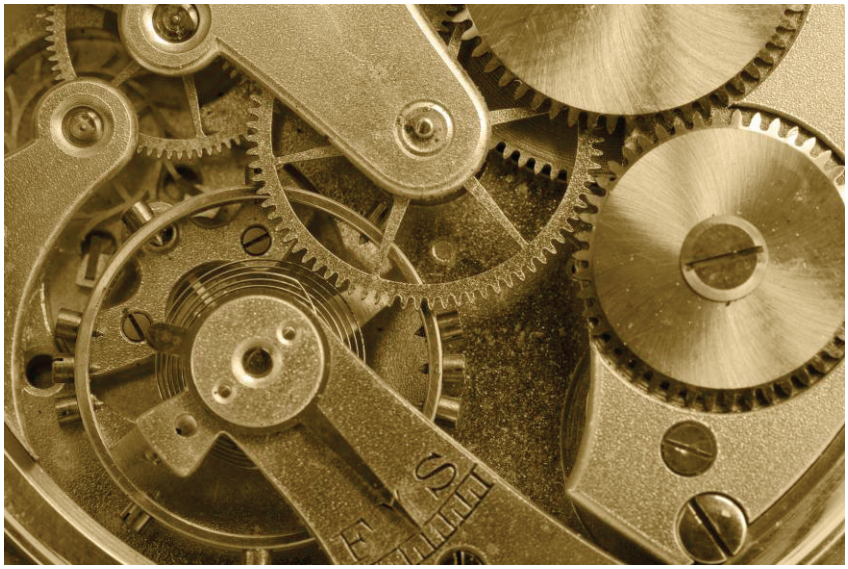
OKLAHOMA SCHOOL TESTING PROGRAM

OKLAHOMA CORE CURRICULUM TESTS

TEST AND ITEM SPECIFICATIONS

End-of-Instruction

ACE Geometry



Oklahoma State Department of Education
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OKLAHOMA CORE CURRICULUM TESTS

TEST AND ITEM SPECIFICATIONS

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Oklahoma Academic Standards
ACE Geometry End-of-Instruction

Purpose

The purpose of this test is to measure Oklahoma students' level of proficiency at the End-of-Instruction Geometry. On the ACE Geometry End-of-Instruction (EOI) test, students are required to respond to a variety of items linked to the Geometry content standards identified in the Oklahoma Academic Standards (OAS). Each Geometry test form will test each identified content standard and objective listed below. The following content standards and objectives are intended to summarize the knowledge as identified in the Oklahoma Academic Standards.

Oklahoma Academic Standards Geometry Content Standards and Objectives
Logical Reasoning • Inductive and Deductive Reasoning (1.1) • Conditional Statements (1.2)
Properties of 2-Dimensional Figures • Line and Angle Relationships (2.2) • Polygons and Other Plane Figures (2.3) • Similarity (2.4) • Congruence (2.5) • Circles (2.6)
Triangles and Trigonometric Ratios • Pythagorean Theorem (3.1) • Right Triangle Relationships (3.2) • Trigonometric Functions (3.3)
Properties of 3-Dimensional Figures • Polyhedra and Other Solids (4.1) • Similarity (4.2) • Models and Perspective (4.3)
Coordinate Geometry • Properties of Points, Segments, and Lines (5.1) • Properties of Figures (5.2)

Note: All references to Oklahoma Academic Standards (OAS) indicate the content standards and objectives previously known as Priority Academic Student Skills (PASS).

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Test Structure, Format, and Scoring

The test will consist of 55 operational multiple-choice items and 10 field-test items, written at a reading level about three grade levels below an ACE Geometry End-of-Instruction audience, and includes four responses from which to choose: the correct answer and three distractors. The total 65 items will be divided into two test sections.

Each multiple-choice item is scored as correct or incorrect. Only operational multiple-choice items contribute to the total test score. Thus, for example, if a test contains 55 operational items, only those 55 items (not the 10 field test) 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 OAS Standards and Objectives
1. Categorical Concurrence The test is constructed so that there are at least six items measuring each OAS standard. 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 at least 75 percent of the objectives for each OAS standard have at least one corresponding assessment item.
3. Balance of Representation* The test construction shall yield a balance of representation with an index value of 0.7 or higher of assessed objectives related to an OAS standard.
4. Source of Challenge Each test item is constructed in such a way that the major cognitive demand comes directly from the targeted OAS standard or objective being assessed, not from specialized knowledge or cultural background that the test-taker may bring to the testing situation.

*When new OAS standards and objectives are implemented, there is a transition period before the criteria for test alignment with OAS can be completely met. During this transition time, items are developed and field tested in order to meet the criteria for alignment to the OAS standards and objectives.

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Oklahoma School Testing Program

ACE Geometry EOI – Test Blueprint
School Years 2014-2015, 2015-2016, 2016-2017

The blueprint describes the content and structure of an assessment and defines the ideal number of test items by standard and objective of the Priority Academic Student Skills/ Oklahoma Academic Standards (PASS/OAS).

Standards and Objectives	Ideal Number of Items	Ideal Percentage of Items
1.0 Logical Reasoning	**6**	**11%**
1.1 Inductive and Deductive Reasoning	4	
1.2 Conditional Statements	2	
2.0 Properties of 2-Dimensional Figures	**20**	**36%**
2.2 Line and Angle Relationships	4	
2.3 Polygons and Other Plane Figures	4	
2.4 Similarity	4	
2.5 Congruence	4	
2.6 Circles	4	
3.0 Triangles and Trigonometric Ratios	**12**	**22%**
3.1 Pythagorean Theorem	4	
3.2 Right Triangle Relationships	4	
3.3 Trigonometric Functions	4	
4.0 Properties of 3-Dimensional Figures	**10**	**18%**
4.1 Polyhedra and Other Solids	6	
4.2 Similarity	2	
4.3 Models and Perspective	2	
5.0 Coordinate Geometry	**7**	**13%**
5.1 Properties of Points, Segments, and Lines	4	
5.2 Properties of Figures	3	
Total Test	**55**	**100%**

(Please note this blueprint does not include items that may be field-tested.)

- A minimum of 6 items is required to report a standard, and a minimum of 4 items is required to report results for an objective.
- Percentages are approximations and may result in a sum other than 100 due to rounding.

Depth-of-Knowledge Assessed by Test Items

The test will approximately reflect the following "Depth-of-Knowledge" distribution of items:[1]

Depth-of-Knowledge	Percent of Items
Level 1—Recall and Reproduction	10–15%
Level 2—Skills and Concepts	60–70%
Level 3—Strategic Thinking	15–25%

Level 1 (Recall and Reproduction) requires the student to recall facts, terms, definitions, or simple procedures, perform 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 activi 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%20and%20INSTR%20Align%20Anal%20513.pdf

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[1] This is the ideal depth-of-knowledge distribution of items. There may be slight differences in the actual distribution of the upcoming testing session.

Universal Test 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 End-of-Instruction tests, modifications have been made to some items that simplify and clarify instructions, and 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. These modifications are evident in the sample items included in this document.

Testing Schedule

Each End-of-Instruction test is meant to be administered in two sections within one day or consecutive days with the exception of ACE English II and ACE English III, which will be administered in three sections over two or three days. Estimated time for scheduling purposes is given in the table below.

ACE Geometry Online Test Time Schedule	
Distributing login information Section 1: Test instructions/tutorial and reviewing sample items Total:	Approximately 5 minutes Approximately 15 minutes Approximately 20 minutes
Administering Section 2 of the ACE Geometry Online Test Total:	Approximately 60 minutes Approximately 60 minutes
Distributing login information Administering Section 3 of the ACE Geometry Online Test Total:	Approximately 5 minutes Approximately 60 minutes Approximately 65 minutes

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, only one of which is correct.
- Multiple-choice item stems present a complete 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.
- In summary, End-of-Instruction ACE Geometry test items assess whether students understand geometric concepts and procedures, whether they can communicate their understandings effectively in mathematical terms, and whether they can approach problems and develop viable solutions.

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Item Types

Each multiple-choice item has four responses—the correct answer and three distractors. Distractors are developed based on the types of errors students are most likely to make.

For item review committee purposes, information regarding the OAS standard(s) and objectives addressed, item format, and correct answer key accompany each item.

Each item begins with a stem that asks a question or poses a clear problem. A stem will seldom include an incomplete sentence.

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?).

A stimulus that gives information precedes a question or a set of questions.

Stimulus Materials

Stimulus materials are the passages, graphs, models, figures, etc., that students must read and examine in order to respond to items. The following characteristics are necessary for stimulus materials:

1. When students are given information to evaluate, they should know the question and the purpose of the information.
2. Passages, graphics, tables, etc., provide sufficient information for assessment of multiple objectives.
3. Stimulus materials for a set of items may be a combination of multiple stimuli.
4. Information in stimulus materials is based on situations students would encounter in or beyond school.
5. For conceptual items, stimulus materials are necessary but not conceptually sufficient for student response.
6. 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.

Online Administration

Test questions will be presented one at a time.

Answers may be selected by using either the mouse or the keyboard.

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 scientific calculator on the ACE Algebra I and ACE Geometry assessments and a graphing calculator for the ACE Algebra II assessment) appear at the top of the screen/page to aid in answering questions.

Students will be able to use scratch paper for all online multiple choice 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.

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

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Item Speci.cations

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 End-of-Instruction 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.
9. All multiple-choice answer choices—keys and distractors—are similar in length, syntax, or magnitude or have two sets of parallel answer choices (e.g., two short and two long). Students should not be able to rule out a wrong answer or identify a correct response solely by its appearance. Distractors are created so that students reason their way to the correct answer rather than simply identify incorrect responses because of a distractor's obviously inappropriate nature. Distractors should always be plausible (but incorrect) in the context of the item stem. Correct responses will be approximately equally distributed among answer choices.

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.

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General Considerations-Oklahoma Core Curriculum Tests

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 and objectives listed in the ACE Geometry EOI Test Blueprint.
3. To the greatest extent possible, no item or response choice clues the answer to other items.
4. All items reviewed and approved by the Oklahoma Item Review Committee are assigned an OAS standard and/or objective. The Test Blueprints and score reports reflect the degree to which each OAS standard and/or objective is represented on the test.
5. Test items are tied closely and particularly to the stimuli from which they are derived, 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 are approximately equally distributed among A's, B's, C's, and D's.
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 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. It is not possible to measure every OAS objective on the test. However, at least 75% of the objectives from each of the Oklahoma Academic Standards are included on the test.
13. The range of items measuring an OAS objective consisting of more than one skill will provide a balanced representation of those skills.
14. Items should be focused on what all students should know and be able to do as they complete their End-of-Instruction coursework.
15. The responses "Both of the above," "All of the above," "None of the above," and "Neither of the above" will not be used.
16. The material presented is balanced, culturally diverse, well written, and of interest to End-of-Instruction level students. The stimuli and items are fairly presented in order to gain a true picture of students' skills.
17. Across all forms, a balance of gender and active/passive roles by gender is maintained.
18. Forms attempt to represent the ethnic diversity of Oklahoma students.
19. Approved calculators may be used on specified sections of the ACE Geometry EOI. No other resource materials may be used by students during the test.
20. The stimuli avoid subject matter that might prompt emotional distress on the part of the students.
21. In addition to the 55 operational items, there will be 10 field-test items per form.
22. Permission to use stimuli from copyrighted material is obtained as necessary by the testing vendor.

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OVERVIEW OF ITEM SPECIFICATIONS

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

- OAS Standard
- OAS Objective
- OAS Skill
- 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 Standard" and "OAS Objective" state the OAS standard followed by the OAS objective being measured in the mathematics section of the Oklahoma Academic Standards document.

For each objective, the information under the heading "Item Specifications" highlights important points about a test item's emphasis, stimulus attributes, format, content limits, primary Process Standard(s), and distractor domain. Sample test items are included with each objective 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 content 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.

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.

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MATHEMATICS CONTENT STANDARDS
Geometry

The following skills are required of all students completing Geometry. **Major Concepts** should be taught in depth using a variety of methods and applications (concrete to the abstract). **Maintenance Concepts** have been taught previously and are a necessary foundation for this course. The major concepts are considered minimal exit skills, and districts are strongly encouraged to exceed these skills when building a Geometry curriculum. Visual and physical models, calculators, and other technologies are recommended when appropriate and can enhance both instruction and assessment.

MAJOR CONCEPTS	MAINTENANCE CONCEPTS
Logical Reasoning	**Ratios, Proportions**
Properties	**Perimeter, Area, Surface Area, Volume**
Coordinate Geometry	**Equations**
Triangles	**Formulas**

Standard 1: Logical Reasoning—The student will use deductive and inductive reasoning to solve problems.

1. Identify and use logical reasoning skills (inductive and deductive) to make and test conjectures, formulate counterexamples, and follow logical arguments.
2. State, use, and examine the validity of the converse, inverse, and contrapositive of "if-then" statements.

*3. Compare the properties of Euclidean geometry to non-Euclidean geometries (for example, elliptical geometry, as shown on the surface of a globe, does not uphold the parallel postulate).

Standard 2: Properties of 2-Dimensional Figures—The student will use the properties and formulas of geometric figures to solve problems.

*1. Use geometric tools (for example, protractor, compass, straightedge) to construct a variety of figures.

2. Line and Angle Relationships
   a. Use the angle relationships formed by parallel lines cut by a transversal to solve problems.
   b. Use the angle relationships formed by two lines cut by a transversal to determine if the two lines are parallel and verify, using algebraic and deductive proofs.
   c. Use relationships between pairs of angles (for example, adjacent, complementary, vertical) to solve problems.

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Note: Asterisks (*) have been used to identify standards and objectives that must be assessed by the local school district. All other skills may be assessed by the Oklahoma School Testing Program (OSTP).

3. Polygons and Other Plane Figures
   a. Identify, describe, and analyze polygons (for example, convex, concave, regular, pentagonal, hexagonal, *n*-gonal).
   b. Apply the interior and exterior angle sum of convex polygons to solve problems, and verify using algebraic and deductive proofs.
   c. Develop and apply the properties of quadrilaterals to solve problems (for example, rectangles, parallelograms, rhombi, trapezoids, kites).
   d. Use properties of 2-dimensional figures and side length, perimeter or circumference, and area to determine unknown values and correctly identify the appropriate unit of measure of each.
4. Similarity
   a. Determine and verify the relationships of similarity of triangles, using algebraic and deductive proofs.
   b. Use ratios of similar 2-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference, and area.
5. Congruence
   a. Determine and verify the relationships of congruency of triangles, using algebraic and deductive proofs.
   b. Use the relationships of congruency of 2-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference, and area.
6. Circles
   a. Find angle measures and arc measures related to circles.
   b. Find angle measures and segment lengths using the relationships among radii, chords, secants, and tangents of a circle.

Standard 3: Triangles and Trigonometric Ratios—The student will use the properties of right triangles and trigonometric ratios to solve problems.

1. Use the Pythagorean Theorem and its converse to find missing side lengths and to determine acute, right, and obtuse triangles, and verify using algebraic and deductive proofs.
2. Apply the 45-45-90 and 30-60-90 right triangle relationships to solve problems, and verify using algebraic and deductive proofs.
3. Express the trigonometric functions as ratios and use sine, cosine, and tangent ratios to solve real-world problems.

*4. Use the trigonometric ratios to find the area of a triangle.

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Standard 4: Properties of 3-Dimensional Figures—The student will use the properties and formulas of geometric figures to solve problems.

1. Polyhedra and Other Solids
   a. Identify, describe, and analyze polyhedra (for example, regular, decahedral).
   b. Use properties of 3-dimensional figures and side lengths, perimeter or circumference, and area of a face; and volume, lateral area, and surface area and to determine unknown values and correctly identify the appropriate unit of measure of each.
2. Similarity: Use ratios of similar 3-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference of a face, area of a face, and volume.
3. Create a model of a 3-dimensional figure from a 2-dimensional drawing and make a 2-dimensional representation of a 3-dimensional object (for example, nets, blueprints, perspective drawings).

Standard 5: Coordinate Geometry—The student will solve problems with geometric figures in the coordinate plane.

1. Find the distance between two points; the midpoint of a segment; and calculate the slopes of parallel, perpendicular, horizontal, and vertical lines.
2. Properties of Figures
   a. Given a set of points, determine the type of figure formed based on its properties.
   b. Use transformations (reflection, rotation, translation) on geometric figures to solve problems within coordinate geometry.

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Note: Asterisks (*) have been used to identify standards and objectives that must be assessed by the local school district. All other skills may be assessed by the Oklahoma School Testing Program (OSTP).

PROCESS STANDARDS

High School

The National Council of Teachers of Mathematics (NCTM) has identified five process standards: Problem Solving, Reasoning and Proof, Communication, Connections, and Representation. Active involvement by students using these processes is likely to broaden mathematical understandings and lead to increasingly sophisticated abilities required to meet mathematical challenges in meaningful ways.

Standard 1: Problem Solving

1. Apply a wide variety of problem-solving strategies (identify a pattern, use equivalent representations) to solve problems from within and outside mathematics.
2. Identify the problem from a described situation, determine the necessary data, and apply appropriate problem-solving strategies.

Standard 2: Communication

1. Use mathematical language and symbols to read and write mathematics and to converse with others.
2. Demonstrate mathematical ideas orally and in writing.
3. Analyze mathematical definitions and discover generalizations through investigations.

Standard 3: Reasoning

1. Use various types of logical reasoning in mathematical contexts and real-world situations.
2. Prepare and evaluate suppositions and arguments.
3. Verify conclusions, identify counter-examples, test conjectures, and justify solutions to mathematical problems.
4. Justify mathematical statements through proofs.

Standard 4: Connections

1. Link mathematical ideas to the real world (e.g., statistics helps qualify the confidence we can have when drawing conclusions based on a sample).
2. Apply mathematical problem-solving skills to other disciplines.
3. Use mathematics to solve problems encountered in daily life.
4. Relate one area of mathematics to another and to the integrated whole (e.g., connect equivalent representations to corresponding problem situations or mathematical concepts).

Standard 5: Representation

1. Use algebraic, graphic, and numeric representations to model and interpret mathematical and real-world situations.
2. Use a variety of mathematical representations as tools for organizing, recording, and communicating mathematical ideas (e.g., mathematical models, tables, graphs, spreadsheets).
3. Develop a variety of mathematical representations that can be used flexibly and appropriately.

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OAS Standard:

Standard 1: Logical Reasoning

OAS Objective:

Objective 1.1: Identify and use logical reasoning skills (inductive and deductive) to make and test conjectures, formulate counterexamples, and follow logical arguments.

Item Specifications:

Emphasis:

- The student will use deductive and inductive reasoning, including the Law of Syllogism, to develop a logical conclusion.

Stimulus Attributes:

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

Format:

- The student may identify a logical conclusion from "if-then" statements.
- The student may be given a situation to determine if it is deductive or inductive reasoning.
- The student may be given a set of constraints and asked to determine a logical conclusion.

Content Limits:

- Limit logic puzzles to no more than 4 individuals and no more than 2 characteristics (e.g., name and ice cream flavor, or flavor and order in line).
- Limit Venn Diagrams to no more than 3 categories.
- Limit scientific content to 7th-grade material.
- Limit real-life and mathematical contexts to age-appropriate situations.
- Limit repeating pattern to repetition of up to 5 elements.

Primary Process Standard(s):

- Reasoning

Distractor Domain:

- Common logic misconceptions
- Logical inconsistencies
- Inductive for deductive
- Deductive for inductive

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Depth-of-Knowledge: 2

Which of these is an example of deductive reasoning leading to a correct conclusion?

A Bill is a Dalmatian. All Dalmatians have spots. Therefore, Bill has spots.

B All roses are plants. All roses have thorns. Therefore, all plants have thorns.

C All of Mary's sisters have brown eyes. Linda has brown eyes. Therefore, Linda is Mary's sister.

D Oak trees have leaves. Maple trees have leaves. Birch trees have leaves. Therefore, all trees have leaves.

Correct Response: **A**

Depth-of-Knowledge: 2

If $n + 2$ is divisible by 2, then which statement is <u>always</u> true?

A n is an even number.

B n is an odd number.

C n is a prime number.

D n is equal to $n + 1$.

Correct Response: **A**

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Depth-of-Knowledge: 2

12, 14, 18, 26, 42, _?_ , _?_

What are the next two numbers in this sequence?

A 64, 128

B 64, 138

C 74, 128

D 74, 138

Correct Response: **D**

Depth-of-Knowledge: 2

Mary, Dan, Jane, and Lucy walked into a shop at four different times. If Mary went into the shop before Lucy, Jane was the first person after Dan, and Mary was not the first person in the shop, who was the first person to walk into the shop?

A Dan

B Lucy

C Jane

D Mary

Correct Response: **A**

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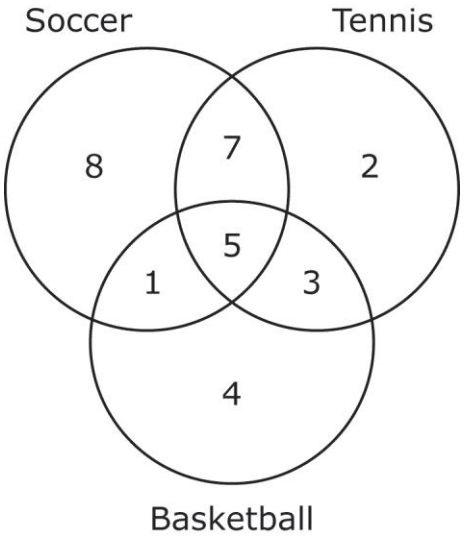
Depth-of-Knowledge: 2

The Venn diagram shows the number of students who play basketball, soccer, and tennis.



How many students play basketball or soccer?

A 13 students

B 28 students

C 34 students

D 36 students

Correct Response: **B**

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OAS Standard:

Standard 1: Logical Reasoning

OAS Objective:

Objective 1.2: State, use, and examine the validity of the converse, inverse, and contrapositive of "if-then" statements.

Item Specifications:

Emphasis:

- The student will use "if-then" statements to develop a logical conclusion.

Stimulus Attributes:

- Test items may include lists, statements, tables, graphs, charts, or diagrams.
- Test items may include "if-then" statements.

Format:

- The student may identify a logical conclusion from "if-then" statements.
- The student may develop converse, inverse, and contrapositive of "if-then" statements.

Content Limits:

- Limit scientific content to 7th-grade material.
- Limit real-life and mathematical contexts to age-appropriate situations.

Primary Process Standard(s):

- Reasoning

Distractor Domain:

- Common logic misconceptions
- Logical inconsistencies
- Misconceptions of converse, inverse, and contrapositive assumptions

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Sample Test Items for Objective 1.2

Depth-of-Knowledge: 1

If the radii of two circles are equal, then the circles are congruent.

What is the inverse of the statement above?

A If the radii of two circles are equal, then the circles are not congruent.

B If two circles are not congruent, then their radii are unequal.

C If two circles are congruent, then the radii of the circles are equal.

D If the radii of two circles are unequal, then the circles are not congruent.

Correct Response: **D**

Depth-of-Knowledge: 1

If a polygon is a square, then it is a quadrilateral.

What is the converse of this conditional statement?

A If a quadrilateral is a square, then it is a polygon.

B If a polygon is a quadrilateral, then it is a square.

C If a polygon is not a quadrilateral, then it is not a square.

D If a polygon is not a square, then it is not a quadrilateral.

Correct Response: **B**

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Depth-of-Knowledge: 2

If a quadrilateral does <u>not</u> have 4 congruent sides, then it is <u>not</u> a rhombus.

Which of these statements is the conditional statement that corresponds to the inverse statement above?

A If a quadrilateral has four congruent sides, then it is a rhombus.

B If a quadrilateral is a rhombus, then it has four congruent sides.

C If a quadrilateral has four congruent sides, then it is not a rhombus.

D If a quadrilateral does not have four congruent sides, then it is a rhombus.

Correct Response: **A**

Depth-of-Knowledge: 3

If two lines are parallel, then they will never intersect.

Which of these statements follows logically from the statement above?

A If two lines intersect, then they are not parallel.

B If two lines are not parallel, then they will never intersect.

C If two lines do not intersect, then they are parallel.

D If two lines are not parallel, then they will intersect.

Correct Response: **A**

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OAS Standard:

Standard 1: Logical Reasoning

OAS Objective:

*Objective 1.3: Compare the properties of Euclidean geometry to non-Euclidean geometries (for example, elliptical geometry, as shown on the surface of a globe, does not uphold the parallel postulate).

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Note: Asterisks (*) have been used to identify standards and objectives that must be assessed by the local school district. All other skills may be assessed by the Oklahoma School Testing Program (OSTP).

OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

*Objective 2.1: Use geometric tools (for example, protractor, compass, straight edge) to construct a variety of figures.

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Note: Asterisks (*) have been used to identify standards and objectives that must be assessed by the local school district. All other skills may be assessed by the Oklahoma School Testing Program (OSTP).

OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.2: Line and Angle Relationships

OAS Skill:

Skill 2.2a: Use the angle relationships formed by parallel lines cut by a transversal to solve problems.

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.

Stimulus Attributes:

- The student may be given parallel lines cut by a transversal and angle measures.

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 angle measures.
- 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.

Content Limits:

- Limit angle measurements given in diagrams to whole numbers up to 180°.
- Limit algebraic solutions to whole numbers.

Primary Process Standard(s):

- Problem Solving

Distractor Domain:

- Angle relationship and parallel line misconceptions
- Misconceptions of vertical, adjacent, complementary, and supplementary angle assumptions

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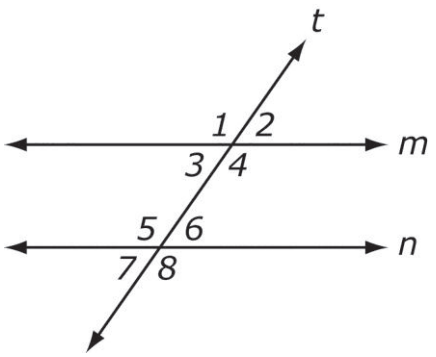
Depth-of-Knowledge: 1

Transversal *t* cuts parallel lines *m* and *n*.



Which angle is congruent to ∠1?

A ∠ 2

B ∠ 3

C ∠ 7

D ∠ 8

Correct Response: **D**

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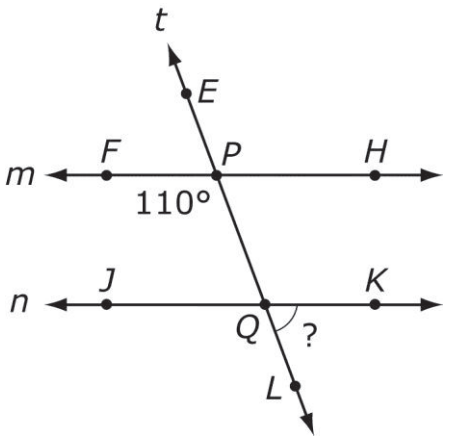
Depth-of-Knowledge: 2

Transversal *t* cuts parallel lines *m* and *n*.



What is the measure of ∠*KQL*?

A 20°

B 55°

C 70°

D 110°

Correct Response: **C**

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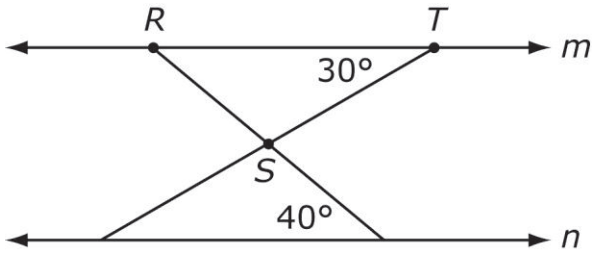
Depth-of-Knowledge: 3

Lines *m* and *n* are parallel.



What is the measure of ∠*RST*?

A 20°

B 70°

C 90°

D 110°

Correct Response: **D**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.2: Line and Angle Relationships

OAS Skill:

Skill 2.2b: Use the angle relationships formed by two lines cut by a transversal to determine if the two lines are parallel and verify, using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- 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.

Stimulus Attributes:

- The student may be given parallel lines cut by a transversal and angle measures.

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 if 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.

Content Limits:

- Limit angle measurements given in diagrams to whole numbers up to 180°.

Primary Process Standard(s):

- Problem Solving
- Reasoning

Distractor Domain:

- Angle relationship and parallel line misconceptions
- Misconceptions of vertical, adjacent, complementary and supplementary angle assumptions

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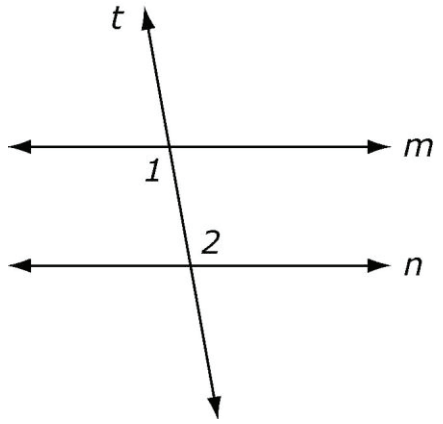
Depth-of-Knowledge: 1



Which statement must be true about ∠*1* and ∠*2* in order for line *m* and line *n* to be parallel?

A Their measures must be equal.

B Their measures must be supplementary.

C Their measures must be complementary.

D The measure of ∠*1* must be greater than the measure of ∠*2*.

Correct Response: **A**

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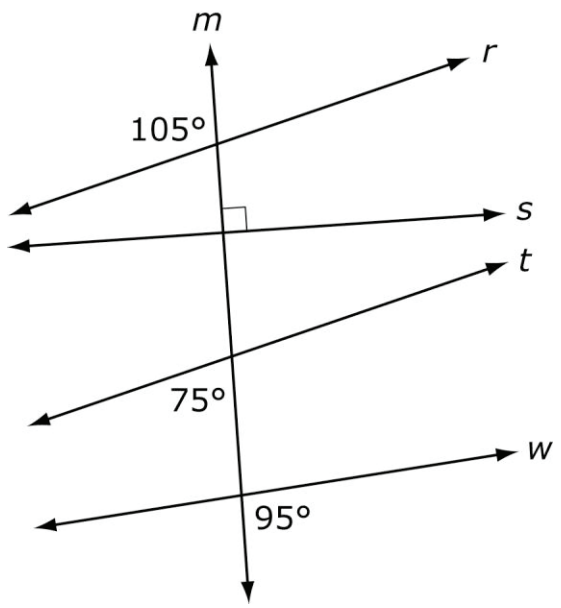
Depth-of-Knowledge: 2



Line *m* intersects lines *r, s, t,* and *w*. Which statement must be true?

A Lines *r* and *s* are parallel.

B Lines *r* and *t* are parallel.

C Lines r and w are parallel.

D Lines s and w are parallel.

Correct Response: **B**

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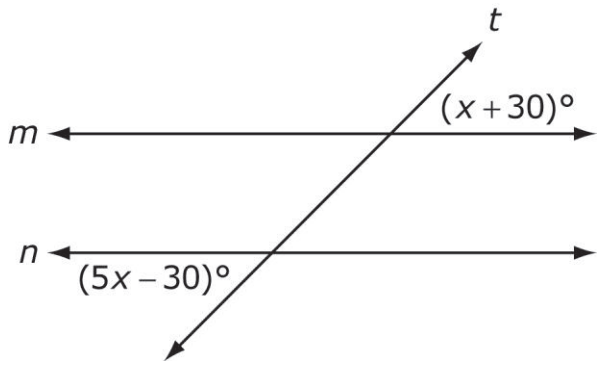
Depth-of-Knowledge: 2

Line *t* intersects lines *m* and *n*.



For what value of *x* are lines *m* and *n* parallel?

A 12

B 15

C 30

D 45

Correct Response: **B**

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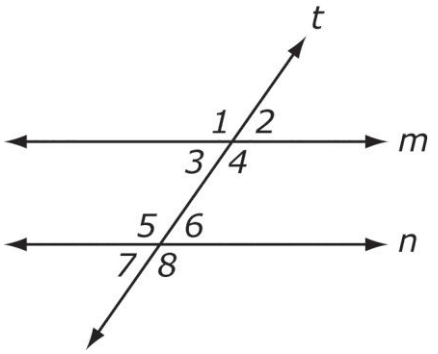
Depth-of-Knowledge: 3

Line *t* intersects lines *m* and *n*.



Which angle has to be supplementary to ∠*6* for lines *m* and *n* to be parallel?

A ∠2

B ∠4

C ∠7

D ∠8

Correct Response: **B**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.2: Line and Angle Relationships

OAS Skill:

Skill 2.2c: Use relationships between pairs of angles (for example, adjacent, complementary, vertical) to solve problems.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of relationships between pairs of angles to solve problems.

Stimulus Attributes:

- The student will be given sets of angles.

Format:

- Identify geometric relationships between pairs of angles formed by parallel lines and a transversal or adjacent angles.
- Identify angle measures.

Content Limits:

- Limit angle measurements given in diagrams to whole numbers up to 180°.

Primary Process Standard(s):

- Problem Solving

Distractor Domain:

- Angle relationship and parallel line misconceptions
- Misconceptions of vertical, adjacent, complementary and supplementary angle assumptions

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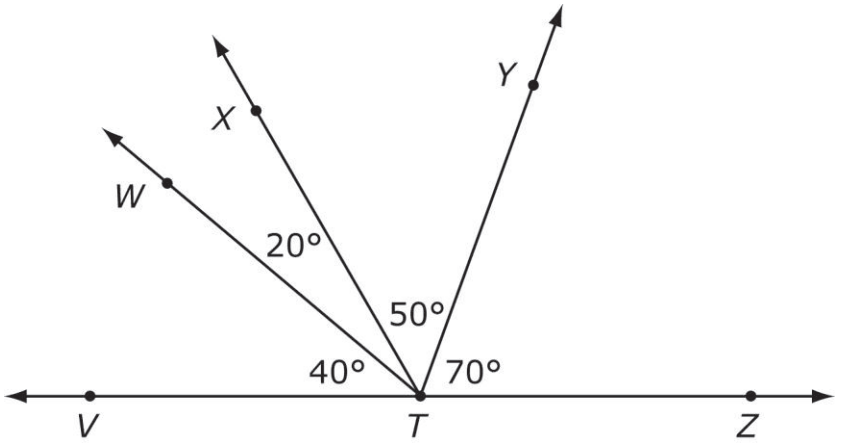
Depth-of-Knowledge: 1



Which angle is supplementary to ∠ *WTV*?

A ∠ *XTY*

B ∠ *XTZ*

C ∠ *WTZ*

D ∠ *WTX*

Correct Response: **C**

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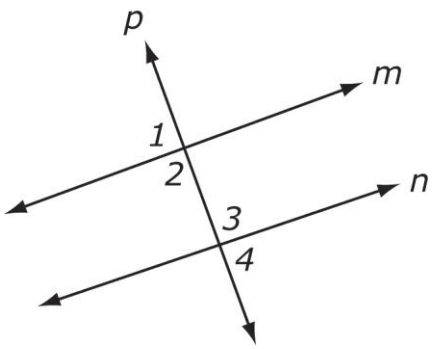
Depth-of-Knowledge: 2



If $\angle 3 \cong \angle 4$, which statement must be true?

A Line *m* is parallel to line *n*.

B Line *m* is perpendicular to line *n*.

C Line *n* is parallel to line *p*.

D Line *n* is perpendicular to line *p*.

Correct Response: **D**

Depth-of-Knowledge: 2

The measures of two complementary angles are $(2x + 2)°$ and $(3x - 5)°$. What is the measure of the smaller angle?

A 36.8°

B 39.2°

C 47.2°

D 50.8°

Correct Response: **B**

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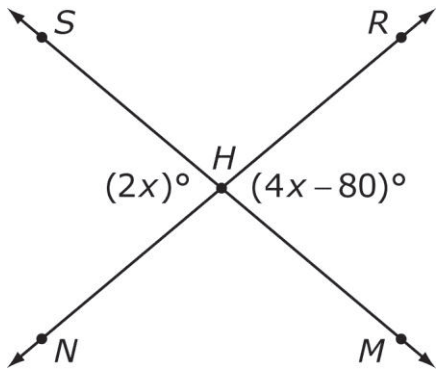
Depth-of-Knowledge: 3

Two lines intersect at point *H*.



What is the measure in degrees of ∠*RHS*?

A 40°

B 80°

C 90°

D 100°

Correct Response: **D**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.3: Polygons and Other Plane Figures

OAS Skill:

Skill 2.3a: Identify, describe, and analyze polygons (for example, convex, concave, regular, pentagonal, hexagonal, n-gonal).

Item Specifications:

Emphasis:

- The student will use the properties and formulas of polygons to solve problems.

Stimulus Attributes:

- The student may be given geometric figures either by name or diagram.

Format:

- Identify properties of geometric figures.
- Identify polygons.

Content Limits:

- Limit polygons to no more than 12 sides (dodecagon).
- Limit decimals to the hundredths place.
- Limit angle measures to whole numbers.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Geometric figures with different numbers of sides and angles
- Misconceptions of regular, convex and concave assumptions

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Sample Test Items for Skill 2.3a

Depth-of-Knowledge: 1

How many sides does a heptagon have?

A 5 sides

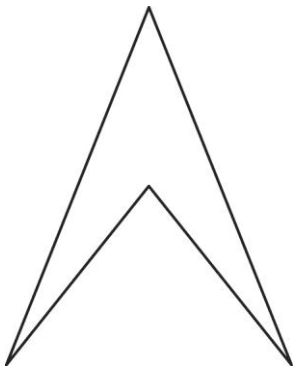
B 6 sides

C 7 sides

D 8 sides

Correct Response: **C**

Depth-of-Knowledge: 1



What type of figure is shown?

A convex triangle

B convex quadrilateral

C concave triangle

D concave quadrilateral

Correct Response: **D**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.3: Polygons and Other Plane Figures

OAS Skill:

Skill 2.3b: Apply the interior and exterior angle sum of convex polygons to solve problems, and verify using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of convex polygons to solve problems.

Stimulus Attributes:

- The student may be given geometric convex polygons either by name or diagram.

Format:

- Identify interior and exterior angle measures to confirm relationships.

Content Limits:

- Limit polygons to no more than 12 sides (dodecagon).
- Limit decimals to the hundredths place.
- Limit angle measures to whole numbers.

Primary Process Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of interior and exterior angle assumptions

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Depth-of-Knowledge: 1

What is the measure in degrees of an interior angle of an equiangular triangle?

A 30°

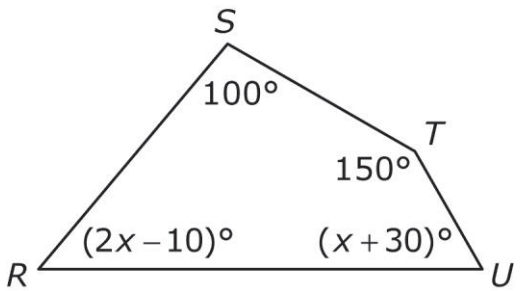
B 45°

C 60°

D 120°

Correct Response: **C**

Depth-of-Knowledge: 2



Given quadrilateral *RSTU,* what is the value of *x*?

A 15

B 30

C 45

D 60

Correct Response: **B**

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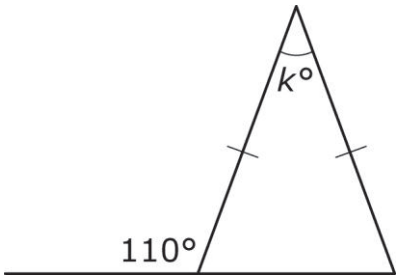
Depth-of-Knowledge: 2



What is the value of *k*?

A 35

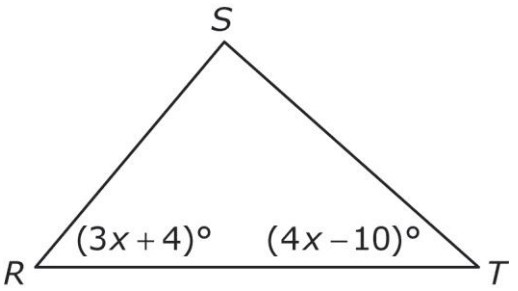
B 40

C 55

D 70

Correct Response: **B**

Depth-of-Knowledge: 3



In terms of *x*, what is the measure of ∠*S*?

A $(7x - 14)°$

B $(7x - 6)°$

C $(86 - 7x)°$

D $(186 - 7x)°$

Correct Response: **D**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.3: Polygons and Other Plane Figures

OAS Skill:

Skill 2.3c: Develop and apply the properties of quadrilaterals to solve problems (for example, rectangles, parallelograms, rhombi, trapezoids, kites).

Item Specifications:

Emphasis:

- The student will use the properties and formulas of quadrilaterals to solve problems.

Stimulus Attributes:

- The student may be given geometric quadrilaterals either by name or diagram.

Format:

- Determine measures of lengths, widths, segments, and diagonals within quadrilaterals.
- Use relationships of lengths, widths, segments, and diagonals within quadrilaterals.

Content Limits:

- Limit decimals to the hundredths place.
- Limit angle measures to whole numbers.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of lengths, widths and diagonals

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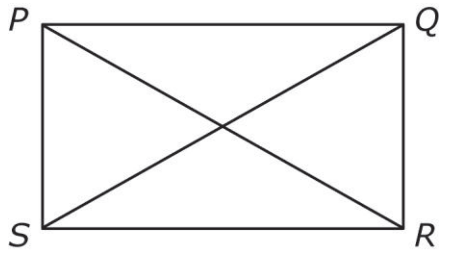
Depth-of-Knowledge: 1

For rectangle *PQRS*, the diagonal from *P* to *R* is 100 feet.



How long is the diagonal from *Q* to *S*?

A 50 feet

B 100 feet

C 141 feet

D 200 feet

Correct Response: **B**

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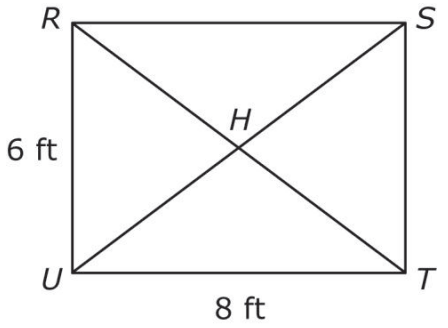
Depth-of-Knowledge: 2



For rectangle *RSTU*, what is the length of $\overline{HT}$?

A 4 ft

B 5 ft

C 6 ft

D 10 ft

Correct Response: **B**

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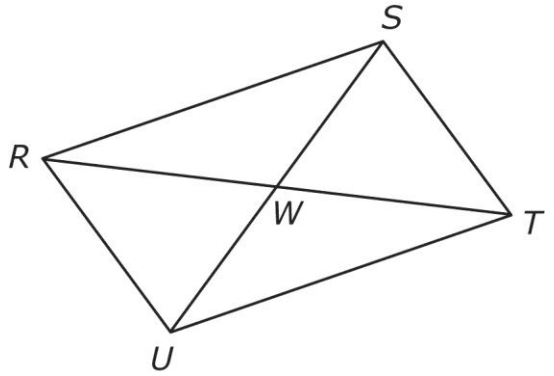
Depth-of-Knowledge: 3

In the parallelogram *RSTU*, the diagonals $\overline{RT}$ and $\overline{SU}$ intersect at point *W*.



If $RW = 2x + 2$ and $RT = 3x + 8$, what is the length of $\overline{WT}$?

A 4

B 8

C 10

D 20

Correct Response: **C**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.3: Polygons and Other Plane Figures

OAS Skill:

Skill 2.3d: Use properties of 2-dimensional figures and side length, perimeter or circumference, and area to determine unknown values and correctly identify the appropriate unit of measure of each.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of 2-dimensional figures to solve problems.

Stimulus Attributes:

- 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.

Format:

- Use side, angle, area and perimeter measures to solve problems.

Content Limits:

- Limit polygons to no more than 12 sides (dodecagon).
- Limit decimals to the hundredths place.
- Limit angle measures to whole numbers.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of side, angle, area and perimeter relationships

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Sample Test Items for Skill 2.3d

Depth-of-Knowledge: 1

Robert wants to build a fence around his square garden. If the area of the garden is 100 square feet, how many feet of fence will he need?

A 10 feet

B 20 feet

C 40 feet

D 100 feet

Correct Response: **C**

Depth-of-Knowledge: 2

Susan's circular swimming pool has an area of 314 square feet. What is the approximate diameter of the pool? (Use 3.14 for π.)

$$A = \pi r^2$$

A 10 feet

B 20 feet

C 30 feet

D 60 feet

Correct Response: **B**

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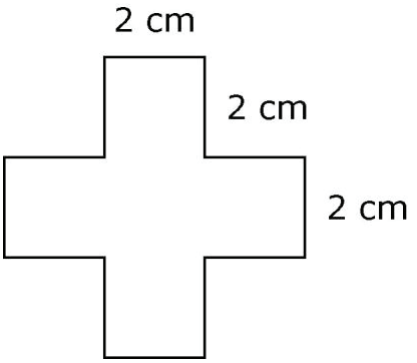
Depth-of-Knowledge: 3

This shaded figure is composed of 5 squares.



What is the area of this shaded figure?

A 8 cm^2

B 16 cm^2

C 20 cm^2

D 24 cm^2

Correct Response: **C**

Depth-of-Knowledge: 3

Four circular parks of different sizes are to be surrounded with fence. Park 1 has half the diameter of Park 2, one third the diameter of Park 3, and one fourth the diameter of Park 4. If one bundle of fence exactly surrounds park 2, how many bundles of fence will be used in this project?

A 3 bundles

B 5 bundles

C 6 bundles

D 8 bundles

Correct Response: **B**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.4: Similarity

OAS Skill:

Skill 2.4a: Determine and verify the relationships of similarity of triangles, using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- The student will use the properties and relationships of similar triangles to determine similarity.

Stimulus Attributes:

- The student may be given sides, angles, and diagrams of similar triangles.

Format:

- The student may solve for missing angles.
- The student may determine what proof is necessary for triangles to be similar.

Content Limits:

- Limit to AA, SSS, and SAS similarity postulates and theorems.

Primary Process Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of angle and side relationships in similar triangles

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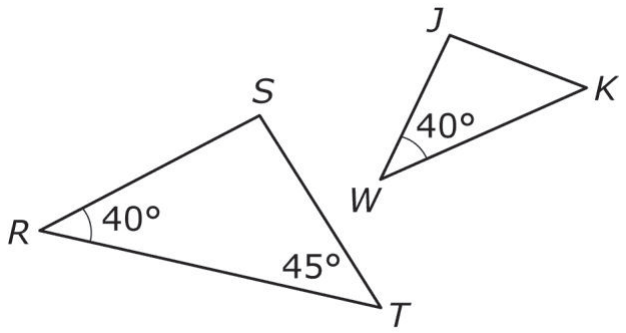
Depth-of-Knowledge: 2



Which additional fact proves that $\triangle RST$ and $\triangle WJK$ are similar?

A The measure of $\angle J$ is 40°.

B The measure of $\angle J$ is 95°.

C The measure of $\angle K$ is 40°.

D The measure of $\angle K$ is 95°.

Correct Response: **B**

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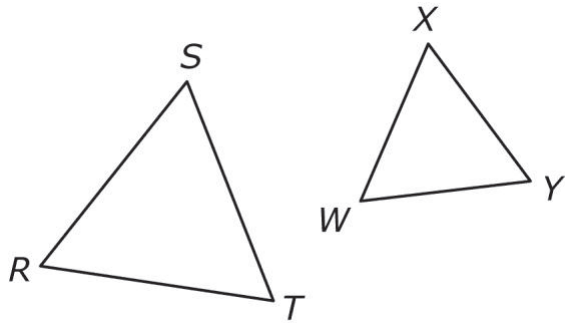
Depth-of-Knowledge: 2



Which pair of facts proves that $\triangle RST$ and $\triangle WXY$ are similar?

A $\angle S \cong \angle X$ and $\angle R \cong \angle W$

B $\overline{ST} \cong \overline{WX}$ and $\angle T \cong \angle W$

C $\overline{RS} \cong \overline{WY}$ and $\angle R \cong \angle Y$

D $\overline{RS} \cong \overline{WY}$ and $\overline{RT} \cong \overline{WX}$

Correct Response: **A**

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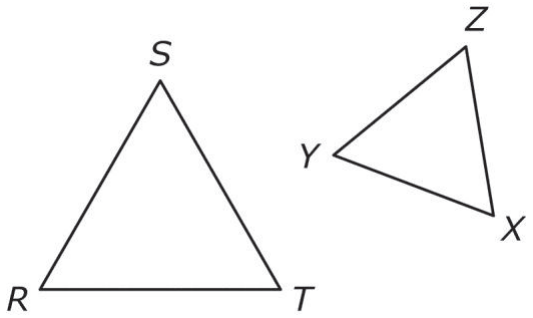
Depth-of-Knowledge: 2



If triangle *RST* and triangle *XYZ* are similar, which of these equations must be true?

A $\frac{ST}{YZ} = \frac{RT}{XZ}$

B $\frac{ST}{YZ} = \frac{SR}{XZ}$

C $\frac{RT}{YZ} = \frac{RT}{XZ}$

D $\frac{RT}{XZ} = \frac{RS}{YZ}$

Correct Response: **A**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.4: Similarity

OAS Skill:

Skill 2.4b: Use ratios of similar 2-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference, and area.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of similar 2-dimensional figures to solve problems.

Stimulus Attributes:

- The student may be given sides, angles and diagrams of 2-dimensional figures.
- Items involving π may have answers given in terms of π or in decimal form.

Format:

- The student may solve for missing angles, sides, perimeters, and areas.

Content Limits:

- 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 decimals to the hundredths place.

Primary Process Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of angle and side ratios in similar 2-dimensional figures
- Misconceptions of areas, perimeters and circumferences in similar 2-dimensional figures

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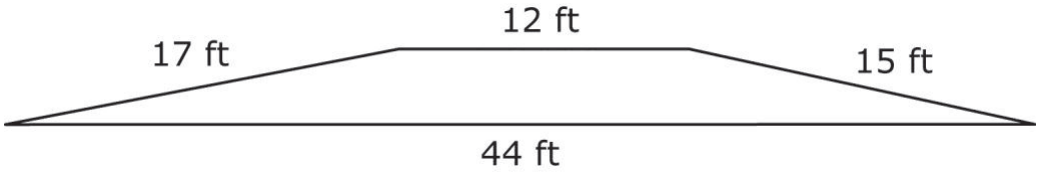
Depth-of-Knowledge: 2

Chris is planning a play area shaped like this polygon.



She draws a model similar to the desired play area. If the length of the longest side of her model is 33 cm, what is the length of the shortest side of the model?

A 9 cm

B 12 cm

C 13 cm

D 16 cm

Correct Response: **A**

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Depth-of-Knowledge: 3

The ratio of the perimeter of square *RSTU* to the perimeter of square *WXYZ* is 1 to 2. The area of square *RSTU* is 25 square inches. What is the area of square *WXYZ*?

A 20 sq in.

B 25 sq in.

C 50 sq in.

D 100 sq in.

Correct Response: **D**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.5: Congruence

OAS Skill:

Skill 2.5a: Determine and verify the relationships of congruency of triangles, using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of congruent triangles to solve problems.

Stimulus Attributes:

- The student may be given sides, angles, and diagrams of triangles.

Format:

- The student may determine what proof is necessary for triangles to be congruent.

Content Limits:

- Limit to SSS, SAS, ASA, and AAS congruence postulates and theorems.
- Limit decimals to the hundredths place.

Primary Process Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of angle and side relationships in congruent triangles

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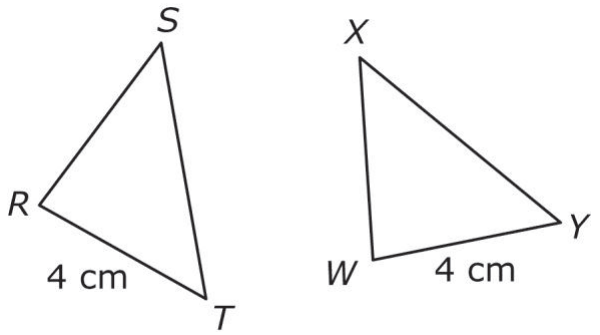
Depth-of-Knowledge: 1



Which additional facts prove that $\triangle RST$ and $\triangle WXY$ are congruent?

A $\overline{RS} \cong \overline{WX}$ and $\overline{ST} \cong \overline{XY}$

B $\overline{RS} \cong \overline{WX}$ and $\overline{RT} \cong \overline{XY}$

C $\overline{RT} \cong \overline{WY}$ and $\overline{ST} \cong \overline{XY}$

D $\overline{RT} \cong \overline{WY}$ and $\overline{RS} \cong \overline{WX}$

Correct Response: **A**

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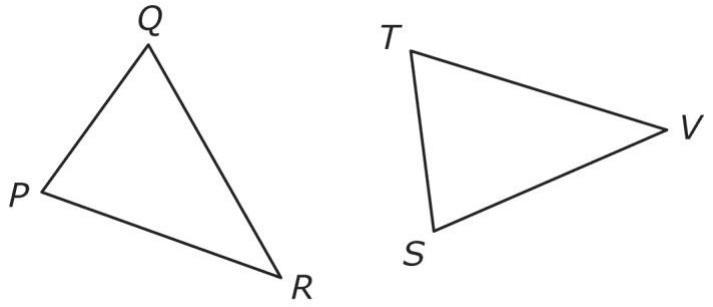
Depth-of-Knowledge: 1

In the diagram, $\triangle PQR \cong \triangle TSV$.



Which of these must be true?

A $\overline{QR} \cong \overline{ST}$

B $\overline{QR} \cong \overline{SV}$

C $\overline{PR} \cong \overline{ST}$

D $\overline{PR} \cong \overline{SV}$

Correct Response: **B**

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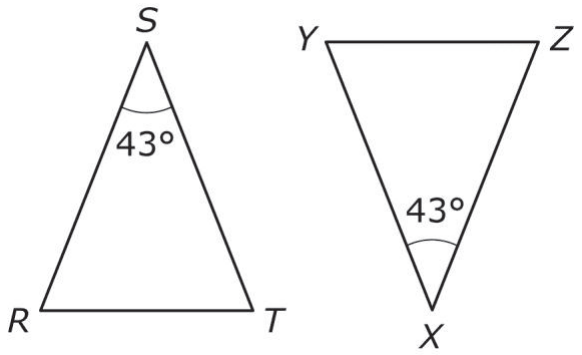
Depth-of-Knowledge: 2



Which additional facts prove that $\triangle RST$ and $\triangle ZXY$ are congruent?

A $\angle R \cong \angle Z$ and $\angle T \cong \angle Y$

B $\angle R \cong \angle Y$ and $\angle T \cong \angle Z$

C $\overline{RS} \cong \overline{ZX}$ and $\overline{RT} \cong \overline{ZY}$

D $\overline{RS} \cong \overline{ZX}$ and $\overline{ST} \cong \overline{XY}$

Correct Response: **D**

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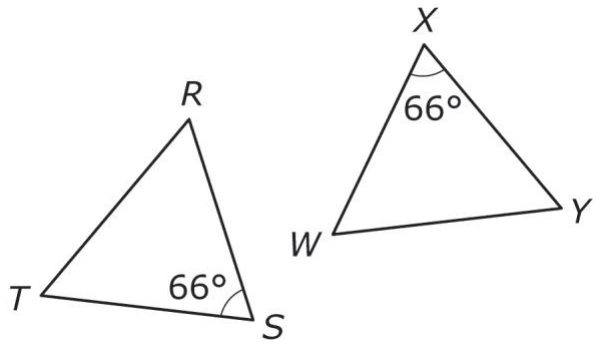
Depth-of-Knowledge: 2



Which additional facts prove that $\triangle RST$ and $\triangle WXY$ are congruent?

A $\overline{RS} \cong \overline{XY}$ and $\overline{TS} \cong \overline{WY}$

B $\overline{RS} \cong \overline{WX}$ and $\overline{RT} \cong \overline{WY}$

C $\angle R \cong \angle W$ and $RS \cong WX$

D $\angle R \cong \angle W$ and $\angle T \cong \angle Y$

Correct Response: **C**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.5: Congruence

OAS Skill:

Skill 2.5b: Use the relationships of congruency of 2-dimensional figures to determine unknown values, such as angles, side lengths, perimeter, circumference and area.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of congruent 2-dimensional figures to solve problems.

Stimulus Attributes:

- The student may be given sides, angles, and diagrams of 2-dimensional figures.

Format:

- The student may solve for missing angles, sides, perimeters, circumferences, and areas.
- Items involving π may have answers given in terms of π or in decimal form.

Content Limits:

- 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 decimals to the hundredths place.
- Limit angles to whole numbers.

Primary Process Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of angle and side ratios in congruent 2-dimensional figures
- Misconceptions of areas, perimeters, and circumferences in congruent 2-dimensional figures

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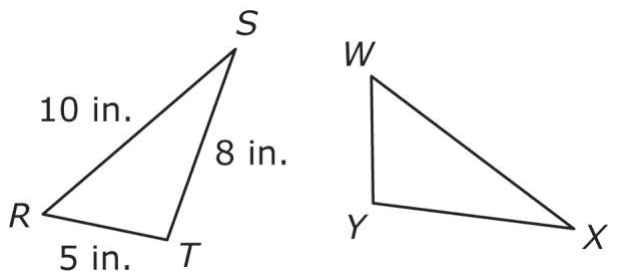
Depth-of-Knowledge: 1

ΔRST and ΔWXY are congruent.



What is the measure of $\overline{WX}$?

A 5 in.

B 8 in.

C 9 in.

D 10 in.

Correct Response: **D**

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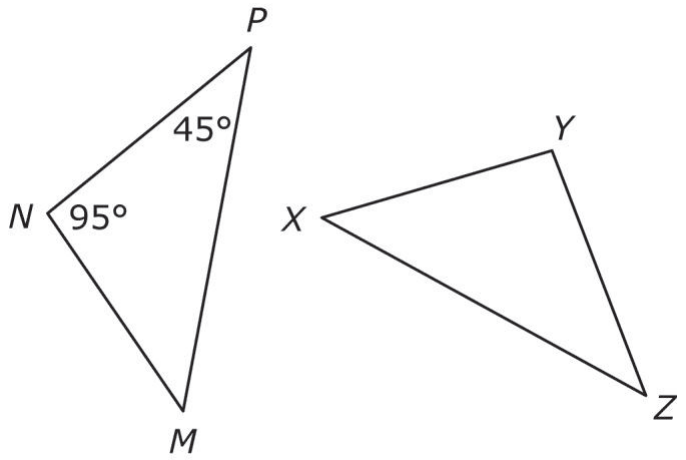
Depth-of-Knowledge: 2



If $\triangle MNP \cong \triangle XYZ$, what are $m\angle YXZ$ and m $\angle ZYX$?

A $m\angle YXZ = 40°$ and $m\angle ZYX = 45°$

B $m\angle YXZ = 45°$ and $m\angle ZYX = 40°$

C $m\angle YXZ = 40°$ and $m\angle ZYX = 95°$

D $m\angle YXZ = 95°$ and $m\angle ZYX = 45°$

Correct Response: **C**

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Depth-of-Knowledge: 2

Circle *R* and Circle *T* are congruent. The area of Circle *R* is 12.56 square feet. To the nearest tenth of a foot, what is the circumference of Circle *T*? (Use 3.14 for π.)

$$A = \pi r^2$$
$$C = 2\pi r$$

A 3.1 feet

B 6.3 feet

C 12.6 feet

D 25.1 feet

Correct Response: **C**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.6: Circles

OAS Skill:

Skill 2.6a: Find angle measures and arc measures related to circles.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of angle measures and arc measures of circles to solve problems.

Stimulus Attributes:

- The student may be given angle measures, arc measures, and diagrams of circles.
- Arc symbol may be used.
- Items involving π may have answers given in terms of π or in decimal form.

Format:

- The student will determine angle and arc measures and arc lengths based on information about a circle.

Content Limits:

- 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 decimals to the hundredths place.

Primary Process Standard(s):

- Problem Solving

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of angle and arc measures in circles

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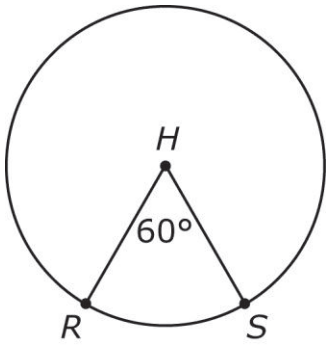
Depth-of-Knowledge: 1

The center of this circle is *H*.



What is the measure of *RS*?

A 15°

B 30°

C 60°

D 120°

Correct Response: **C**

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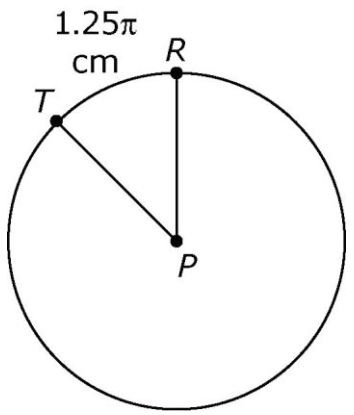
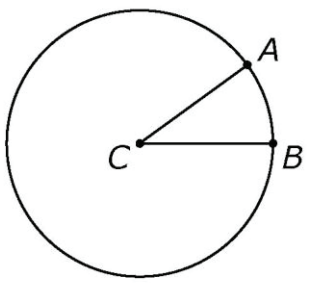
Depth-of-Knowledge: 2

The center of this circle is *P*.



If the length of $\overline{PT}$ is 5 cm, what is the measure of $\angle RPT$?



$$\frac{\text{Arc length of } \widehat{AB}}{2\pi r} = \frac{m\widehat{AB}}{360°}$$

A 22.5°

B 45°

C 67.5°

D 90°

Correct Response: **B**

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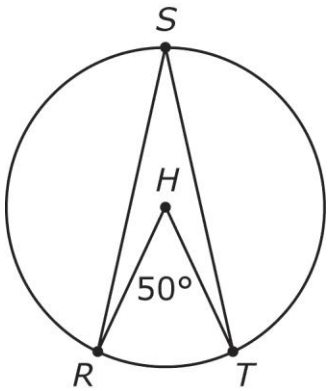
Depth-of-Knowledge: 2

The center of this circle is *H*.



What is the measure of ∠*RST*?

A 25°

B 50°

C 75°

D 100°

Correct Response: **A**

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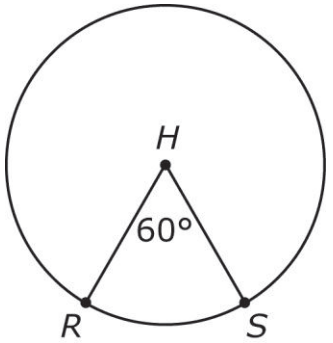
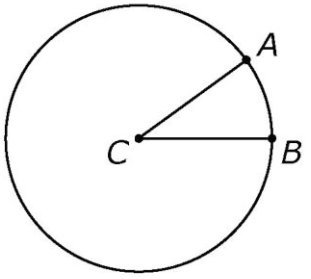
Depth-of-Knowledge: 2

The radius of circle *H* is 10 inches.



What is the arc length of *RS*?



$$\frac{\text{Arc length of } \overset{\frown}{AB}}{2\pi r} = \frac{m\overset{\frown}{AB}}{360°}$$

A $\frac{10}{3}\pi$ inches

B $\frac{5}{3}\pi$ inches

C 10π inches

D 20π inches

Correct Response: **A**

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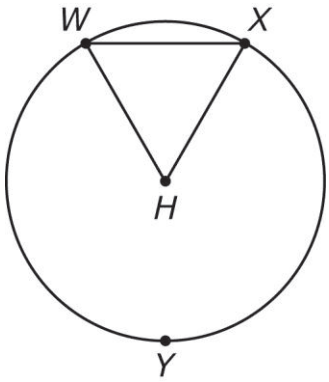
Depth-of-Knowledge: 3

In this circle, *H* is the center, and Δ*WXH* is an equiangular triangle.



What is the measure of *WYX*?

A 60°

B 120°

C 300°

D 320°

Correct Response: **C**

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OAS Standard:

Standard 2: Properties of 2-Dimensional Figures

OAS Objective:

Objective 2.6: Circles

OAS Skill:

Skill 2.6b: Find angle measures and segment lengths using the relationships among radii, chords, secants and tangents of a circle.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of angle measures and segment lengths of a circle to solve problems.

Stimulus Attributes:

- The student may be given angle measures, arc measures, radii, chords, secants, tangents, and diagrams of circles.
- Arc symbol may be used.
- Items involving π may have answers given in terms of π or in decimal form.

Format:

- The student may determine angle measures based on information about a circle. (Formulas will be provided for angles formed by intersecting chords, secants, and tangents.)
- Given the formula, the student may determine segment lengths based on information about a circle.

Content Limits:

- 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 decimals to the hundredths place.

Primary Process Standard(s):

- Problem Solving

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of the relationships of angle and arc measures, radii, chords, secants, and tangents in circles

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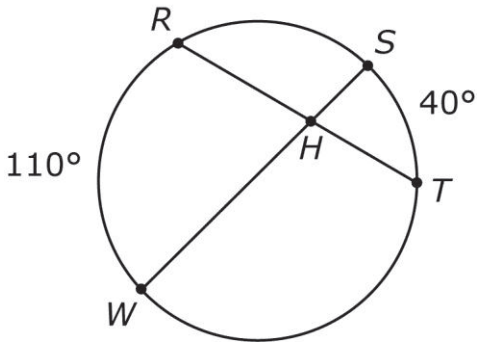
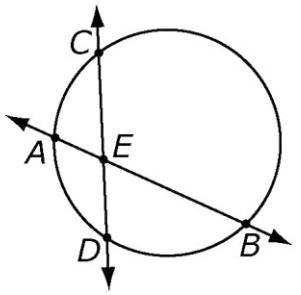
Depth-of-Knowledge: 1

Chords $\overline{RT}$ and $\overline{WS}$ intersect at point *H* in this circle.



What is the measure of $\angle RHW$?



$$m\angle AEC = \frac{1}{2}(m\widehat{AC} + m\widehat{DB})$$

A 40°

B 75°

C 110°

D 150°

Correct Response: **B**

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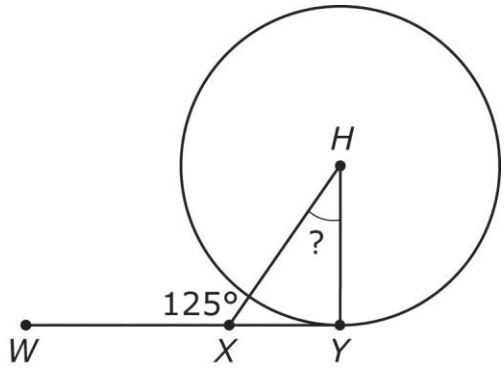
Depth-of-Knowledge: 2

In the circle, *H* is the center, and $\overline{XY}$ is tangent to the circle.



What is the measure of $\angle XHY$?

A 25°

B 35°

C 90°

D 125°

Correct Response: **B**

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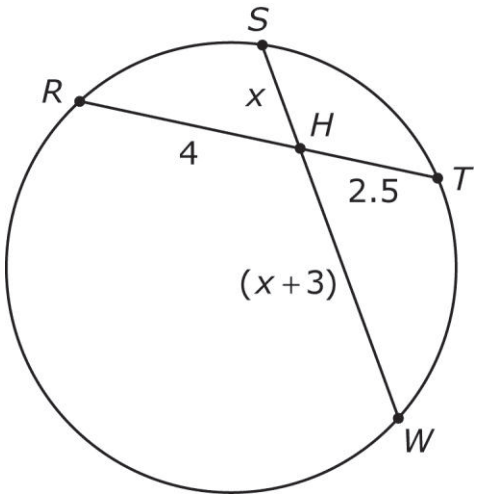
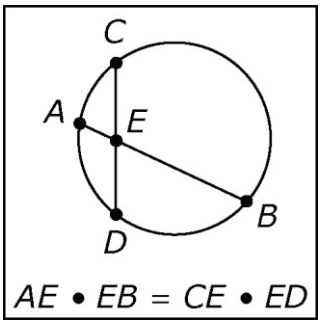
Depth-of-Knowledge: 2

Chords $\overline{RT}$ and $\overline{WS}$ intersect at point *H* in this circle.



What is the value of *x*?



A 2

B 2.5

C 4

D 5

Correct Response: **A**

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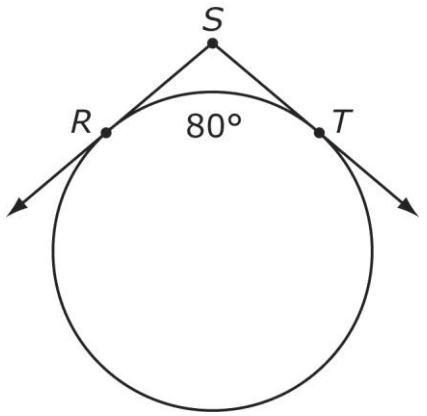
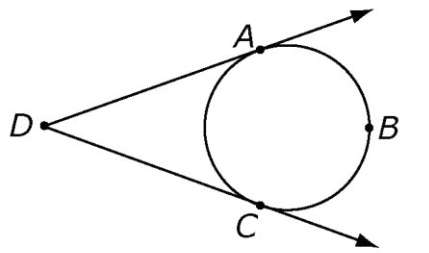
Depth-of-Knowledge: 3

The measure of arc *RT* is 80°.



What is the measure of ∠*RST*?



$$m\angle ADC = \frac{1}{2}(m\widehat{ABC} - m\widehat{AC})$$

A 50°

B 80°

C 100°

D 160°

Correct Response: **C**

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OAS Standard:

Standard 3: Triangles and Trigonometric Ratios

OAS Objective:

Objective 3.1: Use the Pythagorean Theorem and its converse to find missing side lengths and to determine acute, right, and obtuse triangles, and verify using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- The student will use the properties of right triangles and trigonometric ratios to solve problems.

Stimulus Attributes:

- The student may be given side lengths and diagrams of right triangles.
- Pythagorean formula will not be given.
- Items may include labeled graphic with compass directions if necessary.

Format:

- The student may solve for side lengths in right triangles.

Content Limits:

- Limit given measurements to whole numbers or simplified radicals with no coefficient (e.g. $\sqrt{15}$)
- Limit proofs to classifying triangles.
- Limit real-life and mathematical contexts to age-appropriate situations.

Primary Process Standard(s):

- Problem Solving
- Reasoning

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of side length relationships in right triangles

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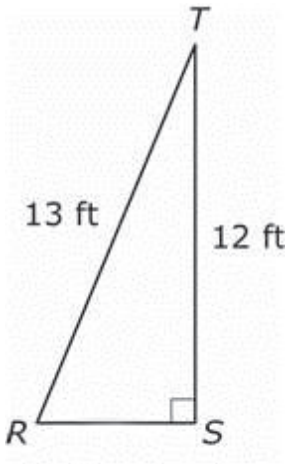
Depth-of-Knowledge: 1



For the right triangle *RST*, what is the length of $\overline{RS}$?

A 4 feet

B 5 feet

C 12.5 feet

D 25 feet

Correct Response: **B**

Depth-of-Knowledge: 2

Which set of measurements could be the side lengths of an obtuse triangle?

A 3 in., 4 in., 4 in.

B 5 in., 12 in., 13 in.

C 6 in., 7 in., 12 in.

D 6 in., 8 in., 9 in.

Correct Response: **C**

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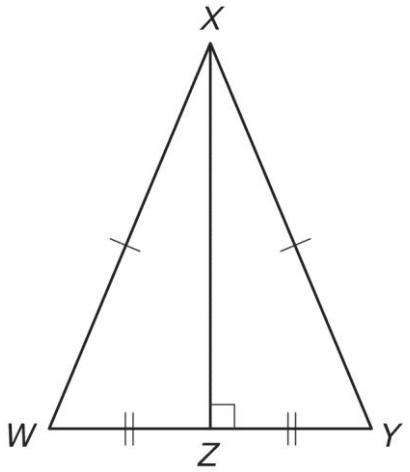
Depth-of-Knowledge: 3

In isosceles triangle *WXY*, $\overline{XY}$ is 13 inches in length and $\overline{WY}$ is 10 inches in length.



What is the length of $\overline{XZ}$?

A 5 in.

B 6 in.

C 12 in.

D 18 in.

Correct Response: **C**

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OAS Standard:

Standard 3: Triangles and Trigonometric Ratios

OAS Objective:

Objective 3.2: Apply the 45-45-90 and 30-60-90 right triangle relationships to solve problems, and verify using algebraic and deductive proofs.

Item Specifications:

Emphasis:

- The student will use the properties of right triangles with 45-45-90 and 30-60-90 relationships to solve problems.

Stimulus Attributes:

- The student may be given side lengths, angle measures, and diagrams of right triangles.
- Pythagorean formula will not be given.
- Answers may be in decimal form or radical form.

Format:

- The student may solve for side lengths and angle measures in right triangles.
- The student may solve problems using side lengths and/or angle measures.

Content Limits:

- Limit decimals to the hundredths place.
- For 30-60-90 triangles, limit longest leg to multiples of 3 or $\sqrt{3}$.
- For 45-45-90 triangles, limit hypotenuse to multiples of 2 or $\sqrt{2}$.

Primary Process Standard(s):

- Problem Solving
- Reasoning

Distractor Domain:

- Common geometric misconceptions

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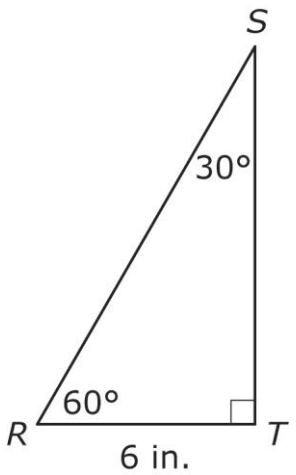
Depth-of-Knowledge: 1



In ΔRST, what is the length in inches of $\overline{ST}$?

A 6 in.

B $6\sqrt{2}$ in.

C $6\sqrt{3}$ in.

D 12 in.

Correct Response: **C**

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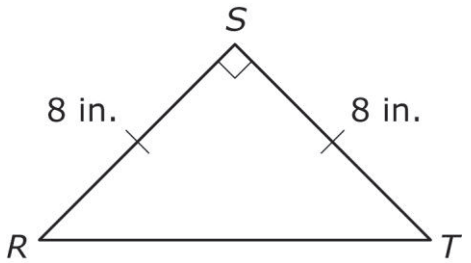
Depth-of-Knowledge: 2



What is the measure of $\angle R$?

A 30°

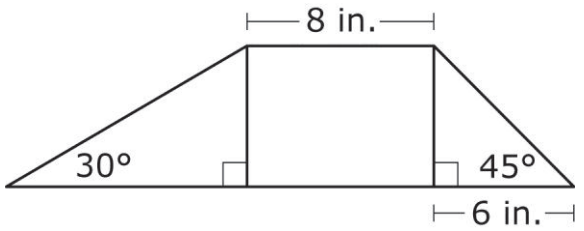
B 45°

C 60°

D 80°

Correct Response: **B**

Depth-of-Knowledge: 3



In radical form, what is the perimeter of this trapezoid?

A $30 + 6\sqrt{3} + 6\sqrt{2}$ in.

B $34 + 6\sqrt{3} + 6\sqrt{2}$ in.

C $30 + 8\sqrt{3} + 8\sqrt{2}$ in.

D $38 + 8\sqrt{3} + 6\sqrt{2}$ in.

Correct Response: **B**

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OAS Standard:

Standard 3: Triangles and Trigonometric Ratios

OAS Objective:

Objective 3.3: Express the trigonometric functions as ratios and use sine, cosine, and tangent ratios to solve real-world problems.

Item Specifications:

Emphasis:

- The student will use the properties of right triangles and trigonometric ratios to solve problems.

Stimulus Attributes:

- The student may be given side lengths, angle measures, and diagrams of right triangles.

Format:

- The student may solve for side lengths and trigonometric ratios in right triangles.

Content Limits:

- Limit functions to sine, cosine, and tangent.
- Limit given side lengths to whole numbers.
- Limit real-life and mathematical contexts to age-appropriate situations.
- Limit missing lengths to decimals to the hundredths place.

Primary Process Standard(s):

- Problem Solving
- Connections

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of side length and trigonometric ratio relationships in right triangles

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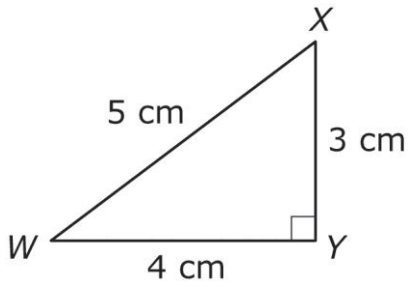
Depth-of-Knowledge: 1



What is the tangent ratio of angle *W*?

A $\frac{3}{4}$

B $\frac{3}{5}$

C $\frac{4}{3}$

D $\frac{4}{5}$

Correct Response: **A**

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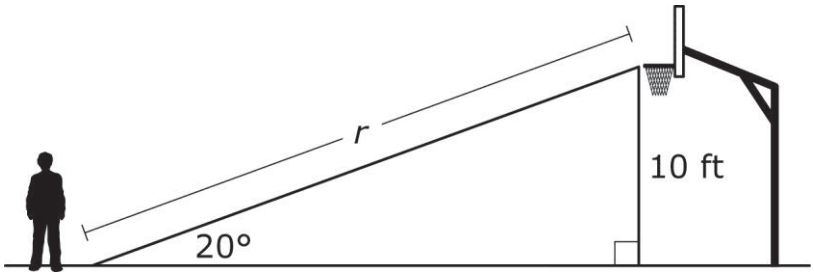
Depth-of-Knowledge: 2

Michael wants to build a ramp to reach a basketball rim that is 10 feet high, and the angle of elevation from the floor where he is standing to the rim is 20 degrees.



Which equation can be used to find the length in feet of the ramp, *r*?

A $\sin 20° = \frac{10}{r}$

B $\cos 20° = \frac{10}{r}$

C $\sin 20° = \frac{r}{10}$

D $\cos 20° = \frac{r}{10}$

Correct Response: **A**

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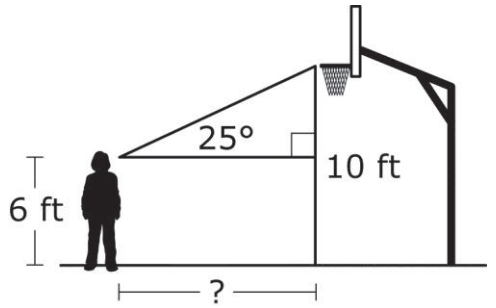
Depth-of-Knowledge: 3

A basketball player looks directly at the rim that is 10 feet high. The angle of elevation from her eye level, which is 6 feet above the ground, to the rim is 25 degrees.



sin 25° ≈ 0.42
cos 25° ≈ 0.91
tan 25° ≈ 0.47

To the nearest foot, how far away from the rim is she standing?

A 6 ft

B 9 ft

C 21 ft

D 25 ft

Correct Response: **B**

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OAS Standard:

Standard 3: Triangles and Trigonometric Ratios

OAS Objective:

*Objective 3.4: Use the trigonometric ratios to find the area of a triangle.

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Note: Asterisks (*) have been used to identify standards and objectives that must be assessed by the local school district. All other skills may be assessed by the Oklahoma School Testing Program (OSTP).

OAS Standard:

Standard 4: Properties of 3-Dimensional Figures

OAS Objective:

Objective 4.1: Polyhedra and Other Solids

OAS Skill:

Skill 4.1a: Identify, describe, and analyze polyhedra (for example, regular, decahedral).

Item Specifications:

Emphasis:

- The student will use the properties and formulas of polyhedra to solve problems.

Stimulus Attributes:

- Diagrams of polyhedra may be provided.

Format:

- Identify types of polyhedra.
- Count number of faces, edges, and/or vertices.

Content Limits:

- Limit to single solids or a comparison of two single solids.
- Limit polyhedra up to dodecahedra.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Inappropriate types of polyhedra
- Miscounts of faces, edges, and/or vertices

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Depth-of-Knowledge: 1

Which polyhedron has 8 faces?

A hexagonal prism

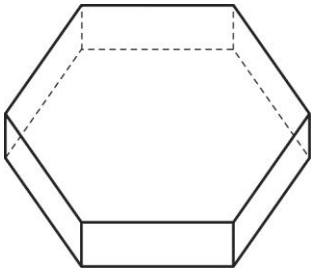
B pentagonal prism

C hexagonal pyramid

D pentagonal pyramid

Correct Response: **A**

Depth-of-Knowledge: 2



Which type of polyhedron is shown?

A hexagonal prism

B pentagonal prism

C hexagonal pyramid

D pentagonal pyramid

Correct Response: **A**

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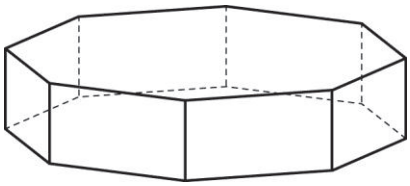
Depth-of-Knowledge: 2



What is the sum of the number of faces, edges, and vertices for an octagonal prism?

A 40

B 48

C 50

D 64

Correct Response: **C**

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OAS Standard:

Standard 4: Properties of 3-Dimensional Figures

OAS Objective:

Objective 4.1: Polyhedra and Other Solids

OAS Skill:

Skill 4.1b: Use properties of 3-dimensional figures; side lengths, perimeter or circumference, and area of a face; and volume, lateral area, and surface area to determine unknown values and correctly identify the appropriate unit of measure of each.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of 3-dimensional figures to solve problems.

Stimulus Attributes:

- Diagrams may be provided.
- Formulas may be provided.
- The student may be given areas, volumes, and/or segment lengths.
- Items involving π may have answers given in terms of π or in decimal form.

Format:

- The student will solve for areas, volumes and/or segment lengths.

Content Limits:

- Limit to a single type of solids.
- Limit solutions to those not involving cube roots.
- Limit figures up to dodecahedra.
- Limit real-life and mathematical contexts to age-appropriate situations.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of relationships between surface areas, volumes, and segment lengths

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Depth-of-Knowledge: 1

Kevin has a spherical ball with a diameter of 20 centimeters. To the nearest square centimeter, what is the surface area of the ball? (Use 3.14 for π.)

$$SA = 4\pi r^2$$

A 628 square centimeters

B 1,256 square centimeters

C 4,187 square centimeters

D 5,024 square centimeters

Correct Response: **B**

Depth-of-Knowledge: 2

A cylindrical fish food package has a volume of 2,512 cubic centimeters. The diameter of the package is 20 centimeters. What is the height of the package to the nearest centimeter? (Use 3.14 for π.)

$$V = \pi r^2 h$$

A 2 cm

B 4 cm

C 8 cm

D 10 cm

Correct Response: **C**

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Depth-of-Knowledge: 3

Which cylinder would require the most paint to cover?

$$SA = 2\pi r^2 + 2\pi rh$$

A a cylinder with radius 2 and height 4

B a cylinder with radius 3 and height 3

C a cylinder with radius 4 and height 2

D a cylinder with radius 5 and height 1

Correct Response: **D**

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OAS Standard:

Standard 4: Properties of 3-Dimensional Figures

OAS Objective:

Objective 4.2: Similarity: Use ratios of similar 3-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference of a face, area of a face, and volume.

Item Specifications:

Emphasis:

- The student will use the properties and formulas of similar 3-dimensional figures to solve problems.

Stimulus Attributes:

- The student will be given areas, volumes, angles, and/or segment lengths.
- Items involving π may have answers given in terms of π or in decimal form.

Format:

- The student will solve for areas, volumes, and/or segment lengths.

Content Limits:

- Limit to a single type of solids.
- Limit solutions to those not involving cube roots.
- Limit real-life and mathematical contexts to age-appropriate situations.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of relationships between surface areas, volumes, and segment lengths given respective ratios

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Sample Test Items for Objective 4.2

Depth-of-Knowledge: 1

Two similar cones have heights 8 cm and 10 cm. What is the ratio of their surface areas?

A 1:2

B 4:5

C 8:25

D 16:25

Correct Response: **D**

Depth-of-Knowledge: 2

A rectangular prism has a length of 4 feet, a width of 2 feet, and a height of 6 feet. If a larger and similar rectangular prism has a length of 8 feet what is the volume of the larger rectangular prism?

$$V = Bh$$

A 48 cu ft

B 96 cu ft

C 384 cu ft

D 512 cu ft

Correct Response: **C**

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Depth-of-Knowledge: 2

Two holiday presents are in the shape of cubes. The ratio of the side lengths of the presents is 3 to 1. If the side length of the larger present is 12 inches, what is the volume of the smaller present?

$$V = S^3$$

A 27 cu in.

B 36 cu in.

C 64 cu in.

D 1,728 cu in.

Correct Response: **C**

Depth-of-Knowledge: 3

A box in the shape of a rectangular prism with a square base has a volume of 18 cubic feet. The height is 2 feet. What is the volume of a similar box whose square base has an area of 36 square feet?

$$V = Bh$$

A 18 cu ft

B 36 cu ft

C 72 cu ft

D 144 cu ft

Correct Response: **D**

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OAS Standard:

Standard 4: Properties of 3-Dimensional Figures

OAS Objective:

Objective 4.3: Create a model of a 3-dimensional figure from a 2-dimensional drawing and make a 2-dimensional representation of a 3-dimensional object (for example, nets, blueprints, perspective drawings).

Item Specifications:

Emphasis:

- The student will use the properties and formulas of 3-dimensional figures and a 2-dimensional drawing to create a model.

Stimulus Attributes:

- The student will be given names and/or diagrams of nets.

Format:

- The student will identify models and representations of figures.

Content Limits:

- Limit 3-dimensional figures to prisms, pyramids, cylinders, and cones.
- Limit perspective drawings to no more than two different types of 3-dimensional objects.

Primary Process Standard(s):

- Representation

Distractor Domain:

- Common geometric misconceptions
- Inappropriate nets
- Inappropriate characteristics of nets

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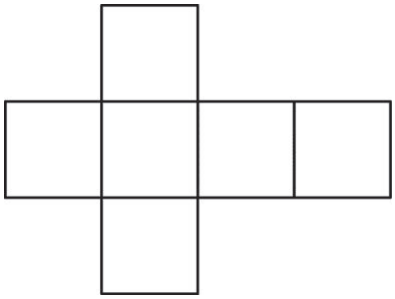
Sample Test Items for Objective 4.3

Depth-of-Knowledge: 1



Which polyhedron is best represented by this net?

A hexagon

B hexahedron

C hexagonal prism

D hexagonal pyramid

Correct Response: **B**

Depth-of-Knowledge: 2

What shapes would appear in drawing a net for a square pyramid?

A 1 square and 3 triangles

B 1 square and 4 triangles

C 4 squares and 3 triangles

D 4 squares and 4 triangles

Correct Response: **B**

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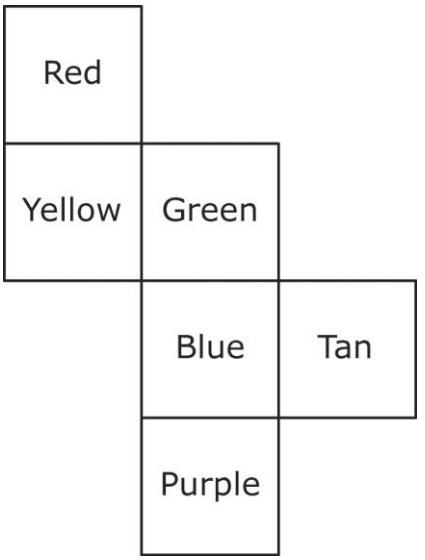
Depth-of-Knowledge: 2

Imagine that this net will be folded into a cube.



Which color will <u>not</u> be adjacent to the red face?

A Purple

B Green

C Blue

D Tan

Correct Response: **C**

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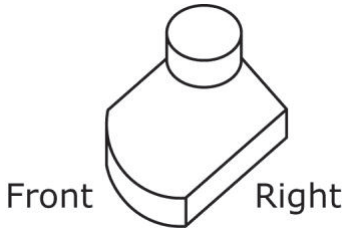
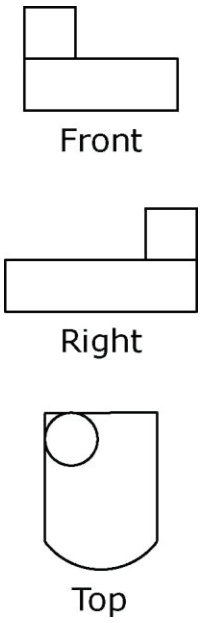
Depth-of-Knowledge: 2

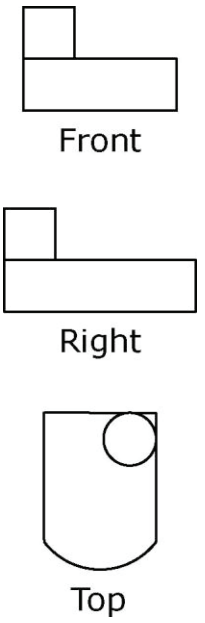


Which set shows the front, right, and top views of this three-dimensional figure?

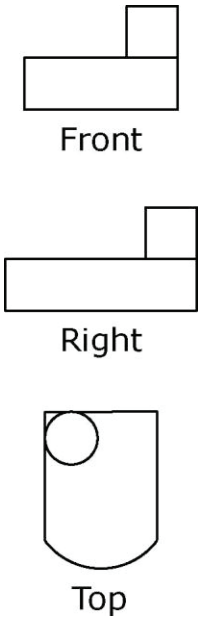
A



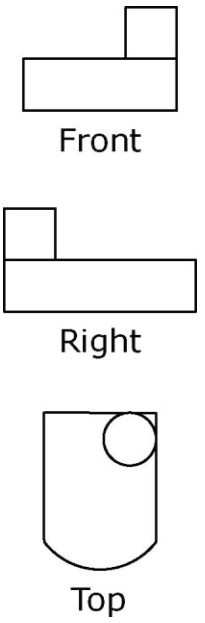
B



C



D



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Correct Response: **A**

OAS Standard:

Standard 5: Coordinate Geometry

OAS Objective:

Objective 5.1: Find the distance between two points; the midpoint of a segment; and calculate the slopes of parallel, perpendicular, horizontal, and vertical lines

Item Specifications:

Emphasis:

- The student will solve problems with geometric figures in the coordinate plane.

Stimulus Attributes:

- Graphs will be no more than 6 by 6.

Format:

- The student may determine distances, coordinates, and slopes.

Content Limits:

- Limit slope to integers and fractions.
- Limit decimal answers to hundredths.
- Limit real-life and mathematical contexts to age-appropriate situations.
- Limit radical answers to simplified forms.

Primary Process Standard(s):

- Problem Solving

Distractor Domain:

- Common geometric misconceptions
- Misconceptions of slope and coordinates

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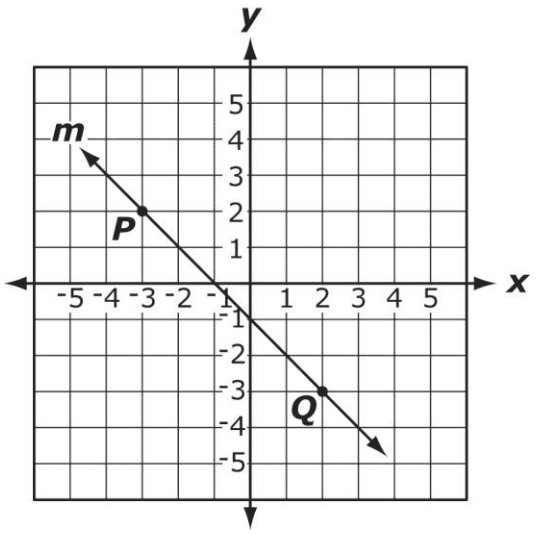
Depth-of-Knowledge: 1



What is the slope of a line parallel to line *m*?

A −1

B −2

C −3

D −5

Correct Response: **A**

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Depth-of-Knowledge: 1

Line m has a slope of 3. Line *n* is perpendicular to line *m*. What is the slope of line *n*?

A $\frac{-1}{3}$

B $\frac{1}{3}$

C -3

D 3

Correct Response: **A**

Depth-of-Knowledge: 2

What is the distance between (4, ⁻1) and (⁻2, 3)?

Distance between two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$:

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

A $\sqrt{17}$

B $\sqrt{34}$

C $5\sqrt{2}$

D $2\sqrt{13}$

Correct Response: **D**

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Depth-of-Knowledge: 3

Point S is the midpoint of $\overline{RT}$. The coordinates of points *R* and S are ($^{-}1$, $^{-}3$) and (5, $^{-}5$), respectively. What are the coordinates of point *T*?

Midpoint between two points
$P_1(x_1, y_1)$ and $P_2(x_2, y_2)$:

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

A (7, 1)

B (2, $^{-}4$)

C (7, $^{-}11$)

D (11, $^{-}7$)

Correct Response: **D**

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OAS Standard:

Standard 5: Coordinate Geometry

OAS Objective:

Objective 5.2: Properties of Figures

OAS Skill:

Skill 5.2a: Given a set of points determine the type of figure formed based on its properties.

Item Specifications:

Emphasis:

- The student will identify geometric figures in the coordinate plane.

Stimulus Attributes:

- Points are either given as coordinates or shown on a graph.

Format:

- The student will identify the type of figure.

Content Limits:

- Limit answer choices that are graphs to no more than 6 by 6.
- Limit to triangles or quadrilaterals.

Primary Process Standard(s):

- Problem Solving
- Representation

Distractor Domain:

- Common geometric misconceptions
- Inappropriate 2-dimensional figures

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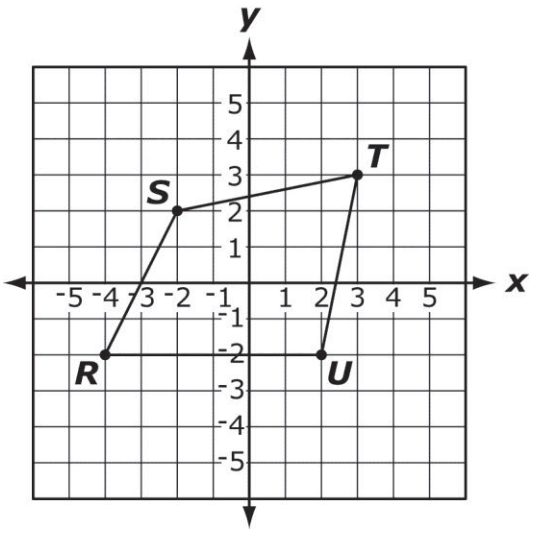
Depth-of-Knowledge: 1

What is the most specific name for figure *RSTU*?



A square

B rhombus

C quadrilateral

D parallelogram

Correct Response: **C**

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Depth-of-Knowledge: 2

Which type of triangle has vertices at the points *R*(2, 1), *S* (2, 5), and *T*(4, 1)?

A right

B acute

C isosceles

D equilateral

Correct Response: **A**

Depth-of-Knowledge: 3

Which quadrilateral can be represented by points *R* (⁻4, 1), *S* (⁻1, 4), *T* (5, ⁻2), and *U* (2, ⁻5)?

A kite

B square

C rhombus

D rectangle

Correct Response: **D**

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OAS Standard:

Standard 5: Coordinate Geometry

OAS Objective:

Objective 5.2: Properties of Figures

OAS Skill:

Skill 5.2b: Use transformations (reflection, rotation, translation) on geometric figures to solve problems within coordinate geometry.

Item Specifications:

Emphasis:

- The student will perform transformations (reflection, rotation, translation) on geometric figures in the coordinate plane.

Stimulus Attributes:

- Points are either given as coordinates or shown on a graph.

Format:

- The student may determine coordinates after a rotation, translation, and/or reflection.

Content Limits:

- Limit rotations to rotation about the origin.
- Limit rotations to 90°, 180°, or 270°, clockwise.
- 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 Standard(s):

- Problem Solving
- Reasoning
- Representation

Distractor Domain:

- Common geometric misconceptions
- Incorrect counts
- Inappropriate coordinates

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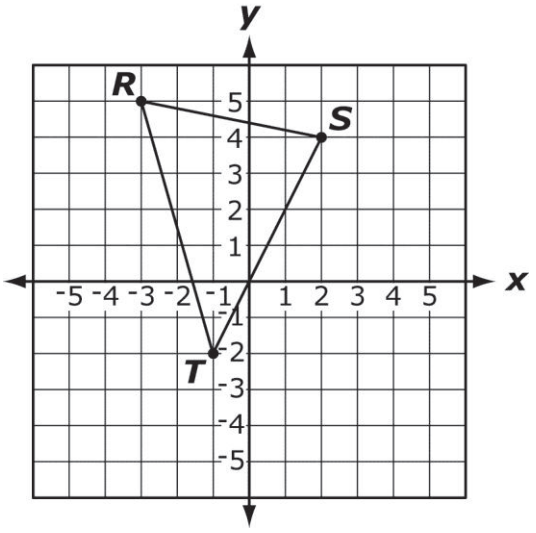
Depth-of-Knowledge: 1



How many units down would triangle *RST* need to be translated in order for the coordinates of *R*′ to be (⁻3, 0)?

A 0 units

B 3 units

C 5 units

D 7 units

Correct Response: **C**

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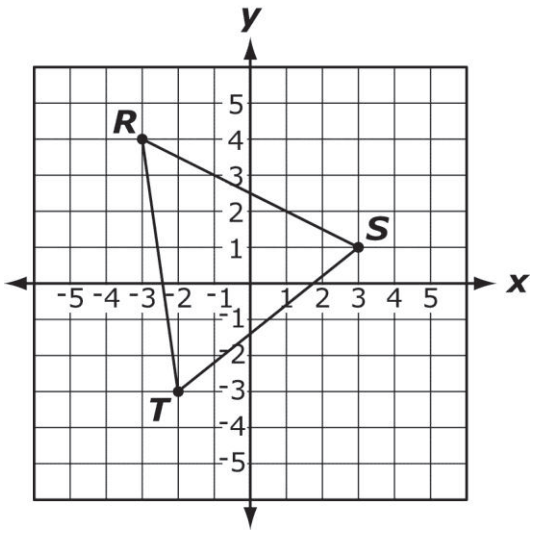
Depth-of-Knowledge: 2



What are the coordinates of *R*′ after △*RST* is rotated 90° clockwise about the origin?

A (⁻3, ⁻4)

B (⁻4, ⁻3)

C (3, 4)

D (4, 3)

Correct Response: **D**

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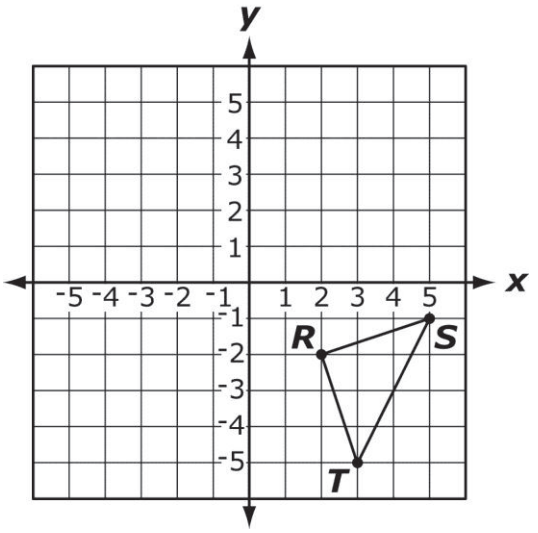
Depth-of-Knowledge: 3



In this grid, $\triangle RST$ is reflected across the *y*-axis and then translated 1 unit up to create $\triangle R'S'T'$. What are the coordinates for S'?

A $(^{-}5, {}^{-}2)$

B $(^{-}5, 0)$

C $(^{-}4, {}^{-}1)$

D $(^{-}4, 0)$

Correct Response: **B**

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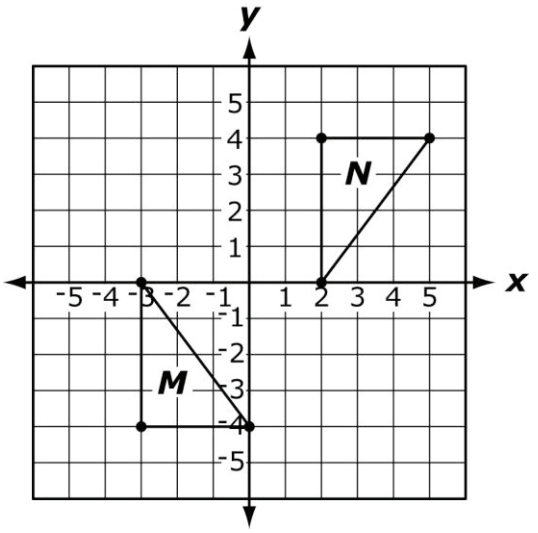
Depth-of-Knowledge: 3



Which statement describes the transformation that would map triangle *M* to triangle *N* on this grid?

A $(x, y) \rightarrow (^{-}x + 5, {}^{-}y)$

B $(x, y) \rightarrow (^{-}x + 5, y)$

C $(x, y) \rightarrow (^{-}x + 5, {}^{-}y)$

D $(x, y) \rightarrow (^{-}x + 5, y)$

Correct Response: **C**

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