ D. 34

Item Information		
Answer:	C	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
Evidence Statement:	8.G.7-1	Apply the Pythagorean Theorem in a simple planar case. i) Tasks have "thin context" or no context. ii) Tasks require students to find one side of a right triangle in the plane, given the other two sides. iii) In 50% of tasks, the answer is a whole number and is to be given as a whole number. iv) In 50% of tasks, the answer is irrational and is to be given approximately to three decimal places. v) The testing interface can provide students with a calculation aid of the specified kind for these tasks.
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:	0.696	

Two companies rent boats by the hour. The total cost, in dollars, c, depends on the number of hours, h. The equations that represent the rental rates of both companies are shown.

$$\text{Company A: } c = 15h + 20$$
$$\text{Company B: } c = 20h$$

- A person rents a boat from Company A for h hours and realizes they would have paid the same amount if they had rented the boat from Company B. How many hours, h, did the person rent the boat? Explain or show each step of your work.
- Verify that your solution for h hours of renting the boat is the same cost, c, for each company.

Enter your answer and your explanations or steps in the space provided.

Item Information	
Answer:	See Scoring Rubric and Sample Student Responses
Colorado Academic Standards (CAS) Evidence Outcomes:	8.EE.C.8.c — Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.
Evidence Statement:	8.C.4-1 — Present solutions to multi-step problems in the form of valid chains of reasoning, using symbols such as equals signs appropriately (for example, rubrics award less than full credit for the presence of nonsense statements such as 1 + 4 = 5 + 7 = 12, even if the final answer is correct), or identify or describe errors in solutions to multi-step problems and present corrected solutions. Content Scope: Knowledge and skills articulated in 8.EE.8c.
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:	4.7% of students earned 3 points. 20.0% of students earned 2 points. 10.5% of students earned 1 point. 64.9% of students earned 0 points.

Scoring Rubric	
Points	**Attributes**
3	Student response includes each of the following 3 elements. • **Reasoning component**: Valid work or explanation of how to determine the number of hours needed to rent a boat from either company for the cost to be the same. • **Computation component**: Correct number of hours, 4. • **Reasoning component**: Valid work or explanation that the solution for h hours of renting a boat is the same cost, c, for each company.
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:	The person rented the boat for 4 hours. To figure this out I took the 2nd equation which was $c = 20h$ and plugged it into the first which was $c = 15h + 20$ to get this: $20h = 15h + 20$ $-15h$ $-15h$ $5h = 20/5$ $h = 4$ So then to check I plugged 4 into the equations separately. Company A: $c = 20(4)$ $c = 80$ Company B: $c = 15(4) + 20$ $c = 60 + 20$ $c = 80$

Annotation for Sample Student Response:	**Score Point 3**
	 The response receives full credit. It includes each of the 3 required elements.
	 Reasoning Component:
	 • **Student Response:** I took the 2nd equation which was $c = 20h$ and plugged it into the first which was $c = 15h + 20$ to get this: $20h = 15h + 20$, $-15h$ $-15h$, $5h = 20/5$, $h = 4$.
	  ○ **Rationale for Score:** The student provides valid work to determine the number of hours needed to rent a boat from either company for the cost to be the same ($20h = 15h + 20$, $-15h$ $-15h$, $5h = 20/5$, $h = 4$).
	 Computation Component:
	 • **Student Response:** The person rented the boat for 4 hours
	  ○ **Rationale for score:** The correct number of hours is provided (4 hours).
	 Reasoning Component:
	 • **Student Response:** to check I plugged 4 into the equations separately. Company A: $c = 20(4)$, $c = 80$. Company B: $c = 15(4) + 20$, $c = 60 + 20$, $c = 80$.
	  ○ **Rationale for score:** The student provides valid work to show that the hours determined (4), is the same cost for both Company A and Company B (Company A: $c = 20(4)$, $c = 80$. Company B: $c = 15(4) + 20$, $c = 60 + 20$, $c = 80$).
	
	 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.

Two linear functions are described.

Function Q

$y = 2x + 7$

Function R

x	0	1
y	0	6

Which statement is true about the rate of change of Function Q?

○ A. It is 3 times the rate of change of Function R.

○ B. It is 2 times the rate of change of Function R.

○ C. It is $\frac{1}{2}$ the rate of change of Function R.

● D. It is $\frac{1}{3}$ the rate of change of Function R.

Item Information		
Answer:	D	
Colorado Academic Standards (CAS) Evidence Outcomes:	8.F.A.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables,or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greatest rate of change.
Evidence Statement:	8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greatest rate of change. i) Tasks have "thin context" or no context. ii) The testing interface can provide students with a calculation aid of the specified kind for these tasks. iii) Equations can be presented in forms other than y = mx + b, for example, 2x + 2y = 7.
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	0.328	

Two snails climbed up a tree at a constant rate. A person measured and recorded their respective distances above the ground.

- Snail A was 12.5 inches above the ground at 10 minutes and 16 inches above the ground at 24 minutes.
- Snail B started at 3 inches above the ground and climbed 0.3 inch per minute.

The snails continued at the same speeds.

- Determine the amount of time, in minutes, it took for the two snails to be the same distance above the ground.
- Include an equation to represent each snail's distance above the ground, y, in terms of x, the minutes elapsed since the measurement started. Show your work or explain your answer.

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

Item Information	
Answer:	See Scoring Rubric and Sample Student Responses
Colorado Academic Standards (CAS) Evidence Outcomes:	8.EE.C.8.c — Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.
Evidence Statement:	8.D.1 — Solve multi-step contextual word problems with degree of difficulty appropriate to grade 8, requiring application of 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 8.
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:	Not Available

Scoring Rubric	
Points	**Attributes**
3	Student response includes each of the following 3 elements. • **Computation component**: Correct amount of time, in minutes, it takes for the two snails to be the same distance above the ground, 140. • **Modeling component:** Valid equation to represent each snail's distance above the ground, y, in terms of x, the minutes elapsed since the measurement started. • **Modeling component**: Valid work or explanation for how the equations and answer were determined.
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:	Find rates Snail A = $\frac{3.5}{14}$ = 0.25 inches per minute Snail B = 0.3 inches per minute Find starting distance Snail A = 12.5 – (10 x 0.25) = 10 Snail B = 3 Equations Snail A y = 0.25x + 10 Snail B y = 0.3x + 3 Solve as system of equations 0.25x + 10 = 0.3x + 3 7 = 0.05x x = 140 So 140 minutes will have elapsed when they reach the same distance above ground.

Annotation for Sample Student Response:	**Score Point 3**
	The response receives full credit. It includes each of the 3 required elements.
	Computation Component:
	• **Student Response:** x = 140, 140 minutes will have elapsed when they reach the same distance above ground.
	   o **Rationale for Score:** The student provides a correct amount of time, in minutes, it takes for the two snails to be the same distance above the ground (140).
	Modeling Component:
	• **Student Response:** Equations . . . Snail A y = 0.25x + 10 . . . Snail B y = 0.3x + 3
	   o **Rationale for score:** Valid linear equations are provided for snail A and Snail B that represent each snail's distance above the ground, y, in terms of x, the minutes elapsed since the measurement started (Snail A y = 0.25x + 10 . . . Snail B y = 0.3x + 3).
	Modeling Component:
	• **Student Response:** Snail A = $\frac{3.5}{14}$ = 0.25 inches per minute, Snail B = 0.3 inches per minute Snail A = 12.5 – (10 x 0.25) = 10, Snail B = 3, Snail A y = 0.25x + 10, Snail B y = 0.3x + 3 Solve as system of equations, 0.25x + 10 = 0.3x + 3, 7 = 0.05x, x = 140
	   o **Rationale for score:** Valid work is provided to show how the equations and answer were determined (Snail A = $\frac{3.5}{14}$ = 0.25 inches per minute, Snail B = 0.3 inches per minute, Snail A = 12.5 – (10 x 0.25) = 10, Snail B = 3, Snail A y = 0.25x + 10, Snail B y = 0.3x + 3, 0.25x + 10 = 0.3x + 3, 7 = 0.05x, x = 140).
	
	Note: If the equations are incorrect, but the student solves for the amount of time it takes for the two snails to be at the same distance above the ground correctly, 1 computation point is earned.
	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.