OKLAHOMA SCHOOL TESTING PROGRAM

TEST BLUEPRINT AND ITEM SPECIFICATIONS

GRADE 6 MATHEMATICS

OKLAHOMA Education

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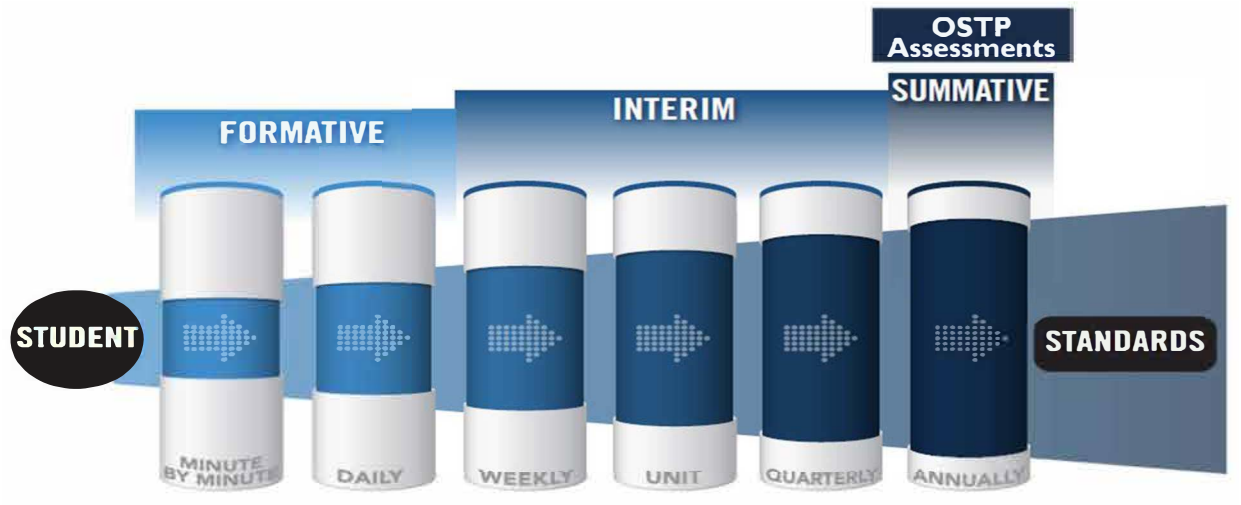
Purpose

A robust assessment system is predicated upon the knowledge that no one assessment is able to provide answers to all questions affecting instructional decisions. An assessment system utilizes different types of assessment to gather multiple pieces of evidence to provide timely, relevant, actionable, and reliable information about what students know and can do relative to a set of standards.

Assessments According to the Oklahoma ESSA Plan

According to page 48 of the Oklahoma ESSA Consolidated State Plan, Oklahoma recognizes that a **robust assessment system** is tied closely to students' learning and teachers' instructional practices by valuing and promoting **local, classroom-based formative assessments** that help make **student learning visible**. At the same time, that system should provide a **strong summative assessment** program that fits as a component within a multifaceted state, district, and school accountability system.



The OSDE supports an assessment system by working with Oklahoma educators and stakeholders to:

- Ensure that state and federally required annual summative assessments delivered through the Oklahoma School Testing Program (OSTP) are effective and meaningful to families, districts, educators, and members of the community;
- Develop instructional resources to support local formative and interim assessments through the curriculum frameworks projects and assessment guidance toolkit; and
- Build and deliver professional learning through face-to-face and web-based resources to support local assessment needs and interpretation of state assessment data.

Annual assessments delivered through the OSTP are aligned to the Oklahoma Academic Standards and can therefore provide point-in-time data for programmatic and curricular decisions by supporting criterion-referenced interpretations at appropriate levels and grain size (e.g., grade, student group, teacher, building/district administrator, state). Standards-based formative and interim assessments conducted at the local level can provide additional information and evidence

of learning at a smaller grain size to inform instructional decisions made at the student and classroom level.

While state summative assessments are only one measure of what students know and can demonstrate, having Oklahoma students take OSTP assessments:

- ✓ Helps students, their families, and the public know how students have grown over time and how they are performing relative to the standards, their peers in Oklahoma, and the nation;
- ✓ Enables teachers to see how their students are performing against grade-level expectations communicated through the Performance Level Descriptors (PLDs) to support evaluation and enhancement of curriculum and programs for the next school year;
- ✓ Provides a standardized and reliable measure for school/district leaders, the state, policymakers, and the public to determine how well a system is meeting the goals of helping every child grow along a continuum to prepare them for careers, college, and life; and
- ✓ Provides comparable information and data to inform continuous improvement of a system and appropriately support federal and state accountability decisions.

Test Structure, Format, and Scoring

The Grade 6 Mathematics test will consist of 50 operational items and 10 field-test items, written at a reading level about two grade levels below a Grade 6 audience. The total 60 items will be divided into two test sections.

Each item is scored as correct or incorrect. Only the 50 operational items contribute to a student's scaled score on the test. Correct and incorrect field test-items do not contribute to a student's score.

The student's raw score is converted to a scaled score using the number correct scoring method.

Test Alignment with Oklahoma Academic Standards (OAS)

Criteria for Aligning the Test with the Oklahoma Academic Standards Content Strands and Standards
1. Categorical Concurrence The test is constructed so that there are at least six items measuring each OAS strand. The number of items, six, is based on estimating the number of items that could produce a reasonably reliable estimate of a student's mastery of the content measured.
2. Range-of-Knowledge Correspondence The test is constructed so that every standard for each OAS strand has at least one corresponding assessment item.
3. Source of Challenge Each test item is constructed in such a way that the major cognitive demand comes directly from the targeted OAS strand or standard being assessed, not from specialized knowledge or cultural background that the test-taker may bring to the testing situation.

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TEST BLUEPRINT MATHEMATICS GRADE 6

This blueprint describes the content and structure of an assessment and defines the ideal number of test items by strand and standard of the Oklahoma Academic Standards (OAS).

IDEAL % OF ITEMS	STRANDS AND STANDARDS
38–42%	**NUMBER AND OPERATIONS** 6.N.1 Number Sense of Integers and Rational Numbers 6.N.2 Addition and Subtraction of Integers 6.N.3 Ratios 6.N.4 Multiplication and Division of Rational Numbers
20–24%	**ALGEBRAIC REASONING AND ALGEBRA** 6.A.1 Algebraic Representations 6.A.2 Algebraic Expressions 6.A.3 Equations and Inequalities
22–26%	**GEOMETRY AND MEASUREMENT** 6.GM.1 Area of Parallelograms and Triangles 6.GM.2 Angle Relationships on Intersecting Lines 6.GM.3 Units of Measurement and Unit Conversions 6.GM.4 Congruency and Symmetry of Transformations
12–16%	**DATA AND PROBABILITY** 6.D.1 Data Analysis 6.D.2 Probability
100%	**TOTAL: 50 ITEMS**

(Please note this blueprint does not include items that may be field-tested.)
A minimum of 6 items is required to report a strand.

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Depth-of-Knowledge Assessed by Test Items

The Grade 6 test will approximately reflect the following "depth-of-knowledge (DOK)" distribution of items:

Depth-of-Knowledge	Percent of Items
Level 1—Recall	15–25%
Level 2—Skills/Concept	65–75%
Level 3—Strategic Thinking	10–20%

DOK Ranges are based on the DOK of the OAS. The standards increase grade-level expectations and rigor, and set expectations for students to be college- and career-ready.

- **Level 1** (Recall and Reproduction) requires the student to recall facts, terms, definitions, or simple procedures, perform simple algorithms or apply formulas. One-step, well-defined, or straight algorithmic procedures should be included at this level.
- **Level 2** (Skills and Concepts) requires the student to make some decisions as to how to approach the problem or activity. Level 2 activities include making observations and collecting data; classifying, comparing, and organizing data; and organizing and displaying data in tables, charts, and graphs.
- **Level 3** (Strategic Thinking) requires reasoning, planning, using evidence, and a higher level of thinking. Level 3 activities include making conjectures, drawing conclusions from observations, citing evidence and developing a logical argument for concepts, explaining phenomena in terms of concepts, and using concepts to solve nonroutine problems.

Note: These descriptions are adapted from Review Background Information and Instructions, Standards and Assessment Alignment Analysis, CCSSO TILSA Alignment Study, May 21–24, 2001, Version 2.0. For an extended description of each depth-of-knowledge level, see the web site at https://sde.ok.gov/sites/default/files/documents/files/Math%20WebbAlign_DOK_Summary_Table.pdf.

Universal Design for Learning (UDL) Considerations

Universal Design for Learning (UDL), as applied to assessments, is a framework that provides flexibility in the way information is presented and in the ways students demonstrate knowledge and skills. This reduces barriers while maintaining high expectations for all students, including students with disabilities and students who are limited English proficient. In the Oklahoma Grade 6 tests, items and instructions have been designed to provide maximum readability, comprehensibility, and legibility for all students. This includes such design aspects as reducing the language load in content areas other than Language Arts, increasing the font size, displaying fewer items per page, and boxing the items to assist visual focus.

Test Administration Details

Online Administration

Test questions will be presented one at a time.

Answers may be selected by using the mouse to click on the radio button to the left of the answer choice.

Navigation buttons appear at the bottom of the page for each question. For longer items, a scroll bar will appear on the right-hand side of the window to allow scrolling through the answer choices.

Tools (including a calculator on the Grade 6 Mathematics assessment) appear at the bottom of the screen/page to aid in answering questions.

Students will be able to use scratch paper for all online assessments. This paper must be collected and destroyed by the test administrator immediately following the test. The test administrator must not look at what the student has written on the scratch paper.

Paper Administration

Paper/pencil testing is used only as a testing accommodation. In the paper/pencil test booklet, any technology-enhanced items that appear in the online test form will be replaced by paired multiple-choice items that target the same constructs.

Students will be able to use scratch paper or blank grid paper for the paper Grade 6 Math test. This paper must be collected and destroyed by the test administrator immediately following the test. The test administrator must not look at what the student has written on the scratch paper.

Estimated Testing Time

This section appears in all of the test specification documents and is provided to give the reader a general sense of the overall testing program at this particular grade level.

Each Grade 6 test is meant to be administered in two sessions within one day with a break given between sessions or on consecutive instructional days. Estimated time for scheduling purposes is given in the table below.

Grade 6 Mathematics Estimated Online Testing Time	
Distributing login information	Approximately 5 minutes
Test instructions/tutorial and reviewing sample items	Approximately 15 minutes
Total:	Approximately 20 minutes
Administering Section 1 of the G6 Mathematics Online Test	Approximately 40 minutes
Administering Section 2 of the G6 Mathematics Online Test	Approximately 40 minutes
Total testing time (Suggested Maximum Time: 200 minutes	**Approximately 100 minutes**

ITEM SPECIFICATIONS

Introduction

The test will consist of a combination of multiple-choice and technology-enhanced items.

Most stems are positively worded—avoiding the use of the word "not." If a negative is required, it is underlined for emphasis (e.g., if a bag has the same number of red, blue, and black marbles, what is the probability that a marble randomly selected from the bag is <u>not</u> red?).

Multiple-Choice Item Specifications

- All items must clearly indicate what is expected in a response and direct students to focus on their responses.
- Each multiple-choice item has a stem (question, statement, and/or graphic component) and four answer options—the correct answer and three distractors. Distractors will be developed based on the types of errors students are most likely to make.
- Multiple-choice item stems ask a question or pose a clear problem so that students will know what to do before looking at the answer choices. Students should not need to read all answer choices before knowing what is expected. A stem will seldom include an incomplete sentence.

Technology-Enhanced Item Specifications

- Technology-Enhanced Items (TEIs) should be used to more authentically address some aspects of the OAS performance expectations and/or provide more opportunity for students to construct rather than select their response.
- Interaction types are match, hot-spot, drag-drop, and drop-down. Each technology-enhanced item contains only one interaction type per item.
- For each TEI, the interaction type used is that which is the most appropriate and enhancing to the construct to be measured.
- Each TEI is structured to contain the question (content) first followed by directions for how to complete the interaction in that item. Consistent style and language are used in these directions (e.g., "Drag the pictures," "Click the object," etc.).

In summary, Grade 6 test items assess whether students understand algebraic concepts and procedures, whether they can communicate their understandings effectively in mathematical terms, and whether they can approach problems and develop viable solutions.

Stimulus Materials

Stimulus materials are the tables, charts, graphs, passages, and illustrations students must use in order to respond to items. The following characteristics are necessary for stimulus materials:

1. A stimulus that gives information must precede a question or a set of questions.
2. When students are given information to evaluate, they should know the question and the purpose of the information.
3. Passages, graphics, tables, etc., provide sufficient information for assessment of multiple objectives.
4. Stimulus materials for a set of items may be a combination of multiple stimuli.
5. Information in stimulus materials is based on situations students would encounter in or beyond school.

6. For conceptual items, stimulus materials are necessary but not conceptually sufficient for student response.
7. There is a balance of graphic and textual stimulus materials within a test form. Approximately 50 percent of the items will have appropriate pictorial or graphical representations. Graphs, tables, or figures are clearly associated with their intended items.

   The stimulus and question will appear on the screen at the same time.

General Considerations—Oklahoma School Testing Program

1. Items deal with issues and details that are of consequence in the stimulus and central to students' understanding and interpretation of the stimulus.
2. Test items are varied and address all OAS standards listed in the Test Blueprint.
3. To the greatest extent possible, no item or response choice clues the answer to any other item.
4. All items reviewed and approved by the Oklahoma Item Review Committee are assigned an OAS strand, standard, and/or objective. The Test Blueprints and score reports reflect the degree to which each OAS strand and standard is represented on the test.
5. Test items are tied closely and particularly to the stimuli from which they derive, so that the impact of outside (prior) knowledge, while never wholly avoidable, is minimized.
6. Each multiple-choice item contains a question and four answer options, only one of which is correct. Correct answers will be approximately equally distributed among answer options.
7. Distractors adopt the language and sense of the material in the stimuli so that students must think their way to the correct answer rather than simply identify incorrect responses by virtue of a distractor's obviously inappropriate nature.
8. Distractors should always be plausible (but, of course, incorrect) in the context of the stimulus. Students should not be able to rule out a wrong answer or identify a correct response solely because it looks different from the other answer choices.
9. Order of presentation of item types is dictated by logic (chronological, spatial, etc.).
10. Items are worded precisely and clearly. The better focused an item, the more reliable and fair it is certain to be, and the more likely all students will understand it in the same way.
11. The range of items measuring an OAS standard consisting of more than one skill will provide a balanced representation of those skills.
12. Items should be focused on what all students should know and be able to do as they complete their Grade 6 coursework.
13. The responses "Both of the above," "All of the above," "None of the above," and "Neither of the above" will not be used.
14. The material presented is balanced, culturally diverse, well written, and of interest to Grade 6 test level students. The stimuli and items are fairly presented in order to gain a true picture of students' skills.
15. Across all forms, a balance of gender and active/passive roles by gender is maintained.
16. Forms attempt to represent the ethnic diversity of Oklahoma students.
17. Approved calculators and the provided formula sheet may be used on the Grade 6 Mathematics test. No other resource materials may be used by students during the test. The calculator policy and formula sheet can be found at https://sde.ok.gov/documents/ostp-accommodation-manuals-companion-documents.

18. Accommodations, designated features embedded in the online testing platform, and paper-based test formats are available for students with an indicated need per their IEP or 504 Plan.
19. The stimuli avoid subject matter that might prompt emotional distress on the part of the students.
20. Permission to use stimuli from copyrighted material is obtained as necessary by testing vendor.

Considerations Specific to the Grade 6 Mathematics Test

It is necessary to create test items that are reliable, fair, and targeted to the Oklahoma Academic Standards listed on the following pages. There are some general considerations and procedures for effective item development.

These considerations include, but are not limited to, the following:

1. Each test form contains items assessing all content standards.
2. Test items that assess each standard are not limited to one particular type of response format.
3. Test questions attempt to focus on content that is authentic and that Grade 6 level students can relate to and understand.
4. Test items are worded precisely and clearly. The better focused an item, the more reliable and fair it is likely to be, and the more likely all students will understand what is required of them.
5. All items are reviewed to eliminate language that shows bias or that would otherwise likely disadvantage a particular group of students. That is, items do not display unfair representations of gender, race, ethnicity, disability, culture, or religion; nor do items contain elements that are offensive to any such groups.
6. Items are written so that calculations are kept to a minimum, and numbers are selected to minimize the time spent on computations.
7. All test items and answer choices have appropriate labels and units.
8. Most graphs are placed on a gray grid, with the x- and y-axes labeled and marked.

All items developed using these specifications are reviewed annually by Oklahoma educators and approved by the Oklahoma State Department of Education. The distribution of newly developed items is based on difficulty, cognitive ability, percentage of art/graphics, and grade-level appropriateness as determined by an annual Item Development Plan approved by the Oklahoma State Department of Education.

Overview of Item Specifications

For each OAS strand, item specifications are organized under the following headings:

- OAS Strand
- OAS Standard
- OAS Objectives
- Item Specifications
    a. Emphasis
    b. Stimulus Attributes
    c. Format
    d. Content Limits
    e. Primary Process Standard(s)
    f. Distractor Domain
    g. Sample Test Items

The headings "OAS Strand" and "OAS Standard" state the OAS strand followed by the OAS standard being measured in the mathematics section of the Oklahoma Academic Standards document.

For each standard, the information under the heading "Item Specifications" highlights important points about a test item's emphasis, format, content limits, and distractor domain. Sample test items are provided with each strand to illustrate these specifications. Although it is sometimes possible to score single items for more than one concept, all items in these tests are written to address a single objective as the primary concept.

Note: With the exception of content limits, the Item Specifications offer suggestions of what might be included and do not provide an exhaustive list of what can be included. For this reason, Item Specifications are only meant to be a supplemental resource for classroom instruction.

In addition, the sample test items are not intended to be definitive in nature or construction—the stimuli and the test items that follow them may differ from test form to test form, as may their presentations. Sample test items are not intended to predict a student's performance on the actual test, but rather to allow students to familiarize themselves with the item types and formats that they may see on the test.

STANDARDS & SAMPLE ITEMS

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.1

OAS STANDARD	**6.N.1**	Read, write, and represent integers and rational numbers expressed as fractions, decimals, percents, and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations.
OAS OBJECTIVES	**6.N.1.1**	Represent integers with counters and on a number line and rational numbers on a number line, recognizing the concepts of opposites, direction, and magnitude; use integers and rational numbers in real-world and mathematical situations, explaining the meaning of 0 in each situation.
	6.N.1.2	Compare and order positive rational numbers, represented in various forms, or integers using the symbols <, >, and =.
	6.N.1.3	Explain that a percent represents parts "out of 100" and ratios "to 100."
	6.N.1.4	Determine equivalencies among fractions, decimals, and percents. Select among these representations to solve problems.
	6.N.1.5	Factor whole numbers and express prime and composite numbers as a product of prime factors with exponents.
	6.N.1.6	Determine the greatest common factors and least common multiples. Use common factors and multiples to calculate with fractions, find equivalent fractions, and express the sum of two-digit numbers with a common factor using the distributive property.
ITEM SPECIFICATIONS	**Emphasis:** • Demonstrate the ability to represent integers with counters and on a number line. • Demonstrate the ability to represent rational numbers on a number line. • Demonstrate a working knowledge of the concepts of opposites, direction, and magnitude. • Demonstrate the ability to use integers and rational numbers in real-world and mathematical situations. • Demonstrate the ability to explain the meaning of zero in real-world situations. • Demonstrate a working knowledge of positive and negative integers to solve problems in mathematical and real world contexts. • Demonstrate the ability to convert, compare, and order rational numbers or integers. • Demonstrate the ability to convert between a fraction, a decimal, and a percent to solve a problem. • Demonstrate an understanding of percent and what it represents. • Demonstrate an understanding of prime and composite numbers as a product of prime factors with exponents. • Demonstrate the ability to find the greatest common factors and least common multiples. • Demonstrate the ability to use common factors and multiples to calculate with fractions, find equivalent fractions, and express the sum of two-digit numbers with a common factor using the distributive property.	

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.1

ITEM SPECIFICATIONS

Stimulus Attributes:

- Test items may include illustrations of the following: graphs, charts, coordinate graphs, number lines, balances, rulers, thermometers, calculator displays, tables, data sets; line, bar, and circle graphs; other diagrams, 10 x 10 grids, 1000's blocks, and fraction strips.

Format:

- Represent integers with counters and on a number line
- Represent rational numbers on a number line
- Communicate the concepts of opposites, direction, and magnitude
- Identify and compare representations of positive and negative integers in real-life contexts, explaining the meaning of 0 in each situation
- Convert between and among numerical representations of decimals, fractions, and percents
- Compare and order two or more decimals, fractions, or percents
- Explain how a percent represents parts "out of 100" and ratios "to 100"
- Write positive integers as products of factors
- Factor whole numbers
- Find the greatest common factor
- Find the least common multiple
- Use common factors and multiples to calculate with fractions
- Use common factors to find equivalent fractions
- Use common factors to express the sum of two-digit numbers with a common factor using the distributive property
- Items may include fractions with different denominators

Content Limits:

- Limit integers to 4 digits
- Limit integers and rational numbers to decimals, fractions, percents, and ratios
- Limit fractions to halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths
- Limit decimals to 1000ths place
- Limit percents to up to and including 100 percent
- Limit real-world and mathematical contexts to age appropriate situations

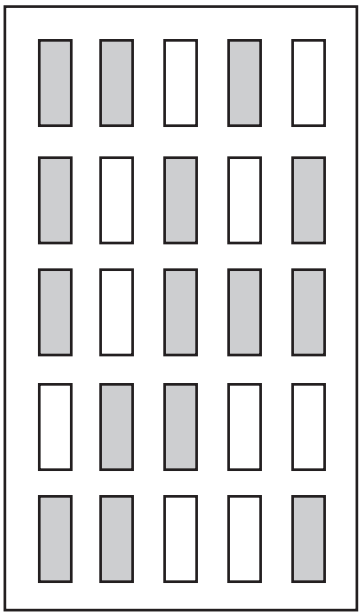
Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect comparisons
- Misidentification of integers
- Incorrect procedures
- Computational errors
- Misunderstanding of mathematical symbols

1 **The office building shown has shaded windows for the rooms in which the lights are turned off.**



What portion of the rooms have their lights turned off?

A $\frac{2}{3}$

B $\frac{3}{4}$

C 15%

D 60%

Standard: 6.N.1.4 Determine equivalencies among fractions, decimals, and percents. Select among these representations to solve problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to find the number of rooms with lights turned off and then express this as a fraction.

Distractor Rationale:

A. The student saw that on the top or bottom floor there are 2 unshaded windows and 3 shaded windows.
B. Balance distractor
C. The student found the number of shaded windows, 15, and thought this meant 15%.
D. **Correct. The student demonstrated an ability to determine equivalency among a fraction and a percent to solve a problem.**

2 **Four friends played a game. At the end of the game, their scores were −8, −2, 1, and −3. What is the lowest score?**

A −8

B −2

C 1

D −3

Standard: 6.N.1.1 Represent integers with counters and on a number line and rational numbers on a number line, recognizing the concepts of opposites, direction, and magnitude; use integers and rational numbers in real-world and mathematical situations, explaining the meaning of 0 in each situation.

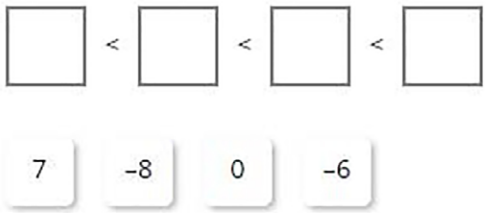
Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to complete a simple procedure, comparing numbers and identifying the lowest.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to recognize the concept of magnitude by ordering numbers.**
B. Student knew –2 was smaller than 1, but thought since 2 < 8, –2 must be smaller than –8.
C. The student chose the smallest number, ignoring the negative signs.
D. Possible response

3 **Drag the integers into the spaces in order from least to greatest.** To drag an integer, click and hold the integer, and then drag it to the desired space. To change an integer, click and hold it, and then drag it back to the desired space.



Standard: 6.N.1.2 Compare and order positive rational numbers, represented in various forms, or integers using the symbols <, >, and =.

Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to complete a simple procedure, ordering numbers from smallest to largest.

Sample Distractor Rationales:

Correct

–8 < –6 < 0 < 7

Incorrect

0 < –6 < 7 < –8

The student ignored the negative signs.

–6 < –8 < 0 < 7

The student knew that the negative numbers were smaller, but didn't know how to order –6 and –8.

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.2

OAS STANDARD	**6.N.2**	Add and subtract integers in order to solve real-world and mathematical problems.
OAS OBJECTIVES	**6.N.2.1**	Estimate solutions to addition and subtraction of integers problems in order to assess the reasonableness of results.
	6.N.2.2	Illustrate addition and subtraction of integers using a variety of representations.
	6.N.2.3	Add and subtract integers; use efficient and generalizable procedures including but not limited to standard algorithms.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate an ability to assess the reasonableness of results of estimated solutions to addition and subtraction of integers problems.
- Demonstrate a working knowledge of positive and negative integers to solve problems in mathematical and real-world contexts.
- Demonstrate the ability to represent addition and subtraction of integers through illustration.
- Demonstrate the ability to add and subtract integers.

Stimulus Attributes:

- Test items may include illustrations of coordinate graphs, number lines, balances, deposits and withdrawals, rulers, thermometers, tables, graphs, charts, maps, data sets, and other diagrams.

Format:

- Assess the reasonableness of results by estimating solutions to addition and subtraction of integers problems
- Select, apply, and justify the use of the basic operations on positive and negative integers to solve problems in mathematical, geometric, and real-world contexts
- Use illustrations to represent addition and subtraction of integers

Content Limits:

- Limit operations to addition and subtraction

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.2

ITEM SPECIFICATIONS

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Incorrect representation of problem

4 **Eli's family had $60 for a party. They spent $28 on food. They were given an additional $10. This expression shows how much money, in dollars, Eli's family has available for the party.**

$$60 + (-28) + 10$$

How much money does Eli's family have available for the party?

A $22

B $42

C $58

D $98

Standard: 6.N.2.3 Add and subtract integers; use efficient and generalizable procedures including but not limited to standard algorithms.

Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to complete a simple procedure, adding and subtracting integers.

Distractor Rationale:

A. The student subtracted 10 instead of added 10.

B. Correct. The student demonstrated an ability to add and subtract integers.

C. Balance distrctor

D. The student ignored the negative sign on 28.

5 **The temperature at a location was −12° Fahrenheit (°F). The table shows the changes in temperature over the next 4 hours.**

Changes in Temperature

Hour	Change in Temperature (°F)
1	4
2	−3
3	−5
4	3

What is the temperature at the end of the 4th hour?

A −13°F

B −11°F

C 11°F

D 13°F

Standard: 6.N.2.3 Add and subtract integers; use efficient and generalizable procedures including but not limited to standard algorithms.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to extract information from the table and then add and subtract integers.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to add and subtract integers.**
B. Balance distractor
C. The student missed the negative on −12.
D. The student computed −12 + 4 − 3 − 5 + 3 = −13, but then forgot the negative sign for the answer.

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.3

OAS STANDARD

6.N.3 Understand the concept of ratio and its relationship to fractions and percents and to the multiplication and division of whole numbers. Use ratios to solve real-world and mathematical problems.

OAS OBJECTIVES

6.N.3.1 Identify and use ratios to compare quantities. Recognize that multiplicative comparison and additive comparison are different.

6.N.3.2 Determine the unit rate for ratios.

6.N.3.3 Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixture and concentrations.

6.N.3.4 Use multiplicative reasoning and representations to solve ratio and unit rate problems.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate the ability to identify and use ratios to compare quantities.
- Demonstrate an understanding of the difference between multiplicative comparison and additive comparison.
- Demonstrate the ability to find the unit rate for ratios.
- Demonstrate the ability to use ratio and proportional relationships to estimate and solve mathematical and real-world problems.
- Demonstrate the ability to solve percent application problems in mathematical and real-world contexts.
- Demonstrate the ability to solve ratio and unit rate problems using multiplicative reasoning.

Stimulus Attributes:

- Test items may include: illustrations of coordinate graphs, number lines, balances, two- and three-dimensional geometric figures; illustrations of rulers, thermometers, beakers, and other measuring instruments; calculator displays, tables, graphs, charts, maps, scale drawings, frequency charts; line, bar, and picture graphs; Venn diagrams; stem-and-leaf plots, box-and-whisker plots, scatter plots; histograms, circle graphs, data sets, spinners, and other diagrams.

Format:

- Select and use ratios to compare quantities
- Identify the difference between multiplicative comparison and additive comparison
- Select the unit rate for ratios
- Select and apply ratios and proportions to solve problems in mathematical, geometric, and real-world contexts
- Select and apply ratios and proportions among other methods to solve percent application problems in mathematical, geometric, and real-world contexts
- Use multiplicative reasoning and representations to solve ratio and unit rate problems

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.3

ITEM SPECIFICATIONS

Content Limits:

- Limit number of variables in a proportion to one
- Limit real-world contexts to age-appropriate situations
- Limit decimal points to the thousandths

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop a Deep and Flexible Conceptual Understanding

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Use of incorrect equivalencies

6 **In a survey of 292 students, about 9.9% have attended more than one play. Which is closest to the number of students in the survey who have attended more than one play?**

A 3 students

B 10 students

C 20 students

D 30 students

Standard: 6.N.3.3 Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixture and concentrations.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to determine how to solve the problem and then find the closest, not the exact, answer.

Distractor Rationale:

A. The student confused 10% and 1%

B. The student thought 10% was the same as 10 students.

C. The student rounded 292 to 200.

D. **Correct. The student demonstrated an ability to apply the relationship between ratios and percents to solve a problems with a real-world context.**

7 **During soccer practice, the goalie blocked 72% of the shots attempted by the opponents. If the goalie blocked a total of 18 shots, how many total shots were attempted?**

A 5

B 13

C 20

D 25

Standard: 6.N.3.3 Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixture and concentrations.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to decide how to approach the problem, finding the total number of shots attempted when given the percentage and number of shots blocked.

Distractor Rationale:

A. The student found 28% of 18, then rounded to the nearest whole number.

B. The student found 72% of 18, then rounded to the nearest whole number.

C. Balance distractor

D. **Correct. The student demonstrated an ability to apply the relationships between ratios, equivalent fractions, and percents to solve a real-world problem.**

8

A student has a box of crayons. The table shows the color and number of crayons in the box.

Crayons in a Box

Color	Number
Blue	5
Red	9
Green	7
Yellow	1

Select the color or ratio that best completes each statement. To select a word or color, click the menu and then click the desired color or ratio. To choose a different color or ratio, click the menu and click the new color or ratio.

Based on the information in the table, the ratio of -Select an Answer- crayons to -Select an Answer- crayons in the box is -Select an Answer-.

Based on the information in the table, the ratio of blue crayons to -Select an Answer- s -Select an Answer-.

blue
red
green
yellow

Based on the information in the table, the ratio of -Select an Answer- crayons to -Select an Answer- crayons in the box is -Select an A

-Select an Answer-
blue
red
green
yellow

Based on the information in the table, the ratio of -Select an Answer- crayons to -Select an Answer- crayons in the box is -Select an Answer-.

-Select an Answer-
1 to 9
5 to 8
7 to 6
14 to 1

Standard: 6.N.3.1 Identify and use ratios to compare quantities. Recognize that multiplicative comparison and additive comparison are different.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to compare many different colors of crayons using ratio.

Sample Distractor Rationales:

Correct

Based on the information in the table, the ratio of yellow crayons to red crayons in the box is 1 to 9.

Incorrect

Based on the information in the table, the ratio of blue crayons to red crayons in the box is: 5 to 8.

The student found the correct number for blue, but chose an incorrect number for red.

Based on the information in the table, the ratio of green crayons to yellow crayons is: 1 to 9.

The student did not understand that the order of the crayons in the ratio is important.

Based on the information in the table, the ratio of green crayons to yellow crayons is: 7 to 6.

The student's ratio showed green crayons to green minus yellow crayons.

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.4

OAS STANDARD	**6.N.4**	Multiply and divide decimals, fractions, and mixed numbers; solve real-world and mathematical problems with rational numbers.
OAS OBJECTIVES	**6.N.4.1**	Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers and use the estimates to assess the reasonableness of results in the context of the problem.
	6.N.4.2	Illustrate multiplication and division of fractions and decimals to show connections to fractions, whole number multiplication, and inverse relationships.
	6.N.4.3	Multiply and divide fractions and decimals using efficient and generalizable procedures.
	6.N.4.4	Solve and interpret real-world and mathematical problems including those involving money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers.
ITEM SPECIFICATIONS	**Emphasis:** • Demonstrate the ability to find the solution to problems involving rational numbers • Demonstrate the ability to estimate the solution to problems involving rational numbers • Demonstrate the ability to use an estimate to determine the reasonableness of answer • Demonstrate the understanding of multiplication and division of fractions and decimals by using illustrations • Demonstrate the ability to find products and quotients using fractions and decimals • Demonstrate the ability to solve and interpret real-world and mathematical problems involving multiplication and division of fractions and decimals **Stimulus Attributes:** • Test items may include illustrations of the following: number lines, 10 x 10 grids, base-10 blocks, cubes, other counting manipulatives, balances, two-dimensional geometric figures, tables, graphs, charts, maps, scale drawings, bar graphs, picture graphs, data sets, and other diagrams.	

OAS STRAND—NUMBER & OPERATIONS (N): STANDARD 6.N.4

ITEM SPECIFICATIONS

Format:

- Use estimation strategies to solve mathematical and real-world problems involving whole numbers, decimal numbers, fractions, and percents
- Use estimation strategies to determine the soundness of solutions to mathematical and real-world problems involving whole numbers, decimal numbers, fractions, and percents
- Items may include fractions with different denominators
- Use graphs, grids, and other representations of fractions and decimals to illustrate problems involving products and quotients
- Multiply decimals with one- or two-digit multipliers
- Divide whole numbers by two-digit divisors with and without remainders expressed as whole numbers or fractions
- Divide decimals by two-digit divisors without remainder
- Use estimation strategies to solve mathematical and real-world problems involving money, measurement, geometry, and data requiring multiplication and division with decimals, fractions, and mixed numbers
- Interpret the solution to mathematical and real-world problems involving money, measurement, geometry, and data requiring multiplication and division with decimals, fractions, and mixed numbers

Content Limits:

- Limit numbers to whole numbers, decimal numbers, fractions, and mixed numbers
- Limit decimals to the 1000ths place
- Limit fractions to halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths
- Limit operations to multiplication and/or division
- Limit mathematical and real-world contexts to age-appropriate situations
- Limit dividends to four digits
- Limit multiplicands to three digits
- Limit multi-step problems to three operations

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Use of incorrect equivalencies
- Rounding errors
- Error in expression of remainder as fraction

9 **Mr. Lopez bought several types of meat for a party. The amount, in pounds, of each type he bought is shown in the table.**

Meats

Type	Amount (pounds)
ham	2.53
pastrami	0.44
turkey	3.61
roast beef	1.49
salami	1.92

Which is closest to the total amount of meat Mr. Lopez bought?

A 7 pounds

B 8 pounds

C 10 pounds

D 12 pounds

Standard: 6.N.4.4 Solve and interpret real-world and mathematical problems including those involving money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers.

Depth-of-Knowledge: 2

This item is a DOK 2 because the student must extract the information from the table and then find the closest, not the exact, answer.

Distractor Rationale:

A. The student ignored the decimals and added the numbers in the ones places only.

B. The student ignored the decimals and added the numbers in the ones places only and then added 1 more to account for the decimals.

C. Correct. The student demonstrated an ability to estimate the solution to an addition of integers problem.

D. The student rounded each amount up to the next whole number and then added.

10 **A $4\frac{1}{2}$-pound bag of jellybeans is shared equally by 6 friends. What amount of jellybeans does each friend get?**

A $\frac{1}{2}$ pound

B $\frac{3}{4}$ pound

C $1\frac{1}{6}$ pounds

D $1\frac{1}{3}$ pounds

Standard: 6.N.4.3 Multiply and divide fractions and decimals using efficient and generalizable procedures.

Depth-of-Knowledge: 2

This item is a DOK 2 because the student must use a strategy to divide a mixed number by a whole number, resulting in a fractional answer.

Distractor Rationale:

A. The student chose a denominator of 2 because the original mixed number had a denominator of 2.

B. Correct. The student demonstrated an ability to divide a mixed number by a whole number.

C. The student chose a denominator of 6 because the jellybeans will be shared equally by 6 friends.

D. Balance distractor

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD 6.A.1

OAS STANDARD

6.A.1 Recognize and represent relationships between varying quantities; translate from one representation to another; use patterns, tables, graphs and rules to solve real-world and mathematical problems.

OAS OBJECTIVES

6.A.1.1 Plot integer- and rational-valued (limited to halves and fourths) ordered-pairs as coordinates in all four quadrants and recognize the reflective relationships among coordinates that differ only by their signs.

6.A.1.2 Represent relationships between two varying quantities involving no more than two operations with rules, graphs, and tables; translate between any two of these representations.

6.A.1.3 Use and evaluate variables in expressions, equations, and inequalities that arise from various contexts, including determining when or if, for a given value of the variable, an equation or inequality involving a variable is true or false.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate a working knowledge of the location of points on a coordinate grid.
- Demonstrate the ability to plot ordered-pairs as coordinates on a coordinate grid.
- Demonstrate an understanding of the reflective relationships among coordinates that differ only by their signs.
- Demonstrate the ability to identify and analyze number patterns from a variety of sources; identify and develop algebraic rules for number patterns.
- Demonstrate the ability to use variables to represent algebraic relationships.
- Demonstrate the ability to write and solve simple linear equations for mathematical and real-world contexts.
- Demonstrate the ability to use variables to represent quantities in expressions, equations, and inequalities including non-strict inequalities.
- Demonstrate the ability to use the order of operations to find the value of an algebraic expression.
- Demonstrate the ability to write and evaluate simple equations, expressions, and inequalities for mathematical and real-world contexts.

Stimulus Attributes:

- Test items may include illustrations of the following: sequences, coordinate graphs, number lines, balances, calculator displays, two-dimensional geometric figures, protractors, geoboards, other geometric manipulatives, tables, graphs, charts, diagrams, maps, data sets, other diagrams, counting manipulatives, equivalency statements, and algebraic expressions.

Format:

- Plot points for identified coordinates on a coordinate plane or map
- Identify the reflective relationships among coordinates that differ only by their signs
- Identify and analyze patterns of numbers from graphs, sequences, tables, and other data sources
- Identify missing numbers in number patterns

ITEM SPECIFICATIONS

Format continued:

- Use variables to generalize a number pattern algebraically
- Use variables to develop rules which describe a pattern of numbers algebraically
- Write algebraic expressions for mathematical and real-world contexts
- Model and translate among algebraic and pictorial representations of simple linear equations
- Write and evaluate linear equations involving mathematical and real-world contexts
- Evaluate one-step linear inequalities
- Identify one-step inequalities that model mathematical and real-world situations
- Use variables as unknowns
- Substitute numerical values for variables in algebraic expressions
- Use the rules for order of operations with rational numbers to find the value of algebraic expressions
- Items may include parentheses
- Model and translate among algebraic and pictorial representations of simple linear equations

Content Limits:

- Use all four quadrants
- Limit required operations to addition, subtraction, multiplication, and division
- Limit description of rules to one variable
- Limit to one variable in expressions, equations, and inequalities
- Limit coefficients to whole numbers or common fractions. Limit fractional coefficients to halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths.
- Limit inequalities to one step
- Limit multiplication and division to positive rational numbers
- Limit operations to addition, subtraction, multiplication, and division
- Limit values of the variable to up to two-digit whole numbers
- Limit equations to two steps

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Incorrect interpretation of data display
- Order of operations errors
- Inappropriate operations with variables

11 **The table shows the total number of pictures Cal took by the end of each week.**

Cal's Pictures

Week (w)	Total Number of Pictures
1	4
2	8
3	12
4	16

Based on this pattern, which expression can be used to find the total number of pictures Cal took by the end of *w* weeks?

A $2 \bullet w$

B $4 \bullet w$

C $w + 12$

D $4 \bullet w + 4$

Standard: 6.A.1.2 Represent relationships between two varying quantities involving no more than two operations with rules, graphs, and tables; translate between any two of these representations.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to first figure out the pattern presented in a table and then explain the relationship between terms in the pattern using an algebraic expression.

Distractor Rationale:

A. The student saw that the total number of pictures doubled from week 1 to week 2.

B. **Correct. The student demonstrated an ability to represent a real-world situation using an expression involving a variable.**

C. The student added the values from week 1 and week 2 to get 12.

D. The student thought you had to add the 4 from week 1.

12 **Ms. Jones wrote this rule on the board.**

"a number, *n*, increased by eighteen"

Which expression represents the rule Ms. Jones wrote on the board?

A $n + 18$

B $n - 18$

C $n \bullet 18$

D $n \div 18$

Standard: 6.A.1.3 Use and evaluate variables in expressions, equations, and inequalities that arise from various contexts, including determining when or if, for a given value of the variable, an equation or inequality involving a variable is true or false.

Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to complete a simple procedure, turning a expression given in words into an algebraic expression.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to write an expression with a variable from a rule given in words.**
B. The student used the wrong operation.
C. The student used the wrong operation.
D. The student used the wrong operation.

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD 6.A.2

OAS STANDARD

6.A.2 Use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving positive rational numbers.

OAS OBJECTIVES

6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to solve real-world and mathematical problems.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate the ability to generate equivalent expressions for mathematical and real-world contexts.
- Demonstrate the ability to evaluate expressions for mathematical and real-world contexts.
- Demonstrate the ability to use the commutative, associative, and distributive properties to find the value of a numerical expression.
- Demonstrate the ability to use the order of operations to find the value of a numerical expression.

Stimulus Attributes:

- Test items may include coordinate graphs, number lines, calculator displays, tables, graphs, charts, data sets, equivalency statements, and algebraic expressions.

Format:

- Write and solve equivalent expressions involving mathematical and real-world contexts
- Use the rules for order of operations with rational numbers to find the value of expressions
- Use the commutative, associative, and distributive properties to find the value of a numerical expression
- Items may include exponents and parentheses

Content Limits:

- Limit coefficients of variables to positive integers and fractions
- Limit fractional coefficients to halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths
- Limit exponents to natural numbers
- Limit decimals to the hundredths place
- Limit real-world and mathematical contexts to age appropriate situations

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD 6.A.2

ITEM SPECIFICATIONS

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Order of operations errors

13 **What is the value of this expression?**

$$10 \div (2 + 3) \times 5 - 3$$

A 4

B 7

C 17

D 37

Standard: 6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to evaluate a multi-step expression using the order of the operations.

Distractor Rationale:

A. Balance distractor

B. **Correct. The student demonstrated an ability to evaluate an expression using positive rational numbers by applying the order of operations.**

C. The student computed (10 ÷ 2) + (3 × 5) − 3.

D. The student computed from left to right, ignoring the order of operations.

14 **What is the value of this numerical expression?**

$$3.27 + 4.06 \times 2 - (3.19 - 0.18)$$

A 11.65

B 11.29

C 8.38

D 8.02

Standard: 6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to evaluate a multi-step expression using the order of the operations.

Distractor Rationale:

A. The student computed what was in the parenthesis first and then computed from left to right ignoring, the order of operations.

B. The student computed from left to right, ignoring the order of operations and the parenthesis.

C. Correct. The student demonstrated an ability to evaluate an expression using the order of operations.

D. The student performed the multiplication first and then computed from left to right, ignoring the order of operations.

15

Match the expression in the left column to each equivalent expression in the right column. To connect expressions, click an expression in the left column and then an expression in the right column, and a line will automatically be drawn between them. To remove a connection, hold the pointer over the line until it turns red, and then click it. Each expression in the left column matches to only one expression in the right column.

5(6 + 8)	40 + 48
48 + 30	8 + 30
(5 + 6) x 8	6(5 + 8)
5 + 48	40 + 30
6 x 5 + 8	5 + 6 x 8

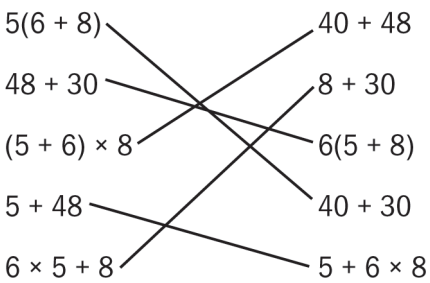
Standard: 6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

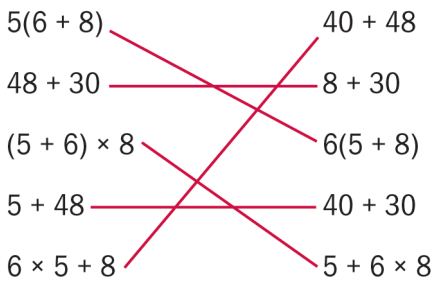
This item is a DOK 2 because it requires the student to find equivalent representations of expressions using different properties.

Sample Distractor Rationales:

Correct



Incorrect



The student did not know how to apply the distributive property.

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD 6.A.3

OAS STANDARD

6.A.3 Use equations and inequalities to represent real-world and mathematical problems and use the idea of maintaining equality to solve equations. Interpret solutions in the original context.

OAS OBJECTIVES

6.A.3.1 Represent real-world or mathematical situations using expressions, equations, and inequalities involving variables and rational numbers.

6.A.3.2 Use number sense and properties of operations and equality to solve real-world and mathematical problems involving equations in the form $x + p = q$ and $px = q$, where x, p, and q are nonnegative rational numbers. Graph the solution on a number line, interpret the solution in the original context, and assess the reasonableness of the solution.

ITEM SPECIFICATIONS

Emphasis:

- Use variables to express real-world or mathematical situations algebraically.
- Demonstrate the ability to write and solve expressions, equations, and inequalities for mathematical and real-world contexts.
- Demonstrate the ability to interpret the solution of an equation in the original context of the problem.
- Demonstrate the ability to assess the reasonableness of a solution of an equation.

Stimulus Attributes:

- Test items may include illustrations of the following: coordinate graphs, number lines, calculator displays, tables, graphs, charts, and data sets.

Format:

- Write algebraic expressions for mathematical and real-world contexts
- Write algebraic equations for mathematical and real-world contexts
- Write algebraic inequalities for mathematical and real-world contexts
- Model and translate among algebraic and pictorial representations of simple linear equations
- Use variables as unknowns
- Substitute numerical values for variables in algebraic expressions, equations, and inequalities
- Use the properties of operations with rational numbers to find the value of algebraic expressions, equations, and inequalities
- Items may include parentheses
- Model and translate among algebraic and pictorial representations of simple linear equations, including graphing the solution on a number line
- Use the original context to interpret the solution
- Assess the reasonableness of the solution
- Write and solve equations in the form of $x + p = q$ and $px = q$, where x, p, and q are nonnegative rational numbers, involving mathematical and real-world contexts

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD 6.A.3

ITEM SPECIFICATIONS

Content Limits:

- Limit to one variable in expressions, equations, and inequalities
- Limit operations to addition, subtraction, multiplication, and division
- Limit values of the variable to up to two-digit whole numbers
- Limit equations and inequalities to one step
- Limit coefficients of variables to positive whole numbers and fractions
- Limit fractional coefficients to halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths
- Limit real-world and mathematical contexts to age appropriate situations

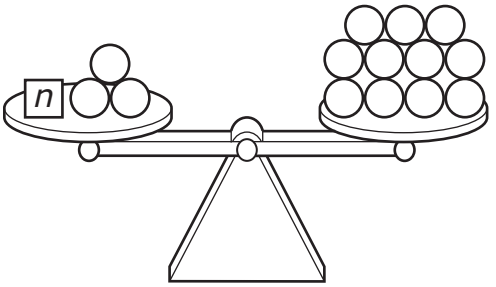
Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Order of operations errors

16 **Yanni balanced a scale as shown.**



How many ◯s equal $\boxed{n}$?

A 3

B 8

C 11

D 14

Standard: 6.A.3.1 Represent real-world or mathematical situations using expressions, equations, and inequalities involving variables and rational numbers.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to use a balance scale to determine the value of one object in relation to another object.

Distractor Rationale:

A. The student focused on the 3 circles on the left side of the balance scale.

B. Correct. The student demonstrated an ability to represent a mathematical situation using an equation.

C. The student added the 8 circles on the right to the 3 on the left.

D. The student added the 8 circles on the right to the 3 on the left and then added 3 more for the value of *n*.

17 **A student survey showed there were more dog owners than cat owners. There were 21 cat owners in the survey. If *d* represents the number of dog owners, which inequality shows the relationship between the number of dog and cat owners in this survey?**

A $d > 21$

B $d \geq 21$

C $d < 21$

D $d \leq 21$

Standard: 6.A.3.1 Represent real-world or mathematical situations using expressions, equations, and inequalities involving variables and rational numbers.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to translate a verbal description of a real-life situation into an inequality.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to represent a real-world situation using an expression involving a variable.**
B. The student thought that the number of dog owners could be the same as the number of cat owners or did not understand what the greater than or equal to symbol means.
C. The student confused the less than and greater than symbols.
D. The student confused the less than and greater than symbols and thought that the number of dog owners could be the same as the number of cat owners or did not understand what the less than or equal to symbol means.

18 **Carly has $10. She used this equation to determine how many tickets, *n*, she can buy.**

$$2 \bullet n = 10$$

How many tickets can Carly buy?

A 5 tickets

B 8 tickets

C 12 tickets

D 20 tickets

Standard: 6.A.3.2 Use number sense and properties of operations and equality to solve real-world and mathematical problems involving equations in the form $x + p = q$ and $px = q$, where x, p, and q are nonnegative rational numbers. Graph the solution on a number line, interpret the solution in the original context, and assess the reasonableness of the solution.

Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to complete a simple procedure, solving for a variable in an equation.

Distractor Rationale:

A. Correct. The student demonstrated an ability to solve a real-world problem involving an equation with one variable.

B. The student computed 10 − 2.

C. The student computed 10 + 2.

D. The student computed 10 × 2.

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.1

OAS STANDARD

6.GM.1 Calculate area of squares, parallelograms, and triangles to solve real-world and mathematical problems.

OAS OBJECTIVES

6.GM.1.1 Develop and use formulas for the area of squares and parallelograms using a variety of methods including but not limited to the standard algorithm.

6.GM.1.2 Develop and use formulas to determine the area of triangles.

6.GM.1.3 Find the area of right triangles, other triangles, special quadrilaterals, and polygons that can be decomposed into triangles and other shapes to solve real-world and mathematical problems.

ITEM SPECIFICATIONS

Emphasis:

- Develop formulas to calculate the area of squares, parallelograms, and triangles.
- Demonstrate the ability to use formulas to calculate the area of squares, parallelograms, and triangles.
- Demonstrate the ability to decompose a polygon into triangles, squares, and rectangles.
- Demonstrate the ability to use the formulas for the areas of squares, parallelograms, and triangles to decompose a polygon and calculate the area of the polygon.

Stimulus Attributes:

- Test items may include illustrations of the following: diagrams of rectangles or squares, dot grids, geoboards, other geometric manipulatives, coordinate graphs, two-dimensional geometric figures, rulers, calculator displays, tables, graphs, charts, combined forms, maps, scale drawings, formulas, and other diagrams.

Format:

- Use the formula to find the area of a square, parallelogram, triangle, or polygon that can be decomposed into triangles and other shapes
- Apply the formulas used to find the area of squares, parallelograms, triangles, or polygons that can be decomposed into triangles and other shapes in a variety of contexts
- Decompose polygons into triangles, squares, and rectangles
- Apply combinations of formulas to determine the area of polygons
- Formulas may or may not be given

Content Limits:

- Limit figures to squares, parallelograms, triangles, and polygons that can be decomposed into triangles, squares, and rectangles
- Limit real-world and mathematical contexts to age appropriate situations

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.1

ITEM SPECIFICATIONS

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Computational errors
- Common errors
- Use of incorrect formula
- Confusion between area and perimeter
- Incorrect use of rules, properties, or formulas
- Incorrect procedures

19 **Mrs. Thompson has some square tiles. If each side measures 5 inches, what is the area of 1 square tile?**

A 25 square inches

B 20 square inches

C 10 square inches

D 5 square inches

Standard: 6.GM.1.1 Develop and use formulas for the area of squares and parallelograms using a variety of methods including but not limited to the standard algorithm.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to know that squares have all sides that measure the same length and then find the area of a square with a given side length.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to use a formula to find the area of a square.**
B. The student found the perimeter.
C. The student computed 5 + 5.
D. The student computed 5 × 1.

20 **Two architects designed an object in the shape of an equilateral triangle. The height of the object is 13.5 meters, and the side length is 15.6 meters. What is the area, in square meters, of the triangular object?**

A 315.9

B 210.6

C 105.3

D 46.8

Standard: 6.GM.1.3 Find the area of right triangles, other triangles, special quadrilaterals, and polygons that can be decomposed into triangles and other shapes to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to understand that the length of an equilateral triangle is the measure of the base and use this to find the area of a triangle.

Distractor Rationale:

A. The student computed $1\frac{1}{2} \times$ *base* $\times$ *height*.

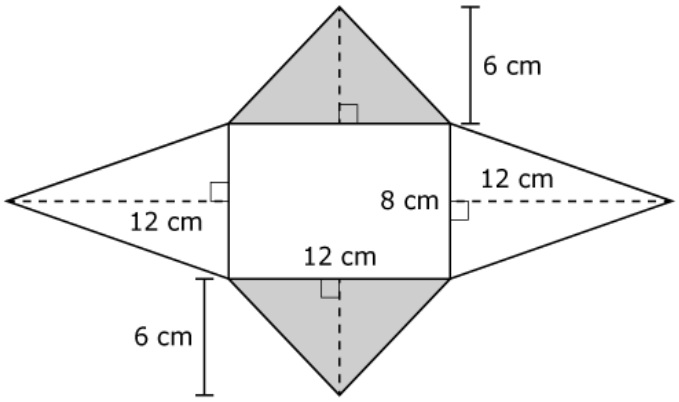
B. The student computed *base* $\times$ *height*.

C. Correct. The student demonstrated an ability to find the area of a triangle.

D. The student computed $3 \times$ *base*.

21

Antoine created the figure shown using four isosceles triangles and one rectangle.



Select the number for each measure to complete the sentences. To select a number, click the menu and then click the desired number. To choose a different number, click the menu and click the new number.

The area of each shaded triangle is -Select an Answer- square centimeters (cm^2).

- 9
- 18
- 36
- 72

The area of each unshaded triangle is -Select an Answer- square centimeters (cm^2).

- 20
- 40
- 48
- 96

The total area of the figure is -Select an Answer- square centimeters (cm^2).

- 40
- 48
- 96
- 180
- 264

Standard: 6.GM.1.3 Find the area of right triangles, other triangles, special quadrilaterals, and polygons that can be decomposed into triangles and other shapes to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to find the area of a composite figure.

Sample Distractor Rationales:

Correct

The area of each shaded triangle is 36 square centimeters (cm^2).
The area of each unshaded triangle is 48 square centimeters (cm^2).
The total area of the figure is 264 square centimeters (cm^2).

Incorrect

The area of each shaded triangle is 72 square centimeters (cm^2).
The student used $A = B \times h$ for the area of a triangle.

The area of each unshaded triangle is 96 square centimeters (cm^2).
The student used $A = B \times h$ for the area of a triangle.

The total area of the figure is 264 square centimeters (cm^2).
The student used $A = B \times h$ for the area of a triangle and then only found the area of the rectangle and two triangles.

The area of each shaded triangle is 18 square centimeters (cm^2).
The student found the area of half of the triangle because the triangle is divided by a dashed line.

The area of each unshaded triangle is 24 square centimeters (cm^2).
The student found the area of half of the triangle because the triangle is divided by a dashed line.

The total area of the figure is 80 square centimeters (cm^2).
The student found the area of half of the triangles because the triangles are divided by dashed lines.

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.2

OAS STANDARD

6.GM.2 Understand and use relationships between angles in geometric figures.

OAS OBJECTIVES

6.GM.2.1 Solve problems using the relationships between the angles (vertical, complementary, and supplementary) formed by intersecting lines.

6.GM.2.2 Develop and use the fact that the sum of the interior angles of a triangle is 180° to determine missing angle measures in a triangle.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate a working knowledge of angle types and their measures formed by intersecting lines.
- Demonstrate the ability to solve problems involving angle types and their measures formed by intersecting lines.
- Demonstrate a working knowledge of the fact that the sum of the interior angles of a triangle is 180°.
- Demonstrate the ability to determine the missing angle measure in a triangle.

Stimulus Attributes:

- Test items may include illustrations of the following: coordinate graphs, two-dimensional geometric figures, protractors, geoboards, other geometric manipulatives, tables, graphs, charts, maps, data sets, and other diagrams.

Format:

- Identify and compare angles and angle relationships based on their positions in geometric figures, including the assessment of vertical, complementary and supplementary angles
- Find the measures of angles based on their positions and relationships in geometric figures
- Determine missing angle measures in a triangle
- Identify angle measures

Content Limits:

- Limit geometric figures to two dimensions
- Limit angle measurements given in diagrams to whole numbers up to 180°

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.2

ITEM SPECIFICATIONS

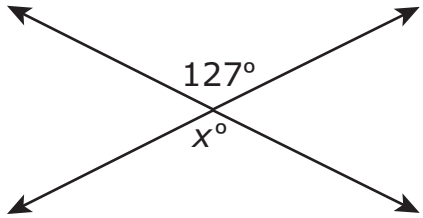
Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop Mathematical Reasoning
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Computational errors
- Incorrect use of rules or properties
- Angle relationship and parallel line misconceptions
- Misconceptions of vertical, complementary, and supplementary angle assumptions

22 **Two lines intersect in the diagram shown below.**



What is the value of *x*?

A 37

B 53

C 127

D 217

Standard: 6.GM.2.1 Solve problems using the relationships between the angles (vertical, complementary, and supplementary) formed by intersecting lines.

Depth-of-Knowledge: 1

This item is a DOK 1 because it requires the student to recall the definition of vertical angles.

Distractor Rationale:

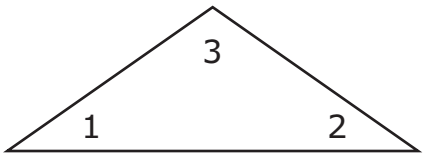
A. The student computed 180−127 = 53 and then 90−53= 37.

B. The student thought the two angles were supplementary.

C. Correct. The student demonstrated an ability to use the relationships between angles formed by intersecting lines to identify an angle measure.

D. The student thought the difference of the two angles must be 90.

23 **In the triangle shown, m∠1 = m∠2 and m∠2 = 35°.**



Which statement must be true?

A m∠1 + m∠3 = 35°

B m∠1 + m∠3 = 70°

C m∠1 + m∠3 = 145°

D m∠1 + m∠3 = 180°

Standard: 6.GM.2.2 Develop and use the fact that the sum of the interior angles of a triangle is 180° to determine missing angle measures in a triangle.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to use the knowledge that the sum of the interior angles of a triangle is 180° and use this to solve for unknown angle measures in a triangle.

Distractor Rationale:

A. The student chose because 35 degrees is part of the givens.

B. The student confused angle 2 and angle 3.

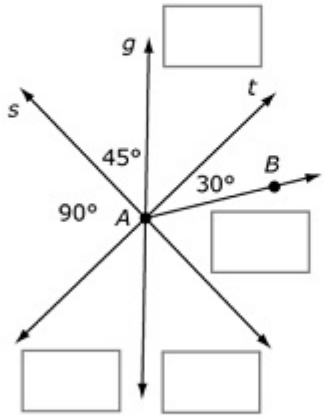
C. Correct. The student demonstrated an ability to use the fact that the sum of the interior angles of a triangle is 180° to determine the missing angle measures in a triangle.

D. The student thought that the sum of two angles of a triangle equals 180°.

24

Lines *s*, *g*, *t*, and ray *AB* intersect at point *A*.

Drag and drop angle measures to show the measures of all the angles. To place an angle measure in the figure, click and hold the angle measure, and then drag it to the desired space. To change an angle measure, click and hold it, and then drag it back to the desired space. You may use each angle once, more than once, or not at all.



30° 35° 45°

60° 90° 180°

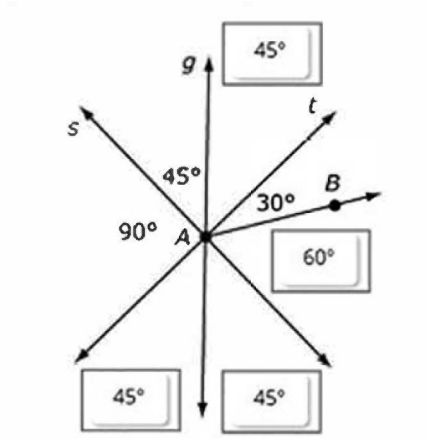
Standard: 6.GM.2.1 Solve problems using the relationships between the angles (vertical, complementary, and supplementary) formed by intersecting lines.

Depth-of-Knowledge: 2

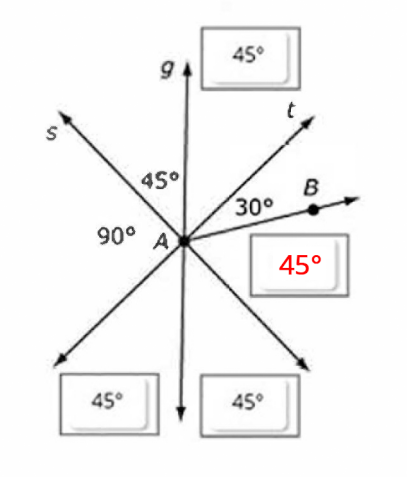
This item is a DOK 2 because it requires the student to use knowledge about the relationships between the angles formed by intersecting lines and use this to identify the angle measures.

Sample Distractor Rationales:

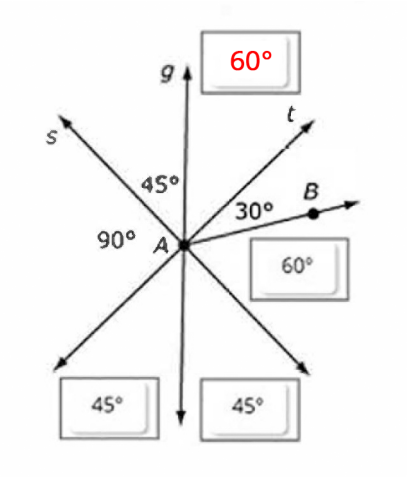
Correct



Incorrect



The student thought all missing angle measurements appeared congruent.



The student thought the incorrect angle was complementary to the 30-degree angle.

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.3

OAS STANDARD

6.GM.3 Choose appropriate units of measurement and use ratios to convert within measurement systems to solve real-world and mathematical problems.

OAS OBJECTIVES

6.GM.3.1 Estimate weights, capacities, and geometric measurements using benchmarks in customary and metric measurement systems with appropriate units.

6.GM.3.2 Solve problems in various real-world and mathematical contexts that require the conversion of weights, capacities, geometric measurements, and time within the same measurement systems using appropriate units.

ITEM SPECIFICATIONS

Emphasis:

- Apply knowledge of customary and metric units to estimate measurements.
- Apply concept of benchmarking to estimate weight, capacity, and other geometric measurements of common objects.
- Apply knowledge of measurement concepts to determine appropriate unit and measurement instrument for specific situations.
- Demonstrate the ability to convert and compute with measurements in the same measurement system.
- Demonstrate the ability to use conversions within the same measurement system to solve real-world problems.

Stimulus Attributes:

- Test items may include tables, graphs, charts, pictures, maps, data sets, diagrams, two- and three-dimensional figures, other geometric manipulatives, rulers, protractors, thermometers, beakers, balances, other measuring instruments, and number lines.

Format:

- Use a benchmark to estimate weight, capacity, or other geometric measurements in customary or metric units
- Identify appropriate unit and instrument of measure needed to solve a weight, capacity, or other geometric measurement problem
- Compute with and express solutions using customary unit conversions to solve problems in mathematical, geometric, and real-world contexts
- Compute with and express solutions using metric conversions to solve problems in mathematical, geometric, and real-world contexts
- Express solutions to problems involving customary or metric units in combined units

ITEM SPECIFICATIONS

Content Limits:

- Limit to objects common to a sixth-grade student
- Limit units of length to millimeter, centimeter, meter, kilometer, inch, foot, yard, or mile
- Limit units of weight (mass) to gram, kilogram, ounce, pound, or ton
- Limit conversion to:
  - inches to feet and feet to inches
  - feet to yards and yards to feet
  - minutes to hours and hours to minutes
  - ounces to pounds and pounds to ounces
  - pounds to tons and tons to pounds
  - ounces to cups and cups to ounces
  - cups to pints and pints to cups
  - pints to quarts and quarts to pints
  - quarts to gallons and gallons to quarts
  - millimeters to centimeters and centimeters to millimeters
  - centimeters to meters and meters to centimeters
  - grams to kilograms and kilograms to grams
  - milliliters to liters and liters to milliliters
- Limit to linear measure, weight, mass, time, perimeter, area, and capacity
- Limit real-world and mathematical contexts to age appropriate situations

Primary Process Standards:

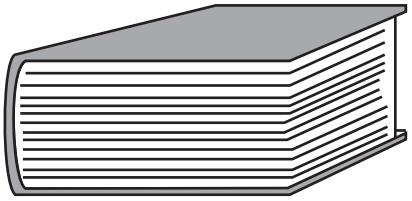
- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Insufficient development of concepts of inch, foot, yard, ounces, and pounds
- Misunderstanding the concept of benchmarking
- Insufficient development of concepts of millimeter, centimeter, meter, grams, and kilograms
- Identify inappropriate unit of measure
- Select inappropriate measurement instrument
- Inappropriate procedure or incorrect value in conversion
- Computational errors
- Common errors
- Incorrect procedures
- Incorrect use of rules or properties
- Use of incorrect equivalencies
- Errors in converting units

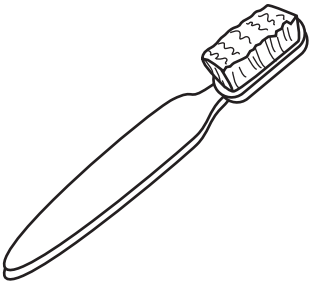
25 **Which object weighs <u>about</u> 1 ounce?**

A



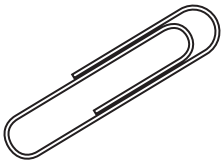
Book

B



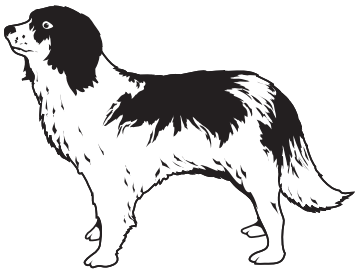
Toothbrush

C



Paper clip

D



Dog

Standard: 6.GM.3.1 Estimate weights, capacities, and geometric measurements using benchmarks in customary and metric measurement systems with appropriate units.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to estimate weights.

Distractor Rationale:

A. The student did not understand how much 1 ounce is.

B. Correct. The student demonstrated an ability to estimate weight in ounces.

C. The student chose an object that weighs the least.

D. The student did not understand how much 1 ounce is.

26 **A centimeter is equal to 10 millimeters. If a cell phone is 5 centimeters wide, what is the width of the cell phone in millimeters?**

A 2

B 10

C 20

D 50

Standard: 6.GM.3.2 Solve problems in various real-world and mathematical contexts that require the conversion of weights, capacities, geometric measurements, and time within the same measurement systems using appropriate units.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to convert between centimeters and millimeters.

Distractor Rationale:

A. The student computed 10 ÷ 5.

B. The student thought millimeters and centimeters are the same size or chose the conversion factor.

C. The student computed 10 × 2.

D. Correct. The student demonstrated an ability to solve a real-world problem that requires the conversion from centimeters to millimeters.

27 **Charles spent 50 minutes mowing his lawn and 1 hour and 55 minutes working on his garden.**

What was the total time Charles spent mowing his lawn and working on his garden?

A 1 hour and 5 minutes

B 1 hour and 45 minutes

C 2 hours and 5 minutes

D 2 hours and 45 minutes

Standard: 6.GM.3.1 Estimate weights, capacities, and geometric measurements using benchmarks in customary and metric measurement systems with appropriate units.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to add time in minutes and hours.

Distractor Rationale:

A. The student subtracted 50 from 55.

B. The student missed the 1 hour part of working on his garden.

C. The student thought there are 160 minutes in 2 hours.

D. Correct. The student demonstrated an ability to solve a problem that requires the conversion of time.

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.4

OAS STANDARD

6.GM.4 Use translations, reflections, and rotations to establish congruency and understand symmetries.

OAS OBJECTIVES

6.GM.4.1 Predict, describe, and apply translations (slides), reflections (flips), and rotations (turns) to a two-dimensional figure.

6.GM.4.2 Recognize that translations, reflections, and rotations preserve congruency and use them to show that two figures are congruent.

6.GM.4.3 Use distances between two points that are either vertical or horizontal to each other (not requiring the distance formula) to solve real-world and mathematical problems about congruent two-dimensional figures.

6.GM.4.4 Identify and describe the line(s) of symmetry in two-dimensional shapes.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate the ability to identify geometric transformations.
- Demonstrate the ability to apply a given geometric transformation.
- Demonstrate a working understanding of how geometric transformations preserve congruency.
- Demonstrate a working understanding of congruency in geometric figures.
- Demonstrate the ability to solve problems about congruent two-dimensional figures.
- Demonstrate the ability to identify and describe line(s) of symmetry.

Stimulus Attributes:

- Test items may include illustrations of the following: coordinate graphs, two-dimensional geometric figures, protractors, measuring instruments, geoboards, other geometric manipulatives, tables, graphs, charts, maps, scale drawings, data sets, and other diagrams.

Format:

- Distinguish among transformations of figures on a coordinate plane and in real-world contexts
- Use geometric transformations to show that two figures are congruent
- Use distances between two points to solve mathematical, geometric, and real-world problems about congruent two-dimensional figures
- Identify line(s) of symmetry in two-dimensional shapes
- Describe the line(s) of symmetry in two-dimensional shapes

Content Limits:

- Limit geometric figures to two dimensions
- Limit transformations to translations, reflections, and rotations
- Limit to one transformation
- Limit distances to whole numbers

OAS STRAND—GEOMETRY & MEASUREMENT (GM): STANDARD 6.GM.4

ITEM SPECIFICATIONS

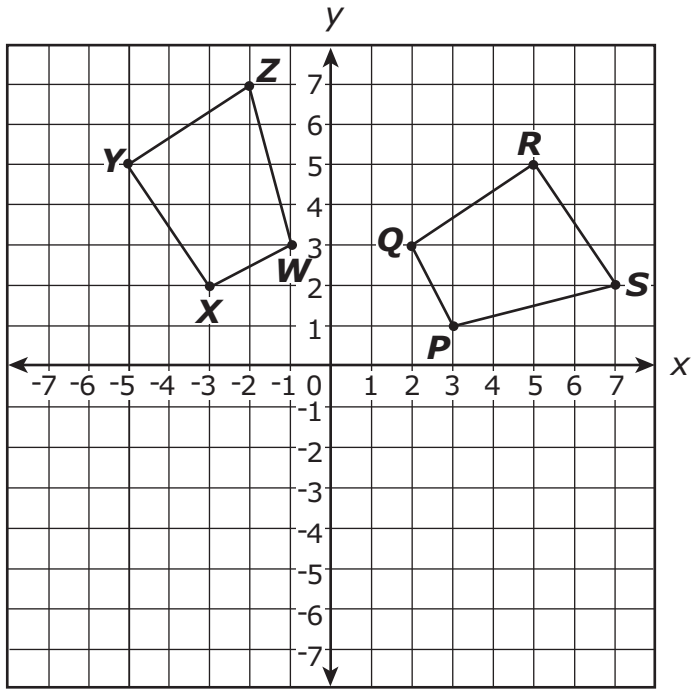
Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common errors
- Incorrect procedures
- Confusion among geometric transformations
- Computational errors
- Incorrect use of rules or properties
- Confusion between congruency and similarity

28 **A computer program was used to transform quadrilateral *PQRS* to quadrilateral *WXYZ*.**



What is the one-step transformation from quadrilateral *PQRS* to quadrilateral *WXYZ*?

A dilation

B reflection

C rotation

D translation

Standard: 6.GM.4.1 Predict, describe, and apply translations (slides), reflections (flips), and rotations (turns) to a two-dimensional figure.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to visualize and name a transformation of a two-dimensional figure.

Distractor Rationale:

A. The student confused rotation and dilation.

B. The student confused rotation and reflection.

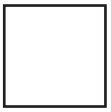
C. Correct. The student demonstrated an ability to describe translations, reflections, and rotations.

D. The student confused rotation and translation.

29 **Which shape has no lines of symmetry?**

A

B



C

D

Standard: 6.GM.4.4 Identify and describe the line(s) of symmetry in two-dimensional shapes.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to assess all shapes and find the one with no lines of symmetry.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to identify lines of symmetry in two-dimensional shapes.**
B. Balance distractor
C. The student saw that there is no horizontal line of symmetry.
D. The student thought that only polygons can have lines of symmetry.

OAS STRAND—DATA & PROBABILITY (D): STANDARD 6.D.1

OAS STANDARD

6.D.1 Display and analyze data.

OAS OBJECTIVES

6.D.1.1 Calculate the mean, median, and mode for a set of real-world data.

6.D.1.2 Explain and justify which measure of central tendency (mean, median, or mode) would provide the most descriptive information for a given set of data.

6.D.1.3 Create and analyze box and whisker plots observing how each segment contains one quarter of the data.

ITEM SPECIFICATIONS

Emphasis:

- Demonstrate the ability to find the mean, median, and mode for a set of real-world data.
- Demonstrate an understanding how the mean, median, and mode can be used to describe a set of data.
- Demonstrate the ability to create and analyze box and whisker plots.

Stimulus Attributes:

- Test items may include lists, tables, graphs, charts, data sets, bar graphs, pictographs, frequency charts, line plots, scatter plots, stem-and-leaf plots, box and whisker plots, and any of the following terms: mean, median, and mode.

Format:

- Given a set of real-world data, the student will determine mean, median, and mode
- Compare how representations of data support inferences and predictions
- Items may include comparisons between mean, median, and mode
- Analyze the appropriate use of the mean in comparison with other measures of central tendency
- Create box and whisker plots
- Analyze box and whisker plots, observing how each segment contains one quarter of the data

Content Limits:

- Limit to descriptor of mean, mode, and median
- Limit data sets to 20 pieces of data
- Limit data sets to numerical data
- Limit real-world and mathematical contexts to age appropriate situations

OAS STRAND—DATA & PROBABILITY (D): STANDARD 6.D.1

ITEM SPECIFICATIONS

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Misreported data
- Miscalculation
- Unsupportable conclusions
- Incorrect choice of measure
- Incorrect procedures
- Use of incorrect measure
- Misunderstanding of concepts
- Common errors

30 **The list shows the number of dollars Pablo saved each week.**

4, 7, 6, 2, 10, 4

What is the difference between the mean and the median of these amounts?

A $0.50

B $1.00

C $1.50

D $3.00

Standard: 6.D.1.1 Calculate the mean, median, and mode for a set of real-world data.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to determine the mean and median of a data set and then find the difference between the two measures of center.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to calculate the mean and median for a set of real-world data.**
B. The student found the difference between the median and the mode.
C. The student found the difference between the mean and the mode.
D. The student found the difference between the range and the median.

31 **The manager at Max Cars recorded the number of cars sold during the first six months of last year in this table.**

Max Cars Sales

Month	Number Sold
January	49
February	49
March	64
April	46
May	45
June	47

What was the median number of cars sold during these months?

A 48

B 49

C 50

D 55

Standard: 6.D.1.1 Calculate the mean, median, and mode for a set of real-world data.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to extract information from a table and then determine the median of the data that is not arranged from smallest to largest.

Distractor Rationale:

A. **Correct. The student demonstrated an ability to calculate the median for a set of real-world data.**
B. The student confused median and mode.
C. The student confused median and mean.
D. The student found the middle number of the two numbers in the middle of the unorganized list in the table, 64 and 46.

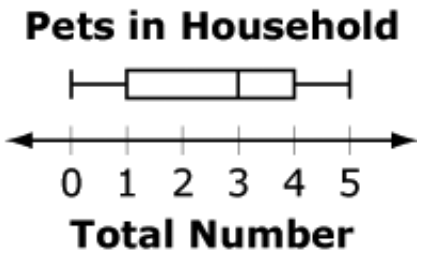
32 **The table shows seven students and the total number of pets in each student's household.**

Pets in Household

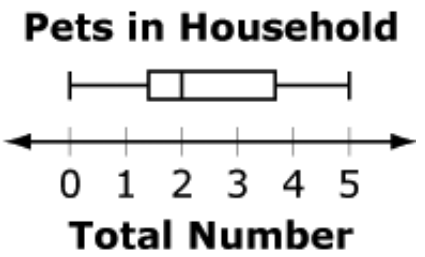
Student	Total Number
Paul	0
Joann	2
Tyler	1
Betty	5
Roberto	4
Kim	1
Ema	3

Which box-and-whisker plot best represents this data?

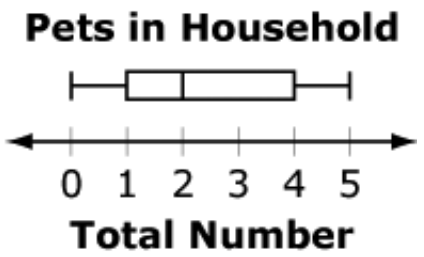
A



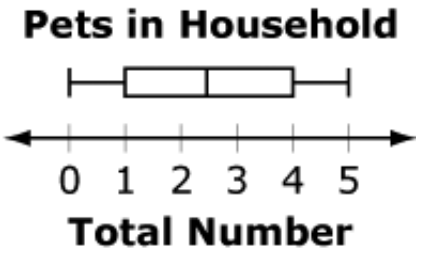
B



C



D



Standard: 6.D.1.3 Create and analyze box and whisker plots observing how each segment contains one quarter of the data.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires requires the student to extract information from a table and then identify the box-and-whisker plot that matches the data.

Distractor Rationale:

A. Balance distractor

B. The student saw the correct median.

C. Correct. The student demonstrated an ability to create a box-and-whisker plot.

D. The student saw the correct lower and upper quartiles.

OAS STRAND—DATA & PROBABILITY (D): STANDARD 6.D.2

OAS STANDARD

6.D.2 Use probability to solve real-world and mathematical problems; represent probabilities using fractions and decimals.

OAS OBJECTIVES

6.D.2.1 Represent possible outcomes using a probability continuum from impossible to certain.

6.D.2.2 Determine the sample space for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables, or pictorial representations.

6.D.2.3 Demonstrate simple experiments in which the probabilities are known and compare the resulting relative frequencies with the known probabilities, recognizing that there may be differences between the two results.

ITEM SPECIFICATIONS

Emphasis:

- Represent possible outcomes of experiments.
- Demonstrate the ability to represent probabilities as fractions and decimals.
- Determine the sample space for a given experiment.
- Determine which members of the sample space are related to certain events.
- Demonstrate the ability to compare the results of an experiment with the known probabilities.

Stimulus Attributes:

- Test items may include the following: spinners, tables, graphs, pictures, coordinate graphs, number lines, charts, such as frequency charts, line, bar, and picture graphs; tree-diagrams, Venn diagrams; stem-and-leaf plots, box-and-whisker plots, and scatter plots; histograms, circle graphs, data sets, and other diagrams.

Format:

- Predict outcomes of an experiment as certain, equally likely, or impossible
- Predict the probability of outcomes of simple experiments
- Fractions may be in simplest form
- Determine the sample space for a given experiment
- Determine which members of the sample space are related to certain events
- Sample space may be determined by the use of tree diagrams, tables, or pictorial representations
- Demonstrate the outcome of an experiment
- Compare the results of an experiment with the known probabilities

Content Limits:

- Limit to simple experiments
- Limit predictions to certain, likely, equally likely, unlikely, or impossible
- Limit to simple probability experiments (e.g., one spinner, one coin, etc.)
- Limit sample to no more than 20 pieces of data
- Limit real-world contexts to age-appropriate situations

OAS STRAND—DATA & PROBABILITY (D): STANDARD 6.D.2

ITEM SPECIFICATIONS

Primary Process Standards:

- Develop Strategies for Problem Solving
- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop a Deep and Flexible Conceptual Understanding
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Misunderstanding of likelihood of event
- Computational errors
- Common errors
- Incorrect procedures
- Incorrect use of rules or properties
- Use of incorrect equivalencies

33 **A bag contains 12 yellow tiles and 12 blue tiles. A student will choose one tile from the bag without looking. Which word(s) describe the probability of choosing a blue tile from the bag?**

A likely

B certain

C impossible

D equally likely

Standard: 6.D.2.1 Represent possible outcomes using a probability continuum from impossible to certain.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to understand the probability experiment described and then represent the probability of a particular outcome using words from impossible to certain.

Distractor Rationale:

A. The student confused likely and equally likely.
B. The student did not know what certain meant.
C. The student did not know what impossible meant.
D. **Correct. The student demonstrated an ability to represent the outcome of an event using a probability continuum from impossible to certain.**

34 **These colored candies are in a bag.**

Candy in Bag

Color	Number
blue	5
green	8
red	6
yellow	1

Sarah chooses one candy from the bag without looking. Which statement is true?

A It is certain that Sarah will pick a green candy.

B It is impossible for Sarah to pick a purple candy.

C Sarah is equally likely to pick a blue candy or a red candy.

D Sarah is less likely to pick a red candy than a yellow candy.

Standard: 6.D.2.1 Represent possible outcomes using a probability continuum from impossible to certain.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to understand the probability experiment described and then determine which statement is true about the possible outcomes.

Distractor Rationale:

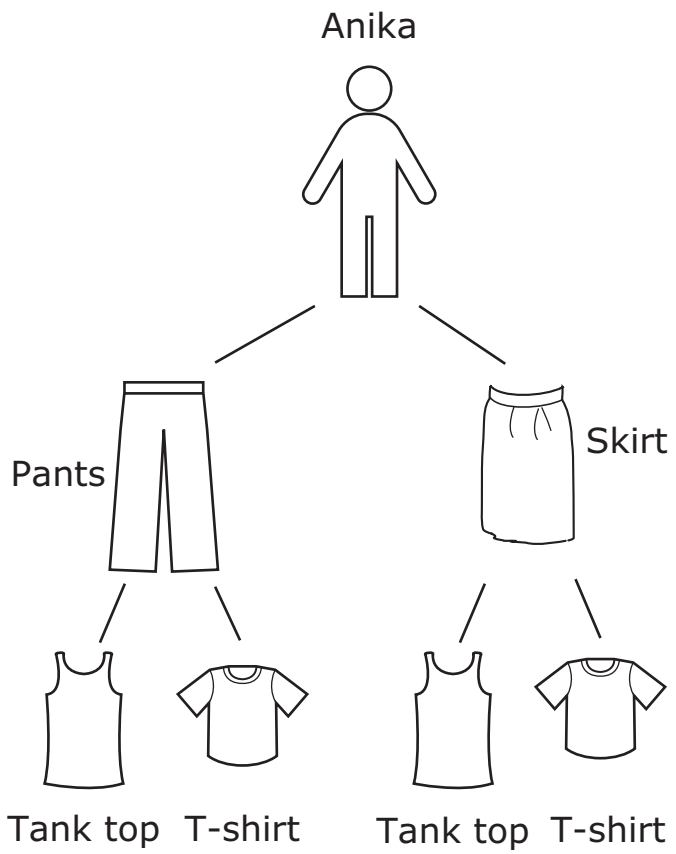
A. The student confused certain and impossible.

B. Correct. The student demonstrated an ability to represent the possible outcomes using a probability continuum from impossible to certain.

C. The student saw that blue and red are very close and thought that was close enough to equal.

D. The student reversed the relationship.

35 **Anika will choose an outfit from the clothes shown.**



Which outfit is impossible for Anika to choose?

A tank top and pants

B tank top and skirt

C T-shirt and pants

D T-shirt and shorts

Standard: 6.D.2.1 Represent possible outcomes using a probability continuum from impossible to certain.

Depth-of-Knowledge: 3

This item is a DOK 3 because it requires the student to understand the information presented in a tree diagram and then use reasoning to determine which outcome is impossible.

Distractor Rationale:

A. The student did not see that this was a possible outcome or misunderstood "impossible."

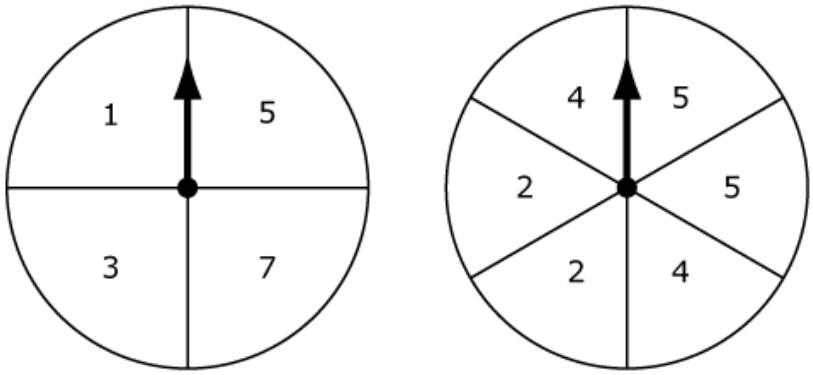
B. The student did not see that this was a possible outcome or misunderstood "impossible."

C. The student did not see that this was a possible outcome or misunderstood "impossible."

D. Correct. The student demonstrated an ability to represent an outcome from a probability situation as impossible.

36

Trevor spins the pointer on each of these spinners.



Select the events (left spinner, right spinner) that are members of the sample space for Trevor's spins. To select an event, click the event. To deselect the event, click it again.

(2, 2)	(1, 3)	(odd number, even number)	(3, 4)
(7, 1)	(odd number, odd number)	(5, 5)	(even number, even number)

Standard: 6.D.2.2 Determine the sample space for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables or pictorial representations.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to understand the probability experiment described and then differentiate between possible and impossible outcomes.

Sample Distractor Rationales:

Correct

		(odd number, even number)	(3, 4)
	(odd number, odd number)	(5, 5)	

Incorrect

(2, 2)	(1, 3)		
(7, 1)	(odd number, odd number)	(5, 5)	(even number, even number)

The student chose all events that are possible with two spins on the same spinner.

(2, 2)	(1, 3)	(odd number, even number)	(3, 4)
(7, 1)	(odd number, odd number)	(5, 5)	(even number, even number)

The student chose all events that are possible with two individual spins of either spinner.

Cluster Items

The following sample items are part of a cluster. The cluster is presented first and then the two items that follow require use of the cluster. The two items are from different standards.

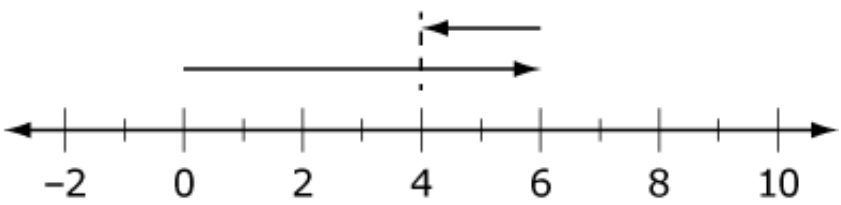
Use this information to answer the following two questions.

Three expressions are shown.

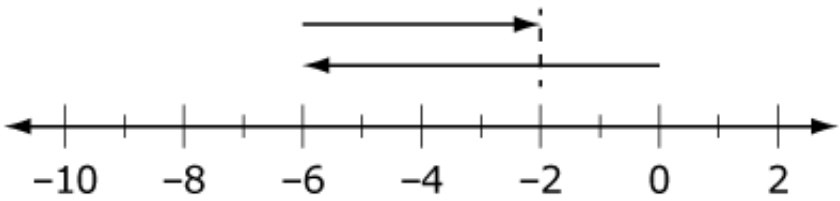
Expression 1	$-6 + 4$
Expression 2	$1.5(9 - 7)$
Expression 3	$4.6 \div 2$

37 **Which number line represents Expression 1?**

A

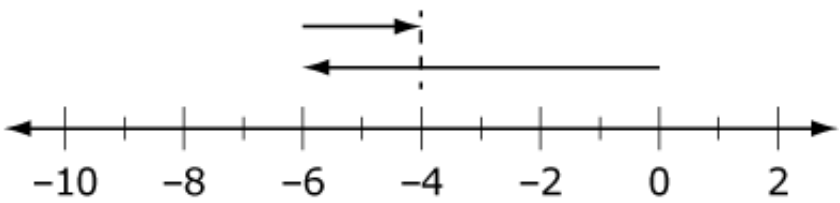


B



C

D



Standard: 6.N.2.2 Illustrate addition and subtraction of integers using a variety of representations.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to understand the addition of integers and then illustrate this addition using a number line model.

Distractor Rationale:

A. The student confused −6 + 4 and 6 − 2.

B. Correct. The student demonstrated an ability to illustrate an addition expression on the number line.

C. The student confused −6 + 4 and 6 + 4.

D. The student confused −6 + 4 and −6 + 2.

38 **What is the sum of Expression 2 and Expression 3?**

A 3.8

B 5.3

C 7.3

D 17.3

Standard: 6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to solve real-world and mathematical problems.

Depth-of-Knowledge: 2

This item is a DOK 2 because it requires the student to use the order of operations and mathematical properties to find the sum of multi-step expressions.

Distractor Rationale:

A. The student computed 1.5 + 2.3, ignoring the (9 − 7).

B. Correct. The student demonstrated an ability to evaluate an expression applying the order of operations.

C. The student made a calculation error.

D. The student made a calculation error.

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