OKLAHOMA SCHOOL TESTING PROGRAM

TEST BLUEPRINT AND ITEM SPECIFICATIONS MATHEMATICS

2016-2017 GRADE 10

OKLAHOMA STATE DEPARTMENT OF EDUCATION

CHAMPION EXCELLENCE

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OKLAHOMA SCHOOL TESTING PROGRAM TEST AND ITEM SPECIFICATIONS

Grade 10 Mathematics Test

Purpose

The purpose of the Grade 10 test (G10) is to measure Oklahoma students' levels of proficiency over the Oklahoma Academic Standards. Students are required to respond to a variety of items that assess identified content strands and standards outlined in the G10 Test Blueprint.

Test Structure, Format, and Scoring

The Grade 10 Mathematics test will consist of 60 operational items and 10 field-test items, written at a reading level about three grade levels below a Grade 10 audience. The total 70 items will be divided into two test sections.

Each item is scored as correct or incorrect. Only operational items contribute to the total test score. Thus, for example, if a test contains 60 operational items, only those 60 items (not the 10 field test items) contribute to a student's scaled score on the test.

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

Test Alignment with Oklahoma Academic Standards

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.

OKLAHOMA SCHOOL TESTING PROGRAM

TEST BLUEPRINT MATHEMATICS
2016-2017 GRADE 10

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	IDEAL # OF ITEMS	STRANDS AND STANDARDS
10%	6	**NUMBER AND OPERATIONS**
	6	A1.N.1 Number Operations and Roots
40%	24	**ALGEBRAIC REASONING AND ALGEBRA**
	6	A1.A.1 Linear, Absolute Value and Systems of Equations
	6	A1.A.2 Linear, Compound and Systems of Inequalities
	6	A1.A.3 Expressions and Sequences
	6	A1.A.4 Slope and Linear Equations
30%	18	**FUNCTIONS**
	6	A1.F.1 Functions, Relations and Function Notation
	6	A1.F.2 Linear and Non-Linear Families of Functions
	6	A1.F.3 Operations and Evaluation of Functions
10%	6	**DATA AND PROBABILITY**
	6	A1.D.1 Data Analysis (3) A1.D.2 Probability (3)
10%	6	**GEOMETRY**
	6	G.2D.1 Two-Dimensional Shapes
100%	60	**TOTAL**

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

Depth-of-Knowledge Assessed by Test Items

The Grade 10 test will approximately reflect the following "depth-of-knowledge (DOK)" distribution of items:

Depth-of-Knowledge	OAS Standards Percent of DOK 2016-2017
Level 1—Recall	10–20%
Level 2—Skills/Concept	65–75%
Level 3—Strategic Thinking	15–25%

DOK Ideal Ranges are based on the DOK of the new OAS standards. The standards increase grade-level expectations, increase rigor, and set the expectation 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.
- **Level 4** (Extended Thinking) requires complex reasoning, planning, developing, and thinking most likely requiring an extended amount of time. The cognitive demands of the item should be high and the work should be very complex. Students are required to make several connections (relate ideas within the content area or among content areas) and have to select one approach among many alternatives on how the situation should be solved in order to be at this highest level.

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 http://facstaff.wcer.wisc.edu/normw/TILSA/INFO and INSTR Align Anal 513.pdf

Universal Design Considerations

Universal Design, as applied to assessments, is a concept that allows the widest possible range of students to participate in assessments and may even reduce the need for accommodations and alternative assessments by expanding access to the tests themselves. In the Oklahoma Grade 10 tests, modifications have been made to some items to simplify and clarify instructions as well as to provide maximum readability, comprehensibility, and legibility. This includes such things 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.

Online Administration

Test questions will be presented one at a time.

The stimulus and question will appear on the screen at the same 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 graphing calculator on the Grade 10 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 taken up 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.

Testing Schedules

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

Grade 10 Mathematics Online Test Time Schedule	
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 G10 Mathematics Online Test	Approximately 60 minutes
Administering Section 2 of the G10 Mathematics Online Test	Approximately 60 minutes

Item Types

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 not red?).

Multiple-Choice Item Guidelines

- 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 Guidelines

- 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-and-drop and drop-down. Each TEI 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).
- See sample item 14 on page 31 for an example of a drag-and-drop item. See Appendix A for examples of the other three TEI interactions. Please note that the sample TEIs shown in the appendix do not come from Grade 10.

In summary, Grade 10 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. Graphics appear either on the same page as the stimulus or on the facing page.

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 A, B, C, and D responses.
7. The four choices are approximately the same length, have the same format, and are syntactically and semantically parallel; 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.
8. 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.
9. Distractors should always be plausible (but, of course, incorrect) in the context of the stimulus.
10. Order of presentation of item types is dictated by logic (chronologically, spatially, etc.).
11. 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.
12. The range of items measuring an OAS standard consisting of more than one skill will provide a balanced representation of those skills.
13. Items should be focused on what all students should know and be able to do as they complete their Grade 10 coursework.
14. The responses "Both of the above," "All of the above," "None of the above," and "Neither of the above" will not be used.
15. The material presented is balanced, culturally diverse, well written, and of interest to Grade 10 test level students. The stimuli and items are fairly presented in order to gain a true picture of students' skills.
16. Across all forms, a balance of gender and active/passive roles by gender is maintained.
17. Forms attempt to represent the ethnic diversity of Oklahoma students.
18. Approved calculators and the formula sheet on page 9 may be used on the G10 Mathematics test. No other resource materials may be used by students during the test. More information regarding the calculator policy can be found at http://sde.ok.gov/sde/assessment-administrator-resources-administrators.
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 10 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 10 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.

Oklahoma State Testing Program
10th Grade Mathematics Formula Sheet

UNIT CONVERSIONS

1 foot = 12 inches	1 pound = 16 ounces	1 cup = 8 fluid ounces
1 yard = 3 feet	1 ton = 2000 pounds	1 pint = 2 cups
1 mile = 5280 feet	1 kilogram = 1000 grams	1 quart = 2 pints
1 mile = 1760 yards		1 gallon = 4 quarts
1 meter = 100 centimeters		
1 meter = 1000 millimeters		

AREA

Rectangle	$A = lw$	Circle	$A = \pi r^2$
Parallelogram	$A = bh$	Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$
Triangle	$A = \frac{1}{2}bh$	Regular Polygon	$A = \frac{1}{2}ap$

CIRCUMFERENCE

Circle $C = \pi d$ or $C = 2\pi r$

VOLUME

Rectangular Prism	$V = Bh$ or $V = lwh$	Right Cylinder	$V = Bh$ or $V = \pi r^2 h$

SURFACE AREA

Rectangular Prism	$S = 2B + Ph$ or $S = 2lw + 2lh + 2wh$
Cylinder	$S = 2\pi rh + 2\pi r^2$

LINEAR EQUATIONS

Slope-intercept	$y = mx + b$	Slope formula	$m = \frac{y_2 - y_1}{x_2 - x_1}$
Point-slope	$y - y_1 = m(x - x_1)$	Direct Variation	$y = kx$
Standard Form	$Ax + By = C$		

OTHER

$d = rt$	Pythagorean Formula $a^2 + b^2 = c^2$
Midpoint Formula $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$	Distance Formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

SEQUENCES

Arithmetic	$a_n = a_1 + (n-1)d$	Geometric	$a_n = a_1 r^{n-1}$

COUNTING PRINCIPLES

Permutations	${}_nP_r = P(n,r) = \frac{n!}{(n-r)!}$	Combinations	${}_nC_r = C(n,r) = \binom{n}{r} = \frac{n!}{(n-r)!r!}$

School Year 2016-2017

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 Strands" and "OAS Standards" 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 standard 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 A1.N.1

OAS STANDARD

A1.N.1 Extend the understanding of number and operations to include square roots and cube roots.

OAS OBJECTIVES

A1.N.1.1 Write square roots and cube roots of monomial algebraic expressions in simplest radical form.

A1.N.1.2 Add, subtract, multiply, and simplify square roots of monomial algebraic expressions and divide square roots of whole numbers, rationalizing the denominator when necessary.

ITEM SPECIFICATIONS

Emphasis:

- Simplify square roots and cube roots of algebraic expressions.
- Add, subtract, multiply, and/or simplify square roots of monomial algebraic expressions.
- Divide square roots of whole numbers and rationalize the denominator.

Stimulus Attributes:

- Test items may include radical algebraic expressions.

Format:

- Simplify radical expressions.
- Operations with radical expressions.
- Identify mathematical and real-world situations that can be represented by specific algebraic expressions and equations.

Content Limits:

- Limit radicals to square roots and cube roots.
- Limit adding, subtracting, and multiplying to square roots of monomial expressions.
- Limit dividing square roots to whole numbers.

Primary Process Standards:

- Develop Accurate and Appropriate Procedural Fluency
- Develop Strategies for Problem Solving

Distractor Domain:

- Common algebraic misconceptions
- Incorrect square roots or cube roots of radicals
- Incorrect arithmetic operations
- Incorrect rationalizing the denominator

1 **What is the simplified form of $\sqrt{48x^8y^5}$?**

A $96x^{16}y^{10}$

B $48x^6y^3$

C $24x^4y^2\sqrt{y}$

D $4x^4y^2\sqrt{3y}$

Correct Response: D
Depth-of-Knowledge: 1

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD A1.A.1

OAS STANDARD	**A1.A.1**	Represent and solve mathematical and real-world problems using linear equations, absolute value equations, and systems of equations; interpret solutions in the original context.
OAS OBJECTIVES	**A1.A.1.1**	Use knowledge of solving equations with rational values to represent and solve mathematical and real-world problems (e.g., angle measures, geometric formulas, science, or statistics) and interpret the solutions in the original context.
	A1.A.1.2	Solve absolute value equations and interpret the solutions in the original context.
	A1.A.1.3	Analyze and solve real-world and mathematical problems involving systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination. Interpret the solutions in the original context.

ITEM SPECIFICATIONS

Emphasis:

- Represent and solve mathematical and real-world problems using equations and interpret the solutions.
- Determine solutions to absolute value equations and interpret the solutions.
- Determine solutions to systems of linear equations and interpret the solutions.

Stimulus Attributes:

- Test items may include equations, tables, graphs, charts, geometric figures, or diagrams.

Format:

- Identify algebraic expressions and equations that represent mathematical and real-world situations.
- Identify mathematical and real-world situations that can be represented by specific algebraic expressions and equations.
- Use scientific formulas to solve problems algebraically.
- Use geometric formulas to solve problems algebraically.
- Use formulas from statistics to solve problems algebraically.
- Identify the solution to an absolute value equation.
- Identify the value of one variable that is the solution of two linear equations represented algebraically.
- Identify an ordered pair that is the solution of two linear equations represented algebraically or graphically.

STANDARD A1.A.1 continued

ITEM SPECIFICATIONS

Content Limits:

- No more than two distinct operations
- Limit real-life and mathematical contexts to age-appropriate situations.
- Formulas may be provided.
- Limit scientific content to 7th-grade material.
- Limit geometric content to 9th-grade material.
- Limit ordered pairs to integers for graphing.
- Limit ordered pairs to rational numbers for algebraic systems.

Primary Process Standards:

- Develop the Ability to Communicate Mathematically
- Develop the Ability to Make Conjectures, Model, and Generalize
- Develop Strategies for Problem Solving

Distractor Domain:

- Common algebraic misconceptions
- Computational errors
- Incorrect ordered pairs

165186A

2 **The velocity of an accelerating object is given by this equation.**

$$v = v_0 + at$$

- v is the velocity in feet per second
- v_0 is the initial velocity in feet per second
- a is the acceleration in feet per second squared
- t is the time in seconds

An object with an initial velocity of 40 feet per second accelerates by 2 feet per second squared for 15 seconds. What is the velocity, in feet per second, of the object after this time?

A 55

B 70

C 95

D 100

Correct Response: B
Depth-of-Knowledge: 1

142677A Multiple Choice D Common

3

$$\begin{cases} 2x + 3y = 2 \\ 2x - 4y = 16 \end{cases}$$

What is the solution to this system of equations?

A (−4, 2)

B (−2, −2)

C (−2, 2)

D (4, −2)

Correct Response: D
Depth-of-Knowledge: 2

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD A1.A.2

OAS STANDARD

A1.A.2 Represent and solve real-world and mathematical problems using linear inequalities, compound inequalities and systems of linear inequalities; interpret solutions in the original context.

OAS OBJECTIVES

A1.A.2.1 Represent relationships in various contexts with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions.

A1.A.2.2 Represent relationships in various contexts with compound and absolute value inequalities and solve the resulting inequalities by graphing and interpreting the solutions on a number line.

A1.A.2.3 Solve systems of linear inequalities with a maximum of two variables; graph and interpret the solutions on a coordinate plane.

ITEM SPECIFICATIONS

Emphasis:

- Represent relationships in various contexts using linear inequalities, compound inequalities, and absolute value inequalities.
- Determine solutions to linear inequalities, compound inequalities, and absolute value inequalities.
- Interpret and graph solutions to linear inequalities, compound inequalities, and absolute value inequalities.
- Determine solutions to systems of linear inequalities.
- Interpret and graph solutions to systems of linear inequalities.

Stimulus Attributes:

- Test items may include tables, graphs, charts, or diagrams.

Format:

- Solve linear inequalities graphically.
- Solve linear inequalities algebraically.
- Identify algebraic inequalities that represent mathematical and real-world situations.
- Identify mathematical and real-world situations that can be represented by specific algebraic inequalities, including compound and absolute value inequalities.
- Solve systems of inequalities graphically.
- Interpret solutions to systems of inequalities.
- Identify solutions to systems of inequalities.
- Identify a graph as a solution to a system of inequalities.

Content Limits:

- Limit inequalities to rational coefficients.
- No more than two distinct operations
- Limit real-life and mathematical contexts to age-appropriate situations.

ITEM SPECIFICATIONS

Primary Process Standards:

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

Distractor Domain:

- Computational errors
- Common algebraic misconceptions
- Incorrectly filled or blank points on number lines
- Misdirected arrows on number lines or wrong shading of graphs
- Incorrect solutions to systems of inequalities
- Incorrect graph as solution to system of inequalities

171720A Multiple Choice D Common

4 **Tom and Jane decided to see who could collect more seashells. The relation between the number of seashells Jane collected (j) and the number of seashells Tom collected (t) is given by the inequality $j > 2t + 8$. If Tom collected 24 seashells, what is the least number of seashells Jane collected?**

A 8 seashells

B 9 seashells

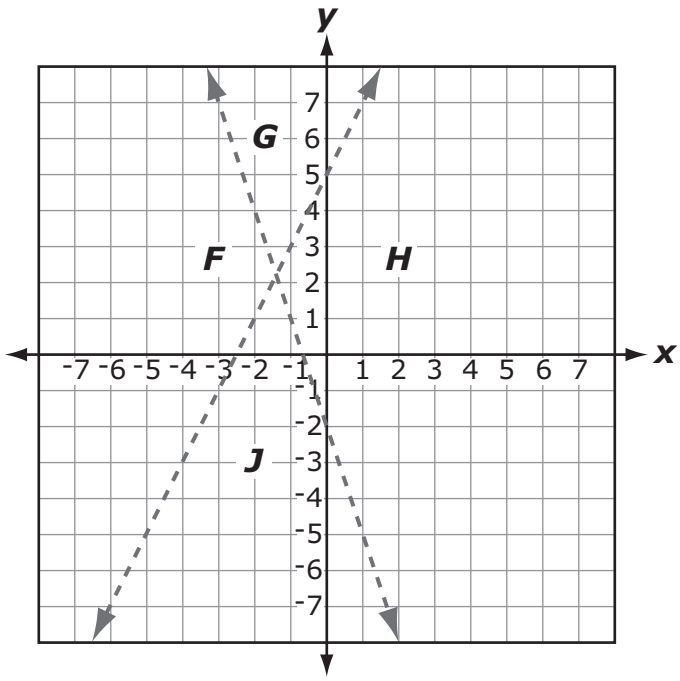
C 56 seashells

D 57 seashells

Correct Response: D
Depth-of-Knowledge: 3

5

$$\begin{cases} y < -3x - 2 \\ y > 2x + 5 \end{cases}$$



Which region on the graph represents the solution to this system of inequalities?

A *F*

B *G*

C *H*

D *J*

Correct Response: A
Depth-of-Knowledge: 2

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD A1.A.3

OAS STANDARD	**A1.A.3**	Generate equivalent algebraic expressions and use algebraic properties to evaluate expressions and arithmetic and geometric sequences.
OAS OBJECTIVES	**A1.A.3.1**	Solve equations involving several variables for one variable in terms of the others.
	A1.A.3.2	Simplify polynomial expressions by adding, subtracting, or multiplying.
	A1.A.3.3	Factor common monomial factors from polynomial expressions and factor quadratic expressions with a leading coefficient of 1.
	A1.A.3.4	Evaluate linear, absolute value, rational, and radical expressions. Include applying a nonstandard operation such as $a \odot b = 2a + b$.
	A1.A.3.5	Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Use the pattern, find the next term.
	A1.A.3.6	Recognize that geometric sequences are exponential using equations, tables, graphs and verbal descriptions. Given the formula $f(x) = a(r)^x$, find the next term and define the meaning of a and r within the context of the problem.
ITEM SPECIFICATIONS	**Emphasis:** • Solve a multi-variable equation for one of its variables. • Simplify polynomial expressions. • Factor polynomial expressions. • Evaluate linear, absolute value, rational, and radical expressions. • Recognize and extend arithmetic sequences. • Recognize, extend, and interpret geometric sequences. **Stimulus Attributes:** • Test items may include polynomials and geometric formulas. • Test items may include polynomial expressions. • Test items may include context, equations, arithmetic, and geometric sequences.	

ITEM SPECIFICATIONS

Format:

- Identify equivalent forms for a given equation or formula.
- Identify the sum of two or more polynomials.
- Identify the difference or product of two polynomials.
- Identify a factor of a polynomial expression.
- Identify a polynomial expression in factored form.
- Identify the Greatest Common Factor for a polynomial expression.
- Simplify and evaluate linear algebraic expressions.
- Simplify and evaluate rational algebraic expressions.
- Simplify and evaluate algebraic expressions that involve radicals.
- Simplify and evaluate algebraic expressions involving absolute value.
- Radical expressions in the denominator are limited to a single term and must be perfect squares, $\sqrt{2}$, and $\sqrt{3}$.
- Identify the nth term in an arithmetic or geometric sequence.
- Identify mathematical and real-world situations that can be represented by specific algebraic expressions and equations.

Content Limits:

- Limit geometric and scientific formulas to ones appropriate for Grade 10.
- Limit non-geometric and nonscientific equations to first degree with no more than four variables.
- Limit real-life and mathematical contexts to age-appropriate situations.
- Limit polynomials to no more than four terms.
- In multiplication of polynomials, limit the factors to no more than a trinomial by a binomial.
- Limit exponents to no more than the power of 6.
- In factoring polynomials, limit to binomials and trinomials.
- Limit radical expressions to those containing square roots up to $\sqrt{144}$ with no variables under the radical.
- Limit computations involving decimals to the tenths place.

Primary Process Standards:

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

Distractor Domain:

- Common algebraic misconceptions
- Computational errors
- Misconceptions of arithmetic and geometric sequences
- Interchange of arithmetic and geometric sequences

142042A Multiple Choice D Common EQ

6 **The equation for the amount of money (*A*) earned by a salesperson is shown.**

$$A = 15n + 7p$$

Which equation is equivalent when solved for *p*?

A $p = 7A - 105n$

B $p = 15n + 7A$

C $p = \frac{7}{A - 15n}$

D $p = \frac{A - 15n}{7}$

Correct Response: D
Depth-of-Knowledge: 2

497370 D Field Test

7

–27, –20, –13, –6, 1, ...

What is the value of the next term in this arithmetic sequence?

A 5

B 6

C 7

D 8

Correct Response: D
Depth-of-Knowledge: 2

OAS STRAND—ALGEBRAIC REASONING & ALGEBRA (A): STANDARD A1.A.4

OAS STANDARD

A1.A.4 Analyze mathematical change involving linear equations in real-world and mathematical problems.

OAS OBJECTIVES

A1.A.4.1 Calculate and interpret slope and the x- and y-intercepts of a line using a graph, an equation, two points, or a set of data points to solve real-world and mathematical problems.

A1.A.4.2 Solve mathematical and real-world problems involving lines that are parallel, perpendicular, horizontal, or vertical.

A1.A.4.3 Express linear equations in slope-intercept, point-slope, and standard forms and convert between these forms. Given sufficient information (slope and y-intercept, slope and one-point on the line, two points on the line, x- and y-intercept, or a set of data points), write the equation of a line.

A1.A.4.4 Translate between a graph and a situation described qualitatively.

ITEM SPECIFICATIONS

Emphasis:

- Determine the slope of a line and interpret its meaning in a given context.
- Determine the x- and y-intercepts of a line and interpret their meaning in a given context.
- Solve real-world and mathematical problems involving lines and pairs of lines.
- Write the equation of a line in various forms.
- Translate between a graph and a given context.

Stimulus Attributes:

- Test items may include graphs, points, ordered pairs, tables, equations and situations.

Format:

- Identify the slope from a graph.
- Identify the slope using the slope formula.
- Identify the slope from the equation of a line.
- Identify rates of constant change.
- Identify the meaning of intercepts in real-world contexts.
- Identify the meaning of rates of change in real-world contexts.
- Characterize a given set of lines by analyzing the slopes of the lines.
- Identify the relationship among lines that are parallel, perpendicular, horizontal, or vertical in real-world contexts.
- Identify the graph of a line given any of a variety of characteristics.
- Identify the equation of a line given any of a variety of characteristics.
- Identify the appropriate situation that corresponds to an algebraic equation.
- Identify the appropriate algebraic equation that represents a situation described graphically or verbally.

STANDARD A1.A.4 continued

ITEM SPECIFICATIONS

Content Limits:

- Limit to linear equations and functions.
- Limit real-world contexts to those that are of age-appropriate recognition.
- Limit sets of lines to at most two lines.

Primary Process Standards:

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

Distractor Domain:

- Computational errors
- Common algebraic misconceptions
- Conceptual errors
- Geometric misconceptions

143614A Multiple Choice C Common EQ

8

$$4x - 5y = -15$$

What is the slope of this line?

A -4

B $-\frac{4}{5}$

C $\frac{4}{5}$

D 4

Correct Response: C
Depth-of-Knowledge: 2

172151A Multiple Choice A In Development

9 **What is the equation of the line with an *x*-intercept of −2 and a *y*-intercept of −1?**

A $y = \frac{-1}{2}x - 1$

B $y = \frac{-1}{2}x - 2$

C $y = -x - 2$

D $y = -2x - 1$

Correct Response: A
Depth-of-Knowledge: 2

OAS STRAND—FUNCTIONS (F): STANDARD A1.F.1

OAS STANDARD	**A1.F.1**	Understand functions as descriptions of covariation (how related quantities vary together) in real-world and mathematical problems.
OAS OBJECTIVES	**A1.F.1.1**	Distinguish between relations and functions.
	A1.F.1.2	Identify the dependent and independent variables as well as the domain and range given a function, equation, or graph. Identify restrictions on the domain and range in real-world contexts.
	A1.F.1.3	Write linear functions, using function notation, to model real-world and mathematical situations.
	A1.F.1.4	Given a graph modeling a real-world situation, read and interpret the linear piecewise function (excluding step functions).
ITEM SPECIFICATIONS		**Emphasis:** • Distinguish between relations and functions. • Identify the dependent and independent variables of a function, equation, or graph. • Identify the domain and range of a function, equation, or graph. • Determine restrictions on the domain and range of a function that represents a real-world situation. • Write linear functions that model real-world and mathematical situations. • Read and interpret a linear piecewise function used to model a real-world situation. **Stimulus Attributes:** • Test items may include graphs, diagrams, tables, and real-world situations. **Format:** • Identify a function from a group of relations represented graphically, numerically, or in diagrams and tables. • Identify the dependent and independent variables and the domain and range of various relations and functions represented algebraically, graphically, numerically, and in tables. • Identify restrictions on the domain and range that arise in real-world contexts. • Write linear functions, using function notation, to model a given real-world or mathematical situation. • Explain how the graph of a linear piecewise function represents a real-world situation.

ITEM SPECIFICATIONS

Content Limits:

- Exclude expressions in the form of xy.
- Exclude step functions or trigonometric functions.

Primary Process Standards:

- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Computational errors
- Interchange range and domain
- Common algebraic misconceptions

170445A Multiple Choice B In Development

10 **Which table represents a function?**

A

x	1	2	3	2	1
y	0	1	2	3	4

B

x	0	1	2	3	4
y	1	2	3	2	1

C

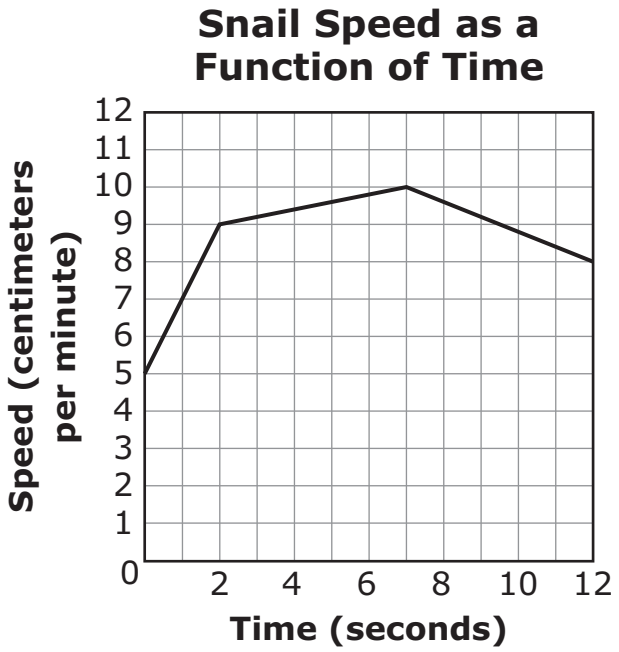
x	1	2	3	1	2
y	2	4	6	4	2

D

x	2	4	6	4	2
y	1	2	3	1	2

Correct Response: B
Depth-of-Knowledge: 1

11 **A scientist puts a snail on a track and records its speed.**



What are the domain and range of the data shown in the graph?

A Domain: $0 \le x \le 10$
Range: $5 \le y \le 8$

B Domain: $0 \le x \le 12$
Range: $5 \le y \le 10$

C Domain: $5 \le x \le 10$
Range: $0 \le y \le 12$

D Domain: $5 \le x \le 12$
Range: $0 \le y \le 8$

Correct Response: B
Depth-of-Knowledge: 1

OAS STRAND—FUNCTIONS (F): STANDARD A1.F.2

OAS STANDARD

A1.F.2 Recognize functions and understand that families of functions are characterized by their rate of change.

OAS OBJECTIVES

A1.F.2.1 Distinguish between linear and nonlinear (including exponential) functions arising from real-world and mathematical situations that are represented in tables, graphs, and equations. Understand that linear functions grow by equal intervals and that exponential functions grow by equal factors over equal intervals.

A1.F.2.2 Recognize the graph of the functions $f(x) = x$ and $f(x) = |x|$ and predict the effects of transformations [$f(x + c)$ and $f(x) + c$, where c is a positive or negative constant] algebraically and graphically using various methods and tools that may include graphing calculators.

ITEM SPECIFICATIONS

Emphasis:

- Distinguish between linear and nonlinear (including exponential) functions.
- Identify growth patterns of linear and exponential functions.
- Predict how a change in the algebraic representation of the parent functions $f(x) = x$ and $f(x) = |x|$ will affect the graph of the function.

Stimulus Attributes:

- Test items may include algebraic and graphical representations of parent functions, functions, and families of functions.

Format:

- Distinguish between linear and nonlinear (including exponential) functions from a group represented graphically, numerically, or in diagrams and tables.
- Identify the type of function by whether it grows by equal intervals (linear functions) or by equal factors over equal intervals (exponential functions).
- Identify the parent function from graphs of functions or families of functions.
- Describe how a change in the algebraic form of a parent function will affect the graph of the function.

Content Limits:

- Exclude step functions.
- Exclude logarithmic functions.
- Limit transformations of functions to parent linear and absolute value functions.

Primary Process Standards:

- Develop the Ability to Communicate Mathematically
- Develop Mathematical Reasoning
- Develop the Ability to Make Conjectures, Model, and Generalize

Distractor Domain:

- Common algebraic misconceptions

172869A Multiple Choice D In Development

12 **Which equation represents a nonlinear relation?**

A $y = 7$

B $y = \frac{1}{2}x + 4$

C $y = 3x - 8$

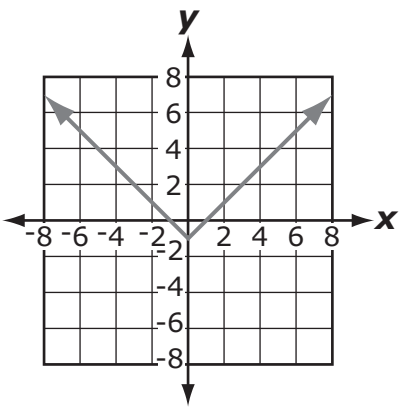
D $y = 5x^2 + 2$

Correct Response: D
Depth-of-Knowledge: 1

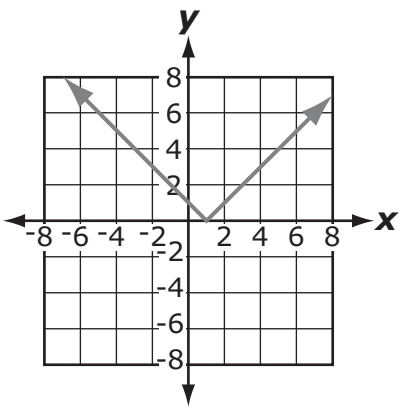
156216A Multiple Choice A Field Test / Pilot

13 **Which graph represents the function $y = |x| - 1$?**

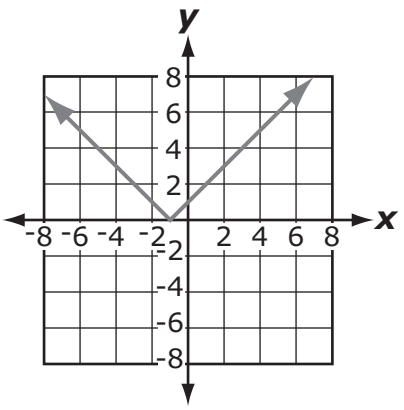
A



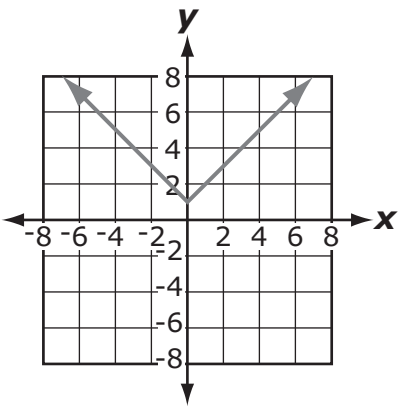
B



C



D



Correct Response: A
Depth-of-Knowledge: 2

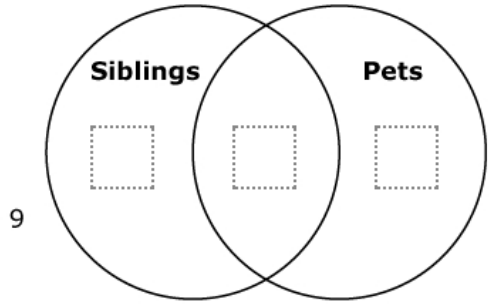
480448

14

Paige surveyed 50 of her classmates about whether they have any siblings and whether they have any pets.

She found that 40% of her classmates have pets. Of those students with pets, 70% also have siblings.

Paige started this Venn diagram to show her results. Complete her diagram by showing the missing numbers.
To place a number in the diagram, click and hold the number and then drag it to the desired space.



1	2	6	7	9	12	14	16	21	25

Correct Response: 21, 14, 6
Depth-of-Knowledge: 3

OAS STRAND—FUNCTIONS (F): STANDARD A1.F.3

OAS STANDARD

A1.F.3 Represent functions in multiple ways and use the representation to interpret real-world and mathematical problems.

OAS OBJECTIVES

A1.F.3.1 Identify and generate equivalent representations of linear equations, graphs, tables, and real-world situations.

A1.F.3.2 Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically and graphically. Interpret the results in terms of real-world and mathematical problems.

A1.F.3.3 Add, subtract, and multiply functions using function notation.

ITEM SPECIFICATIONS

Emphasis:

- Identify and generate equivalent representations of linear functions.
- Evaluate functions for given values in their domains both algebraically and graphically.
- Interpret the values of functions in terms of real-world and mathematical problems.
- Add, subtract, and multiply functions.

Stimulus Attributes:

- Test items may include functions, graphs, tables, and situations.

Format:

- Identify the appropriate real-world situation that corresponds to an algebraic equation.
- Identify the appropriate algebraic equation that represents a real-world situation described graphically or verbally.
- Use algebra to determine the value of a function, using function notation, for a given value in its domain.
- Use a graph to determine the value of a function, using function notation, for a given value in its domain.
- Identify real-world and mathematical results of functions for given values in their domains.
- Identify the result of operations with functions.

Content Limits:

- Limit real-life and mathematical contexts to age appropriate situations.
- Limit to linear equations.
- Limit to the use of no more than two functions.
- Limit to polynomial functions.
- Limit function operations to addition, subtraction, and multiplication.

Primary Process Standards:

- Develop the Ability to Make Conjectures, Model, and Generalize
- Develop the Ability to Communicate Mathematically
- Develop Strategies for Problem Solving

Distractor Domain:

- Common algebraic misconceptions
- Incorrect function operations

718A Multiple Choice B Common EQ

15 **The table shows the amount of money in dollars that a pizza restaurant charges to deliver different numbers of pizzas.**

Delivered Pizza

Number of Pizzas	1	2	3	4
Total Charged	$15	$25	$35	$45

Based on the information in the table, which equation represents the total amount of money charged (y) to deliver x pizzas?

A $y = 10x$

B $y = 10x + 5$

C $y = 15x$

D $y = 20x - 5$

Correct Response: B
Depth-of-Knowledge: 2

173861A Multiple Choice D In Development

16 **Given $f(x) = 2x - 3$ and $g(x) = 5 - x$, which expression is equivalent to $(g - f)(x)$?**

A $x - 8$

B $3x - 8$

C $-3x + 2$

D $-3x + 8$

Correct Response: D
Depth-of-Knowledge: 2

OAS STRAND—DATA & PROBABILITY (D): STANDARD A1.D.1

OAS STANDARD

A1.D.1 Display, describe, and compare data. For linear relationships, make predictions and assess the reliability of those predictions.

OAS OBJECTIVES

A1.D.1.1 Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics.

A1.D.1.2 Collect data and use scatterplots to analyze patterns and describe linear relationships between two variables. Using graphing technology, determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions.

A1.D.1.3 Interpret graphs as being discrete or continuous.

ITEM SPECIFICATIONS

Emphasis:

- Describe a set of data using an appropriate data display.
- Describe and compare data sets using summary statistics.
- Display data and calculate summary statistics using technology.
- Analyze, describe, and interpret data involving two variables to specifically identify the best linear model.
- Determine regression lines and correlation coefficients of a set of data.
- Determine regression lines and use them to make predictions and determine correlation coefficients and use them to assess the reliability of those predictions.
- Collect data and use scatterplots to analyze patterns and describe linear relationships between two variables.
- Determine whether a graph represents data that are discrete or continuous.

Stimulus Attributes:

- Test items may include graphs, scatterplots, and data tables.

Format:

- Describe a set of data using an appropriate data display.
- Describe a set of data using measures of central tendency.
- Describe a set of data using measures of location.
- Describe a set of data using measures of spread.
- Identify characteristics of a scatterplot.
- Determine the best-fit line of a set of data.
- Make predictions using linear models.
- Identify whether a provided graph represents data that are discrete or continuous.

STANDARD A1.D.1 continued

ITEM SPECIFICATIONS

Content Limits:

- Limit data displayed to strong positive or negative correlations.

Primary Process Standards:

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

Distractor Domain:

- Computational errors
- Common algebraic misconceptions

17 **Each morning Allan records the number of ducks that he sees on a lake near his house. After 7 days he calculates the mean to be 12 ducks. Allan made the table below to display the data.**

Ducks on a Lake

Day	Number of Ducks
Monday	10
Tuesday	8
Wednesday	13
Thursday	15
Friday	16
Saturday	**?**
Sunday	16

How many ducks did Allan see on Saturday?

A 6 ducks

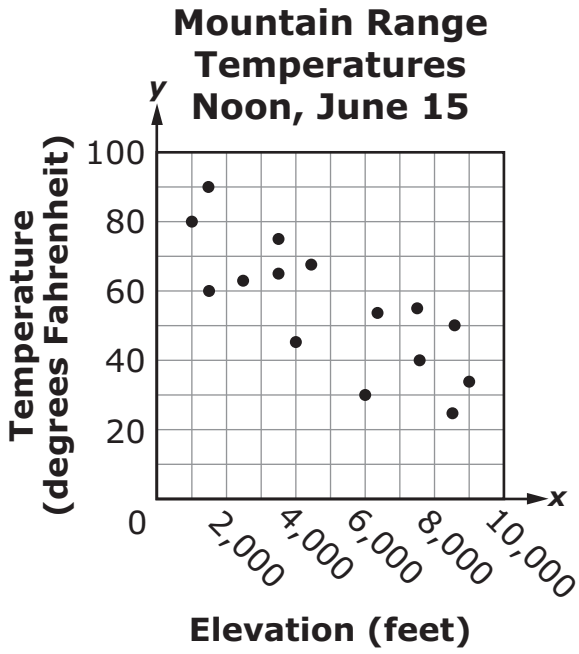
B 8 ducks

C 13 ducks

D 16 ducks

Correct Response: A
Depth-of-Knowledge: 2

18 **The temperatures at noon on June 15 at various elevations in a mountain range are given in the graph.**



What is the <u>best</u> prediction of the temperature at an elevation of 5,000 feet?

A 31° F

B 39° F

C 56° F

D 71° F

Correct Response: C
Depth-of-Knowledge: 1

OAS STRAND—DATA & PROBABILITY (D): STANDARD A1.D.2

OAS STANDARD	**A1.D.2** Calculate probabilities and apply probability concepts.
OAS OBJECTIVES	**A1.D.2.1** Select and apply counting procedures, such as the multiplication and addition principles and tree diagrams, to determine the size of a sample space (the number of possible outcomes) and to calculate probabilities. **A1.D.2.2** Describe the concepts of intersections, unions, and complements using Venn diagrams to evaluate probabilities. Understand the relationships between these concepts and the words AND, OR, and NOT. **A1.D.2.3** Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes. **A1.D.2.4** Apply probability concepts to real-world situations to make informed decisions.
ITEM SPECIFICATIONS	**Emphasis:** • Determine the size of a sample space using appropriate counting procedures. • Calculate probabilities using appropriate counting procedures. • Use Venn diagrams to evaluate probabilities of intersections, unions, and complements. • Develop understanding of use of the terms AND, OR, and NOT related to probabilities with intersections, unions, and complements. • Use relative frequencies of outcomes to find experimental probabilities. • Apply probability concepts to make decisions in real-world situations. **Stimulus Attributes:** • Test items may include data tables, diagrams, and situations. **Format:** • Find the number of possible outcomes of a given experiment. • Use counting procedures to calculate probabilities. • Find probabilities of compound events including intersections, unions, and complements. • Determine the experimental probability shown by the relative frequency of outcomes in a simulation or experiment. • Make informed decisions given real-world problems involving probability.

STANDARD A1.D.2 continued

ITEM SPECIFICATIONS

Content Limits:

- Limit real-life and mathematical contexts to age-appropriate situations.

Primary Process Standards:

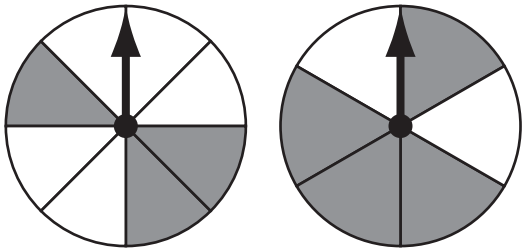
- Develop a Deep and Flexible Conceptual Understanding
- Develop Accurate and Appropriate Procedural Fluency
- Develop the Ability to Make Conjectures, Model, and Generalize
- Develop the Ability to Communicate Mathematically

Distractor Domain:

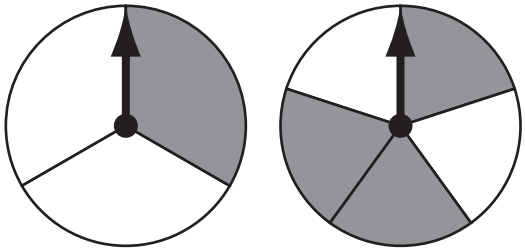
- Common algebraic misconceptions
- Computational errors
- Misconceptions of simple and compound events

19 **Marc drew two spinners. The probability of both spinners landing on a shaded section is greater than 25% but less than 50%. Based on this information, which pair of spinners did Marc draw?**

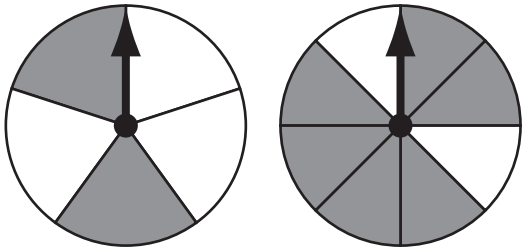
A



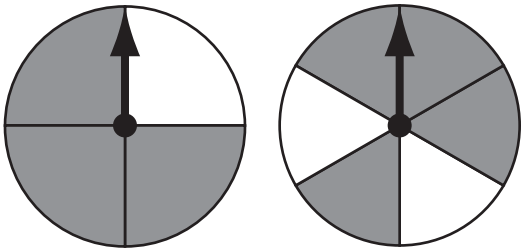
B



C



D



Correct Response: C
Depth-of-Knowledge: 2

OAS STRAND—GEOMETRY (G): STANDARD G.2D.1

OAS STANDARD	**G.2D.1**	Discover, evaluate and analyze the relationships between lines, angles, and polygons to solve real-world and mathematical problems; express proofs in a form that clearly justifies the reasoning, such as two-column proofs, paragraph proofs, flow charts, or illustrations.
OAS OBJECTIVES	**G.2D.1.1**	Apply the properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve real-world and mathematical problems and determine if two lines are parallel, using algebraic reasoning and proofs.
	G.2D.1.2	Apply the properties of angles, including corresponding, exterior, interior, vertical, complementary, and supplementary angles to solve real-world and mathematical problems using algebraic reasoning and proofs.
	G.2D.1.3	Apply theorems involving the interior and exterior angle sums of polygons and use them to solve real-world and mathematical problems using algebraic reasoning and proofs.
	G.2D.1.4	Apply the properties of special quadrilaterals (square, rectangle, trapezoid, isosceles trapezoid, rhombus, kite, parallelogram) and use them to solve real-world and mathematical problems involving angle measures and segment lengths using algebraic reasoning and proofs.
	G.2D.1.5	Use coordinate geometry to represent and analyze line segments and polygons, including determining lengths, midpoints, and slopes of line segments.
	G.2D.1.6	Apply the properties of polygons to solve real-world and mathematical problems involving perimeter and area (e.g., triangles, special quadrilaterals, regular polygons up to 12 sides, composite figures).
	G.2D.1.7	Apply the properties of congruent or similar polygons to solve real-world and mathematical problems using algebraic and logical reasoning.
	G.2D.1.8	Construct logical arguments to prove triangle congruence (SSS, SAS, ASA, AAS and HL) and triangle similarity (AA, SSS, SAS).
	G.2D.1.9	Use numeric, graphic and algebraic representations of transformations in two dimensions, such as reflections, translations, dilations, and rotations about the origin by multiples of 90°, to solve problems involving figures on a coordinate plane and identify types of symmetry.

ITEM SPECIFICATIONS

Emphasis:

- The student will use the properties and formulas of angle relationships formed by parallel lines cut by a transversal to solve problems.
- The student will use the properties and formulas of angle relationships formed by two lines cut by a transversal to solve problems, and verify using proofs.
- The student will use the properties and formulas of interior and exterior angles to solve problems.
- The student will use the properties and formulas of polygons, including quadrilaterals, to solve problems.
- The student will solve problems with geometric figures in the coordinate plane.
- The student will use the properties and formulas of 2-dimensional figures to solve problems involving perimeter and area.
- The student will use the properties and formulas of similar and congruent 2-dimensional figures, including triangles, to solve problems.
- The student will perform transformations (reflection, rotation, translation, dilation) on geometric figures in the coordinate plane.

Stimulus Attributes:

- The student may be given parallel lines cut by a transversal and angle measures.
- The student will be given sets of angles.
- The student may be given geometric polygons, including quadrilaterals, either by name or diagram.
- Graphs will be no more than 6 by 6.
- The student will be given geometric figures either by name or diagram.
- Items involving π may have answers given in terms of π or in decimal form.
- The student may be given sides, angles, and diagrams of 2-dimensional figures, including triangles.
- Points for transformations are either given as coordinates or shown on a graph.

Format:

- Identify geometric relationships (e.g., same-side interior, same-side exterior, corresponding, alternate interior, alternate exterior) between angles formed by parallel lines and a transversal.
- Identify geometric relationships between pairs of adjacent angles.
- Identify angle measures.
- Identify if lines are parallel.
- Identify which lines are parallel.
- Angles should not be considered right angles unless directly stated as such in the item or shown in the figure with a right-angle mark.
- Identify interior and exterior angle measures to confirm relationships.
- Determine measures of lengths, widths, segments, and diagonals within quadrilaterals.
- Use relationships of lengths, widths, segments, and diagonals within quadrilaterals.
- The student may determine distances, coordinates, and slopes.
- Use side, angle, area, and perimeter measures to solve problems.
- The student may solve for missing angles, sides, perimeters, circumferences, and areas.
- The student may determine what proof is necessary for triangles to be similar or congruent.
- The student may determine coordinates after a rotation, translation, reflection, and/or dilation.

ITEM SPECIFICATIONS

Content Limits:

- Limit angle measurements given in diagrams to whole numbers up to 180°.
- Limit algebraic solutions to whole numbers.
- Limit polygons to no more than 12 sides (dodecagon).
- Limit decimals to the hundredths place.
- Limit slope to integers and fractions.
- Limit real-life and mathematical contexts to age-appropriate situations.
- Limit radical answers to simplified forms.
- Limit answers to the same format as given in the item (e.g., decimals in the problems need decimal answers, fractions in the problems need fraction answers).
- Limit to AA, SSS, and SAS similarity postulates and theorems.
- Limit to SSS, SAS, ASA, AAS, and HL congruence postulates and theorems.
- Limit rotations to rotation about the origin.
- Limit rotations to multiples of 90°.
- Limit reflections to reflections across the x- or y-axis.
- Limit to no more than 2 transformations when determining transformations given the figure and its image.
- Limit to no more than 3 transformations when determining the image given the figure and the transformation.

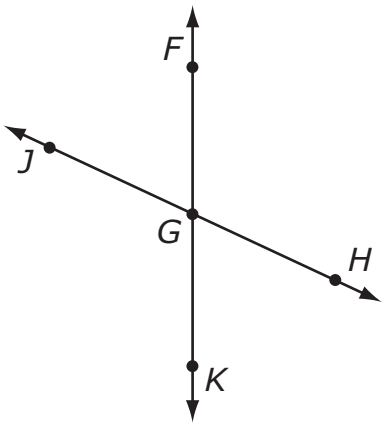
Primary Process Standards:

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

Distractor Domain:

- Angle relationship and parallel line misconceptions
- Misconceptions of vertical, adjacent, complementary, and supplementary angle assumptions
- Common geometric misconceptions
- Misconceptions of interior and exterior angle assumptions
- Misconceptions of lengths, widths, and diagonals
- Misconceptions of slope and coordinates
- Misconceptions of side, angle, area, and perimeter relationships
- Misconceptions of angle and side ratios in similar and congruent 2-dimensional figures, including triangles
- Misconceptions of areas, perimeters, and circumferences in similar and congruent 2-dimensional figures
- Incorrect counts
- Inappropriate coordinates

20



If $m\angle FGJ = (8x + 17)°$ and $m\angle HGK = (12x - 7)°$, what is the value of x?

A 6.0

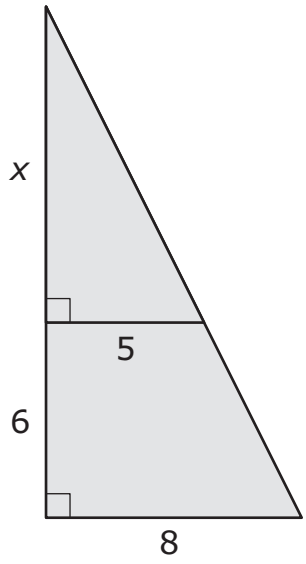
B 8.5

C 65.0

D 85.0

Correct Response: A
Depth-of-Knowledge: 2

21 **In this figure, what is the value of *x*?**



A 2.3

B 3.75

C 9.0

D 10.0

Correct Response: D
Depth-of-Knowledge: 3

APPENDIX A: SAMPLE TECHNOLOGY ENHANCED ITEMS (TEIS) FROM GRADES 6, 7, AND 8

The three sample TEIs in this appendix do not come from Grade 10, but are included to provide an understanding of how each interaction type used in Grade 10 works. For an example of a drag-and-drop interaction, see sample item 14 on page 31.

479089

A1

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.

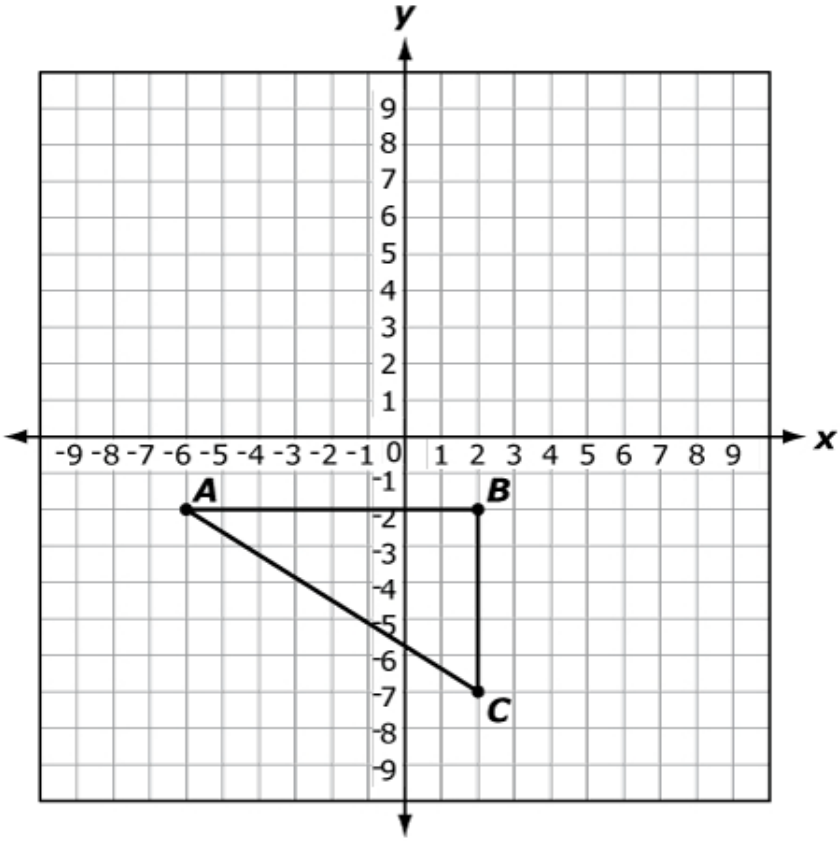
5(6 + 8)	40 + 48
48 + 30	8 + 30
(5 + 6) x 8	6(5 + 8)
5 + 48	40 + 30
6 x 5 + 8	5 + 6 x 8

Correct Response: 1A – 2D; 1B – 2C; 1C – 2A; 1D –2E; 1E – 2B
Depth-of-Knowledge: 2
OAS Standard: 6.A.2.1

480363

A2

Triangle *ABC* is translated 8 units up to create new triangle *A′B′C′*.



Which ordered pairs show the coordinates of the vertices of triangle *A′B′C′*?

To select the coordinates for a vertex, click the ordered pair. To deselect the coordinates, click on the ordered pair again.

(2, –2)	(–6, 6)	(–6, –10)	(2, 6)
(2, –10)	(10, –7)	(2, 1)	(10, –2)

Correct Response: (–6, 6); (2, 1); (2, 6)
Depth-of-Knowledge: 2
OAS Standard: 7.GM.4.3

484748

A3

Complete the statements to describe the outcomes of operations with the following numbers.

- a and b are non-zero rational numbers.
- x and y are irrational numbers.

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

$a + b$ is -Select an Answer- rational.

$x \cdot y$ is -Select an Answer- irrational.

$a + x$ is -Select an Answer- rational.

$b \cdot x$ is -Select an Answer- irrational.

Correct Response: always; sometimes; never; always
Depth-of-Knowledge: 2
OAS Standard: PA.N.1.4

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