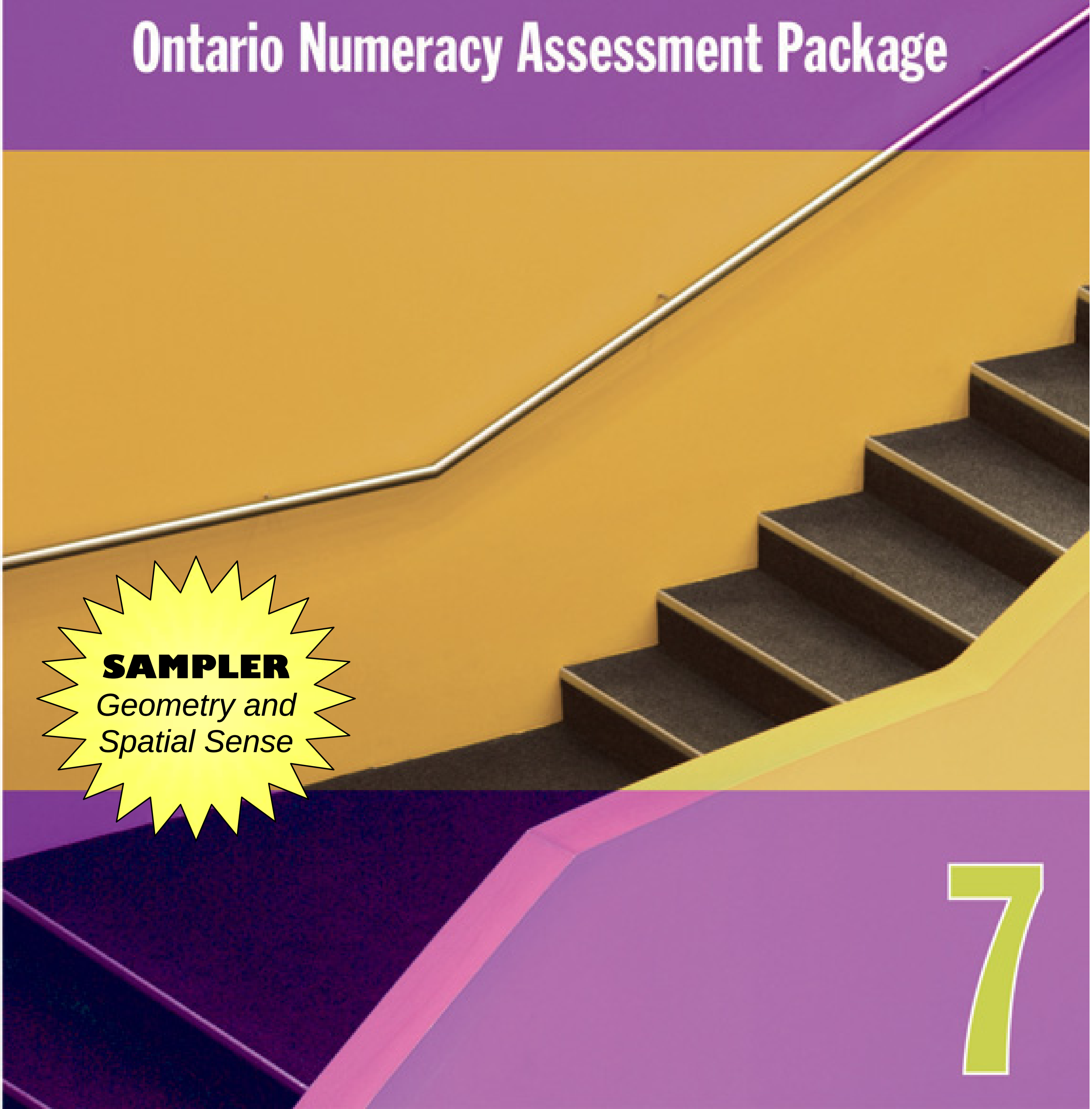
ONAP

Ontario Numeracy Assessment Package



SAMPLER
Geometry and Spatial Sense

7

GEOMETRY AND SPATIAL SENSE

The Geometry and Spatial Sense Strand of the Ontario Curriculum for Grade 6 identifies seven Mathematical Process Expectations: problem solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating. Using these process expectations, students study, learn, and apply concepts and skills organized under the big ideas/headings of Geometric Properties, Geometric Relationships, and Location and Movement.

The following chart highlights key knowledge and skill development as students move from Grade 6 to 7.

GRADE 6	GRADE 7
• sort quadrilaterals by geometric properties related to symmetry, angles, and sides through investigation, using a variety of tools	• sort and classify triangles and quadrilaterals by geometric properties related to symmetry, angles, and sides, through investigation using a variety of tools
• sort polygons according to the number of lines of symmetry and the order of rotational symmetry, through investigation using a variety of tools	
• measure and construct angles up to 180°, using a protractor	• construct angle bisectors and perpendicular bisectors, using a variety of tools
	• represent equal angles and equal lengths, using mathematical notation
• classify angles as acute, right, obtuse, or straight angles	
• construct polygons, using a variety of tools, given angle and side measurements	• investigate, using concrete materials, the angles between the faces of a prism, and identify right prisms
	• construct parallel, perpendicular, and intersecting lines (35° and 45°), using angle properties and a variety of tools
• build three-dimensional models, using connecting cubes, given isometric sketches or different views	• identify the minimum side and angle information (side-side-side, side-angle-side, angle-side-angle) needed to describe a unique triangle
	• determine, through investigation using a variety of tools, relationships among area, perimeter, corresponding side lengths, and corresponding angles of congruent shapes
	• demonstrate an understanding that enlarging or reducing two-dimensional shapes creates similar shapes
• sketch three-dimensional figures built with interlocking cubes, using a variety of tools	• distinguish between and compare similar and congruent shapes, using a variety of tools and strategies

GRADE 6	GRADE 7
• explain how a coordinate system represents location and plot points in the first quadrant of a Cartesian coordinate plane	• plot points using all four quadrants of the Cartesian coordinate plane
• identify, perform, and describe rotations of 180° and clockwise and counterclockwise rotations of 90° with the centre of rotation inside or outside the shape	• identify, perform, and describe dilatations, through investigations using a variety of tools
• create and analyze designs made by reflecting, translating, and/or rotating a shape, or shapes, by 90° or 180°	• create and analyze designs involving translations, reflections, dilatations, and/or simple rotations of two-dimensional shapes, using a variety of tools
	• determine, through investigation using a variety of tools, polygons or combinations of polygons that tile a plane, and describe the transformation(s) involved

For each strand of the curriculum, ONAP provides three types of assessment materials. Consider the following points when administering the assessments for the strand:

Part A: Activating Prior Knowledge (page 144)

- The activities in Part A have been created to activate students' prior knowledge before they complete the Part B assessment or the Part C performance tasks.
- No score is assigned during this part of the assessment.
- It is recommended that you spend one or two periods working on and discussing the activities provided in this part.

Part B: Concepts and Skills Assessment (page 151)

- The paper-and-pencil assessment in Part B addresses the majority of the specific expectations within the three overall expectations in the Geometry and Spatial Sense Strand.
- Students will be responding to a mix of questions: short-response, fill-in-the-blank, and multiple-choice.
- Most students will be able to complete the entire assessment in a 60-minute period. Individual students may be allowed additional time to complete the assessment if needed, as long as they complete the assessment in one sitting. Although students may sketch some of their responses freehand, rulers are recommended.

Part C: Performance-Based Assessment (page 165)

- The two performance tasks in Part C are designed to provide you with insights into how well students are able to perform measured against the categories of the Ontario Achievement Chart: Knowledge and Understanding, Thinking, Communication, and Application.
- All of the overall expectations for this strand have been assessed through the Concepts and Skills Assessment in Part B.
- It is recommended that both performance tasks for the Geometry and Spatial Sense Strand be completed to address expectations requiring students to construct geometric shapes and angles.
- Each task is designed to be completed in a 45- to 60-minute period. If necessary, provide additional time as long as students complete the task in one sitting.

Part A: Activating Prior Knowledge

Administration

To activate students' prior knowledge of the Geometry and Spatial Sense Strand, choose two or three of the following activities to work on prior to administering the assessments. Introductory and culminating suggestions have been provided for each. No score is assigned for these activities.

Timing

It is recommended that you spend one or two periods working on and discussing the activities provided in this part.

Accommodating Students with Special Needs

Observe students as they complete the activities. While the activities in this section are not designed as a formal diagnostic assessment, you may want to consider whether students who are having extreme difficulties with the activities are ready to participate in the full ONAP assessment for this grade level. Observations at this stage might also indicate students who will need special accommodations during the assessment, such as someone to read questions to them or to scribe responses.

Activity 1: Line 'Em Up

Materials

- BLM A1: *Activity 1: Polygon Set* (two copies per four students)
- number cube or die (one per four students)
- scissors (two per four students)
- cardboard or other divider (one per four students)

Introducing the Activity

This activity challenges students to use oral communication to describe a series of two-dimensional shapes they have organized in a line. Students will improve their chances of success by using precise mathematical vocabulary to describe their line of shapes.

Provide each set of four students with two copies of BLM A1: *Activity 1: Polygon Set*. One copy is to create the initial sequence, and one copy is to reconstruct the sequence.

Game Rules

Number of players: four (two sets of partners)
Goal: to physically reconstruct a sequence based on oral descriptions
How to play:

- Step 1 — The two students sitting across from each other are partners (Student A and Student B). Each pair rolls the die. The pair that rolls the highest number goes first.
- Step 2 — Set up the divider between Student A and Student B so they cannot see the other's shapes. Student A cuts out 10 two-dimensional shapes from BLM A1: *Activity 1: Polygon Set* and arranges them in a line. Student A describes the sequence to Student B.

- Step 3 — Student B uses the second copy of BLM A1: *Activity 1: Polygon Set* to cut out and reconstruct the line of shapes based on Student A's description. Both lines are revealed. If Student B reconstructed the line exactly, the pair gets a point.
- Step 4 — Play continues with the other pair. Students switch roles with each round (i.e., Student B describes the line to Student A, who must reconstruct it).
- Step 5 — The first pair to reach 5 points wins.

Culminating Discussion

1. What properties of the shapes did you use to describe your sequence?
   First I told my partner if the shape was regular or "weird" (irregular) looking so that he/she could decide which piece to use. I told my partner it had so many sides, and I also told him/her if the lengths of the sides were the same (congruent) or different. I tried to say things like "the biggest triangle" or "the triangle with the sharpest corner" to help my partner put the shapes in the right order.

   Make a list of the different properties the students used on a piece of chart paper or on the chalkboard. Suggest mathematical vocabulary to supplement the students' informal language. For example, if students use the word *weird* in a description, ask the class to suggest math vocabulary that can be used instead.

2. Were some shapes more difficult to describe than others? How did you handle this?
   Yes, some shapes were hard to describe because they are not the usual shapes we talk about like squares and equilateral triangles. I tried to use the size of the angles. The shapes that had four sides, but weren't squares or rectangles, were hard to talk about. I described it as something we would know about like a "crocodile jaw."

   Review polygon names that are based on the number of sides (triangle, quadrilateral, pentagon, etc.) and also those named for other relationships (a square is a special type of rectangle).

3. What math terms do you need to help you be more precise in your descriptions?
   I think we need to talk more about the shapes we are used to using and what we should call the other shapes. If you could tell your partner which angles were bigger in the corners of some of the shapes, then that would help pick out the other shapes. I think words like vertices, angle, *and* the number of sides *would help us to describe the shape in a better way.*

   Create a math word wall to list the vocabulary words recalled by the students.

4. What strategies did you use to visualize the shape when you were listening?
   I tried to think of the number of sides and then think of something I know that looks like that shape. When my partner was telling me about the shape, I tried to draw a sketch on paper as he/she talked.

   Help students to make connections about visualization. Students will relate to examples, such as thought bubbles from comic books, to think about what visualization means. Suggesting real-life examples (letter-sized paper is a rectangle; a bandana folded in half corner to corner is a triangle; a stop sign is an octagon) may help some students to grasp the idea of visualizing a shape.

Activity 2: Orient Me

Materials

- BLM A1: *Activity 1: Polygon Set* (two copies per four students)
- number cube or die (one per four students)
- grid chart paper (four per four students)
- pencil or coloured pencils
- scissors (two per four students)
- cardboard or other divider (one per four students)

Introducing the Activity

This activity is an extension of Activity 1. Students repeat the game but must also replicate the exact orientation of the shapes. Students are required to use transformational geometry to try to describe the shapes to their partner. Using grid chart paper, instruct students to draw the first quadrant of the Cartesian plane so that both partners have an identical grid to use for the game.

Game Rules

Number of players: four (two sets of partners)
Goal: to physically reconstruct a sequence based on oral descriptions
How to play:

- Step 1 — The two students sitting across from each other are partners (Student A and Student B). Each pair rolls the die. The pair that rolls the highest number goes first.
- Step 2 — Set up the divider between Student A and Student B so they cannot see the other's shapes. Student A cuts out 1 two-dimensional shape from BLM A1: *Activity 1: Polygon Set*, traces it, and cuts out four more identical shapes. Student A arranges all five identical shapes on the grid in various locations and orientations. Student A describes the location and orientation of each shape to Student B. (Student A can label the vertices of the shapes to help describe the orientation of the shapes.)
- Step 3 — Student B uses the second copy of BLM A1: *Activity 1: Polygon Set* to cut out and reconstruct the arrangement of shapes based on Student A's description. Both grids are revealed. If both grids match, the pair gets a point.
- Step 4 — Play continues with the other pair. Students switch roles with each round (i.e., Student B describes the grid and Student A must reconstruct it).
- Step 5 — The first pair to reach 5 points wins.

Culminating Discussion

1. What key elements did you use to assist your partner in placing the shapes in the correct positions?
   I told my partner to label the shapes and then we used letter names to put the right letter in the right position. I tried to use the words point *and* side *to help my partner know what I was talking about.*

2. How did you use transformation math vocabulary to help your partner place and orient the shapes?
   I used words like slide, translation, flip, reflection, *and so on. Sometimes I said the position of one shape to help me describe the location of another shape.*

Activity 3: Design Dilemmas

Materials

- number cube or die (one per four students)
- grid chart paper (20 per four students)
- pencil or coloured pencils
- cardboard or other divider (one per four students)

Introducing the Activity

Students continue to use oral language and math vocabulary to activate their prior knowledge about two-dimensional geometry. In this version of the activity, Student A creates a design and describes it to Student B, who attempts to recreate the design. Students use the first quadrant of the Cartesian plane to assist them in making their descriptions.

Game Rules

Number of players: four (two sets of partners)
Goal: to physically reconstruct a simple design as described
How to play:

- Step 1 — The two students sitting across from each other are partners (Student A and Student B). Students use a die to decide which pair will begin the game. The highest number on the die wins.
- Step 2 — Set up the divider between Student A and Student B so they cannot see the other's grid paper. Student A draws a simple geometric design on the grid paper. Student A then describes the design to Student B.
- Step 3 — Student B reconstructs the design on grid paper based on Student A's description. Both designs are revealed. If Student B reconstructed the design exactly, the pair gets a point.
- Step 4 — Play continues with the other pair. Students switch roles with each round (i.e., Student B describes the design and Student A must reconstruct it).
- Step 5 — The first pair to reach 5 points wins.

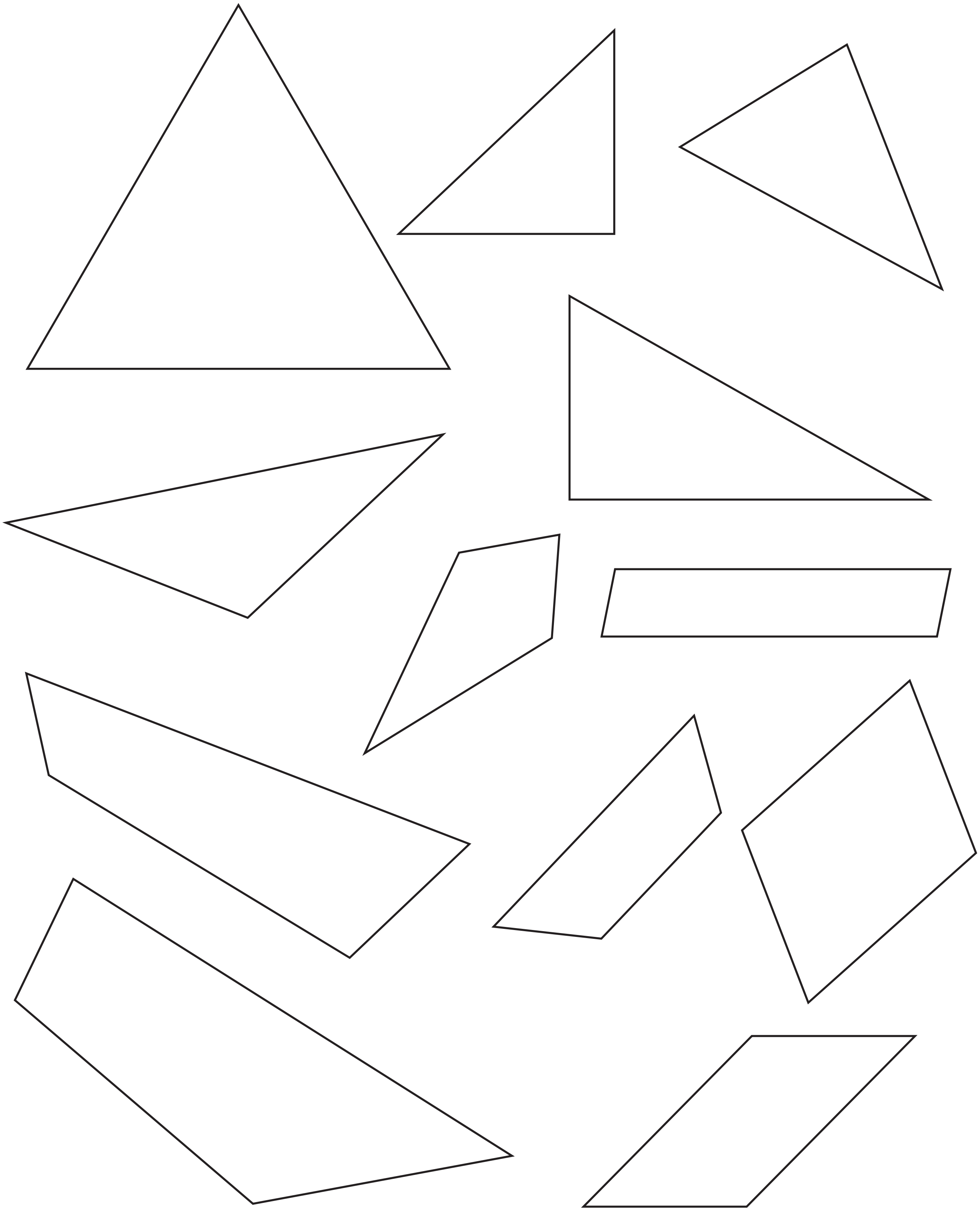
Culminating Discussion

1. If you were to describe this game to a friend, how would you advise them to play so that they would be successful?
   I would tell my friend to say each step separately to help him/her think about it first. I would also tell my friend to ask their partner questions to see if he/she understood the direction and to ask their partner to tell them what the design looked like after each move.

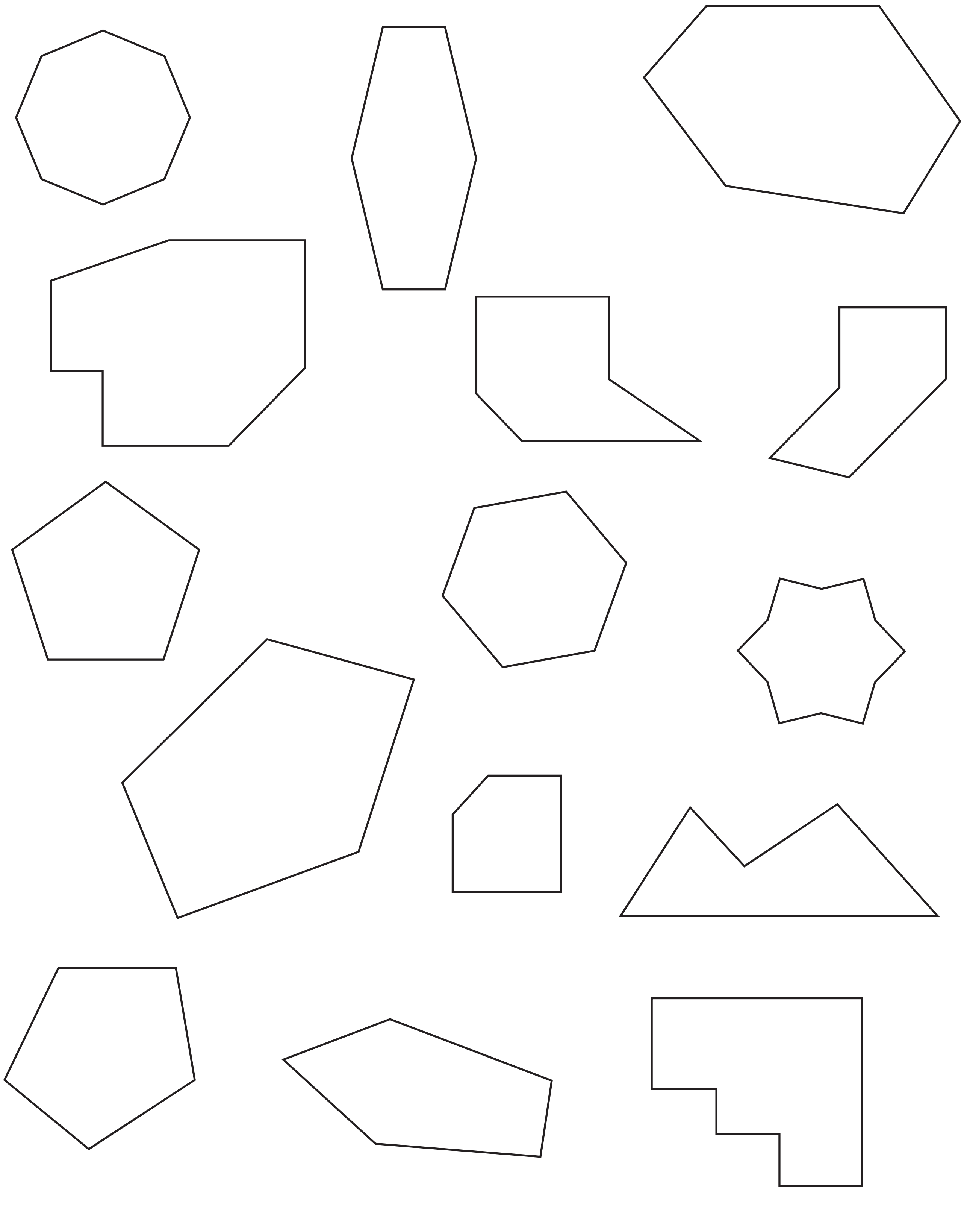
2. What critical pieces of information did you include in your descriptions to assist your partner?
   By telling my partner what the first shape was I could build on it with my words. I always told my partner how the next piece connected to the last piece. If there was a reflection or slide in the design I tried to point it out so that it could be checked.
3. How would you make this game more challenging?
   I would see if you could describe the design after it was turned 90°. I would not allow people to use colour to describe any part of the design, only sides, vertices, and location.
4. What geometric properties did you need to know about to be successful at this game?
   You have to know how to describe how shapes are alike or different. It helps to compare the sides of the shapes. You need to be able to describe where the shapes are located on the grid and how they connect to one another.

Discuss with the class the advantages of using a specific strategy as compared to working without one. This is also an opportunity to discuss the necessity for explicit, precise communication for describing mathematical actions, ideas, and solutions.

Activity 1: Polygon Set (page 1)



Activity 1: Polygon Set (page 2)



Part B: Concepts and Skills Assessment

Administration

The paper-and-pencil assessment in Part B addresses the majority of the specific expectations within the three overall expectations in the Geometry and Spatial Sense Strand. Part B includes several styles of questions: short-response, fill-in-the-blank, and multiple-choice.

Timing

Most students will be able to complete the entire assessment in a 60-minute period. If necessary, provide students with additional time to complete the assessment as long as they complete it in one sitting.

Materials

FOR THE TEACHER	FOR EACH STUDENT	FOR EACH GROUP OF STUDENTS
• Individual Student Scoring Guide: pp. 160–161 • Class Tracking Sheet: pp. 162–163 • ONAP 7 CD-ROM (optional)	• Assessment Part B: pp. 153–159 • pencil • eraser • ruler • protractor	• centimetre cubes

Introducing the Assessment

Inform students that they will be completing an assessment to help you get to know what they have learned about math in earlier grades. Tell students that it is important that they answer the questions as fully as possible. To communicate effectively, they can use pictures, numbers, words, and/or diagrams to represent their thinking.

Point out the manipulative materials you have provided for students to use throughout the assessment. Encourage students to access other materials available in the classroom that they think might help them to answer questions and/or solve problems.

Note: *Calculators are not recommended during this assessment.*

Accommodating Students with Special Needs

If individual or groups of students have difficulties with reading, consider reading the questions orally as they complete the assessment.

If individual students have difficulties explaining their thinking in writing, consider providing scribes to record for the students or encourage students to show and explain their thinking using concrete materials.

Some students will require additional time to complete the assessment. You may wish to note this accommodation in your anecdotal records about the student. However, there should be no reduction of the student's overall score in terms of the amount of time it takes the student to complete the assessment.

Scoring the Assessment

A detailed Individual Student Scoring Guide has been provided on pages 160 and 161. The guide is designed to be completed for each student. The individual scores can then be used to fill in the Class Tracking Sheet. Alternatively, you may record student results directly on the Class Tracking Sheet. The results can be recorded on a photocopy, or electronically using the ONAP 7 CD-ROM.

While great care has been taken to consider the range of possible answers for each question, there will be times when you will need to apply your professional judgment to score an individual answer. You may use the Curriculum Correlation chart provided on page 164 to help you to determine whether the student has demonstrated the intended concept, knowledge, or skill based on the overall and specific expectations being assessed by the particular question.

At times a student may provide an answer that you think does not completely represent his or her knowledge and skill level. You may ask probing questions to better assess a student's overall understanding.

Some questions are delivered in more than one part (a and b) and are given more than one point. Should a student's answer in one part reveal that a correct answer in the other part was arrived at for the wrong reason, a score of zero should be given for both parts.

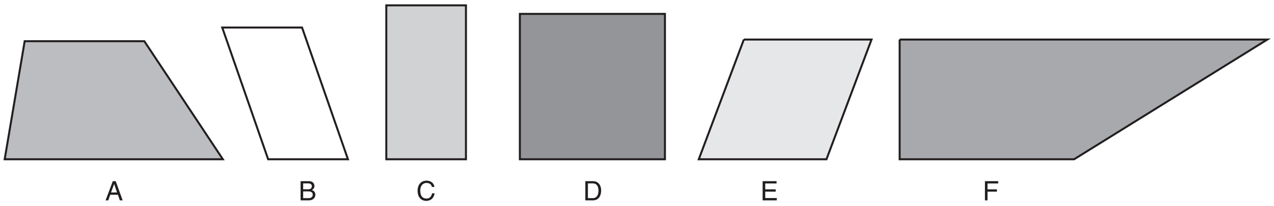
Summarizing Individual and Class Achievement

Once you have completed scoring the students' assessments, you will need to record the results. You may record the results electronically using the ONAP 7 CD-ROM, or use a photocopy of the Class Tracking Sheet provided on pages 162 and 163.

Name: ______________________________ **Date:** ____________________

Geometry and Spatial Sense

Use these shapes to answer questions 1 and 2.



1. Fill in the chart by writing the letter of the quadrilateral(s) that fits the property.

Property	Example(s)
Quadrilateral(s) with at least one right angle	
Quadrilateral(s) with at least one angle less than 90º	
Quadrilateral(s) with at least one angle more than 90º	
Quadrilateral(s) with angles that are both less than and more than 90º	

2. Fill in the chart by writing the letter of the quadrilateral(s) that fits the property.

Property	Example(s)
Quadrilateral(s) with all sides of equal length	
Quadrilateral(s) with sides of different lengths	

Name: ______________________________ **Date:** ______________________

3. Draw the angles. Label each one as acute or obtuse.

16°

Type of angle: ______________________

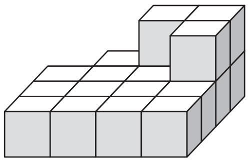
127°

Type of angle: ______________________

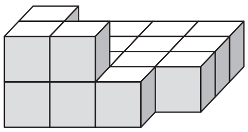
Name: ______________________________ **Date:** ____________________

4. Construct a trapezoid with a 45° angle and the longest side measuring 11 cm.

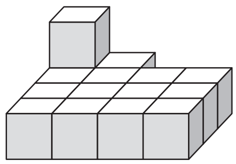
5. Which of the structures below represents another view of this structure?



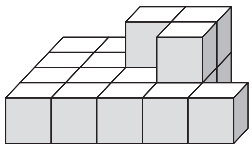
Circle the correct answer.



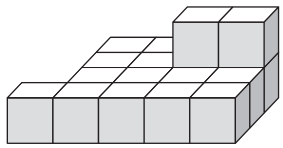
A



B



C

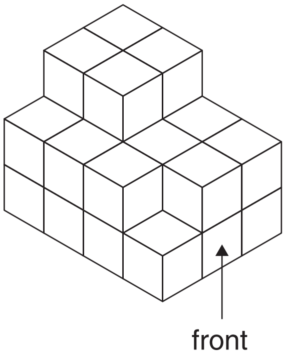


D

Explain how you know.

Name: ______________________________ **Date:** ____________________

6. Sketch and label the top, front, and left-side views of the three-dimensional figure.



Name: ______________________________ **Date:** ______________________

7. **a)** Plot and label the following points on the coordinate plane:

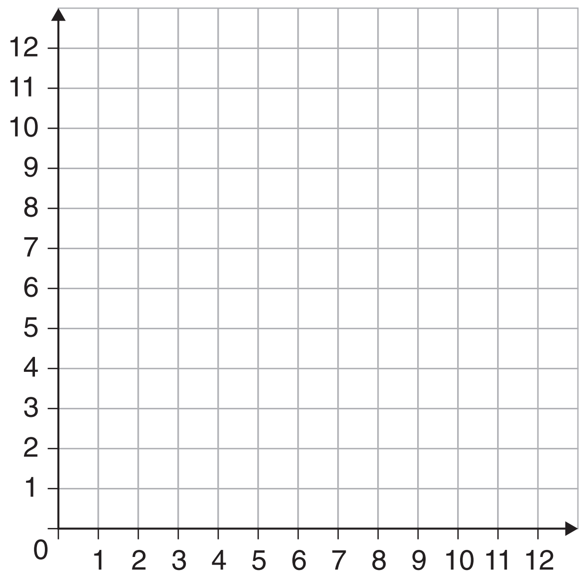
A (3, 5)

B (1, 7)

C (7, 1)

D (0, 0)

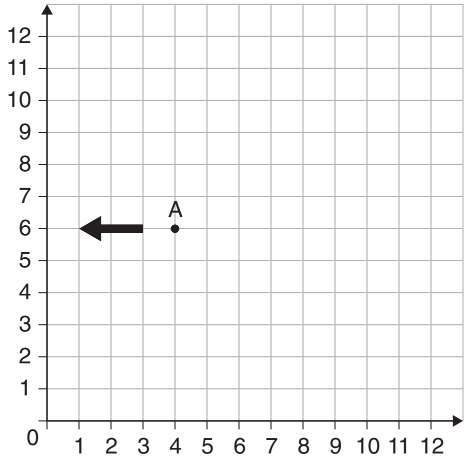
E (5, 3)



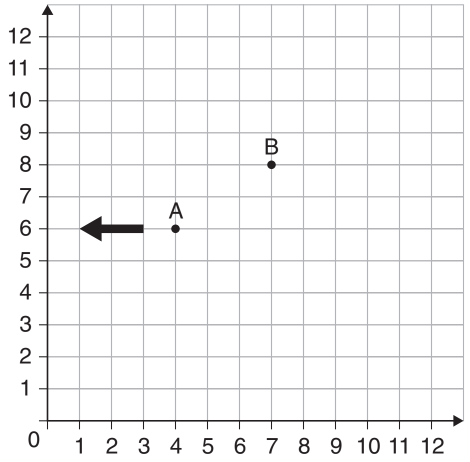
b) How do you read the coordinates of a point on the coordinate grid?

Name: ________________________________ **Date:** ____________________

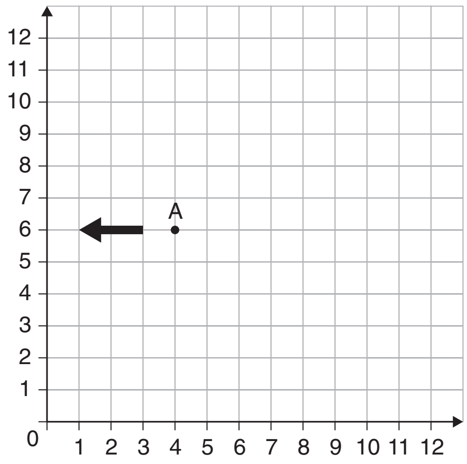
8. a) Rotate the arrow 180° clockwise around point A.



b) Rotate the arrow 180° counterclockwise around point B.

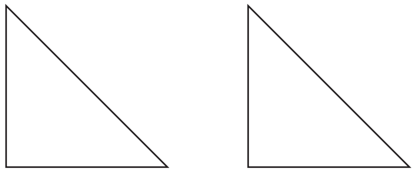


c) Rotate the arrow 90° clockwise around point A.



Name: ______________________________ **Date:** ____________________

9. a) Identify whether the figures below show a translation, a rotation, and/or a reflection. You can use more than one motion if necessary.

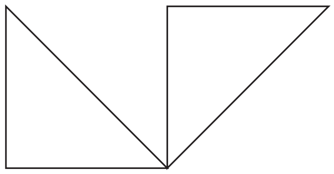


A

Type(s) of motion: ____________________

____

____

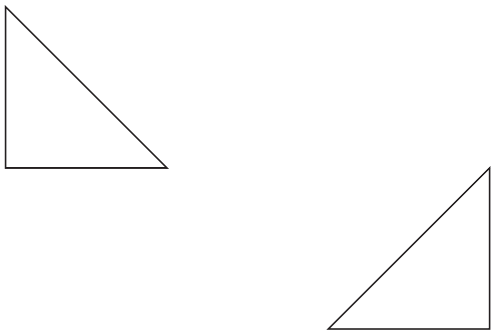


B

Type(s) of motion: ____________________

____

____



C

Type(s) of motion: ____________________

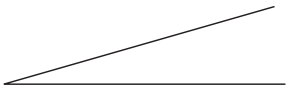
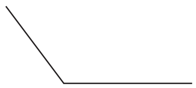
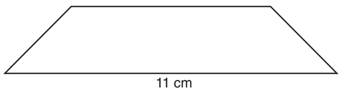
____

____

b) Choose one of your answers and explain your thinking.

ONAP INDIVIDUAL STUDENT SCORING GUIDE
GRADE 7: GEOMETRY AND SPATIAL SENSE — PART B

Name: ______________________ **Date:** ______________________

Overall Expectation 6m43 (Geometric Properties): **Classify and construct polygons and angles.**		
6m46 1	quadrilaterals with at least one right angle: C, D, F quadrilaterals with at least one angle less than 90°: A, B, E, F quadrilaterals with at least one angle more than 90°: A, B, E, F quadrilaterals with angles that are both less than and more than 90°: A, B, E, F **1 point** for correctly identifying all the quadrilaterals for two or three rows of the chart OR **2 points** for correctly identifying all the quadrilaterals for all rows of the chart	
6m47 2	quadrilateral with all sides of equal length: D, E quadrilateral with sides of different lengths: A, B, C, F **1 point** for correctly identifying all the quadrilaterals for one row of the chart OR **2 points** for correctly identifying all the quadrilaterals for both rows of the chart	
6m48 3	 Type of angle: acute  Type of angle: obtuse **1 point** for each correctly drawn angle and label, up to **2 points** NOTE: You may wish to accept answers that fall within ± 2°.	
6m49 4	 **1 point** for a correctly drawn trapezoid. Use a ruler and protractor to check for at least one 45° angle (within ± 1°) and one side measuring 11 cm (within ± 0.5 cm).	
	Total for Overall Expectation 6m43:	___ 7
Overall Expectation 6m44 (Geometric Relationships): **Sketch three-dimensional figures, and construct three-dimensional figures from drawings.**		
6m50 5	A **1 point** for the correct answer AND **1 point** for a partial explanation that demonstrates some understanding, e.g., *C doesn't work and A does since a cube could be hidden.* OR **2 points** for a complete explanation that demonstrates full understanding, e.g., *B and D only have 1 and 2 cubes on top, not 3, so they aren't possible. In the original, two cubes on the top are in the same row as the missing cube on the bottom. That doesn't happen with C. So it has to be A.*	

6m51

6

1 point for each correctly sketched view, up to **3 points** e.g.,

top

2	3	3
2	3	3
2	2	2
1	2	2

front

0	2	2
3	4	4
4	4	4

(left) side

2	2	0	0
3	3	3	2
3	3	3	3

NOTE: If students have drawn representations in a different format from what is shown here, points may be awarded as long as the representations are accurate.

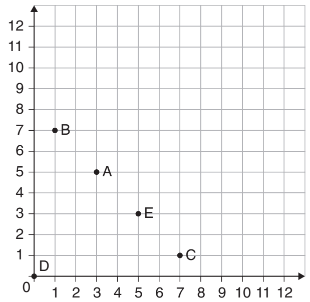
Total for Overall Expectation 6m44: ___ / 6

Overall Expectation 6m45 (Location and Movement):
Describe location in the first quadrant of a coordinate system, and rotate two-dimensional shapes.

6m52

7 a)

1 point for correctly plotting and labelling three or four points
OR **2 points** for correctly plotting and labelling all five points



6m52

7 b)

1 point for a partial explanation that demonstrates some understanding, e.g., *The first coordinate tells how far over and the second how far up*.

OR **2 points** for a complete explanation that demonstrates full understanding, e.g., *You start at (0,0) where the two axes meet. Then you go over the amount of the first coordinate and up the amount of the second coordinate to find the point*.

6m53

8 a)–c)

a) an arrow pointing right starting at (5, 6) and ending at (7, 6); b) an arrow pointing right starting at (11, 10) and ending at (13, 10); c) an arrow pointing up starting at (4, 7) and ending at (4, 9)

1 point for two correct rotations

OR **2 points** for three correct rotations

6m54

9 a)

A: translation; B: rotation; C: reflection and translation

1 point for two correct answers

OR **2 points** for three correct answers

6m54

9 b)

1 point for a partial explanation that demonstrates some understanding, e.g., *In a translation, you only slide*.

OR **2 points** for a complete explanation that demonstrates full understanding, e.g., *In a translation, the points all move exactly the same amount; I drew arrows between the start and end points for the three vertices, and the arrows were exactly the same*.

Total for Overall Expectation 6m45: ___ / 10

ONAP GRADE 7: GEOMETRY AND SPATIAL SENSE

Date: ______________________ **Grade:** ________ **School:** ______________________________

Overall Expectation			**6m43 (Geometric Properties)** Classify and construct polygons and angles.				
Specific Expectation #			6m46	6m47	6m48	6m49	Total
Question #			1	2	3	4	
Student Name	Gender (M/F)	IEP/ ELL					

CLASS TRACKING SHEET — PART B

Board: ______________________________ **Teacher Name:** ______________________________

6m44 (Geometric Relationships) Sketch three-dimensional figures, and construct three-dimensional figures from drawings.			**6m45 (Location and Movement)** Describe location in the first quadrant of a coordinate system, and rotate two-dimensional shapes.					
6m50	6m51	**Total**	6m52		6m53	6m54		**Total**
5	6		7(a)	7(b)	8	9(a)	9(b)	

ONTARIO CURRICULUM CORRELATION TO ONAP GEOMETRY AND SPATIAL SENSE 7 — PART B
NOTE: This correlation is to the Grade 6 Ontario Curriculum Expectations

Overall Expectation 6m43 (Geometric Properties):
Classify and construct polygons and angles.

Question Number	Specific Expectation
1	**6m46:** sort and classify quadrilaterals by geometric properties related to symmetry, angles, and sides, through investigation using a variety of tools (e.g., geoboard, dynamic geometry software) and strategies (e.g., using charts, using Venn diagrams)
2	**6m47:** sort polygons according to the number of lines of symmetry and the order of rotational symmetry, through investigation using a variety of tools (e.g., tracing paper, dynamic geometry software, Mira)
3	**6m48:** measure and construct angles up to 180° using a protractor, and classify them as acute, right, obtuse, or straight angles
4	**6m49:** construct polygons, using a variety of tools, given angle and side measurements

Overall Expectation 6m44 (Geometric Relationships):
Sketch three-dimensional figures and construct three-dimensional figures from drawings.

Question Number	Specific Expectation
5	**6m50:** build three-dimensional models using connecting cubes, given isometric sketches or different views (i.e., top, side, front) of the structure
6	**6m51:** sketch, using a variety of tools (e.g., isometric dot paper, dynamic geometry software), isometric perspectives and different views (i.e., top, side, front) of three-dimensional figures built with interlocking cubes

Overall Expectation 6m45 (Location and Movement):
Describe location in the first quadrant of a coordinate system, and rotate two-dimensional shapes.

Question Number	Specific Expectation
7 a)–b)	**6m52:** explain how a coordinate system represents location, and plot points in the first quadrant of a Cartesian coordinate plane
8	**6m53:** identify, perform, and describe, through investigation using a variety of tools (e.g., grid paper, tissue paper, protractor, computer technology), rotations of 180° and clockwise and counterclockwise rotations of 90°, with the centre of rotation inside or outside the shape
9 a)–b)	**6m54:** create and analyze designs made by reflecting, translating, and/or rotating a shape, or shapes, by 90° or 180°

Part C: Performance-Based Assessment

Administration

The two performance tasks in Part C are designed to provide insight into how well students are able to perform in terms of the categories of the Ontario Achievement Chart: Knowledge and Understanding, Thinking, Communication, and Application.

Most of the specific and overall expectations for this strand have been assessed through the Concepts and Skills Assessment in Part B. It is recommended that both performance tasks for the Geometry and Spatial Sense Strand be completed to address expectations requiring students to construct geometric shapes and angles.

Read all parts of the problem orally to students. Tell students that they should provide detailed answers to the problem, including how they solved the problem. Remind students that they may use pictures, numbers, words, diagrams, and/or charts to explain effectively how they solved the problem.

Timing

Each task is designed to be completed in a 45- to 60-minute period. If necessary, provide additional time as long sudents complete the task in one sitting.

Accommodating Students with Special Needs

If individual students have difficulties explaining their thinking in writing, consider providing scribes to record for the students or encourage students to show and explain their thinking using concrete materials.

Scoring the Assessment

A generic rubric based on the Ontario Achievement Chart for Mathematics has been provided on page 175 to assist with scoring student responses to the tasks. Spend some time reviewing the anchors and rationales provided for each level of achievement on pages 176 to 191. The four categories should be considered as interrelated, reflecting the wholeness and interconnectedness of learning. Each student's performance should therefore be determined holistically by selecting the level that best describes the student's overall achievement.

Sometimes a student will not achieve at the same level for each criterion within a category or across categories. For example, a student may perform at Level 3 on Knowledge and Understanding, Thinking, and Application but at Level 2 on Communication. While you may determine that, overall, the student performed most consistently at Level 3, you may want to make a note that this student would benefit from additional instruction in the area of Communication.

Note: *When scoring student work on the performance tasks, it is appropriate to note what you observed and heard while the student worked on the task.*

Once you have completed scoring the students' assessments, you will need to record the results. You may record the results electronically using the ONAP 7 CD-ROM, or use a photocopy of the Performance Task Class Tracking Summary Sheet provided on page 174.

Next Steps

Strategies for improving performance in the four areas of the Achievement Chart are provided in the ONAP Introduction, pages 18 and 19.

Performance Task 1: Create a Wall Design

Materials

FOR THE TEACHER	FOR EACH STUDENT	FOR EACH GROUP OF STUDENTS
• Performance Task Class Tracking Sheet: p. 174 • Performance Task Rubric: p. 175 • anchors and rationales: pp. 176–183 • ONAP 7 CD-ROM (optional)	• BLM C1: *Performance Task 1: Create a Wall Design*: pp. 171–172 • pencil • eraser • protractor • ruler	

Introducing the Task

For this task, students are asked to create a wall design that shows how math and art connect.

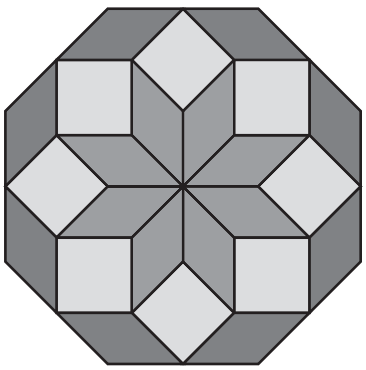
Tell students that they will

- draw a wall design that includes polygons, shapes with at least two, three, and four lines of symmetry, and three different angles between 0° and 180°
- describe where each element is included in their design

Have students use BLM C1: *Performance Task 1: Create a Wall Design* to complete this activity.

Answers

1. Sample answer:



2. Answers based on sample design from question 1:

MY DESIGN

Element	How You Created It/Them
shapes with two lines of symmetry	*The rhombuses have two lines of symmetry because you can fold them in two ways so that the edges have no overlap.*
shapes with three lines of symmetry	*I noticed the shape of the entire design as a whole (an octagon) can be folded at least three ways to create three lines of symmetry.*
shapes with four lines of symmetry	*The square can be folded in four different ways to form a line of symmetry.*
angle 1: *90°*	*The squares each have four right angles. A right angle is 90°.*
angle 2: *135°*	*The parallelograms have two angles that are more than 90°. They are 135°.*
angle 3: *45°*	*The parallelograms each have two acute angles of 45°.*

Performance Task 2: The 3-D Figure

Materials

FOR THE TEACHER	FOR EACH STUDENT	FOR EACH GROUP OF STUDENTS
• Performance Task Class Tracking Sheet: p. 174 • Performance Task Rubric: p. 175 • anchors and rationales: pp. 184–191 • ONAP 7 CD-ROM (optional)	• BLM C2: *Performance Task 2: The 3-D Figure*: p. 173 • pencil • eraser • 15 cubes	

Introducing the Task

For this task, students are asked to recreate a three-dimensional figure using 15 cubes and to draw different views of the figure.

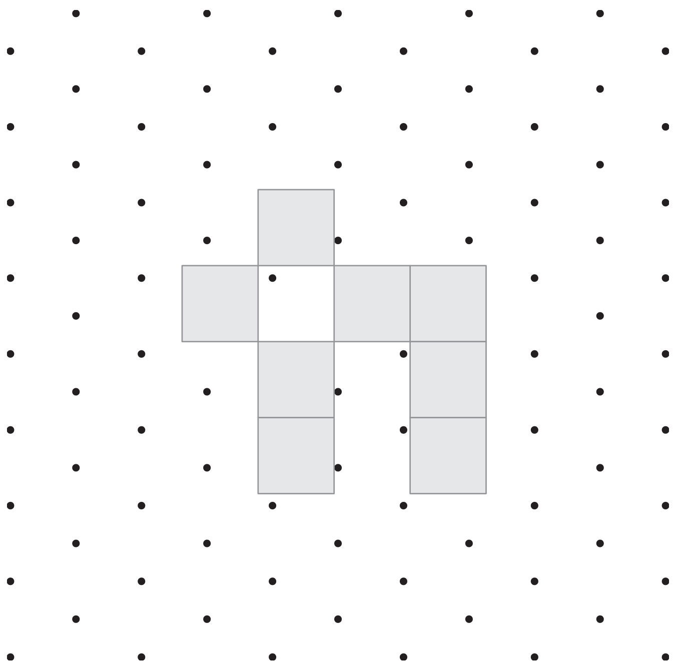
Tell the students that they will

- use 15 cubes to recreate a three-dimensional figure
- draw the front, side, and top views of the figure on isometric paper

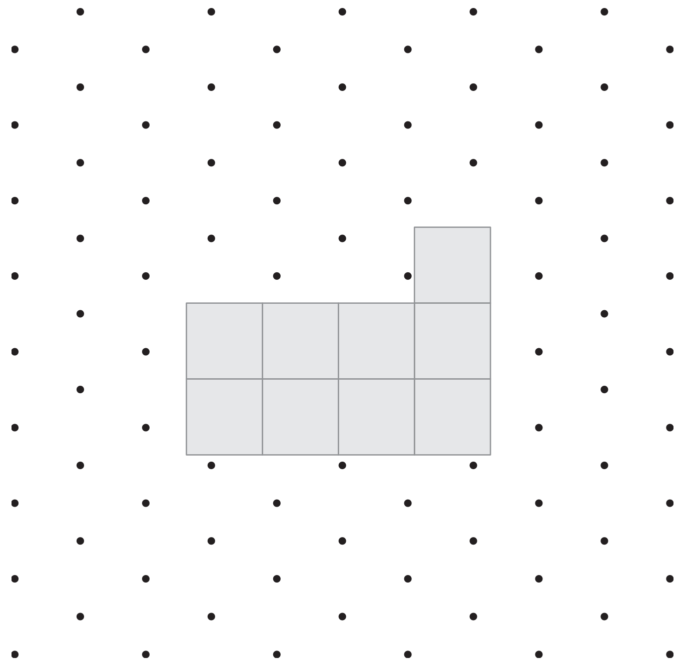
Have students use BLM C2: *Performance Task 2: The 3-D Figure* to complete this activity.

Answers

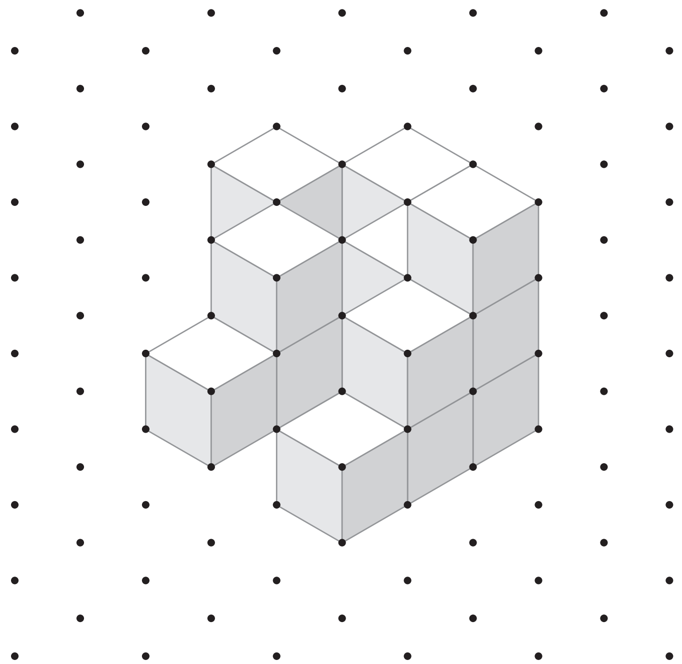
1.



top view



front view



side view

Name: ______________________________ **Date:** ____________________

Performance Task 1: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes

- polygons
- shapes with two, three, and four lines of symmetry
- at least three different angles between 0° and 180°

Refer to your design when completing the table in question 2.

Name: ______________________________ Date: ______________________

Performance Task 1: Create a Wall Design (page 2)

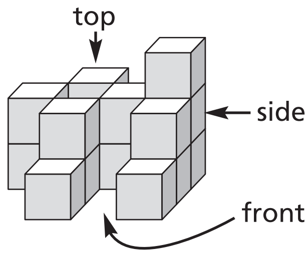
2. Complete the table.

MY DESIGN

Element	How You Created It/Them
shapes with two lines of symmetry	
shapes with three lines of symmetry	
shapes with four lines of symmetry	
angle 1: __________°	
angle 2: __________°	
angle 3: __________°	

Name: ______________________________ **Date:** ______________________

Performance Task 2: The 3-D Figure



1. Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be three-dimensional.

ONAP PERFORMANCE TASK CLASS TRACKING SHEET GRADE 7: GEOMETRY AND SPATIAL SENSE PART C

Date: ______________________ **Grade:** ______________________

School: ______________________ **Board:** ______________________

Teacher Name: ______________________

Performance Task Title: ______________________

Student Name	Level 1–4	Comments

Performance Task Rubric

Assessment of Learning – What to Look For in Student Work

CATEGORY	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Knowledge and Understanding	• demonstrates a limited or inaccurate understanding of the concepts needed to solve the problem • demonstrates a limited or inaccurate knowledge of the specific concepts, terms, or procedural skills that have been taught	• demonstrates some understanding of the concepts needed to solve the problem • demonstrates some knowledge of the specific concepts, terms, or procedural skills that have been taught	• demonstrates considerable understanding of the concepts needed to solve the problem • demonstrates considerable knowledge of the specific concepts, terms, or procedural skills that have been taught	• demonstrates a thorough understanding of the concepts needed to solve the problem • demonstrates a thorough knowledge of the specific concepts, terms, or procedural skills that have been taught
Thinking	• demonstrates a limited understanding of the problem • shows little or no evidence of a plan • uses a strategy and attempts to solve the problem but does not arrive at an answer	• demonstrates some understanding of the problem • shows some evidence of a plan • carries out the plan to some extent by using a strategy and develops a partial and/or incorrect solution	• demonstrates considerable understanding of the problem • shows evidence of an appropriate plan • carries out the plan effectively by using an appropriate strategy and solving the problem	• demonstrates a thorough understanding of the problem • shows evidence of a thorough plan • shows flexibility and insight when carrying out the plan by trying and adapting when necessary one or more strategies to solve the problem
Communication	• provides a limited or inaccurate explanation/ justification that lacks clarity or logical thought • communicates with limited effectiveness (may include words, pictures, symbols, and/or numbers)	• provides a partial explanation/justification that shows some clarity and logical thought • communicates with some effectiveness (may include words, pictures, symbols, and/or numbers)	• provides a complete, clear, and logical explanation/ justification • communicates with considerable effectiveness (may include words, pictures, symbols, and/or numbers)	• provides a thorough, clear, and insightful explanation/justification • communicates with a high degree of effectiveness (may include words, pictures, symbols, and/or numbers)
Application	• demonstrates a limited ability to apply mathematical knowledge and skills	• demonstrates some ability to apply mathematical knowledge and skills	• demonstrates a considerable ability to apply mathematical knowledge and skills	• demonstrates a sophisticated ability to apply mathematical knowledge and skills

Performance Task 1: Create a Wall Design LEVEL 1 (Anchor 1)

Knowledge and Understanding
- demonstrates limited understanding of symmetry in chart
- shows limited evidence of knowledge of angle measurement in chart

Communication
- provides a verbal explanation that is not mathematical or helpful in describing thinking or process; diagrams are somewhat more helpful
- employs limited use of mathematical vocabulary; no link between diagrams and verbal explanations

Thinking
- demonstrates limited evidence of thinking processes
- shows conflicting evidence of processing symmetry between design and chart (e.g., one line in trapezoid is a line of symmetry; the other is not)

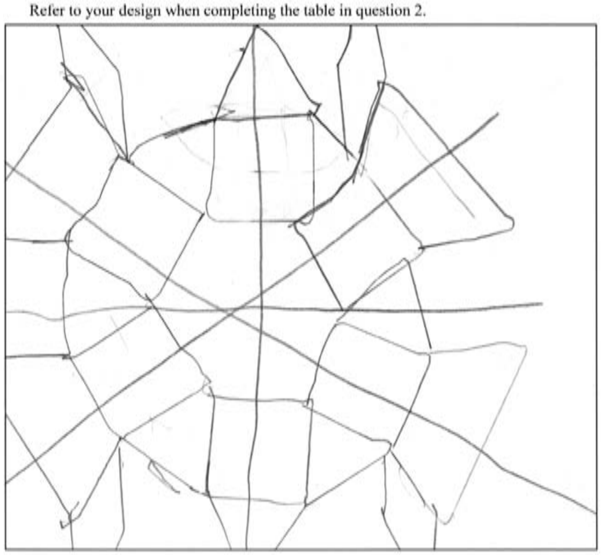
Application
- applies a fragile understanding of symmetry with some effectiveness
- applies properties of angles with limited effectiveness

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	figured it out
Shapes with three lines of symmetry	figured it out
Shapes with four lines of symmetry	figured it out
Angle 1: 70 °	figured it out
Angle 2: 60 °	figured it out
Angle 3: 40 °	figured it out

Performance Task 1: Create a Wall Design LEVEL 1 (Anchor 2)

Knowledge and Understanding
- shows a limited understanding of symmetry in chart
- demonstrates limited evidence of understanding of angle properties in chart

Communication
- shows limited expression of thinking in partial answers
- provides little evidence of math vocabulary in chart

Thinking
- shows little evidence of creative thinking in design
- shows limited evidence of planning skills that meet the demand for a number of different angles and a variety of shapes and polygons

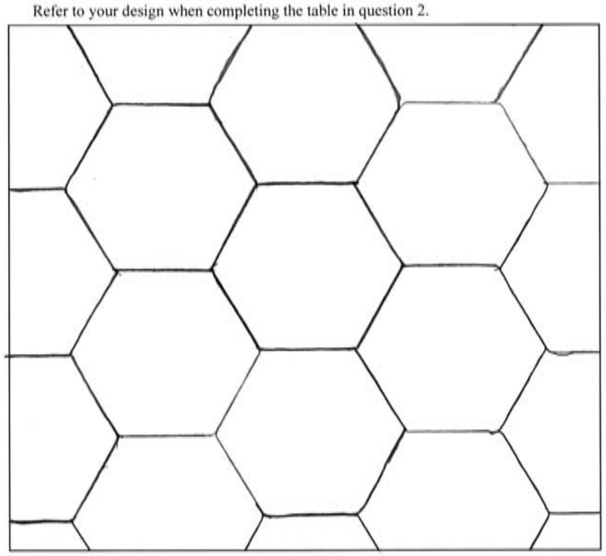
Application
- applies shape properties to design with some proficiency
- demonstrates limited evidence of application of angle properties in question 2

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

   Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	none
Shapes with three lines of symmetry	hexagon
Shapes with four lines of symmetry	none
Angle 1: 120 °	
Angle 2: ______ °	
Angle 3: ______ °	

Performance Task 1: Create a Wall Design LEVEL 2 (Anchor 1)

Knowledge and Understanding
- shows some understanding of symmetry in design and chart
- articulates some understanding of angles in chart based on the verbal description

Communication
- expresses and organizes ideas with some effectiveness
- uses math vocabulary with considerable effectiveness

Thinking
- demonstrates some evidence of planning and processing skills in design
- demonstrates a fragile understanding of angles in triangles in chart

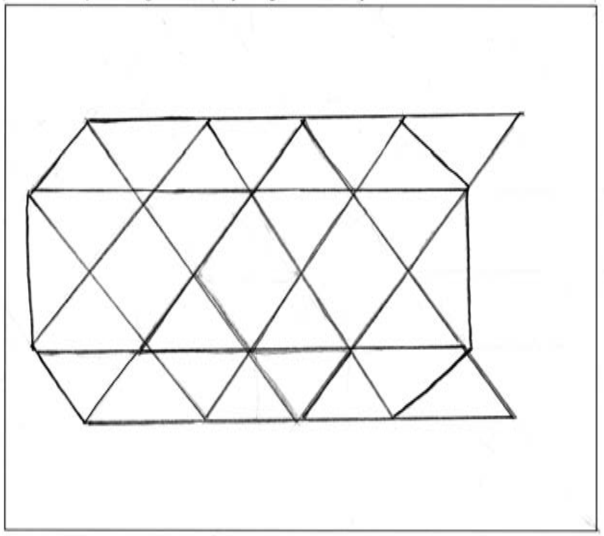
Application
- applies fragile understanding of angles in chart
- applies concepts of symmetry with considerable effectiveness in chart and within design

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

   Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	I used this shape and rotated it 360 degrees at the • to get this: and erased the line in between
Shapes with three lines of symmetry	I used a trianglar polygon (△)
Shapes with four lines of symmetry	I used a ruler and drew a line (strait). Then I measured 40° and drew two angles on both sides.
Angle 1: 40 °	I drew an isocelese triangle with 110° on one angle and 40° on the others
Angle 2: 103 °	I drew a shape like this ▱
Angle 3: 55 °	I drew an equalateral triangle

Performance Task 1: Create a Wall Design LEVEL 2 (Anchor 2)

Knowledge and Understanding
- demonstrates considerable knowledge of symmetry in design and chart
- shows some understanding of internal polygon angles with small error on triangle angles in chart

Communication
- uses diagrams and lines with considerable effectiveness
- explains symmetry in the design with some connection to the angles in the chart

Thinking
- shows some effectiveness in planning and processing design

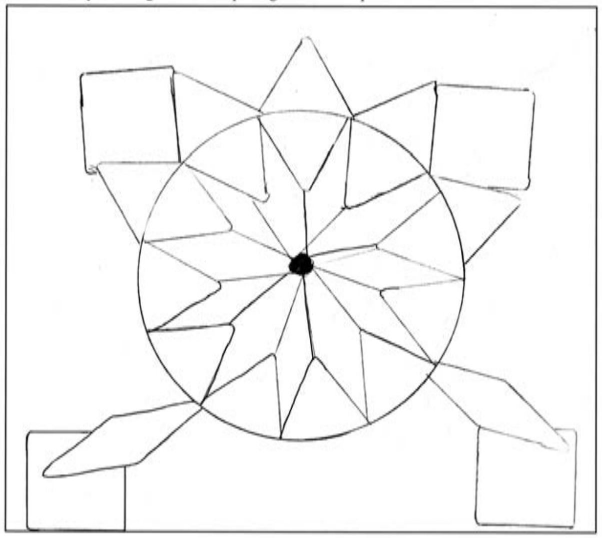
Application
- applies understanding of symmetry with considerable effectiveness
- presents angle properties in chart with some effectiveness

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

   Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	Diamond Shape
Shapes with three lines of symmetry	triangle
Shapes with four lines of symmetry	Square
Angle 1: 90° °	Square 90° 90° 90° 90°
Angle 2: 65° °	triangle 65° 65° 65°
Angle 3: 50° °	Diamond Shape 50° 50°

Performance Task 1: Create a Wall Design LEVEL 3 (Anchor 1)

Knowledge and Understanding
- demonstrates considerable understanding of symmetry in the design
- shows some understanding of internal angles of polygons in the angle descriptions

Communication
- explains symmetry and angles with considerable effectiveness in the chart

Thinking
- shows some analysis of design for angle properties in the chart

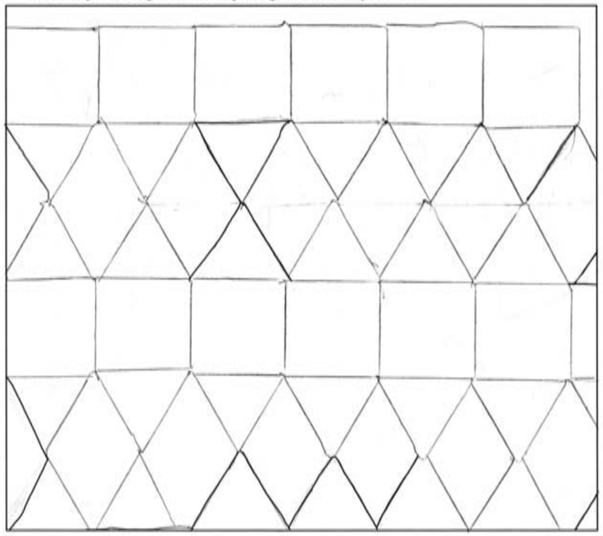
Application
- applies considerable knowledge of symmetry and angle properties to create and describe wall design creation

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	Diamond,
Shapes with three lines of symmetry	None
Shapes with four lines of symmetry	Square
Angle 1: 115 °	inside diamond
Angle 2: 60 °	inside triangle
Angle 3: 90 °	outside + inside square

Performance Task 1: Create a Wall Design LEVEL 3 (Anchor 2)

Knowledge and Understanding
- demonstrates considerable understanding of symmetry and angle properties
- shows considerable knowledge of angle notation in the chart

Communication
- shows considerable representation of mathematical thinking
- uses conventions of labelling symmetry and angle measurements with considerable effectiveness

Thinking
- demonstrates considerable planning and analysis for symmetry and angles within the design and chart

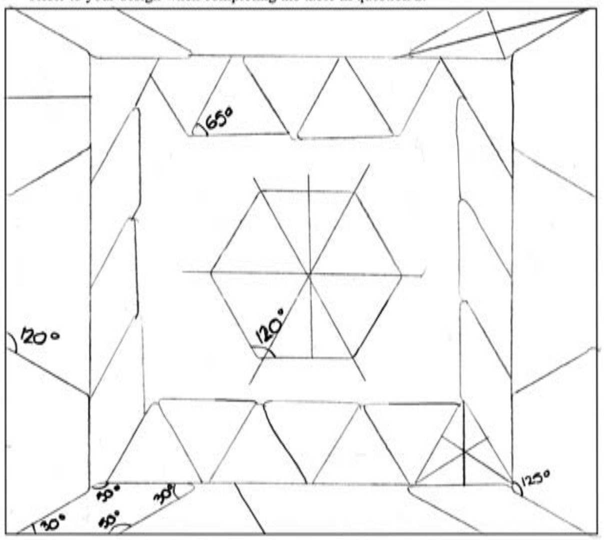
Application
- employs knowledge of symmetry and angles in design

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	I drew 2 lines of symetry on my page then drew a shape
Shapes with three lines of symmetry	I draw 3 lines on my page then drew my sape
Shapes with four lines of symmetry	I drew 4 lines on my page then drew my sape
Angle 1: 120 °	I used my shape and found the angle with a protractor
Angle 2: 30 °	I did the same as angle 1.
Angle 3: 65 °	I did the same as angle 1 and 2.

Performance Task 1: Create a Wall Design LEVEL 4 (Anchor 1)

Knowledge and Understanding
- demonstrates a thorough understanding of symmetry and angle properties
- shows considerable knowledge of internal angles in the chart

Communication
- uses thorough representation of mathematical thinking
- uses conventions of labelling symmetry and angle measurements with a high degree of effectiveness

Thinking
- demonstrates thorough planning and analysis for symmetry and angles in the design and chart

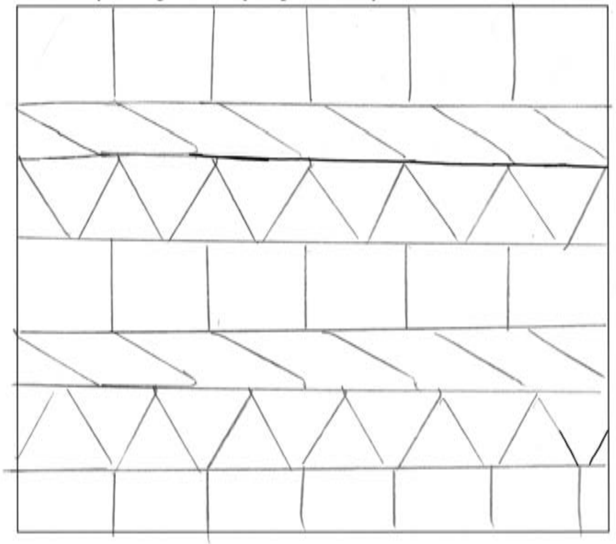
Application
- shows highly effective application of symmetry and angle properties to create and describe wall design

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

   Refer to your design when completing the table in question 2.



Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry dimond	
Shapes with three lines of symmetry Triangle	
Shapes with four lines of symmetry Square	
Angle 1: 60°	
Angle 2: 150°	
Angle 3: 90°	

Performance Task 1: Create a Wall Design LEVEL 4 (Anchor 2)

Knowledge and Understanding
- shows a thorough understanding of symmetry and selections of angles within polygons in the design
- demonstrates a thorough knowledge of math language and representations in a highly effective manner in the chart

Communication
- shows a thorough representation of mathematical thinking with a high degree of effectiveness
- uses conventions of labelling symmetry and angle measurements with a high degree of effectiveness

Thinking
- demonstrates considerable planning and analysis for symmetry and angles in the design and chart

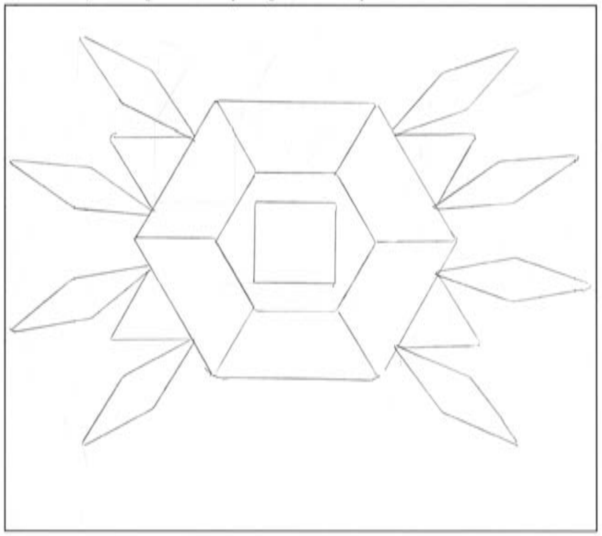
Application
- employs robust knowledge of symmetry and angles in design
- applies correct notation of angle location and degrees

Performance Task: Create a Wall Design (page 1)

The art group is in charge of providing a new wall design for the school. They have asked students to submit their ideas for designs. They asked students to make sure the designs show how math and art are connected.

1. Draw a wall design that includes:
   - polygons
   - shapes with two, three and four lines of symmetry
   - at least three different angles between 0 and 180°

   Refer to your design when completing the table in question 2.

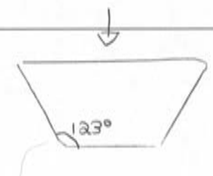


Performance Task: Create a Wall Design (page 2)

2. Complete the table.

My Design

Element	How you created it/them
Shapes with two lines of symmetry	I used a common shape
Shapes with three lines of symmetry	triangle (a common) shape
Shapes with four lines of symmetry	square a square is a common shape
Angle 1: 90° °	a square 90° 90° 90° 90°
Angle 2: 150° °	150°
Angle 3: 123° °	



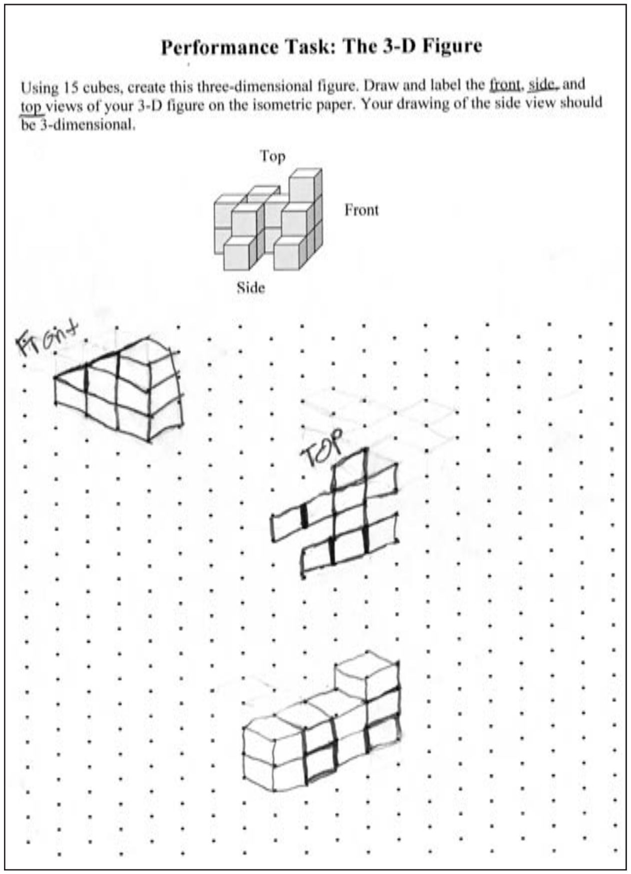
Performance Task 2: The 3-D Figure LEVEL 1 (Anchor 1)

Knowledge and Understanding
- shows a limited understanding of front view, as the front drawing is missing two blocks on the far right of the view
- sketches a top view with the bottom row missing a block on the left
- draws a three-dimensional side view (unlabelled)

Communication
- uses labels and accurate representations on some of the drawings; some of the drawings are accurate.
- employs limited use of arrows, extra labels, or placement of labels to clearly communicate thinking

Thinking
- shows some planning skills in the drawings
- analyzes the front and side views in a limited manner based on the errors in the drawings.

Application
- shows a limited ability to consistently apply visualization of the different views of a three-dimensional figure as represented in the drawings on this sample


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

Performance Task 2: The 3-D Figure LEVEL 1 (Anchor 2)

Knowledge and Understanding

- shows correct front view; top view is incorrect because it is missing one block on the left of the "t" formation and two blocks toward the bottom left
- draws a three-dimensional side view, missing one of the blocks in the back

Communication

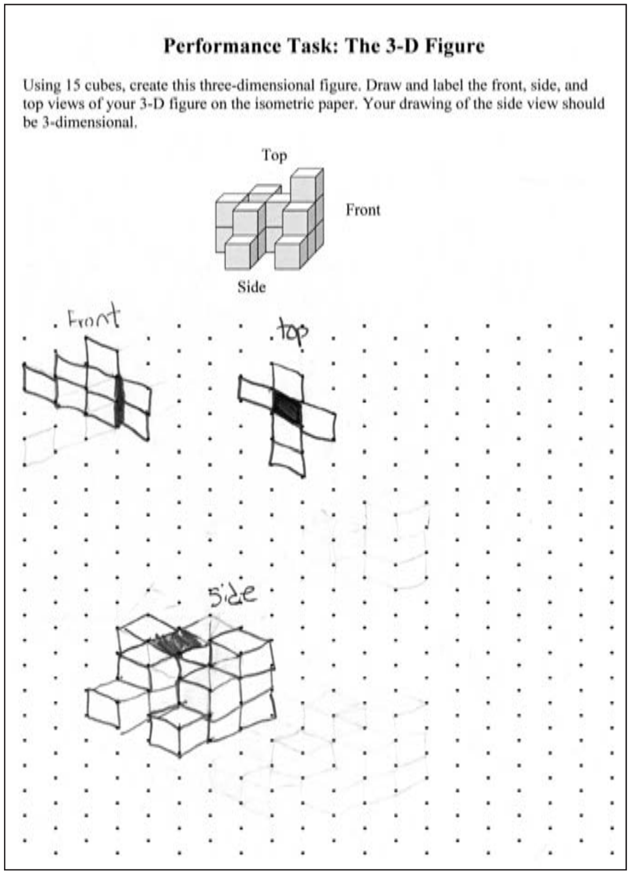
- draws the top view of the figure accurately
- labels the drawings; draws the figure inaccurately in the drawings

Thinking

- demonstrates some planning in the drawings
- analyzes the top and side views in a limited manner based on the errors in the drawings

Application

- shows limited ability to consistently apply visualization of the different views of a three-dimensional figure and represent it with accurate drawings



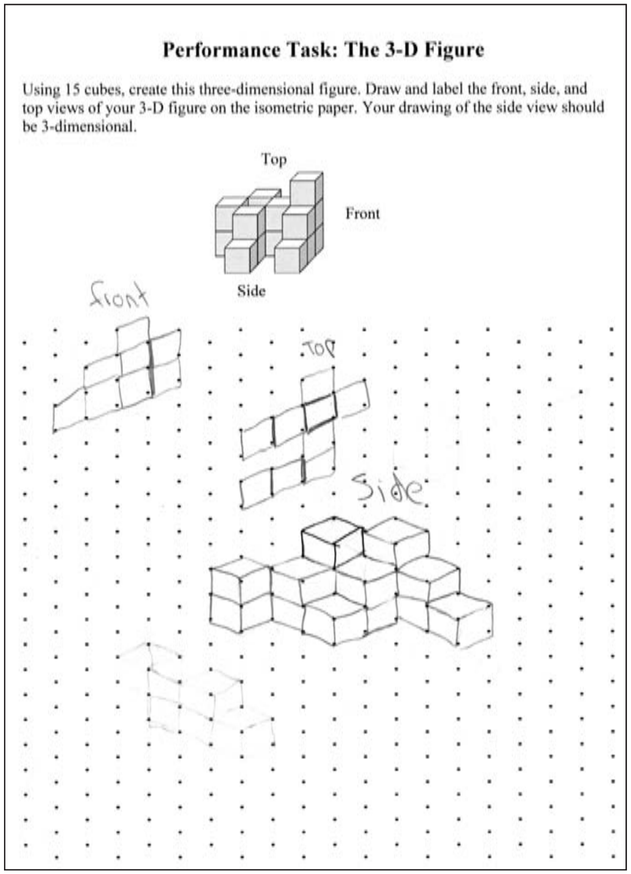
Performance Task 2: The 3-D Figure LEVEL 2 (Anchor 1)

Knowledge and Understanding
- draws the front and top views correctly
- shows some ability to draw a three-dimensional visualization of the figure in the side view; part of the side view is incorrectly represented

Communication
- labels drawings correctly
- expresses some degree of effective communication with accurate drawings

Thinking
- demonstrates some planning in the drawings
- analyzes the front and top views correctly
- shows some evidence of analysis of the side view, although it is misrepresented in the drawing

Application
- shows some ability to consistently apply visualization of the different views of a three-dimensional figure and represent it with accurate two-dimensional and three-dimensional drawings


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

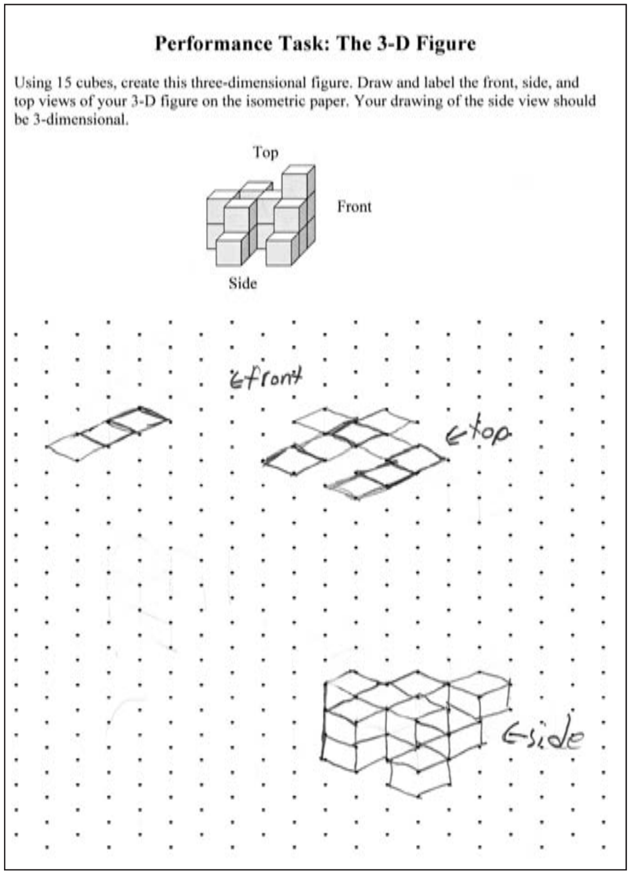
Performance Task 2: The 3-D Figure LEVEL 2 (Anchor 2)

Knowledge and Understanding
- draws the correct top view
- draws a front view missing the middle and top layers
- shows some ability to draw a three-dimensional visualization of the figure in the side view; part of the side view is missing on the second row in the middle and back; labelling is confusing

Communication
- labels drawings correctly
- expresses some degree of effective communication in the accuracy of the drawings

Thinking
- demonstrates some planning in the drawings
- analyzes the top view correctly
- displays some evidence of analysis of the side view although it is misrepresented in the drawing

Application
- shows some ability to consistently apply visualization of the different views of a three-dimensional figure and represent it with accurate two-dimensional and three-dimensional drawings



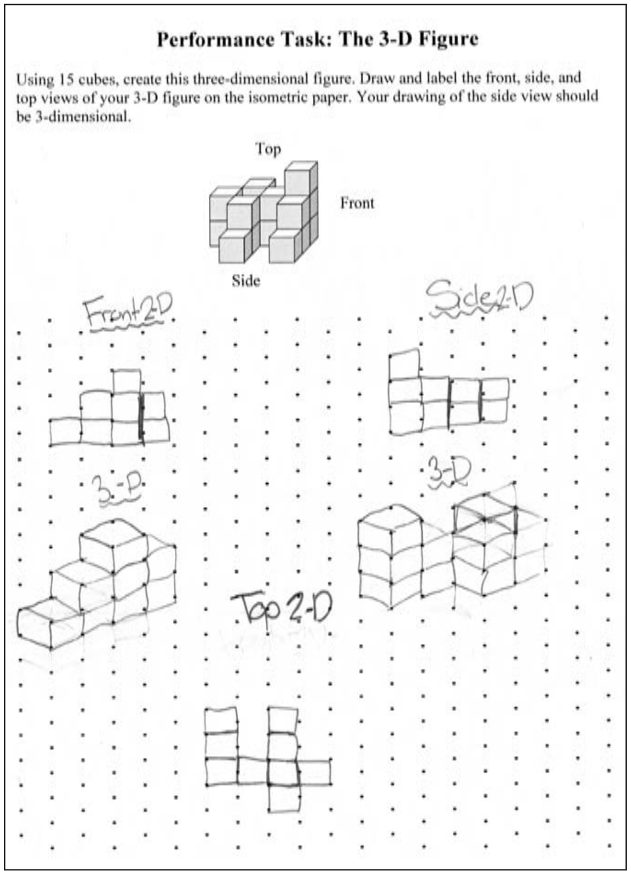
Performance Task 2: The 3-D Figure LEVEL 3 (Anchor 1)

Knowledge and Understanding
- draws the top view correctly (although reflected)
- draws the front and three-dimensional views correctly
- draws the two-dimensional side view correctly (although it is two-dimensional instead of the requested three-dimensional)
- shows some ability to draw a three-dimensional visualization of the figure in the side view; the representation is not fully correct and confusing to interpret

Communication
- labels drawings correctly
- shows a considerable degree of effective communication by accurately drawing different views of the figure

Thinking
- demonstrates considerable planning in the drawings
- exhibits considerable analysis as represented in the front, top, and two-dimensional side views drawings

Application
- displays considerable ability to consistently apply visualization of the different views of a three-dimensional figure and represent it accurately with two-dimensional and three-dimensional drawings most of the time


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

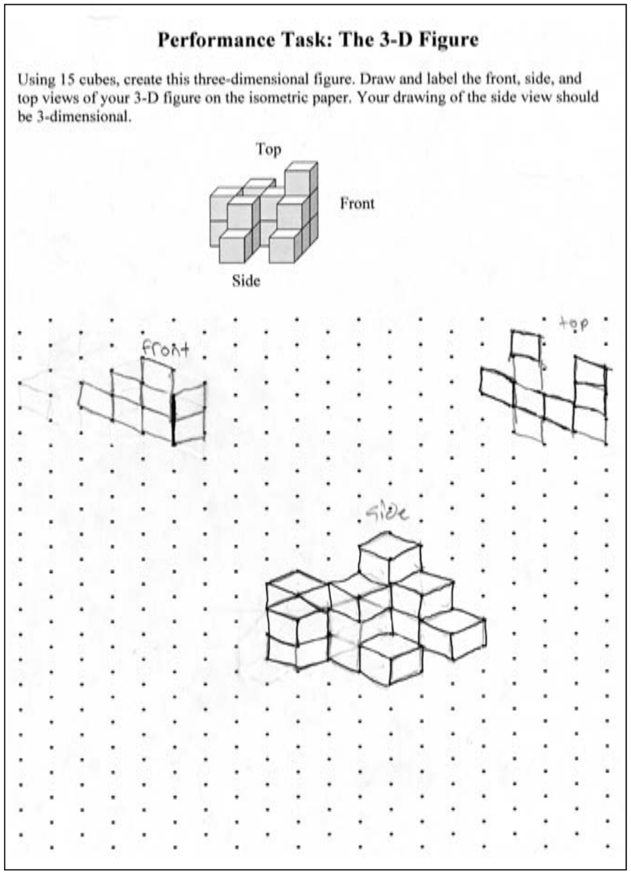
Performance Task 2: The 3-D Figure LEVEL 3 (Anchor 2)

Knowledge and Understanding
- draws the top view correctly (although reflected)
- draws a front view, which seems to be a mix of two-dimensional and three-dimensional drawings, but does show an understanding of the front view
- demonstrates accurate knowledge of three-dimensional drawing in the side view

Communication
- labels drawings correctly
- expresses effective communication in the accuracy of the drawings

Thinking
- shows considerable planning and some revision (see erased lines) in the drawings
- analyzes the top and side views with considerable accuracy in the drawings

Application
- shows considerable ability to consistently apply visualization of the different views of a three-dimensional figure and represent it with accurate two-dimensional and three-dimensional drawings


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

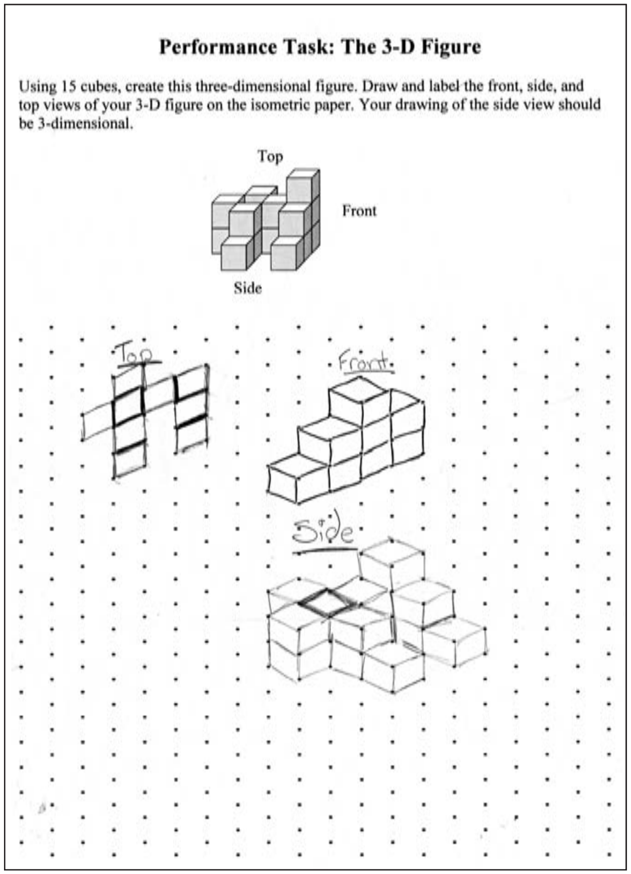
Performance Task 2: The 3-D Figure LEVEL 4 (Anchor 1)

Knowledge and Understanding
- draws the top, front, and side views correctly
- represents all of the views with a highly developed ability to draw two-dimensional and three-dimensional representations of the visualization of the figure

Communication
- labels drawings correctly
- displays a high degree of effective communication by accurately drawing the different views of the figure

Thinking
- shows careful planning and review (notice erasure corrections) in the drawings and labels
- indicates a careful and thorough visualization process prior to representing the views with two-dimensional and three-dimensional drawings

Application
- represents the three-dimensional figure with a highly developed ability to consistently apply visualization of the different views of a three-dimensional figure and represent it with accurate two-dimensional and three-dimensional drawings


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

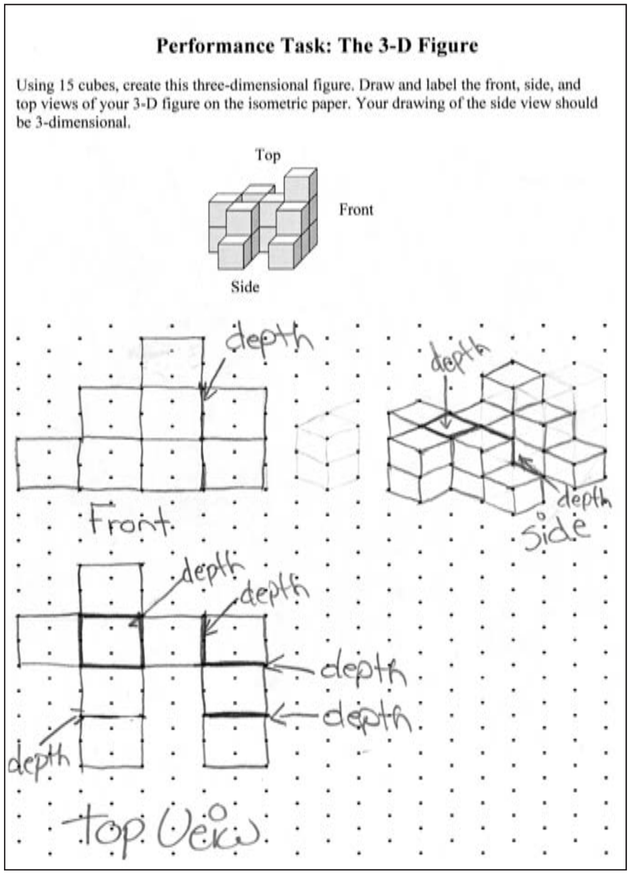
Performance Task 2: The 3-D Figure LEVEL 4 (Anchor 2)

Knowledge and Understanding
- represents the top, front, and side views accurately
- draws both the side and front views in three dimensions for the task
- shows a highly developed ability to draw representations of a three-dimensional visualization of the figure in the front and side views

Communication
- labels drawings correctly
- draws the three-dimensional qualities of the figure clearly

Thinking
- analyzes all of the views correctly
- represents the images accurately in two-dimensional and three-dimensional drawings showing visualization and planning

Application
- shows a highly developed ability to consistently apply visualization of many views of a three-dimensional figure and represent that figure with accurate two-dimensional and three-dimensional drawings


Performance Task: The 3-D Figure

Using 15 cubes, create this three-dimensional figure. Draw and label the front, side, and top views of your 3-D figure on the isometric paper. Your drawing of the side view should be 3-dimensional.

Next Steps for Geometry and Spatial Sense

Instructional Next Steps for Overall Expectations

After summarizing individual and class performance on each overall expectation, you may find that there are areas that could be retaught to some students. The following suggestions have been provided to assist you in preparing tasks for individuals or small groups of students.

Overall Expectation 6m43 (Geometric Properties)
Classify and construct polygons and angles.

Background

This overall expectation is about geometric properties. Understanding geometric properties provides the structure for making comparisons and noting relationships between and among different shapes, designs, and structures. The van Hiele Levels of Geometric Thought include five distinct levels:

- Level 0: Visualization — shapes and what they look like
- Level 1: Analysis — classes of shapes rather than individual shapes
- Level 2: Informal Deduction — properties of shapes (if all four angles are right, then it must be a square)
- Level 3: Deduction — relationships among properties of geometric figures
- Level 4: Rigor — deductive axiomatic systems for geometry

Students entering Grade 7 will be working within the first three levels of van Hiele's Levels of Geometric Thought (Van Hiele, P. M. *Structure and Insight: A Theory of Mathematics Education*. Orlando, FL: Academic Press, 1986).

Strategies

The following suggestions include some strategies to help students meet this overall expectation.

- Provide students with opportunities to visualize, classify, and construct polygons and three-dimensional figures and to describe their properties (symmetry, angles, and sides).
- Have students use dynamic geometry software (e.g., Geometer's Sketchpad) and manipulatives (e.g., geoboards, dot paper) to create different shapes and figures.
- Provide students with opportunities to use technology to investigate the angles within shapes and figures and how those angles are affected by changes to the dimensions.
- Using tracing paper, rotate shapes so students can see both the original image and its rotation.
- Use transparent geoboards and dynamic geometry software resources to demonstrate to students how shapes move across the plane.
- Show a series of rotations and then leave one out, to challenge students to visualize the missing rotation and draw it on grid or dot paper.

- Have students use protractors to measure angles on everyday objects (e.g., hands on a clock, nets of common packages, angles on photographs) and review how to construct benchmark angles such as 45°, 90°, and 180°.
- Have students use Venn diagrams, t-charts, and concept maps to organize, sort, and describe acute, obtuse, right, and straight angles.

Overall Expectation 6m44 (Geometric Relationships)

Sketch three-dimensional figures and construct three-dimensional figures from drawings.

Background

Students require practice with a wide range of materials to connect visualizations of three-dimensional shapes to sketches of three-dimensional shapes. Constructing three-dimensional figures can take the form of nets, skeletons, or faces.

Strategies

The following suggestions include some strategies to help students meet this overall expectation.

- Provide groups of students with 4 m cloth elastic bands (elastic found in fabric stores) that have been sewn into circles. Ask each group to use the elastics to create skeletons of three-dimensional figures that you name. This challenges students to consider all the properties of the figures (e.g., vertices, sides, number of faces).
- Challenge students to create three-dimensional figures using dynamic geometry software resources.
- Create cards that name a different type of prism or pyramid. Have students each draw a card and create that particular prism or pyramid using dynamic geometry software resources. (Use Smart Board technology if it is available to model software and to share student creations of figures.)
- Create several different activity centres containing a variety of materials, such as
  - toothpicks and marshmallows
  - toothpicks and clay
  - plastic plumbing pipes and elbows
  - magnetic building sets
  - connecting sets
  - clear tape, grid paper, scissors
  - digital camera
- At each centre, provide students with a series of figures to construct or photograph. Create an anchor chart or display that shows the figures and gives the properties of the figures, such as
  - number of vertices
  - number of faces
  - number of edges
  - number and size of angles
  - classification of angles

Overall Expectation 6m45 (Location and Movement)

Describe location in the first quadrant of a coordinate system, and rotate two-dimensional shapes.

Background

This overall expectation is about location and movement. Understanding how location and movement are described using geometric language is an essential life skill. Road maps, warehouses, and spreadsheets are examples of how locations are identified through geometric language. Students continue their study of location and movement by using the first quadrant of a Cartesian coordinate grid. Students begin to use paired numbers (x, y) to describe locations. The x places the location along a horizontal number line. The y places that same point on a vertical number line. Where the numbers from the two number lines intersect, the point (x, y), is plotted on the grid.

Strategies

The following suggestions include some strategies to help students meet this overall expectation.

- Ask pairs of students to work together. One student secretly writes down the location of the treasure on the "treasure map" (a grid of the first quadrant of the coordinate plane). The second student states various points using ordered pairs to try to guess the location. Both students keep track of each ordered pair guess by placing an X in the appropriate spot on the grid. All guesses are recorded until the student guesses correctly. Students switch roles and play continues.
- Model for students the use of dynamic geometry software to show rotations of shapes on the plane.
- In small groups or pairs, ask students to use grid paper to draw where they think a 90° rotation of a shape will be located. You can use dynamic software to check the students' predictions.
- Provide students with photographs of different architectural mosaics or designs (e.g., Aboriginal, western, eastern). Challenge students to find the following elements within the designs:
  - lines of symmetry
  - rotations of shapes (90° or 180°)
  - reflected shapes