



Checkpoint Results Interpretation Guide

Grade 5 Mathematics

Tennessee Department of Education | August 2020

The Checkpoint

The Checkpoint can be used at the beginning of the school year to measure retention on **key standard-aligned skills that are most essential** for students to be able to **access, and engage in, on-grade-level content** for the current year. Because of this, the Checkpoints are smaller than a summative TCAP assessment and do not cover all the standards from the previous year. Instead, as recommended by experts¹, they focus on fewer, **prioritized vertically-aligned standards**, with the intent of providing educators more meaningful and actionable information about student needs so you can support your students' ability to access grade-level learning throughout the year.

The Grade 5 Math Checkpoint should be given to incoming sixth grade students to help plan for students learning grade 6 math content this year.

To help students in their learning and teachers with their planning, Checkpoints come with fully **annotated questions** that help to understand trends and pinpoint misconceptions that may inhibit student progress. ***Using this Checkpoint Results Interpretation Guide (the Guide) and your student results data found in the Schoolnet platform, you and your students can plan for great academic success this year.***

It is best to use these results to identify any needed pre-requisite learning and incorporate it throughout the year to ensure students can access grade-level content or can build upon their current strengths. After you administer the Checkpoint and use this Guide to better meet student needs at the beginning of the year, **continue monitoring** your students' progress on **grade-appropriate assignments** for the rest of the year to ensure that these core foundations are continually strengthened.

The Checkpoint IS:

- an investigative tool to determine student readiness for the major work of the current grade
- aligned to the Tennessee State Academic Standards, using TN-educator reviewed questions from previous TCAP exams
- designed to identify student misconceptions and learning needs
- providing actionable next steps for informing instructional decisions

The Checkpoint IS NOT:

- a replacement for the performance level determinations a student would have received on the TCAP assessment
- predictive of, or comparable to, summative TCAP results
- a replacement for RTI² diagnostics or universal screeners
- used to evaluate teacher, school, or district performance
- a tool to change student placement decisions (e.g. retake a course, advance to honors)

¹ https://tnnp.org/assets/covid-19-toolkit-resources/TNTP_Learning_Acceleration_Guide.pdf

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“When the COVID-19 pandemic forced prolonged school building closures and canceled spring assessments, it became even more important that districts and schools can reliably gather student data and understand student readiness for the next school year. These free and optional tools are one way the department can support the needs of our district partners in serving all students”

-Commissioner Penny Schwinn

Checkpoint Design

The Checkpoint assessments were designed using **real TCAP questions** from previous summative exams. This ensured each question was aligned to Tennessee state standards and had been reviewed by **Tennessee educators**. The Checkpoint was designed to be quick to access and administer, not requiring complicated adjustments to existing school schedules; with **flexibility for online or paper administration** based on school/district need.

The Math Checkpoint assessments:

1. **are quick easy to administer:** contain two subparts (separated by a section break and new instructions screen) in one short (less than 30 questions) assessment in Schoolnet
2. **Include prioritized content:** standards, concepts, and skills from the designated grade-level/course that are considered essential pre-requisite content for accessing the next grade-level's work

Less than 60 minutes

Less than 30 questions

Two subparts: Calculator
& Non-Calculator

Interpreting and Using Results

Automatic Reporting in Schoolnet

In order to support teachers in using these assessments, students who take the assessment online in the Schoolnet platform will have their Checkpoints scored automatically. Teachers have multiple scoring options for students who take the Checkpoints on paper, and you can find how-to documents and videos at <https://tn.mypearsonsupport.com/schoolnet/>. **Checkpoint assessment scoring in Schoolnet requires all answers to be submitted by the student for results to be produced.** The following automated reports can be found in [Schoolnet](#):

- Individual student results
- Classroom level reports
- Standards analysis reports
- Item analysis
- Test comparison reports (e.g., student, class, school, district, and state)
- Shared reporting (e.g., district to school admin, school admin to educators in same content/grade-level)
- Aggregate and disaggregation of demographics

Overall Scores

The score groups on the checkpoint assessment are ***not meant to represent performance levels or the blueprints of the TCAP summative assessments*** (e.g., below, approaching, on track, and mastered). The score groups were designed to **share student preparedness for next grade level content** and provide guidance around the **level of support** students may need to access that content.

Score Group	% Correct	Results	Recommended Next Steps
Orange	0 – 61%	Likely Needs More Targeted Support	Use other sources of data for deeper insight; use identified misconceptions to offer targeted re-teaching, plan differentiation and intervention as needed as grade-level concepts are introduced.
Yellow	62 – 76%	Likely Able to Engage in Grade Level Content with Some Support	Investigate trends in student responses using the most important errors, to support differentiation on grade-level assignments and scaffolding when introducing new content; provide opportunities to check for understanding throughout the lesson to determine differentiation needs.
Green	77 – 99%	Likely Ready for Grade Level Content	Move directly into grade-level content.
Blue	100%	Ready for Grade Level Content	

Overall scoring is automatically available in the Schoolnet platform. This may help with you use the results of the student and class level reports to develop an overall summary and conclusion about your students' readiness for grade-level content. In responding to the Checkpoint assessments, we recommend addressing the learning needs of students **while engaging with on grade-level content**. For more information and tools for using assessment data to drive instructional decision making, review the [Assessing Learning Toolkit](#), pages 18-21, and the [Learning Loss PLC Guide](#).

While overall scoring is provided and can be helpful in planning for group instruction, the most actionable information in these Checkpoints can be found by analyzing at the question-level results.

Actionable Insights: Annotated Questions and Reporting Tools

Each question on the Checkpoint is fully annotated with information that describes the questions as they were used on previous TCAP tests, and automated scoring tools in Schoolnet that make getting that information easier. The most helpful and actionable information is in the **Item Annotations in this Guide** when combined with the **Item Analysis reports in Schoolnet**.

***When we need more time** in the school year, the best way to get it is to spend less time on things they've already mastered and more time on the specific gaps that students need.*

Answer Choice Rationales in each Question Annotation

It is possible that we have multiple students who may not have mastered some of the foundational content required to fully engage in this year's content. We are most effective at addressing these needs when we can pinpoint, as specifically as possible, the conceptual understanding that would most efficiently close this gap. That way we spend less time on previous content by focusing just on the piece that they need to be successful with this concept during the year. The Question Annotations are designed to help with that process.

To help teachers be more efficient in planning for the year, each question on the Checkpoint is accompanied by a set of answer choice rationales **which offers an explanation for each choice**. These annotations are not definitive: we know there may be many reasons for why students might select different answer choices. However, each rationale listed provides an explanation for why students may have selected a given answer choice, including what mis-steps may have caused them to select an incorrect answer (a "distractor"). These distractor rationales provide an instructional target to improve student understanding by breaking down and diagnosing the likely conceptual mistake, allowing you to **follow up with targeted instruction based on the most common mathematical errors you identify** for your specific group of students. These annotations assume that students tried their best and cannot provide information about whether students selected an option at random.

Item Annotations and Planning for Instruction

The department recommends in using this guide that educators look for trends in incorrect answers using the Item Analysis reporting on Schoolnet and then use the annotations using this process:

1. Find the highest-leverage error trend,
 - A. This can mean comparing the frequency of each student error or understanding the group of students represented by that trend.
2. Unpack the conceptual misunderstanding that led to the most important error, and then use the annotations to support analyzing the incorrect answer by thinking through these questions in order:
 - A. What DO these students understand?
 - B. Based on what students do understand, why might a student think their error was a reasonable choice?
 - C. What specific concept, if they had understood it clearly, would have made them recognize that the error was not a reasonable approach?
3. Put it all together to check your thinking by restating the answers to each of the three questions to articulate this sentence stem:

"Students understood [question A] but made the error of [student error], because they thought [question B] made sense. If they had understood [question C], they would have avoided the error."

This practice of pinpointing misconceptions and target understandings can help with long term planning to support students in accessing year-long content and making the most of the start of year Checkpoint.

Sample Set of Rationales

Rationales	
Incorrect – 1	Students choosing this answer likely skipped a step in multiplying (7×10). Students choosing this answer may need additional support in setting up the multiplication algorithm and tracking that they multiply each multiplicand by the multiplier.
Incorrect – 2	Students choosing this answer likely skipped multiplying 7 by the tens place, instead adding the regrouped 30 to the ten in the multiplicand. Students choosing this answer may need additional support in multiplying with regrouping.
Correct – 3	This problem requires students to understand the process involved to multiply a whole number of four digits by a one-digit whole number and using strategies based on place value and the properties of operations. To determine the correct product, students should have multiplied the multiplicand (2,815) by the multiplier (7) while remembering to regroup correctly.
Incorrect – 4	Students choosing this answer likely added the regrouped tens (30) before multiplying by 7. Students choosing this answer may need additional support or practice in the order of operations while multiplying a whole number of four digits by a one-digit whole.

Grade 5 Math Checkpoint Item Annotations

Item Information

Item Code: TN221545	Grade Level: 5
Standard Code: 5.OA.A.1	Position No: 1
Standard Text: Use parentheses and/or brackets in numerical expressions and evaluate expressions having these symbols using the conventional order (Order of Operations).	
Calculator: N	
Correct Answer: C	

What is the value of this expression?

$$(5 + 3) \times (4 - 2)$$

- A.** 11
- B.** 15
- C.** 16
- D.** 30

Rationales	
Incorrect – 1	Students choosing this answer likely performed the operations in order from right to left. Students choosing this answer may need support with the application of the Order of Operations, particularly with regard to parentheses as well as the correct order after parentheses are completed. They performed the three operations in order from right to left, calculating $(5 + 3) \times (4 - 2) = 5 + 3 \times 2 = 5 + 6 = 11$.
Incorrect – 2	Students choosing this answer likely performed the multiplication operation before the addition and subtraction operations. Students choosing this answer may need support with the application of the Order of Operations, particularly with regard to parentheses. They disregarded the parentheses, calculating $5 + 3 \times 4 - 2 = 5 + 12 - 2 = 17 - 2 = 15$.
Correct – 3	This problem requires students to understand that operations in parentheses should be completed before operations outside of parentheses when evaluating expressions. To determine the correct value, students should have first performed the operations in the two sets of parentheses and then multiplied, calculating $(5 + 3) \times (4 - 2) = 8 \times 2 = 16$.
Incorrect – 4	Students choosing this answer likely performed the operations in order from left to right. Students choosing this answer may need support with the application of the Order of Operations, particularly with regard to parentheses. They performed the three operations in order from left to right, calculating $(5 + 3) \times (4 - 2) = 8 \times 4 - 2 = 32 - 2 = 30$.

Item Information

Item Code: TN957517

Grade Level: 5

Standard Code: 5.NF.A.1

Position No: 2

Standard Text: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Calculator: N

Correct Answer: D

What is $12\frac{4}{9} + 14\frac{5}{12}$?

- A.** $26\frac{1}{4}$
- B.** $26\frac{3}{7}$
- C.** $26\frac{7}{12}$
- D.** $26\frac{31}{36}$

Rationales	
Incorrect – 1	<p>Students choosing this answer likely found an appropriate common denominator but added the numerators without changing them accordingly. Students choosing this answer may need support with how to calculate equivalent fractions. They found the common denominator of 36 but then added the given numerators, calculating</p> $12\frac{4}{9} + 14\frac{5}{12} = 12 + 14 + \frac{4+5}{36} = 26\frac{9}{36} = 26\frac{1}{4}.$
Incorrect – 2	<p>Students choosing this answer likely added the fractions by adding their numerators and denominators. Students choosing this answer may need support with understanding that fractions cannot be added or subtracted unless they have the same denominator and that they can be converted to equivalent fractions with a common denominator. They calculated</p> $12\frac{4}{9} + 14\frac{5}{12} = 12 + 14 + \frac{4+5}{9+12} = 26\frac{9}{21} = 26\frac{3}{7}.$
Incorrect – 3	<p>Students choosing this answer likely found an appropriate common denominator and successfully converted the fractions, but erred when adding the fractions. Students choosing this answer may need support with how to regroup when adding two-digit numbers. They correctly converted the two fractions but added 16 and 15 to get a sum of 21 instead of 31, not regrouping to the tens place and calculating</p> $12\frac{4}{9} + 14\frac{5}{12} = 12\frac{16}{36} + 14\frac{15}{36} = 26\frac{21}{36} = 26\frac{7}{12}.$
Correct – 4	<p>This problem requires students to understand how to add fractions with unlike denominators. To determine the correct value, students should have first found a common denominator for both fractions, then converted each one to a fraction with the same denominator, and then added the whole-number parts and fraction parts, calculating</p> $12\frac{4}{9} + 14\frac{5}{12} = 12\frac{16}{36} + 14\frac{15}{36} = 26\frac{31}{36}.$

Item Information

Item Code: TN157620

Grade Level: 5

Standard Code: 5.NF.B.3

Position No: 3

Standard Text: Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$).
Solve contextual problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers by using visual fraction models or equations to represent the problem.

Calculator: N

Correct Answer: C

Susan plans to make 4 pies for a family reunion. There will be 32 people at the reunion. How much pie will each person get if each piece is the same size?

- A.** $\frac{1}{4}$ of a pie
- B.** $\frac{1}{7}$ of a pie
- C.** $\frac{1}{8}$ of a pie
- D.** $\frac{1}{32}$ of a pie

Rationales	
Incorrect – 1	Students choosing this answer likely disregarded the number of people at the reunion when setting up the fraction. Students choosing this answer may need support with how to interpret a contextual situation. They disregarded the 32 and divided 4 into 1, resulting in a fraction of $\frac{1}{4}$.
Incorrect – 2	Students choosing this answer likely subtracted the given values before setting up the fraction. Students choosing this answer may need support with how to interpret a contextual situation. They subtracted 4 from 32 to get 28 and then divided, resulting in a fraction of $\frac{4}{28}$, which simplifies to $\frac{1}{7}$.
Correct – 3	This problem requires students to solve a contextual problem involving division of whole numbers and to represent the solution as a fraction in which the numerator is divided by the denominator. To determine the correct value, students should have divided the number of pies by the number of people, 4 divided by 32, resulting in a fraction of $\frac{4}{32}$, which simplifies to $\frac{1}{8}$.
Incorrect – 4	Students choosing this answer likely disregarded the number of pies when setting up the fraction. Students choosing this answer may need support with how to interpret a contextual situation. They disregarded the 4 and divided 32 into 1, resulting in a fraction of $\frac{1}{32}$.

Item Information

Item Code: TN157556

Grade Level: 5

Standard Code: 5.NBT.B.6

Position No: 4

Standard Text: Find whole-number quotients and remainders of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Calculator: N

Correct Answer: B,D,E

Which division problems have a quotient greater than 25?

Select **all** that apply.

A.
$$\begin{array}{r} 1250 \\ 50 \end{array}$$

B.
$$\begin{array}{r} 1310 \\ 50 \end{array}$$

C.
$$\begin{array}{r} 1175 \\ 50 \end{array}$$

D.
$$\begin{array}{r} 650 \\ 25 \end{array}$$

E.
$$\begin{array}{r} 675 \\ 25 \end{array}$$

Rationales	
Incorrect – 1	Students choosing this answer likely misread the question as “greater than or equal to.” Students choosing this answer may need to be reminded to be careful when reading the question. They divided correctly finding a final quotient equal to, but not greater than, 25.
Correct – 2	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 50 into 131, resulting in a value of 2 with a remainder of 31, then divided 50 into 310, resulting in a value of 6 with a remainder of 10; the final quotient is 26 with a remainder of 10, which is greater than 25.
Incorrect – 3	Students choosing this answer likely selected the options with the greatest numerators. Students choosing this answer may need support with how to divide numbers with more than one digit. They saw that this option had a numerator greater than 1,000 and concluded that this option would therefore result in one of the three greatest values.
Correct – 4	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 25 into 65, resulting in a value of 2 with a remainder of 15, then divided 25 into 150, resulting in a value of 6; the final quotient is 26, which is greater than 25.
Correct – 5	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 25 into 67, resulting in a value of 2 with a remainder of 17, then divided 25 into 175, resulting in a value of 7; the final quotient is 27, which is greater than 25.

Item Information

Item Code: TN981574

Grade Level: 5

Standard Code: 5.MD.C.4

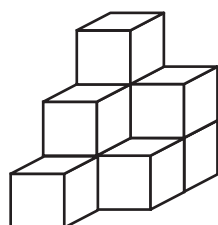
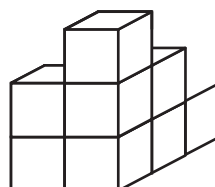
Position No: 5

Standard Text: Measure volume by counting unit cubes, using cubic centimeters, cubic inches, cubic feet, and improvised units.

Calculator: N

Correct Answer: B

This figure is made of unit cubes. It is shown from the front and from the back.

**Front****Back**

What is the volume, in cubic units, of the figure?

- A.** 6
- B.** 9
- C.** 11
- D.** 14

Rationales	
Incorrect – 1	Students choosing this answer likely counted cubes only shown in the image from the front. Students choosing this answer may need to be reminded to use all the views provided when determining the volume of a figure. They counted 3 visible cubes in the front two layers and 3 visible cubes in the back layer, for a total of 6 cubes.
Correct – 2	This problem requires students to measure volume by counting unit cubes. To determine the correct value, students should have counted 1 cube in the top layer, 3 cubes in the middle layer, and 5 cubes in the bottom layer, for a total of 9 cubes.
Incorrect – 3	Students choosing this answer likely counted cubes only shown in the image from the back. Students choosing this answer may need to be reminded to use all the views provided when determining the volume of a figure and may further need support with how to interpret a 2-dimensional representation of a 3-dimensional figure. They interpreted the bottom layer as a full rectangular layer containing 6 cubes and the middle layer as a full square layer containing 4 cubes; combined with the 1 cube in the top layer, for a total of 11 cubes.
Incorrect – 4	Students choosing this answer likely counted the visible cubes from both views and added the totals. Students choosing this answer may need support with how to interpret a 2-dimensional representation of a 3-dimensional figure. They counted 6 visible cubes in the front image and 8 visible cubes in the back image, for a total of 14 cubes.

Item Information

Item Code: TN757572

Grade Level: 5

Standard Code: 5.NF.A.2

Position No: 6

Standard Text: Solve contextual problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Calculator: N

Correct Answer: B

A recipe for chocolate chip cookies calls for $\frac{3}{4}$ cup of flour and $\frac{1}{3}$ cup of sugar.

How much flour and sugar combined is used in the recipe?

- A.** $\frac{4}{7}$ cup
- B.** $1\frac{1}{12}$ cup
- C.** $\frac{1}{4}$ cup
- D.** $\frac{5}{12}$ cup

Rationales	
Incorrect – 1	<p>Students choosing this answer likely added the fractions by adding the numerators, then adding the denominators. Students choosing this answer may need support that uses visual models to help understand the meaning of numerators and denominators of fractions. They</p> $\text{Calculated } \frac{3}{4} + \frac{1}{3} = \frac{3+1}{4+3} = \frac{4}{7}.$
Correct – 2	<p>Students choosing this answer likely multiplied instead of adding. Students choosing this answer may need support with how to interpret the actions and relationships in real-world problems and the mathematical operations that describe them. (e.g. “combining” physical things could describe an additive relationship). They calculated</p> $\frac{3}{4} + \frac{1}{3} = \frac{9}{12} + \frac{4}{12} = \frac{13}{12} = 1 \frac{1}{12}.$
Incorrect – 3	<p>Students choosing this answer likely multiplied instead of adding. Students choosing this answer may need support with how to interpret the context of a problem to understand that combining two amounts means the amounts should be added together. They calculated</p> $\frac{3}{4} \times \frac{1}{3} = \frac{3}{12} = \frac{1}{4}.$
Incorrect – 4	<p>Students choosing this answer likely subtracted instead of adding. Students choosing this answer may need support with how to interpret the context of a problem to understand that combining two amounts means the amounts should be added together. They calculated</p> $\frac{3}{4} - \frac{1}{3} = \frac{9}{12} - \frac{4}{12} = \frac{5}{12}.$

Item Information

Item Code: TN857667

Grade Level: 5

Standard Code: 5.NF.A.1

Position No: 7

Standard Text: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Calculator: N

Correct Answer: D

What is $\frac{3}{5} + \frac{1}{6}$?

A. $\frac{4}{11}$

B. $\frac{2}{15}$

C. $\frac{13}{30}$

D. $\frac{23}{30}$

Rationales	
Incorrect – 1	Students choosing this answer likely added the fractions by adding their numerators and then adding the denominators. Students choosing this answer may need support that uses visual models to help understand the meaning of numerators and denominators of fractions. They calculated $\frac{3}{5} + \frac{1}{6} = \frac{3+1}{5+6} = \frac{4}{11}$.
Incorrect – 2	Students choosing this answer likely added the fractions by finding a common denominator but then adding the numerators without converting them. Students choosing this answer may need support that uses visual models to help understand how the numerator of a fraction changes when the denominator changes. They found the common denominator of 30 but added the given numerators, calculating $\frac{3}{5} + \frac{1}{6} = \frac{3+1}{30} = \frac{4}{30} = \frac{2}{15}$.
Incorrect – 3	Students choosing this answer likely subtracted instead of adding. Students choosing this answer may need support with distinguishing between addition and subtraction. They calculated $\frac{3}{5} - \frac{1}{6} = \frac{18}{30} - \frac{5}{30} = \frac{13}{30}$.
Correct – 4	This problem requires students to understand how to add fractions with unlike denominators. To determine the correct value, students should have first found a common denominator for both fractions, then converted each fraction to an equivalent fraction with the same denominator, and then added, calculating $\frac{3}{5} + \frac{1}{6} = \frac{18}{30} + \frac{5}{30} = \frac{23}{30}$.

Item Information

Item Code: TN557559

Grade Level: 5

Standard Code: 5.NBT.B.6

Position No: 8

Standard Text: Find whole-number quotients and remainders of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Calculator: N

Correct Answer: C,D,E

Which values are greater than or equal to $3876 \div 68$?

Select **all** that apply.

- A.** 55
- B.** 56
- C.** 57
- D.** 58
- E.** 59

Rationales	
Incorrect – 1	Students choosing this answer likely misinterpreted the question and selected a value less than the given quotient. Students choosing this answer may need to be reminded to be careful when reading the question. They divided correctly to find a final quotient of 57, then chose a value less than the given quotient, 55.
Incorrect – 2	Students choosing this answer likely misinterpreted the question and selected a value less than the given quotient. Students choosing this answer may need to be reminded to be careful when reading the question. They divided correctly to find a final quotient of 57, then chose a value less than the given quotient, 56.
Correct – 3	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 68 into 387, resulting in a value of 5 with a remainder of 47, then divided 68 into 476, resulting in a value of 7; the final quotient is 57.
Correct – 4	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 68 into 387, resulting in a value of 5 with a remainder of 47, then divided 68 into 476, resulting in a value of 7; the final quotient is 57, and 58 is greater than this value.
Correct – 5	This problem requires students to find whole-number quotients and remainders with up to four-digit dividends and two-digit divisors. To determine the correct value, students should have divided 68 into 387, resulting in a value of 5 with a remainder of 47, then divided 68 into 476, resulting in a value of 7; the final quotient is 57, and 59 is greater than this value.

Item Information

Item Code: TN356067

Grade Level: 5

Standard Code: 5.NF.B.7.b

Position No: 9

Standard Text: Interpret division of a whole number by a unit fraction and compute such quotients.

Calculator: N

Correct Answer: C

This model can be used to find $8 \div \frac{1}{9}$.

Which statement about $8 \div \frac{1}{9}$ is true?

- A.** $8 \div \frac{1}{9} = \frac{8}{9}$, because $\frac{8}{9} \times \frac{1}{9} = 8$.
- B.** $8 \div \frac{1}{9} = \frac{8}{9}$, because $\frac{8}{9} \times 9 = 8$.
- C.** $8 \div \frac{1}{9} = 72$, because $\frac{1}{9} \times 72 = 8$.
- D.** $8 \div \frac{1}{9} = 72$, because $\frac{1}{9} \times 8 = 72$.

Rationales	
Incorrect – 1	Students choosing this answer likely disregarded the model, divided numerators and used the given denominator, and then did not verify that the second equation was correct. Students choosing this answer may need support with relating a visual model to values in a division expression as well as with rewriting division equations as multiplication equations. They divided 8 by 1 rather than multiplying by 9, and then disregarded the second equation.
Incorrect – 2	Students choosing this answer likely confused division with multiplication. Students choosing this answer may need support with understanding how multiplication and division are related with practice identifying these relationships in models and real-world problems, especially opportunities where the values include fractions. They multiplied 8 by $\frac{1}{9}$ rather than divide, though they did then select a multiplication equation consistent with their selection.
Correct – 3	This problem requires students to interpret division of a whole number by a unit fraction with aid from a model. To determine the correct response, students should identify that each of 8-unit rectangles is divided into 9 equal pieces, resulting in a total of 72 pieces. Working backwards, the 72 pieces are each $\frac{1}{9}$ the size of a unit rectangle, and there is a total of 8-unit rectangles in the model.
Incorrect – 4	Students choosing this answer likely confused where the parts of the division equation should go when rewriting as a multiplication equation. Students choosing this answer may need support with rewriting division equations as multiplication equations. They correctly calculated that $8 \div \frac{1}{9} = 72$, but erred when rewriting the division equation as a multiplication equation.

Item Information

Item Code: TN104759

Grade Level: 5

Standard Code: 5.NBT.B.5

Position No: 10

Standard Text: Fluently multiply multi-digit whole numbers (up to three-digit by four-digit factors) using appropriate strategies and algorithms.

Calculator: N

Correct Answer: D

What is $4,586 \times 908$?

- A.** 439,428
- B.** 449,428
- C.** 4,064,088
- D.** 4,164,088

Rationales	
Incorrect – 1	Students choosing this answer likely disregarded the zero in the tens position of 908 when multiplying, and made a regrouping error. Students choosing this answer may need support with understanding the meaning of each digit in a factor. They multiplied 4,586 by 8 correctly, resulting in a partial product of 36,688, but multiplied 4,586 by 90 instead of 900. During this calculation students regrouped a 4 instead of a 5 to the thousands place, resulting in a partial product of 402,740. They then added the partial products to get a final result of $36,688 + 402,740 = 439,428$.
Incorrect – 2	Students choosing this answer likely disregarded the zero in the tens position of 908 when multiplying. Students choosing this answer may need support with understanding the meaning of each digit in a factor. They multiplied 4,586 by 8 correctly, resulting in a value of 36,688, but multiplied 4,586 by 90 instead of 900, resulting in a value of 412,740. They then added the partial products to get a final result of $36,688 + 412,740 = 449,428$.
Incorrect – 3	Students choosing this answer likely made a regrouping error. Students choosing this answer may need support with regrouping correctly when finding products. They multiplied 4,586 by 8 correctly, resulting in a value of 36,688, but when multiplying 4,586 by 900, they regrouped a 4 instead of a 5, resulting in a partial product of 4,027,400. They then added the partial products to get a final result of $36,688 + 4,027,400 = 4,064,088$.
Correct – 4	This problem requires students to multiply multi-digit whole numbers. To determine the correct value, students should have multiplied 4,586 by 8, resulting in a partial product of 36,688, then multiplied 4,586 by 900, resulting in a partial product of 4,127,400, and then added the partial products to get a final result of $36,688 + 4,127,400 = 4,164,088$.

Item Information

Item Code: TN057580

Grade Level: 5

Standard Code: 5.NBT.B.6

Position No: 11

Standard Text: Find whole-number quotients and remainders of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Calculator: N

Correct Answer: C

What is $728 \div 52$?

- A.** 4
- B.** 11
- C.** 14
- D.** 15

Rationales	
Incorrect – 1	<p>Students choosing this answer likely attempted to divide from right to left, starting with finding the number of times 52 goes into 28.</p> <p>Students choosing this answer may need support with understanding the dividend and divisor in an expression and how they are used to calculate a quotient. They saw that dividing 52 into 28 would not work, concluding that the answer would be a single-digit number; they then saw that 8 divided by 2 is 4; thus, their final quotient was 4.</p>
Incorrect – 2	<p>Students choosing this answer likely completed the first step of the division algorithm correctly but made a place value error while subtracting. Students choosing this answer may need support with completing all subtraction steps needed in long division calculations. They saw that 52 could go into 72 one time but did not use the zero placeholder when subtracting and got 2 instead of 20, then understood that 52 divides into 28 zero times, so 28 would be a remainder. Students disregarded this remainder and chose the closest option; their final quotient was 11.</p>
Correct – 3	<p>This problem requires students to find a whole-number quotient with a three-digit dividend and two-digit divisor. To determine the correct value, students should have divided 52 into 72, resulting in a value of 1 with a remainder of 20, then divided 52 into 208, resulting in a value of 4; their final quotient was 14.</p>
Incorrect – 4	<p>Students choosing this answer likely erred while subtracting 52 from 72. Students choosing this answer may need to be reminded to be careful when performing arithmetic. They divided 52 into 72, resulting in a value of 1, but got a remainder of 30 instead of 20; they then divided 52 into 308, resulting in a value of 5, disregarding the remainder; their final quotient was 15.</p>

Item Information

Item Code: TN031569

Grade Level: 5

Standard Code: 5.NBT.B.5

Position No: 12

Standard Text: Fluently multiply multi-digit whole numbers (up to three-digit by four-digit factors) using appropriate strategies and algorithms.

Calculator: N

Correct Answer: D

What is 1850×135 ?

- A.** 199,800
- B.** 239,750
- C.** 248,550
- D.** 249,750

Rationales	
Incorrect – 1	Students choosing this answer likely missed a zero placeholder during one of their calculations. Students choosing this answer may need support with place value when multiplying numbers with more than one digit. They correctly multiplied 1,850 by 5, resulting in a partial product of 9,250, but then multiplied 1,850 by 3 instead of 30, resulting in a partial product of 5,550; they then correctly multiplied 1,850 by 100, resulting in a partial product of 185,000, then added the partial products to get a final result of $9,250 + 5,550 + 185,000 = 199,800$.
Incorrect – 2	Students choosing this answer likely did not regroup when adding the partial products. Students choosing this answer may need support with regrouping when adding partial products. They correctly multiplied; however, when adding the partial products, they did not regroup the 1 to the ten thousands place, and got a final result of 239,750 instead of 249,750.
Incorrect – 3	Students choosing this answer likely did not regroup when multiplying. Students choosing this answer may need support with understanding how to regroup digits when calculating partial products and then understanding to use them in the addition step to determine the final product. They multiplied 1,850 by 5 but did not regroup 2 to the hundreds place, resulting in a partial product of 9,050, then multiplied 1,850 by 30 but did not regroup 1 to the hundreds place, resulting in a partial product of 54,500, then multiplied 1,850 by 100, resulting in a partial product of 185,000; the added the partial products correctly to get a final result of $9,050 + 54,500 + 185,000 = 248,550$.
Correct – 4	This problem requires students to multiply multi-digit whole numbers. To determine the correct value, students should have multiplied 1,850 by 5, resulting in a partial product of 9,250, then multiplied 1,850 by 30, resulting in a partial product of 55,500, then multiplied 1,850 by 100, resulting in a partial product of 185,000; then added the partial products to get a final result of $9,250 + 55,500 + 185,000 = 249,750$.

Item Information

Item Code: TN747597

Grade Level: 5

Standard Code: 5.NF.A.1

Position No: 13

Standard Text: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Calculator: N

Correct Answer: D

What is the solution to $4\frac{9}{10} + 5\frac{2}{3}$?

- A.** $9\frac{4}{5}$
- B.** $9\frac{11}{13}$
- C.** $10\frac{7}{30}$
- D.** $10\frac{17}{30}$

Rationales	
Correct – 1	Students choosing this answer likely disregarded the given fractions and used the given whole-number parts. Students choosing this answer may need support with understanding the real-world relationships represented by fractions and their operations. They added the whole-number parts and used those same parts to create the fraction, resulting in the value $4 + 5 + \frac{4}{5} = 9\frac{4}{5}$.
Incorrect – 2	Students choosing this answer likely added the fractions by adding the numerators and then adding the denominators. Students choosing this answer may need support that uses visual models to help understand the meaning of numerators and denominators of fractions. They calculated $4\frac{9}{10} + 5\frac{2}{3} = 4 + 5 + \frac{9+2}{10+3} = 9\frac{11}{13}$.
Incorrect – 3	Students choosing this answer likely did not regroup one whole from the improper fraction correctly. Students choosing this answer may need support with how to change an improper fraction to a mixed number. They first found a common denominator for both fractions, then converted each fraction to an equivalent fraction with the same denominator, and then added the whole-number parts and fraction parts, all correctly; however, they subtracted 40 instead of 30 from the resulting numerator, calculating $4\frac{9}{10} + 5\frac{2}{3} = 4\frac{27}{30} + 5\frac{20}{30} = 9\frac{47}{30} = 9 + 1 + \frac{7}{30} = 10\frac{7}{30}$.
Incorrect – 4	This problem requires students to understand how to add fractions with unlike denominators. To determine the correct value, students should have first found a common denominator for both fractions, then converted each fraction to an equivalent fraction with the same denominator, and then added the whole-number parts and fraction parts, regrouping one whole from the improper fraction and calculating $4\frac{9}{10} + 5\frac{2}{3} = 4\frac{27}{30} + 5\frac{20}{30} = 9\frac{47}{30} = 10\frac{17}{30}$.

Item Information

Item Code: TN967598

Grade Level: 5

Standard Code: 5.NF.A.1

Position No: 14

Standard Text: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

Calculator: N

Correct Answer: A

The Carson family went fishing. They caught a $2\frac{5}{8}$ pound trout and a $1\frac{1}{2}$ pound bass.

Which calculation shows how many more pounds the trout weighed than the bass?

- A.** $2\frac{5}{8} - 1\frac{1}{2} = 1\frac{1}{8}$
- B.** $2\frac{5}{8} - 1\frac{1}{2} = 1\frac{4}{6}$
- C.** $2\frac{5}{8} + 1\frac{1}{2} = 3\frac{6}{10}$
- D.** $2\frac{5}{8} + 1\frac{1}{2} = 4\frac{1}{8}$

Rationales	
Correct – 1	This problem requires students to solve a contextual problem involving subtraction of mixed numbers. To determine the correct value, students should have subtracted the two values by first finding a common denominator for both fractions, then converting each fraction to an equivalent fraction with the same denominator, and then subtracting the whole-number parts and fraction parts, calculating $2\frac{5}{8} - 1\frac{1}{2} = 2\frac{5}{8} - 1\frac{4}{8} = 1\frac{1}{8}$.
Incorrect – 2	Students choosing this answer likely subtracted the fractions by subtracting the numerators then subtracting the denominators. Students choosing this answer may need support that uses visual models to help understand the meaning of numerators and denominators of fractions. They correctly reasoned that subtraction would be required, but calculated $2\frac{5}{8} - 1\frac{1}{2} = 2 - 1 + \frac{5-1}{8-2} = 1\frac{4}{6}$.
Incorrect – 3	Students choosing this answer likely thought that addition was the correct operation to use and then added the fractions by adding their numerators then adding the denominators. Students choosing this answer may need support with how to interpret a contextual situation that compares one value to another as a situation requiring subtraction, as well as how to add or subtract fractions with unlike denominators. They incorrectly reasoned that addition would be required and calculated $2\frac{5}{8} + 1\frac{1}{2} = 2 + 1 + \frac{5+1}{8+2} = 3\frac{6}{10}$.
Incorrect – 4	Students choosing this answer likely thought that addition was the correct operation to use. Students choosing this answer may need support with how to interpret a contextual situation that compares one value to another as a situation requiring subtraction, They incorrectly reasoned that addition would be required, though they did correctly add the fractions by first finding a common denominator for both fractions, then converting each fraction to an equivalent fraction with the same denominator, and then added the whole-number parts and fraction parts, regrouping the improper fraction, and calculated $2\frac{5}{8} + 1\frac{1}{2} = 2\frac{5}{8} + 1\frac{4}{8} = 3\frac{9}{8} = 4\frac{1}{8}$.

Item Information

Item Code: TN357571

Grade Level: 5

Standard Code: 5.MD.C.5.b

Position No: 15

Standard Text: Know and apply the formulas $V = l \times w \times h$ and $V = B \times h$ (where B represents the area of the base) 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.

Calculator: N

Correct Answer: D

A crate measures 6 feet by 5 feet by 3 feet. What is the volume of the crate in cubic feet?

- A.** 14
- B.** 17
- C.** 87
- D.** 90

Rationales	
Incorrect – 1	Students choosing this answer likely added the given values instead of multiplying. Students choosing this answer may need support with concrete models to understand the relationship between the dimensions of a rectangular prism and the formula used to determine the volume of the prism. They calculated $6 + 5 + 3 = 14$.
Incorrect – 2	Students choosing this answer likely added the given values instead of multiplying, then attempted to combine both volume formulas. Students choosing this answer may need support with concrete models to understand the relationship between the dimensions of a right rectangular prism and the formula $V = l \times w \times h$ used to determine the volume of the prism. They added the given values instead of multiplying, calculating $6 + 5 + 3 = 14$, and then added 3 to their total because they also interpreted 3 as the base, resulting in a final answer of 17.
Incorrect – 3	Students choosing this answer likely multiplied the given values but then attempted to incorporate the value of 3 in a further calculation. Students choosing this answer may need support with understanding how the dimensions of a rectangular prism relate to the formula $V = l \times w \times h$ used to calculate the volume of a right rectangular prism. They correctly multiplied the three given values, calculating $6 \times 5 \times 3 = 90$, but then subtracted 3 from their total because they saw 3 given values, resulting in a final answer of 87.
Correct – 4	This problem requires students to know and apply the formula $V = l \times w \times h$ to find the volume of a right rectangular prism. To determine the correct value, students should have multiplied the three given values, calculating $6 \times 5 \times 3 = 90$.

Item Information

Item Code: TN767499

Grade Level: 5

Standard Code: 5.NF.B.7.a

Position No: 16

Standard Text: Interpret division of a unit fraction by a non-zero whole number and compute such quotients.

Calculator: Y

Correct Answer: A

An art teacher has $\frac{1}{5}$ of an ounce of glitter. She divides the glitter equally between 10 students.

How much glitter does each student get?

- A.** $\frac{1}{50}$ ounce
- B.** $\frac{1}{15}$ ounce
- C.** $\frac{1}{10}$ ounce
- D.** $\frac{1}{2}$ ounce

Rationales	
Correct – 1	This problem requires students to solve a contextual problem involving division of a unit fraction by a whole number. To determine the correct value, students should have divided the number of ounces of glitter by the number of students, $\frac{1}{5}$ divided by 10, which is equivalent to $\frac{1}{5}$ multiplied by $\frac{1}{10}$, resulting in a fraction of $\frac{1}{5} \times \frac{1}{10} = \frac{1}{50}$.
Incorrect – 2	Students choosing this answer likely knew to find the reciprocal of 10 and multiplied the numerators but then added the denominators. Students choosing this answer may need support with understanding what multiplication by a fraction represents in order to interpret and identify operations to be used on denominators when finding the product of two fractions. They calculated $\frac{1 \times 1}{5 + 10} = \frac{1}{15}$.
Incorrect – 3	Students choosing this answer likely disregarded the given amount of glitter. Students choosing this answer may benefit from practice rearticulating a real-world problem prior to selecting operations and values to represent the relationships. They disregarded the $\frac{1}{5}$ ounce given and assumed the art teacher has 1 ounce of glitter, resulting in a fraction of $\frac{1}{10}$.
Incorrect – 4	Students choosing this answer likely reversed the order of the dividend and divisor and divided numerators and divided denominators instead of multiplying. Students choosing this answer may need support with understanding what multiplication by a fraction represents in order to interpret and identify operations to be used on denominators when finding the product of two fractions. Students choosing this answer may need support with how to set up a division equation given a contextual situation. They calculated $\frac{1 \div 1}{10 \div 5} = \frac{1}{2}$.

Item Information

Item Code: TN920188

Grade Level: 5

Standard Code: 5.MD.C.5.a

Position No: 17

Standard Text: Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent whole-number products of three factors as volumes (e.g., to represent the associative property of multiplication).

Calculator: Y

Correct Answer: B,E

The first layer of a rectangular prism can be packed with 20 unit cubes, without gaps or overlaps. The prism is 6 unit cubes tall.

Select **all** expressions that represent the volume of the prism.

- A.** $20 + 6$
- B.** 20×6
- C.** $20 \times 6 \times 6$
- D.** $20 \times 20 \times 6$
- E.** $20 + 20 + 20 + 20 + 20 + 20$

Rationales	
Incorrect – 1	Students choosing this answer likely thought the given values should be added instead of multiplied. Students choosing this answer may need support with understanding how the number of cubes in the base layer of a rectangular prism and the height of the prism in cubes relate to the volume of the prism. They thought the volume could be found by adding $20 + 6$.
Correct – 2	This problem requires students to identify an expression that represents the volume of a prism. To determine a correct expression, students could have multiplied the area of the base by the height, 20×6 .
Incorrect – 3	Students choosing this answer likely thought 3 factors were needed in an expression that represents the volume because one volume formula uses 3 factors. Students choosing this answer may need support with how to represent the volume of a right rectangular prism in multiple ways. They knew that 20 and 6 should be multiplied, but then chose an expression with an additional factor of 6, $20 \times 6 \times 6$.
Incorrect – 4	Students choosing this answer likely thought 3 factors were needed in an expression that represents the volume. Students choosing this answer may need support with how to represent the volume of a right rectangular prism in multiple ways. They knew that 20 and 6 should be multiplied, but then chose an expression with an additional factor of 20, $20 \times 20 \times 6$.
Correct – 5	This problem requires students to identify an expression that represents the volume of a prism. To determine a correct expression, students could have added the number of cubes in each layer, $20 + 20 + 20 + 20 + 20$.

Item Information

Item Code: TN320263

Grade Level: 5

Standard Code: 5.NF.B.4.b

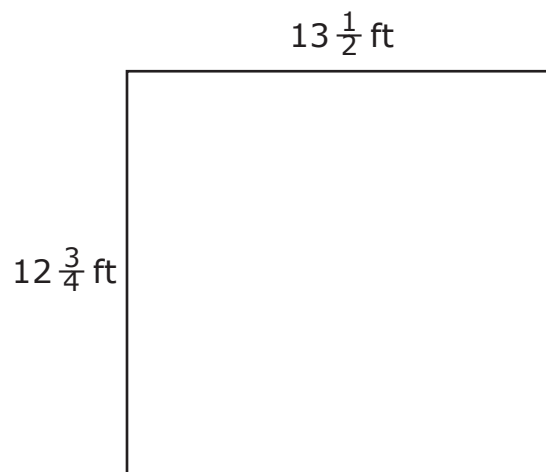
Position No: 18

Standard Text: Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.

Calculator: Y

Correct Answer: D

The lengths of the sides of a room are shown.



What is the area of the room?

- A.** $26\frac{1}{4}$ ft²
- B.** $52\frac{1}{2}$ ft²
- C.** $156\frac{3}{8}$ ft²
- D.** $172\frac{1}{8}$ ft²

Rationales	
Incorrect – 1	<p>Students choosing this answer likely added the given values instead of multiplying. Students choosing this answer may need support with understanding how the dimensions of a rectangle relate to the area of the rectangle. They added the mixed numbers instead of multiplying them, calculating (correctly) $12\frac{3}{4} + 13\frac{1}{2} = 12 + 13 + \frac{3}{4} + \frac{2}{4} = 25\frac{5}{4} = 26\frac{1}{4}$.</p>
Incorrect – 2	<p>Students choosing this answer likely found the perimeter of the rectangle instead of the area. Students choosing this answer may need support with remembering the meaning of perimeter and the meaning of area and distinguishing between the calculations to use for each. They found the perimeter of the rectangle by calculating (correctly)</p> $2\left(12\frac{3}{4} + 13\frac{1}{2}\right) = 2\left(12 + 13 + \frac{3}{4} + \frac{2}{4}\right) = 2\left(25\frac{5}{4}\right) = 2\left(26\frac{1}{4}\right) = 52\frac{1}{2}.$
Incorrect – 3	<p>Students choosing this answer likely multiplied the whole-number parts and the fraction parts separately. Students choosing this answer may need support with how to multiply mixed numbers. They multiplied 12 by 13 and $\frac{3}{4}$ by $\frac{1}{2}$ and then added the results, calculating</p> $12\frac{3}{4} \times 13\frac{1}{2} = 12 \times 13 + \frac{3}{4} \times \frac{1}{2} = 156\frac{3}{8}.$
Correct – 4	<p>This problem requires students to understand how to multiply fractional side lengths to find the area of a rectangle. To determine the correct value, students should have first converted both mixed numbers to improper fractions, then multiplied the two fractions by multiplying the numerators then multiplying the denominators. Then they should have converted the resulting improper fraction back to a mixed number, calculating</p> $12\frac{3}{4} \times 13\frac{1}{2} = \frac{51}{4} \times \frac{27}{2} = \frac{1,377}{8} = 172\frac{1}{8}.$

Item Information

Item Code: TN974422

Grade Level: 5

Standard Code: 5.MD.C.5.a

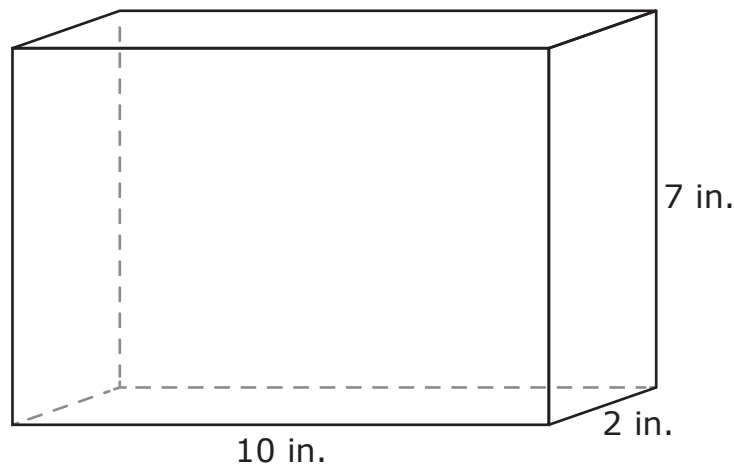
Position No: 19

Standard Text: Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent whole-number products of three factors as volumes (e.g., to represent the associative property of multiplication).

Calculator: Y

Correct Answer: A,B,D

A rectangular prism is shown. The prism will be completely packed with unit cubes.



Which expressions represent the number of unit cubes that will completely pack the prism?

Select the **three** correct answers.

- A.** $7 \times (2 \times 10)$
- B.** $(7 \times 2) \times 10$
- C.** $7 \times (2 + 10)$
- D.** $(10 \times 7) \times 2$
- E.** $(7 \times 2) + (7 \times 10)$
- F.** $(7 \times 2) \times (7 \times 10)$

Rationales	
Correct – 1	This problem requires students to identify an expression that represents the number of unit cubes that will completely pack the prism. To determine a correct expression, students could have multiplied the width by the length, then by the height, $7 \times (2 \times 10)$.
Correct – 2	This problem requires students to identify an expression that represents the number of unit cubes that will completely pack the prism. To determine a correct expression, students could have multiplied the height by the width, then by the length, $(7 \times 2) \times 10$.
Incorrect – 3	Students choosing this answer likely thought the length and width of the prism should be added instead of multiplied. Students choosing this answer may need support with how to set up an equation that represents volume. They thought 10 and 2 should be added before multiplying the sum by the height of 7, $7 \times (2 + 10)$.
Correct – 4	This problem requires students to identify an expression that represents the number of unit cubes that will completely pack the prism. To determine a correct expression, students could have multiplied the length by the height, then by the width, $(10 \times 7) \times 2$.
Incorrect – 5	Students choosing this answer likely thought the length and width of the prism should be added instead of multiplied, then found an expression equivalent to their result. Students choosing this answer may need support with how to set up an equation that represents volume. They thought 10 and 2 should be added before multiplying the sum by the height of 7, resulting in $7 \times (2 + 10)$, then used the Distributive Property to find an equivalent expression, $(7 \times 2) + (7 \times 10)$.
Incorrect – 6	Students choosing this answer likely made a mistake while attempting to use the Distributive Property on a correct expression. Students choosing this answer may need support with how to use the Distributive Property. They correctly reasoned that $7 \times (2 \times 10)$ was a valid expression, but then attempted to apply the Distributive Property incorrectly, multiplying outside of the parentheses instead of adding, to find an equivalent expression, $(7 \times 2) \times (7 \times 10)$.

Item Information

Item Code: TN947350

Grade Level: 5

Standard Code: 5.NF.B.4.b

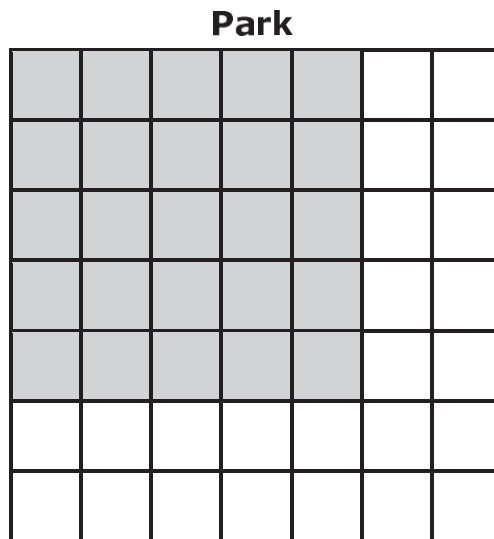
Position No: 20

Standard Text: Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.

Calculator: Y

Correct Answer: A

A park is $\frac{5}{7}$ mile by $\frac{5}{7}$ mile square, as shown in the tiling model. The shaded part of the tiling model shows the fractional part of the park that has picnic tables.



Which equation can be used to find the area, in square miles, of the part of the park that has picnic tables?

A. $\frac{5}{7} \times \frac{5}{7} = ?$

B. $\frac{5}{7} + \frac{5}{7} = ?$

C. $\frac{25}{49} \times \frac{25}{49} = ?$

D. $\frac{25}{49} + \frac{25}{49} = ?$

Rationales	
Correct – 1	This problem requires students to identify an equation that can be used to find a rectangular area. To determine the correct response, students should have recognized that area can be found by multiplying length by width, and that both dimensions in the shaded region are 5/7 mile, $\frac{5}{7} \times \frac{5}{7} = ?$.
Incorrect – 2	Students choosing this answer likely thought addition was required instead of multiplication. Students choosing this answer may need support with understanding how the dimensions of a rectangle relate to the area of the rectangle. They thought addition was required to find area, though they correctly found the dimensions of the shaded region, $\frac{5}{7} + \frac{5}{7} = ?$.
Incorrect – 3	Students choosing this answer likely had a general understanding of how to calculate area but used the wrong fractions as part of the final equation. Students choosing this answer may need support with how to calculate the area of a specific region as defined within the context of the item. They created a fraction by using the area of the shaded squares (5 x 5) as the numerator and the area of the entire figure (7 x 7) as the denominator, then multiplying by itself, $\frac{25}{49} \times \frac{25}{49} = ?$.
Incorrect – 4	Students choosing this answer likely thought addition was required instead of multiplication and used the wrong fractions as part of the final equation. Students choosing this answer may need support with how to calculate the area of a specific region as defined with the context of the item, in addition to how to find the area of a rectangle. They created a fraction by using the area of the shaded squares (5 x 5) as the numerator and the area of the entire figure (7 x 7) as the denominator, and then thought addition was required to find area, $\frac{25}{49} + \frac{25}{49} = ?$.

Item Information

Item Code: TN457631

Grade Level: 5

Standard Code: 5.OA.A.2

Position No: 21

Standard Text: Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them.

Calculator: Y

Correct Answer: D

Which expression correctly shows sixteen minus two, divided by the sum of three and four?

- A.** $(16 + 2 \div 3) + 4$
- B.** $(16 \div 2) - (3 + 4)$
- C.** $(16 \times 2) \div (3 + 4)$
- D.** $(16 - 2) \div (3 + 4)$

Rationales	
Incorrect – 1	Students choosing this answer likely misread “minus” as “plus” and overlooked the correct order of operations. Students choosing this answer may need support with regard to interpreting verbal descriptions of expressions. They associated “minus” with addition, possibly repeating that operation after seeing “sum” in the description, and placed parentheses incorrectly; thus, $(16 + 2 \div 3) + 4$.
Incorrect – 2	Students choosing this answer likely confused “minus” with “divided by”. Students choosing this answer may need support interpreting and articulating verbal descriptions of expressions. They associated “minus” with division and “divided by” with subtraction, instead of the other way around; thus, $(16 \div 2) - (3 + 4)$.
Incorrect – 3	Students choosing this answer likely confused “minus” with “times”. Students choosing this answer may need support interpreting and articulating verbal descriptions of expressions. They associated “minus” with multiplication instead of subtraction, though they interpreted the remainder of the description correctly; thus, $(16 \times 2) \div (3 + 4)$.
Correct – 4	This problem requires students to write an expression given a verbal description. To determine the correct expression, students should have represented “sixteen minus two” as subtraction and “the sum of three and four” as addition, with “divided by” referring to division of the two quantities; thus, $(16 - 2) \div (3 + 4)$.

Item Information

Item Code: TN020269

Grade Level: 5

Standard Code: 5.MD.C.5.b

Position No: 22

Standard Text: Know and apply the formulas $V = l \times w \times h$ and $V = B \times h$ (where B represents the area of the base) 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.

Calculator: Y

Correct Answer: A

A soup company makes a container in the shape of a rectangular prism with a length of 3 inches, a width of 4 inches, and a height of 6 inches.

What is the volume of the soup container?

- A.** 72 in³
- B.** 24 in³
- C.** 13 in³
- D.** 12 in³

Rationales	
Correct – 1	This problem requires students to find the volume of a right rectangular prism with given dimensions. To determine the correct value, students should have multiplied 3 by 4 by 6, calculating $3 \times 4 \times 6 = 72$.
Incorrect – 2	Students choosing this answer likely confused prisms with pyramids. Students choosing this answer may need support with identifying the physical attributes of three-dimensional figures. They found the area of a rectangular-based pyramid with base dimensions of 3 inches and 4 inches and a height of 6 inches, calculating $\frac{1}{3}(3 \times 4 \times 6) = \frac{1}{3}(72) = 24$.
Incorrect – 3	Students choosing this answer likely added the given values instead of multiplying. Students choosing this answer may need support with understanding how the dimensions of a rectangular prism relate to the volume of the prism. They added 3, 4, and 6, calculating $3 + 4 + 6 = 13$.
Incorrect – 4	Students choosing this answer likely calculated base area instead of volume. Students choosing this answer may need support in understanding how the dimensions of a rectangular prism relate to each of the volume formulas for rectangular prisms. They ignored the height and found the base area of the prism, calculating $3 \times 4 = 12$.

Item Information

Item Code: TN277187

Grade Level: 5

Standard Code: 5.NF.A.2

Position No: 23

Standard Text: Solve contextual problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Calculator: Y

Correct Answer: C

Olivia is making lunch.

- She uses $1\frac{3}{8}$ pounds of carrots in soup.
- She uses $\frac{4}{5}$ pound of carrots in a salad.

About how many pounds of carrots did Olivia use in all?

- A.** between and $1\frac{1}{2}$ pounds
- B.** between $1\frac{1}{2}$ and 2 pounds
- C.** between 2 and $2\frac{1}{2}$ pounds
- D.** between $2\frac{1}{2}$ and 3 pounds

Rationales	
Incorrect – 1	Students choosing this answer likely added the fractions by adding their numerators after multiplying their denominators to find a common denominator. Students choosing this answer may need support with understanding why, when a fraction is converted to an equivalent fraction, both the numerator and denominator will change by the same factor. They calculated $1\frac{3}{8} + \frac{4}{5} = 1 + \frac{3+4}{8 \times 5} = 1\frac{7}{40}$; this value is between 1 and $1\frac{1}{2}$.
Incorrect – 2	Students choosing this answer likely added the fractions by adding their numerators and then adding the denominators. Students choosing this answer may need support that uses visual models to help understand the meaning of numerators and denominators of fractions. They calculated $1\frac{3}{8} + \frac{4}{5} = 1 + \frac{3+4}{8+5} = 1\frac{7}{13}$; this value is between $1\frac{1}{2}$ and 2.
Correct – 3	This problem requires students to understand how to add fractions with unlike denominators. To determine the correct response, students should have first found a common denominator for both fractions, then converted each fraction to an equivalent fraction with the same denominator, and then added the whole-number parts and fraction parts, regrouping one whole from the improper fraction and calculating $1\frac{3}{8} + \frac{4}{5} = 1\frac{15}{40} + \frac{32}{40} = 1\frac{47}{40} = 2\frac{7}{40}$; this value is between 2 and $2\frac{1}{2}$.
Incorrect – 4	Students choosing this answer likely used $\frac{5}{4}$ instead of $\frac{4}{5}$ for the number of pounds of carrots in the salad. Students choosing this answer may need to be reminded to be careful when reading the question. They may have added correctly but inverted the second fraction, calculating $1\frac{3}{8} + \frac{5}{4} = 1\frac{3}{8} + \frac{10}{8} = 1\frac{13}{8} = 2\frac{5}{8}$; this value is between $2\frac{1}{2}$ and 3.

Item Information

Item Code: TN127175

Grade Level: 5

Standard Code: 5.NF.A.2

Position No: 24

Standard Text: Solve contextual problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

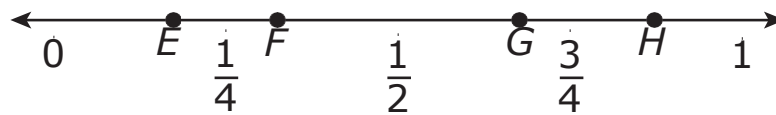
Calculator: Y

Correct Answer: B

Nigel starts working on his math homework. He does $\frac{1}{6}$ of the homework in the

first 10 minutes. Then he does $\frac{1}{5}$ of the homework in the next 10 minutes. The

number line shows points E , F , G , and H . They represent different fractional parts of one whole.



Which point on the number line is closest to the fractional part of Nigel's homework that he does in the first 20 minutes?

- A.** point E
- B.** point F
- C.** point G
- D.** point H

Rationales	
Incorrect – 1	<p>Students choosing this answer likely added the fractions by adding their numerators and denominators. Students choosing this answer may need support understanding why fractions with unlike denominators often need new fractional representations in order to combine them. They added the fractions by adding their numerators and denominators, calculating $\frac{1}{6} + \frac{1}{5} = \frac{1+1}{6+5} = \frac{2}{11}$; this value is greater than 0 but less than $\frac{1}{4}$, so point <i>E</i> is closest.</p>
Correct – 2	<p>This problem requires students to understand how to use benchmark fractions and estimate mentally. To determine the correct response, students should have reasoned that both $\frac{1}{6}$ and $\frac{1}{5}$ are greater than $\frac{1}{8}$, so their sum is greater than $\frac{1}{4}$; at the same time, both $\frac{1}{6}$ and $\frac{1}{5}$ are less than $\frac{1}{4}$, so their sum is less than $\frac{1}{2}$. The point closest to their sum should therefore be between $\frac{1}{4}$ and $\frac{1}{2}$; thus, point <i>F</i> is closest.</p>
Incorrect – 3	<p>Students choosing this answer likely thought that since 6 and 5 are each greater than 4, $\frac{1}{6}$ and $\frac{1}{5}$ are each greater than $\frac{1}{4}$. Students choosing this answer may need support using visual models with the same whole to develop understanding of how unit fractions compare to each other based on their denominators. They reasoned that the sum of two fractions greater than $\frac{1}{4}$ would be greater than $\frac{1}{2}$, though not so large as to be greater than $\frac{3}{4}$; thus, point <i>G</i> is closest.</p>
Incorrect – 4	<p>Students choosing this answer likely considered only the value of the digits greater than one. Students choosing this answer may need support using visual models with the same whole to develop understanding of how unit fractions compare to each other based on their denominators. They reasoned that since 6 and 5 are each greater than 3 and 4, the sum of $\frac{1}{6}$ and $\frac{1}{5}$ must be greater than $\frac{3}{4}$; thus, point <i>H</i> is closest.</p>

Item Information

Item Code: TN691088

Grade Level: 5

Standard Code: 5.MD.C.5.a

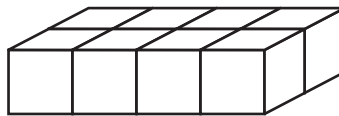
Position No: 25

Standard Text: Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent whole-number products of three factors as volumes (e.g., to represent the associative property of multiplication).

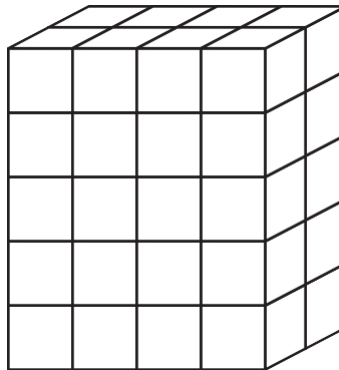
Calculator: Y

Correct Answer: D

Amelia makes a figure out of unit cubes. The first layer of cubes she uses is shown.



Then Amelia adds more layers of cubes. The final figure is shown.



What is the volume, in cubic units, of Amelia's final figure?

- A.** 13
- B.** 28
- C.** 32
- D.** 40

Rationales	
Incorrect – 1	Students choosing this answer likely added the height to the number of unit cubes in each layer instead of multiplying. Students choosing this answer may need support with understanding how the dimensions of a rectangular prism relate to the volume of the prism. They counted 8 cubes in the given layer and added 5, the height of the final figure, for a total of 13 cubes.
Incorrect – 2	Students choosing this answer likely counted only the visible unit cubes in the final figure. Students choosing this answer may benefit from practice identifying all the information provided in a problem and comparing what information is given to the information need to respond to a problem. They disregarded the given layer and focused only on the visible cubes in the final figure: 20 visible cubes in the front layer and 8 visible cubes in the back layer, giving a total of 28 cubes.
Incorrect – 3	Students choosing this answer likely multiplied the number of unit cubes in each layer by the number of additional layers, rather than the height of the final figure. Students choosing this answer may need support with how to interpret a pictures representing three-dimensional objects. They counted 8 cubes in each layer but only accounted for the 4 additional layers when compared to the given layer, thus getting a total of 32 cubes.
Correct – 4	This problem requires students to measure volume by counting unit cubes. To determine the correct value, students should have counted 8 cubes in each layer and a total of 5 layers, for a total of 40 cubes.

Additional Resources

- [Information on Tennessee's Assessment Program](#)
- [Tennessee Academic Standards for Mathematics](#)
- [The eight Standards for Mathematical Practice](#)
- [Best for All Central](#)
- [Assessing Student Learning Reopening Toolkit](#)
- [Assessment Development LiveBinder Resource Site](#)

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