Claim 1: Concepts and Procedures
Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Content Domain: **Geometry**

Target F [a]: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. (DOK Levels 1, 2)

Tasks for this target will require students to solve problems for circumference, area, volume, and surface area of two and three dimensional objects. Other tasks (paired with 7.EE Target D) will require students to write and solve equations to determine an unknown angle in a figure.

Standards: 7.G.B, 7.G.B.4, 7.G.B.5, 7.G.B.6	**7.G.B Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** **7.G.B.4** Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. **7.G.B.5** Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. **7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 6.G.A, 6.G.A.1, 6.G.A.2, 6.G.A.3, 6.G.A.4 8.G.C, 8.G.C.9	**Related Grade 6 standards** **6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.** **6.G.A.1** Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. **6.G.A.2** Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\,w\,h$ and $V = b\,h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. **6.G.A.3** Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. **6.G.A.4** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

	Related Grade 8 Standards
	8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
DOK Levels:	1, 2

Achievement Level Descriptors:

RANGE Achievement Level Descriptor (Range ALD) Target F: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	**Level 1** Students should be able to identify appropriate formulas for the area and circumference of a circle; calculate the area of triangles and rectangles and the volume of cubes; classify pairs of angles as supplementary, complementary, vertical, or adjacent; and measure angles with appropriate tools.
	Level 2 Students should be able to use supplementary, complementary, vertical, or adjacent angles to solve problems with angles expressed as numerical measurements in degrees; calculate the circumference of a circle; and calculate the area of circles, quadrilaterals, and polygons and the volume of right rectangular prisms.
	Level 3 Students should be able to use supplementary, complementary, vertical, and adjacent angles to solve one or two-step problems with angle measures expressed as variables in degrees; use formulas for the area and circumference of a circle to solve problems; and solve problems involving the area of polygons, the surface area of three-dimensional objects composed of triangles and/or quadrilaterals, and the volume of right prisms.
	Level 4 Students should be able to solve problems involving surface area and volume of three-dimensional figures with polygonal faces. They should be able to use supplementary, complementary, vertical, and adjacent angles to solve multi-step problems with angle measures expressed as variables in degrees.
Evidence Required:	1. The student solves real-life and mathematical problems for the circumference and area of circles. 2. The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations. 3. The student solves real-life and mathematical problems for the area of two-dimensional objects composed of polygons. 4. The student solves real-life and mathematical problems for the volume and surface area of three-dimensional objects composed of right prisms and cubes.
Allowable Response Types:	Equation/Numeric, Matching Tables

Allowable Stimulus Materials:	
Construct-Relevant Vocabulary:	area, circumference, pi, circle, radius, diameter, supplementary angles, complementary angles, vertical angles, adjacent angles, linear pairs of angles, volume, surface area, triangles, quadrilateral, square, rectangle, parallelogram, trapezoid, cubes, right prisms
Allowable Tools:	Calculator
Target-Specific Attributes:	Equations are limited to the forms $px + q = r$ or $p(x + q) = r$, where p, q, and r are rational numbers.
Non-Targeted Constructs:	area or arc lengths of circles given angle measures; the relationships of angles formed by parallel lines cut by a transversal (8.G.5); the sum of the interior angles of a triangle is 180° (8.G.5)
Accessibility Guidance:	Item writers should consider the following Language and Visual Element/Design guidelines[1] when developing items. Language Key Considerations: • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references Visual Elements/Design Key Considerations: • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics Items are selected for a student's test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.[2]
Development Notes:	None

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[1] For more information, refer to the General Accessibility Guidelines at:
http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf
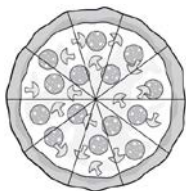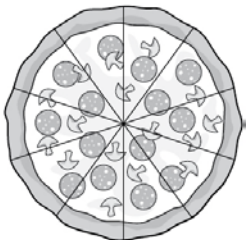[2] For more information about student accessibility resources and policies, refer to
http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

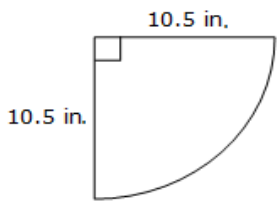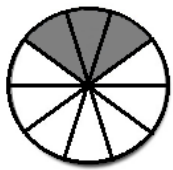| Task Model 1

Response Type:
Equation/Numeric

DOK Level 1

7.G.B.4
Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Evidence Required:
1. The student solves real-life and mathematical problems for the circumference and area of circles.

Tools: Calculator | **Prompt Features:** The student is prompted to give the area of circles for mathematical problems.

Stimulus Guidelines:
• Context should be familiar to students 12–14 years old.
• Unit label is a measurement of length.
• Item difficulty can be adjusted via these example methods:
 ○ Radius is a whole number, decimal, fraction, including mixed numbers
 ○ Diameter is a whole number, decimal, fraction, including mixed numbers
 ○ Number of computational steps
 ○ Partial areas or circumferences

TM1a
Stimulus: The student is presented with the radius, diameter or circumference of a circle in a mathematical context.

Example Stem: The radius of a circle is 7.5 centimeters.

Enter the area of the circle, in square centimeters. Round your answer to the nearest hundredth.

Rubric: (1 point) The student enters the correct area in a range of correct values (e.g., 176.63 – 176.79).

Response Type: Equation/Numeric |

| Task Model 1

Response Type: Equation/Numeric

DOK Level 2

7.G.B.4
Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Evidence Required:
1. The student solves real-life and mathematical problems for the circumference and area of circles.

Tools: Calculator | **Prompt Features:** The student is prompted to give the area of circles for real-life problems.

Stimulus Guidelines:
• Context should be familiar to students 12–14 years old.
• Unit label is a measurement of length.
• Item difficulty can be adjusted via these example methods:
   o Radius is a whole number, decimal, fraction, including mixed numbers.
   o Diameter is a whole number, decimal, fraction, including mixed numbers.
   o Number of computational steps.
   o Partial areas or circumferences.

TM1b
Stimulus: The student is presented with the radius, diameter or circumference of a circle in a real-life context.

Example Stem 1: A circular table top has a radius of 3 feet.

Enter the area, in square feet, of the table top. Round your answer to the nearest tenth.

Example Stem 2: Jill buys two circular pizzas.

The small pizza has an 8-inch diameter.   The medium pizza has a 12-inch diameter.

How much greater, in square inches, is the area of the medium pizza than the small pizza? Round your answer to the nearest tenth.

Rubric: (1 point) The student enters the correct area in a range of correct values (e.g., 28.3 – 28.31; 62.8 – 62.9).

Response Type: Equation/Numeric |

| Task Model 1

Response Type:
Equation/Numeric

DOK Level 2

7.G.B.4
Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Evidence Required:
1. The student solves real-life and mathematical problems for the circumference and area of circles.

Tools: Calculator | **Prompt Features:** The student is prompted to give the circumference of a circle.

Stimulus Guidelines:
• Unit label is a measurement of length.
• Item difficulty can be adjusted via these example methods:
    o Radius is a whole number, decimal, fraction, including mixed numbers.
    o Diameter is a whole number, decimal, fraction, including mixed numbers.
    o Number of computational steps.
    o Partial areas or circumferences.

TM1c
Stimulus: The student is presented with the radius or diameter of a circle in a real-life or mathematical context.

Example Stem: The radius of a circle is 7 centimeters.

Enter the circumference of the circle, in centimeters. Round your answer to the nearest hundredth.

Rubric: (1 point) The student enters the correct circumference in a range of correct values (e.g., 43.96 - 44.03).

Response Type: Equation/Numeric

Prompt Features: The student is prompted to give the radius of a circle given its circumference.

TM1d
Stimulus: The student is presented with the circumference of a circle in a real-world or mathematical context.

Example Stem: The circumference of a circle is 31.4 inches.

Enter the radius of the circle, in inches. Round your answer to the nearest whole number.

Rubric: (1 point) The student enters the correct radius (e.g., 5).

Response Type: Equation/Numeric |

| Task Model 1

Response Type:
Equation/Numeric

DOK Level 2

7.G.B.4
Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Evidence Required:
1. The student solves real-life and mathematical problems for the circumference and area of circles.

Tools: Calculator | **Prompt Features:** The student is prompted to give a fractional part of the area of a circle for both real-life and mathematical problems.

Stimulus Guidelines:
• Context should be familiar to students 12–14 years old.
• Unit label is a measurement of length.
• Item difficulty can be adjusted via these example methods:
 ○ Radius is a whole number, decimal, fraction, including mixed numbers.
 ○ Diameter is a whole number, decimal, fraction, including mixed numbers.
 ○ Number of computational steps.
 ○ Partial areas or circumferences.

TM1e
Stimulus: The student is presented with the radius, diameter or circumference of a circle in a real-life or mathematical context.

Example Stem 1: A corner shelf has a radius of 10.5 inches and represents $\frac{1}{4}$ of a circle, as shown.

Enter the area of the shelf, in square inches. Round your answer to the nearest hundredth.

Example Stem 2: The circumference of the circle is approximately 100.48 centimeters. The shaded region is $\frac{3}{10}$ of the whole circle.

Enter the area of the shaded region, in square centimeters. Round your answer to the nearest hundredth.

Rubric: (1 point) The student enters the correct area in a range of correct values (e.g., 86.55 – 86.68; 240.77 – 241.15).

Response Type: Equation/Numeric |

Task Model 2 **Response Type:** Matching Tables **DOK Level 1** **7.G.B.5** Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. **Evidence Required:** 2. The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations. **Tools:** Calculator

Prompt Features: The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations.

Stimulus Guidelines:
- Measures of certain angles in the figure can be shown.
- Measures of angles shown in the figure should be less than 180.
- Angle measures can be whole numbers or decimals to the tenths place.

TM2a
Stimulus: The student is given a figure involving supplementary, complementary, vertical, and/or adjacent angles that contains a missing angle measure.

Example Stem: Lines *XU* and *WY* intersect at point *A*.
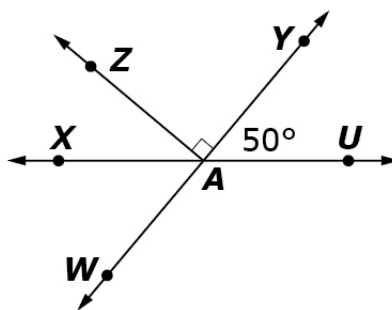
Based on the diagram, determine whether each statement is true. Select True or False for each statement.

Statement	True	False
An angle supplementary to ∠WAU measures 50°.		
An angle complementary to ∠WAX measures 40°.		
The angle vertical to ∠YAU measures 50°.		

Rubric: (1 point) Student correctly identifies each statement as being either true or false (e.g., T, T, T). True choices will be correct angle measures such as False choices will be incorrect angle measure about the computation and comparative statements of the angles.

Response Type: Matching Tables

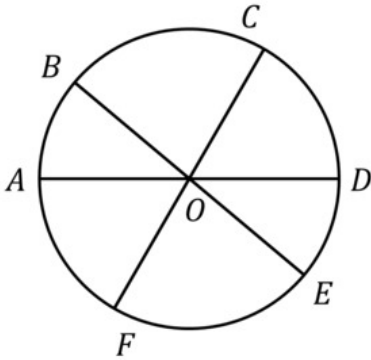| **Task Model 2**

Response Type:
Matching Tables

DOK Level 2

7.G.B.5
Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.

Evidence Required:
2. The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations.

Tools: Calculator

Version 3 Update
Added new TM2c. | **Prompt Features:** The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations.

Stimulus Guidelines:
• Measures of certain angles in the figure can be shown.
• Measures of angles shown in the figure should be less than 180.
• Angle measures can be whole numbers or decimals to the tenths place.

TM2b
Stimulus: The student is given a figure involving supplementary, complementary, vertical, and/or adjacent angles that contains one of more unknown angle measures.

Example Stem: Lines *XU* and *WY* intersect at point *A*.
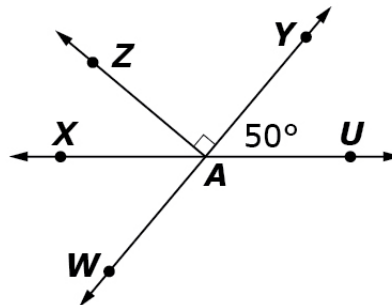
Based on the diagram, determine whether each statement is true. Select True or False for each statement. |

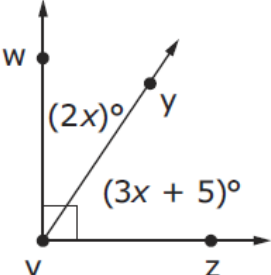| Statement	True	False
m∠*XAZ* = 180° − m∠*ZAY* − m∠*YAU*		
m∠*WAZ* = m∠*WAY* − m∠*ZAY*		
m∠*WAU* = m∠*XAZ* − m∠*ZAY*		

Rubric: (1 point) Student correctly identifies each statement as being either true or false (e.g., T, T, F).

Response Type: Matching Tables

Task Model 2	**Prompt Features:** The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations.
Response Type: Equation/Numeric	
DOK Level 2	**Stimulus Guidelines:**
	• Measures of certain angles in the figure can be shown.
7.G.B.5	• Measures of angles shown in the figure should be less than 180.
Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	• Angle measures can be whole numbers or decimals to the tenths place.
	TM2c
	Stimulus: The student is given a figure involving supplementary, complementary, vertical, and/or adjacent angles that contains one of more unknown angle measures.
Evidence Required: 2. The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations.	$\overline{AD}$, $\overline{BE}$, $\overline{CF}$ are all diameters of the circle shown.
	• m∠AOB=40°
	• m∠COE=100°
Tools: Calculator	
Version 3 Update Added new TM2c.	
	What is the measure of ∠BOC?
	Rubric: (1 point) Student correctly determines the measure of the angle (e.g., 80).
	Response Type: Equation/Numeric

Task Model 2 **Response Type: Equation/Numeric** **DOK Level 2** **7.G.B.5** Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. **Evidence Required:** 2. The student solves real-life and mathematical problems involving angle measure including problems requiring writing and solving equations. **Tools:** Calculator **Version 3 Update:** Retired TM2d	**Prompt Features:** The student gives the solution to a multi-step problem involving supplementary, complementary, vertical, and/or adjacent angles. **Stimulus Guidelines:** • Variables used represent missing angle measure. • Angles in the figure can be identified by variables. • Item difficulty can be adjusted via these example methods: 　○ Angle measures are whole numbers. 　○ Angle measures are decimals. 　○ Angle measures include variables. **TM2c** **Stimulus:** The student is provided a figure showing supplementary, complementary, vertical, and/or adjacent angles. **Example Stem:** Consider this figure. Enter the measure of $\angle YVZ$, in degrees. **Rubric:** (1 point) The student enters the correct value (e.g., 56). **Response Type:** Equation/Numeric

Task Model 3
 	
Response Type: Equation/Numeric
 	
DOK Level 2
 	
7.G.B.6
Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
 	
Evidence Required:
3. The student solves real-life and mathematical problems for the area of two-dimensional objects composed of polygons.
 	
Tools: Calculator
	Prompt Features: The student is prompted to identify the area of two-dimensional figures composed of triangles, quadrilaterals, and/or other polygons for both real-life and mathematical problems.
	
	Stimulus Guidelines:
	• Context should be familiar to students 12–14 years old.
	• Dimensions of figures can be explicitly labeled or indicated by a grid.
	• Item difficulty can be adjusted via these example methods:
	    o Dimensions can include whole numbers, decimals, and fractions including mixed numbers or any combination
	    o Figures can be composed of triangles, quadrilaterals, or polygons
	
	TM3
	Stimulus: The student is presented with a real-life or mathematical problem involving a figure composed of triangles, quadrilaterals, and/or other polygons.
	
	Example Stem 1: This is the floor plan of Julie's bathroom. Julie needs to determine the area of the floor so she can order new tile.
	
	Enter the area, in square feet, of Julie's bathroom floor.
	
	Rubric: (1 point) The student enters the correct area (e.g., $46\frac{3}{4}$).
	
	Response Type: Equation/Numeric

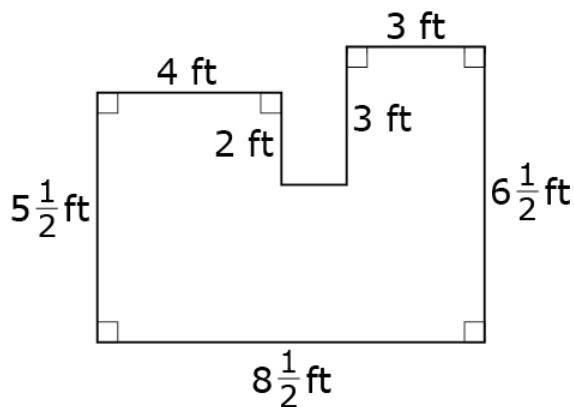|	
Task Model 3 **Response Type: Equation/Numeric** **DOK Level 2** **7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **Evidence Required:** 3. The student solves real-life and mathematical problems for the area of two-dimensional objects composed of polygons. **Tools:** Calculator	**Example Stem 2:** The figure shown is created by joining three rectangles. Enter the area of the figure, in square centimeters. Round to the nearest hundredth. **Rubric:** (1 point) The student enters the correct area (e.g., 46.75). **Response Type:** Equation/Numeric

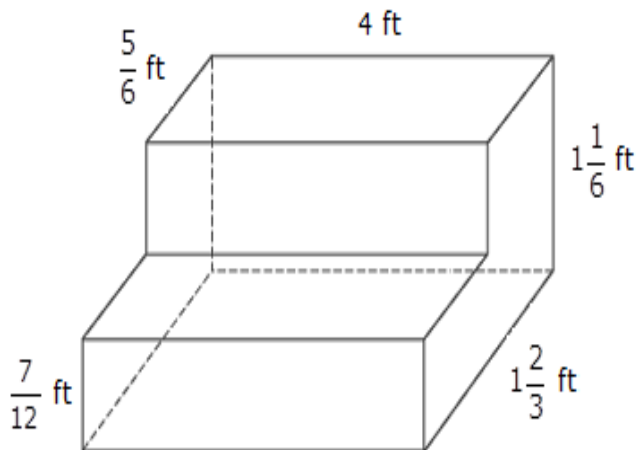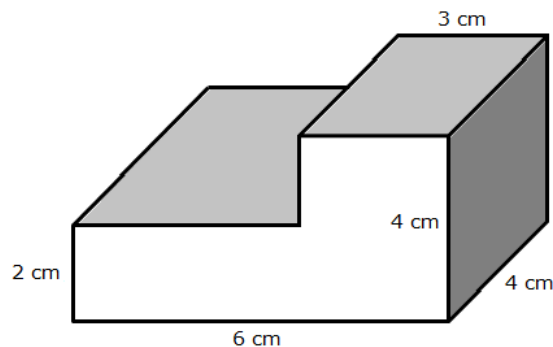| Task Model 4	**Prompt Features:** The student is prompted to give the surface area or volume of three-dimensional objects.

Response Type: Equation/Numeric **DOK Level 2** **7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **Evidence Required:** 4. The student solves real-life and mathematical problems for the volume and surface area of three-dimensional objects composed of right prisms and cubes. **Tools:** Calculator	**Stimulus Guidelines:**
	 • Context should be familiar to students 12–14 years old.
	 • Item difficulty can be adjusted via these example methods:
	    o Dimensions can include whole numbers, decimals, and fractions including mixed numbers or any combination.
	    o Figures can be composed of cubes and right prisms or any combination.
	
	 TM4
	 Stimulus: The student is presented with three-dimensional objects composed of cubes and/or right prisms.
	
	 Example Stem 1: The figure shows a set of concrete stairs to be built.
	
	 Enter the amount of concrete, in cubic feet, needed to build the stairs. Round your answer to the nearest hundredth.
	
	 Example Stem 2: The figure shown is created by joining two right rectangular prisms.
	
	 Enter the volume of the figure, in cubic centimeters.

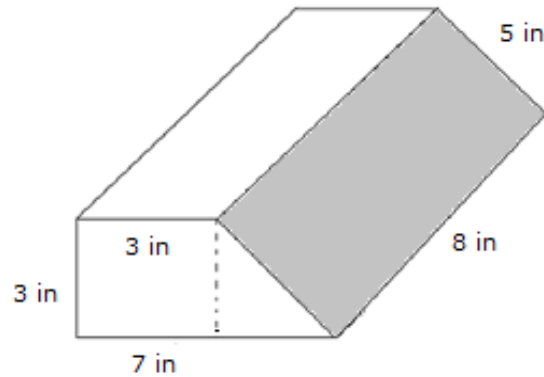|	
Task Model 4 **Response Type: Equation/Numeric** **DOK Level 2** **7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. **Evidence Required:** 4. The student solves real-life and mathematical problems for the volume and surface area of three-dimensional objects composed of right prisms and cubes. **Tools:** Calculator	**Example Stem 3:** The figure shows the dimensions for a package to be shipped. Enter the minimum amount of wrapping paper, in square inches, needed to cover the package. Round your answer to the nearest whole inch. **Rubric:** (1 point) Student provides a correct surface area or volume (e.g., 5.82; 72; 174). **Response Type:** Equation/Numeric