Unit B
Surface Area of Right Prisms and Cylinders

Combined Grade 7 and 8

Lesson Outline

BIG PICTURE

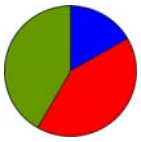
Students will:

- determine the characteristics of right prisms (Grade 7) and polyhedra (Grade 8);
- determine the surface area of right prisms (Grade 7) and cylinders (Grade 8);
- solve problems involving the surface area of right prisms (Grade 7) and cylinders (Grade 8).

Day	Grade 7 Math Learning Goals	Grade 8 Math Learning Goals	Expectations
1	• Build, identify, and investigate characteristics of a variety of right prisms (Grade 7) and polyhedra (Grade 8).		7m49, 8m51 CGE 4c, 5a
2	• Develop and apply the formula for finding the surface area of a rectangular prism. Refer to TIPS4RM Grade 7 Unit 4 Day 13.	• Investigate the relationship between the number of faces, edges, and vertices of various polyhedra.	7m36, 7m41, 7m42 8m51 CGE 5a, 3c
3	• Develop and apply the formula for surface area of a triangular prism. • Solve problems that require conversion between metric units of area. Refer to TIPS4RM Grade 7 Unit 4 Day 14.	• Solve problems that require conversion between metric units of area. • Investigate the definition and historical study of polyhedra. • Construct the five Platonic solids. Refer to TIPS4RM Grade 8 Unit 10 Math Learning Goals for Day 6.	7m36, 7m41, 7m42 8m33, 8m51 CGE 4b, 2c
4	• Determine the surface area of right prisms with parallelogram bases using concrete materials.	• Develop the formula for surface area of a cylinder using concrete materials.	7m36, 7m41, 7m42 8m34, 8m38, 8m39 CGE 3c, 4f
5	• Determine the surface area of right prisms with parallelogram bases, using concrete materials.	• Calculate the surface area for a cylinder, using concrete materials.	7m36, 7m41, 7m42 8m39 CGE 5a, 5b
6	• Build prisms with bases that are composite figures (that include circles for Grade 8) and calculate the surface area. • Solve problems that require conversion between metric units of area.		7m36, 7m41, 7m42 8m33, 8m39 CGE 2c, 5a
7	• Apply knowledge and understanding of surface area of prisms with polygon bases.		7m42 8m33, 8m39 CGE 3a, 3c

Unit B: Day 1: Investigating Right Prisms and Polyhedra

Grades 7 and 8



Math Learning Goals

- Build, identify, and investigate a variety of right prisms (Grade 7).
- Build, identify, and investigate a variety of polyhedra (Grade 8).

Materials

- right prisms
- copies of Frayer charts
- BLM B.1.1–B.1.6
- scissors

Assessment Opportunities

Minds On…

Whole Class → Vocabulary Development

Display a collection of familiar items that are right prisms. Ask students to name and describe the solids using appropriate mathematical vocabulary. Holding up a right prism, point to and orally count the number of faces, edges, and vertices on the solid.

Grade Groups → Vocabulary

Students create definition charts for some or all of the words used to describe right prisms. Key Terms: *prism*, *vertices*, *edges*, *faces*, etc.

Students share their charts orally with the class and post them on the Word Wall.

Include: cube, rectangular prism, triangular-based prism chocolate bar box, octagonal cleaning cloth box, cylindrical salt or oatmeal boxes.

See *Think Literacy: Cross Curricular Approaches – Mathematics* for a variety of definition charts, e.g., Frayer Model, Verbal and Visual Word Association.

Action!

Grade Group Pairs → Investigation

Each pair of students creates one right prism, using polydron material or nets. Ensure that at least one of each type of prism is constructed for this investigation: cube, rectangular prism, triangular prism, pentagonal prism, hexagonal prism, octagonal prism, trapezoidal-based prism, and parallelogram-based prism. Have Grade 8 pairs create a square-based pyramid and a pentagonal pyramid.

When pairs have each constructed one prism or pyramid, hand out BLM B.1.1 (Grade 7) and B.1.6 (Grade 8). Students investigate the characteristics of the faces, edges, and angles and fill in the appropriate row of the chart. When students have completed the row for their solid, they exchange their solids. Students analyse the information gathered on their charts and note the patterns that appeared.

Grade 7: Make a list of the characteristics of right prisms (BLM B.1.1).

Grade 8: Determine any relationships between F, V, and E (B.1.6).

Processes and Learning Skills/Exhibition/Checkbric: Observe students as they work through the investigation (BLM B.1.2).

Refer to BLM B.1.3 and BLM B.1.4 for instructions on drawing right prisms and 3-D solids and BLM B.1.5 for templates.

Skeletons of the various prisms could be constructed using straws and pipe cleaners.

Keep these solids for other activities that will be completed during the unit.

Consolidate Debrief

One Grade at a Time → Sharing

Grade 7: Students present their findings. Emphasize these characteristics of right prisms: all the lateral faces are rectangular; the angle between the lateral faces and the base is always 90°; the number of edges on the prism base equals the number of lateral faces; the angles found at the vertices of the polygon base are the same as the angles between the lateral faces.

Grade 8: Check that students have accurately completed the questions on BLM B.1.6 in preparation for next day's investigation.

These same skills can be observed every day during this unit, allowing the teacher to focus on a small part of the class each day.

Home Activity or Further Classroom Consolidation

Exploration

Grade 7: How many different nets can be made for a cube? Use six congruent squares to investigate different nets. Sketch each net in your math journal.

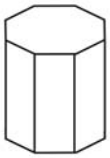
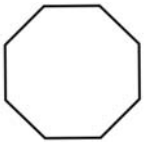
Grade 8: A tetrahedron is a triangular-based pyramid with all faces congruent. Sketch a tetrahedron and its different nets in your math journal.

If available to take home, the use of polydron material will assist students in completing the assignment.

B.1.1: Investigating Right Prisms

Grade 7

1. Examine the faces, edges, and angles of a variety of right prisms. Enter your observations in this table. The octagonal-based prism has been started for you.

Sketch of Right Prism	Shape of Prism Base	Number of Edges on Prism Base	Number of Lateral Faces on the Prism	Shape of Lateral Faces	Angle Between Lateral Faces and Base of Prism
 octagonal-based prism	 octagon				

2. Based on your findings, list the characteristics of right prisms.

3. Choose one of the polygon-based prisms. Measure the angles at the polygon base. Measure the angles between the lateral faces.

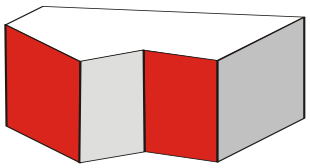
4. Is there a relationship between the angle measures? Check your hypothesis by measuring the angles of a different prism.

B.1.2: Checkbric

Learning Skills	Needs Improvement	Satisfactory	Good	Excellent
Independent Work				
• follows routines and instructions without supervision				
• persists with tasks				
Initiative				
• responds to challenges				
• demonstrates positive attitude towards learning				
• develops original ideas and innovative procedures				
• seeks assistance when necessary				
Use of Information				
• organizes information logically				
• asks questions to clarify meaning and ensure understanding				

B.1.3: Right Prisms and their Nets (Teacher)

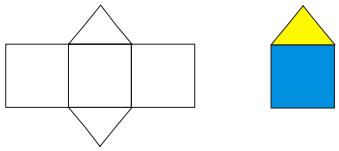
A right prism is a prism with two congruent polygon faces that lie directly above each other.



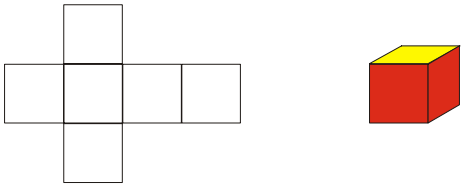
The base is the face that 'stacks' to create the prism. This face determines the name of the prism.

Some right prisms and their nets:

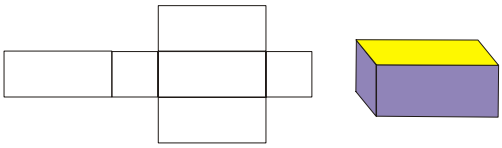
Triangular prism:



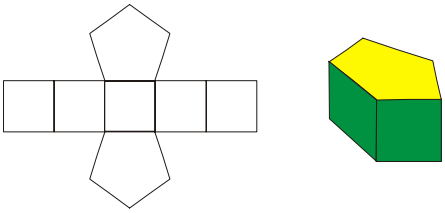
Square prism (cube):



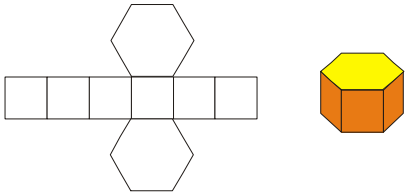
Rectangular prism:



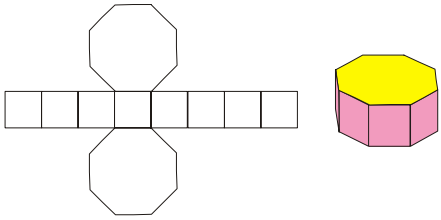
Pentagon-based prism:



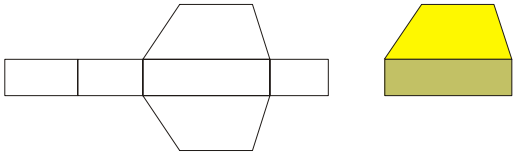
Hexagon-based prism:



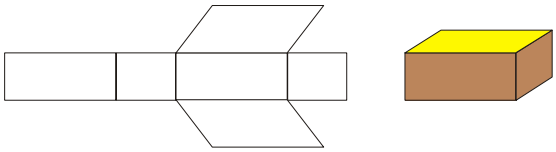
Octagon-based prism:



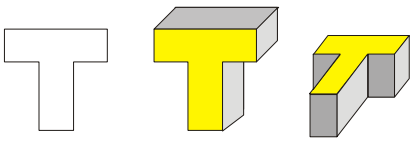
Trapezoid-based prism:



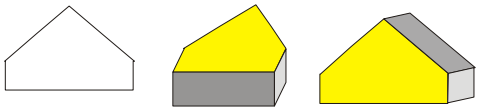
Parallelogram-based prism:



Right prisms with bases that are composite figures:



Composite figure **Right prism**

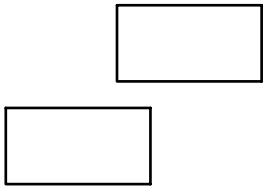


Composite figure **Right prism**

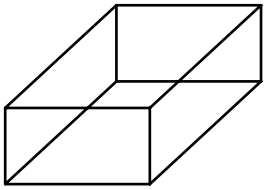
B.1.4: Drawing 3-D Solids (Teacher)

Rectangular Prism

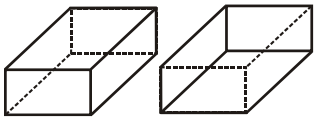
Step 1: Draw two congruent rectangles.



Step 2: Join corresponding vertices.



Step 3: Consider using broken lines for edges that can't be seen.

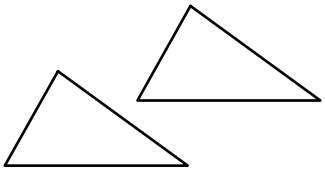


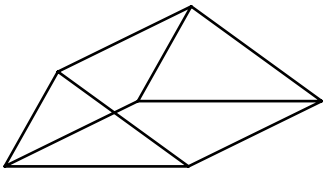
Triangular Prism

Step 1: Draw two congruent triangles.

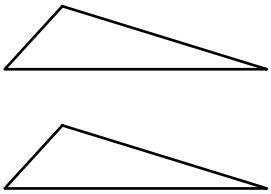
Step 2: Join corresponding vertices.

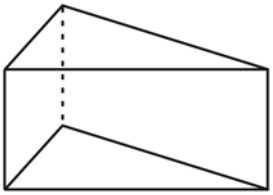
Example 1



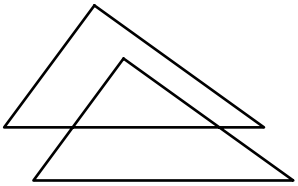


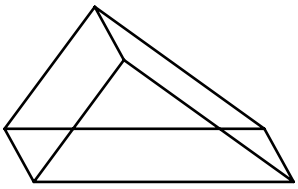
Example 2



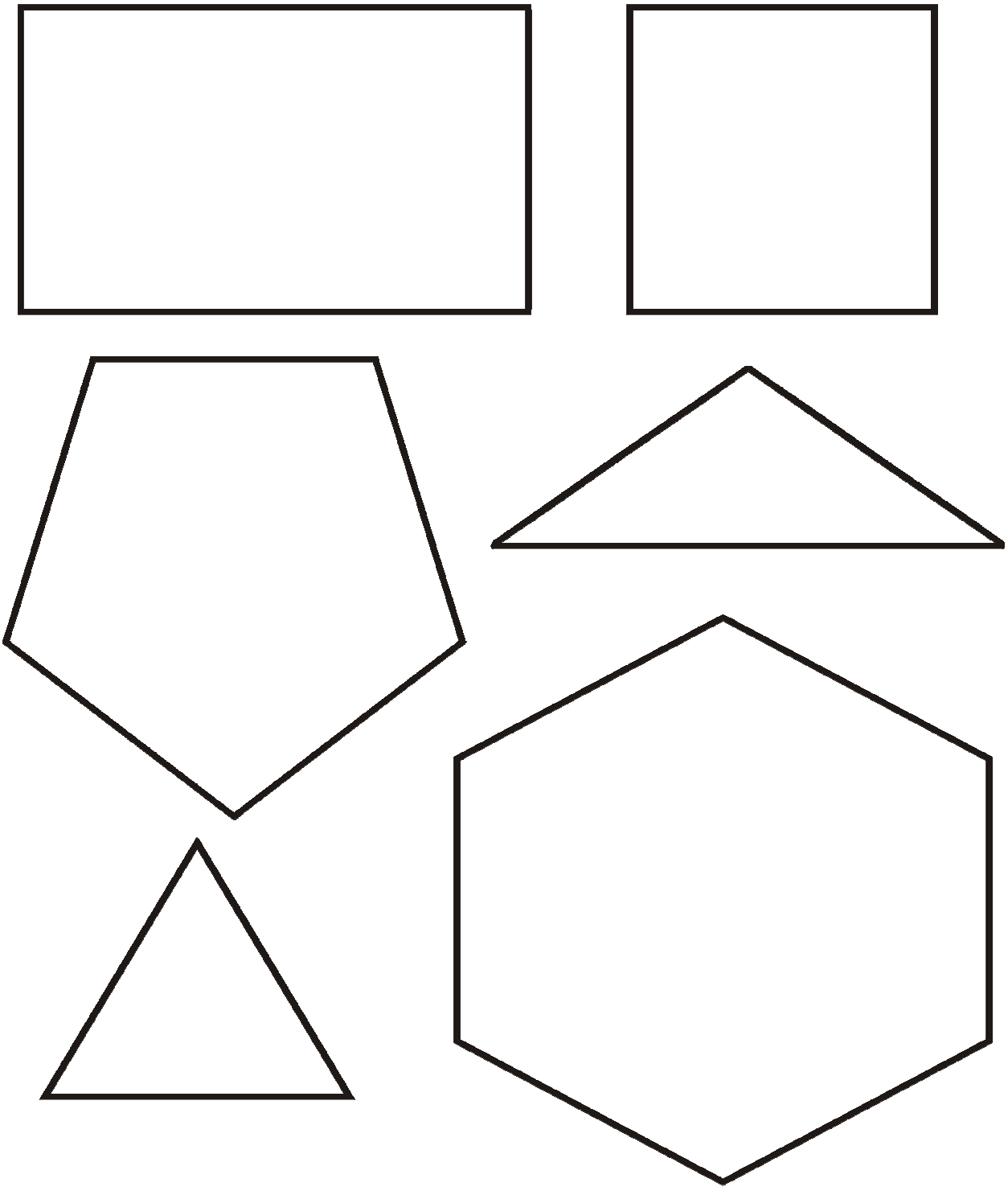


Example 3





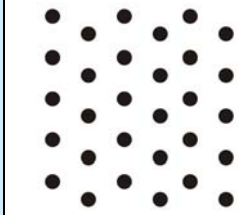
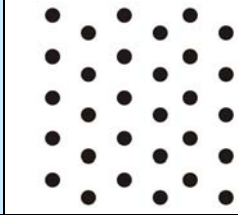
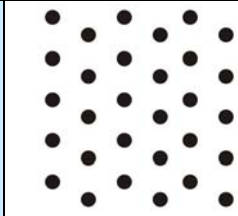
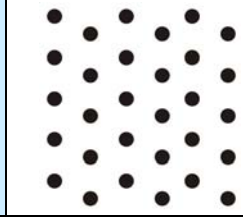
B.1.5: Templates for Building Right Prisms and Pyramids
(Teacher)



B.1.6: Investigating the Properties of Polyhedrons

Grade 8

A polyhedron is a 3-dimensional figure. Examine models of the polyhedra listed in this table. Draw the 3-dimensional, front, side, and top views of each polyhedron:

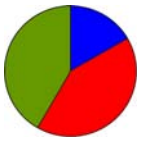
	3-D	Front View	Side View	Top View
Rectangular Prism				
Square-Based Pyramid				
Triangular Prism				
Pentagonal Pyramid				
Hexagonal Prism				

For each of the five polyhedra you examined, determine the number of faces (F), the number of vertices (V), and the number of edges (E):

	F (Number of Faces)	V (Number of Vertices)	E (Number of Edges)
Rectangular Prism			
Triangular Prism			
Hexagonal Prism			
Square Prism			
Pentagonal Prism			

Unit B: Day 2: Surface Area of Rectangular Prisms (Grade 7) Investigating Properties of Polyhedra (Grade 8)

Grades 7 and 8



Math Learning Goals

- **Grade 7:** Develop and apply the formula for finding the surface area of a rectangular prism. (See TIPS4RM Grade 7 Unit 4 Day 13.)
- **Grade 8:** Investigate the relationship between the number of faces, edges, and vertices of various polyhedra.

Materials
- dot paper
- boxes
- polyhedron
- BLM B.2.1

Assessment Opportunities

Minds On…

Whole Class → Sharing

Students share their solutions for different nets of a cube (Grade 7) or tetrahedron (Grade 8), sketching possible nets on the board. Ask the class:
- Is there always more than one way to create a net for a solid?
- Does the number of faces, vertices, edges change when a different net is used?

Encourage students to use descriptive formulas until they are ready for symbolic represtations.

Grade 7 Pairs → Investigation

Introduce surface area, develop a definition of surface area, and determine a method for finding the surface area of a cube with width, length, and height 10 cm. (For details see TIPS4RM Grade 7 Unit 4 Day 13.)

The file GSP®4 26.1 Nets.gsp contains adjustable nets for rectangular and triangular prisms.

Grade 8 Pairs → Task Instructions

Pose this question: How do you think the number of edges, faces, and vertices of a polyhedron are related?

Action!

Grade 7 Small Groups → Investigation

Students use a rectangular prism to develop an algebraic formula for the surface area of a rectangular prism. (For details see Grade 7 Unit 4 Day 13.)

Processes and Learning Skills/Exhibition/Rubric: Observe students as they work through the investigation (see Checkbric BLM B.1.2). **Note:** These same skills can be observed every day during this unit, allowing the teacher to focus on a small part of the class each day.

The relationship is F + V = E + 2, called Euler's theorem. Students need not present it in this form and are not responsible for knowing the name of the formula.

Grade 8 Pairs → Investigation

Students use the models and tables completed during Day 1 and BLM B.2.1 to investigate the relationship between the number of faces, edges, and vertices of a polyhedron. Students should have several different polyhedrons available to use as models as they complete the investigation.

http://matti.usu.edu/nlvm/nav/vlibrary.html Index → Platonic Solids → Geometry (6–8)

Mathematical Processes/Rubric: Assess the mathematical processes, Reasoning and Proving and Communication.

Consolidate Debrief

One Grade at a Time (Grade 7 followed by Grade 8) → Reflecting

Grade 7: (For details see TIPS4RM Grade 7 Unit 4 Day 13.)

Grade 8: Students present their formulas. Include descriptive and algebraic version of the formula. Discuss the inquiry process that students used:
- How many different attempts did you make before finding a working formula?
- What different ways did you find to express the formula?
- On what other solids might you try the formula?

Home Activity or Further Classroom Consolidation

Concept Practice
Reflections

Grade 7: Complete the practice questions.

Grade 8: Research the historical study of polyhedra, Plato, and the Platonic solids.

Include questions that require conversion between metric units of areas.

B.2.1: Investigating the Properties of Polyhedrons

Grade 8

1. a) For each of the five polyhedrons you examined, determine a numeric relationship between the number of faces (F), the number of vertices (V), and the number of edges (E):

	F (Number of Faces)	**V** (Number of Vertices)	**E** (Number of Edges)	**Relationship of F, V, and E**
Rectangular Prism				
Triangular Prism				
Hexagonal Prism				
Square Pyramid				
Pentagonal Pyramid				

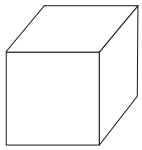
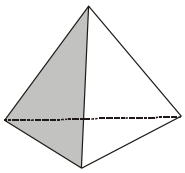
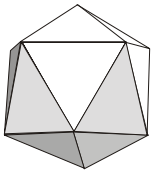
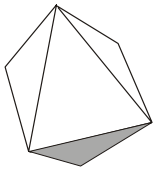
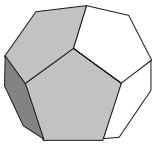
b) Examine the values you recorded for F, V, and E. Identify patterns that you see within each column, e.g., how F changes as the shape changes.

c) Make a conjecture about how F, V, and E are related to each other. Look for patterns across the table, within each row.

d) Give this conjecture a name, e.g., *John's Theory, Moira's Hypothesis, O'Reilly's Idea*. You will investigate the accuracy of your conjecture in question 2b.

2. A Platonic solid is a regular polyhedron that has all faces congruent and each face is a regular polygon. (The Platonic solids are named after Plato, a famous mathematician.)

   There are 5 Platonic Solids:

cube	tetrahedron	icosahedron	octahedron	dodecahedron
				

   a) What regular polygons form the faces of each of the Platonic solids?

cube	tetrahedron	icosahedron	octahedron	dodecahedron

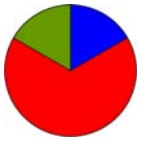
   b) Examine the number of faces, vertices, and edges of the Platonic solids. Is your theory about the relationship of F, V, and E true for these Platonic solids? Justify your answer.

cube	tetrahedron	icosahedron	octahedron	dodecahedron
F V E	F V E	F V E	F V E	F V E

   c) What conclusions can you make about the accuracy of your theory? Justify your conclusion.

Unit B: Day 3: Surface Area of Triangular Prisms

Grades 7 and 8



Math Learning Goals

- **Grade 7:** Develop and apply the formula for surface area of a triangular prism.
- **Grades 7 and 8:** Solve problems that require conversion between metric units of area.
- **Grade 8:** Construct the five Platonic solids.

Materials
- BLM B.3.1, B.3.2
- polydrons
- calculators

Assessment Opportunities

Minds On…

Small Groups (Mixed-Grade Groupings) → Peer Tutoring

Grade 7: Students discuss the homework problem that was the most challenging for them, comparing solutions and methods used.

Grade 8: Students act as peer tutors, as needed in their groups.

Pairs → Activity

Grade 7: Students draw a large, full-page triangle in their math journal. They measure the base and height of their triangle and determine its area, using a calculator. To reinforce the concept that there are three base and height pairs for a triangle, calculate the area two other ways.

Grade 8: Students share their findings on the history they learned about Plato, polyhedra, and the Platonic solids, and offer definitions for polyhedra.

Encourage students to represent their method using words, variables, numbers, or a combination.

Use the file GSP®4 26.1 Nets.gsp for adjustable nets of triangular prisms. Refer to TIPS4RM Grade 7 BLM 4.14.1.

Action!

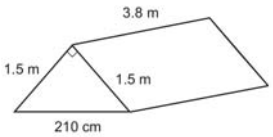
Small Groups → Investigation

Grade 7: Develop the formula for surface area of a triangular prism. See TIPS4RM Grade 7 Unit 4 Day 14 for details.

Grade 8: Construct the five Platonic solids using congruent shapes (BLM B.3.2). Show why there are only five platonic solids. www.mathisfun.com/platonic_solids.html

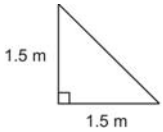
Small Groups → Application

Challenge problem: how much material is required for the illustrated tent?



Grade 7: Provide a solution in two different metric units.

For students who are having difficulty determining the height of the triangle, rotate the prism to visualize the triangle differently:



Processes and Learning Skills/Exhibition/Rubric: Observe small groups of students as they work through the investigation (checkbric BLM B.1.2).

Give students opportunities to progress through different representations (concrete→diagrams →symbolic) – use formulas only after students have personally developed them.

Consolidate Debrief

Whole Class → Discussion

Grade 7: Discuss the small group formulas and tent questions.

Both Grades: Ask students how the formula changes if the prism has no top or bottom, i.e., the tent is open on one or both ends.

Ask students how the formula can be simplified if the prism has three congruent faces (*the triangle is equilateral*), or two congruent faces (*the triangles are isosceles, like the tent example*).

Grade 8: Students present their constructions and show why certain regular polygons will not create a Platonic solid.

Home Activity or Further Classroom Consolidation

Differentiated

In your math journal, describe how the general formula for calculating surface area of a triangular prism can be simplified if the triangular faces are:

a) equilateral
b) isosceles
c) scalene

Use diagrams to illustrate your description.

OR

Practise finding surface area of triangular prism by completing the worksheet.

BLM B.3.1 (Grade 7)

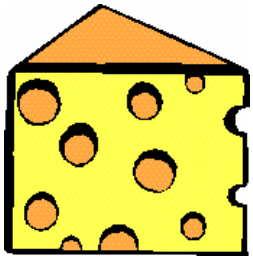
B.3.1: Surface Area of Triangular Prisms

Grade 7

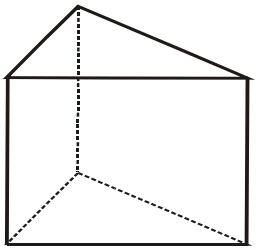
Show your work in good form and be prepared to tell how you solved the problem.

1. Determine the minimum amount of plastic wrap needed to cover the cheese by finding the surface area of the prism. Why might you need more wrap?

Picture

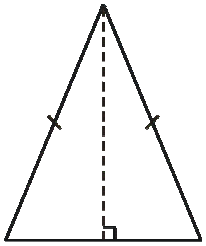


Skeleton



height of prism = 5.0 cm
length of rectangle = 6.3 cm

Base

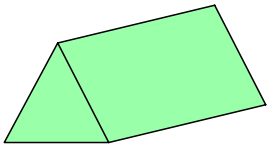


h = height of triangle = 6.0 cm
b = base of triangle = 4.0 cm

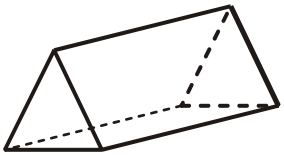
Draw and label the net.

2. Determine the surface area of the nutrition bar.

Picture

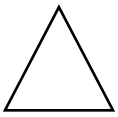


Skeleton



Length of rectangle = 5.0 cm

Base

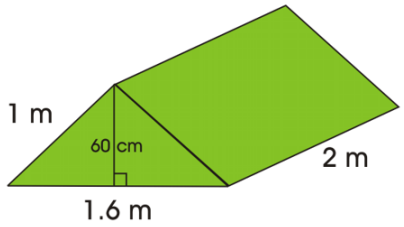


Equilateral triangle with:
height = 3.0 cm
base = 3.5 cm

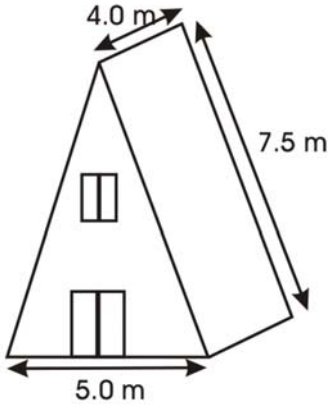
Draw and label the net.

3. Determine the surface area of the tent.
   The front of the tent has the shape on an isosceles triangle.

   Create a problem based on the surface area.



4. a) This A-frame chalet needs to have the roof shingled. Determine the surface area of the roof.



Height of chalet = 7.1 m

Hint:
Think about whether the height of the chalet is the same as the height of the prism. Which measurements are unnecessary for this question?

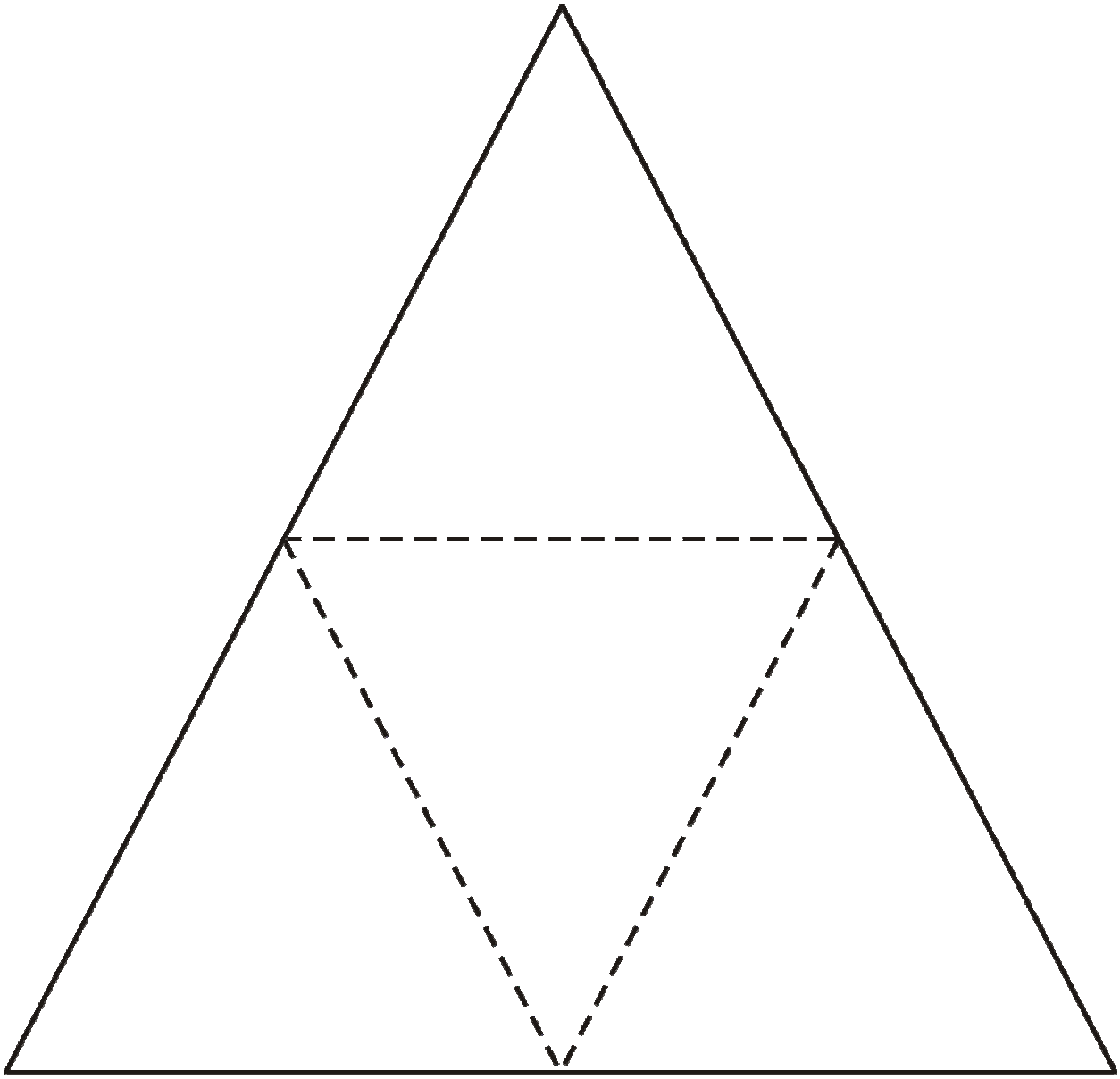
   b) Express the surface area of the roof in square centimetres.

Extension:

If the shingles were 35 cm long and 72 cm wide, how many would you need to cover the roof?

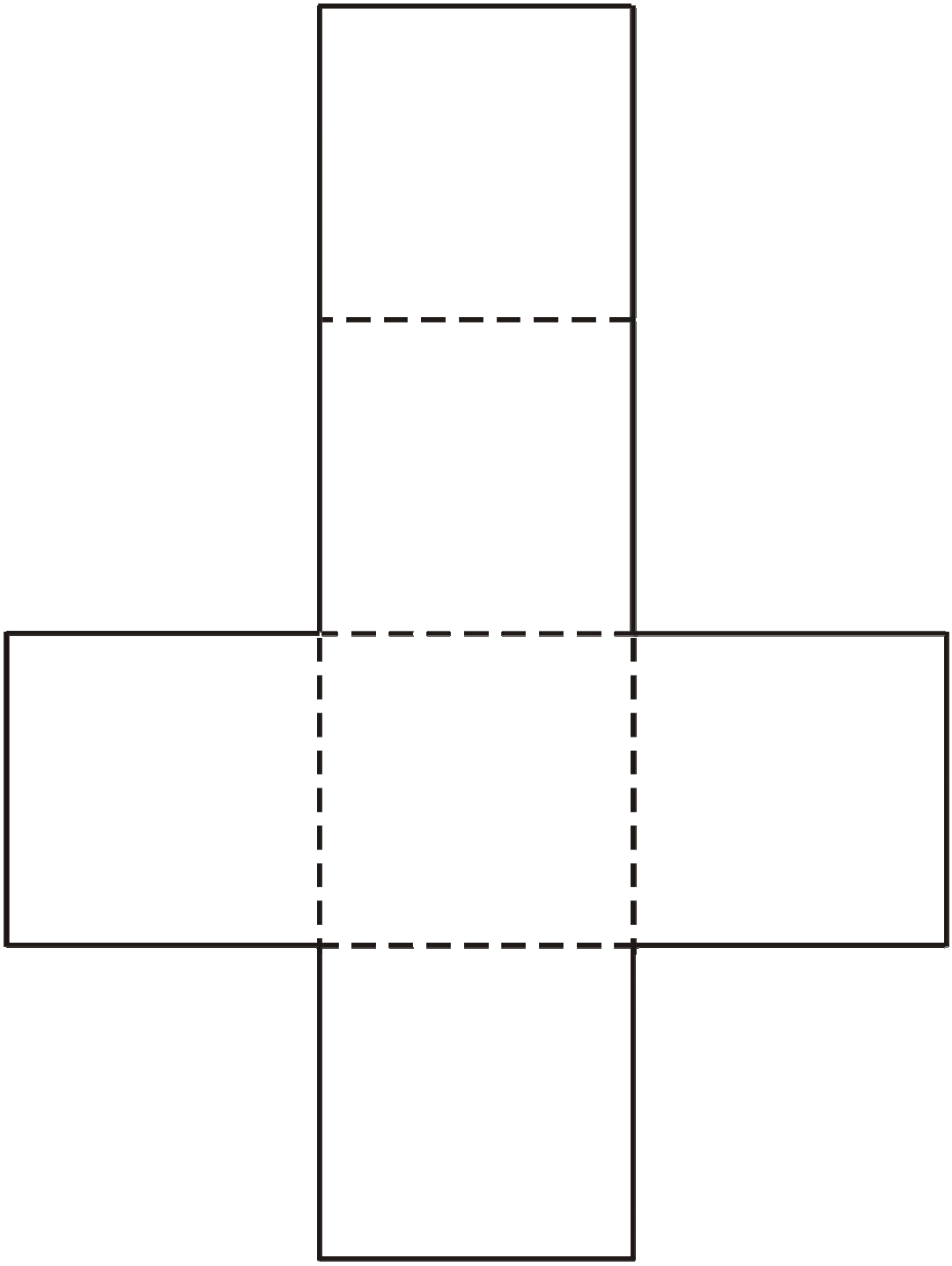
B.3.2: Nets for Platonic Solids

Tetrahedron



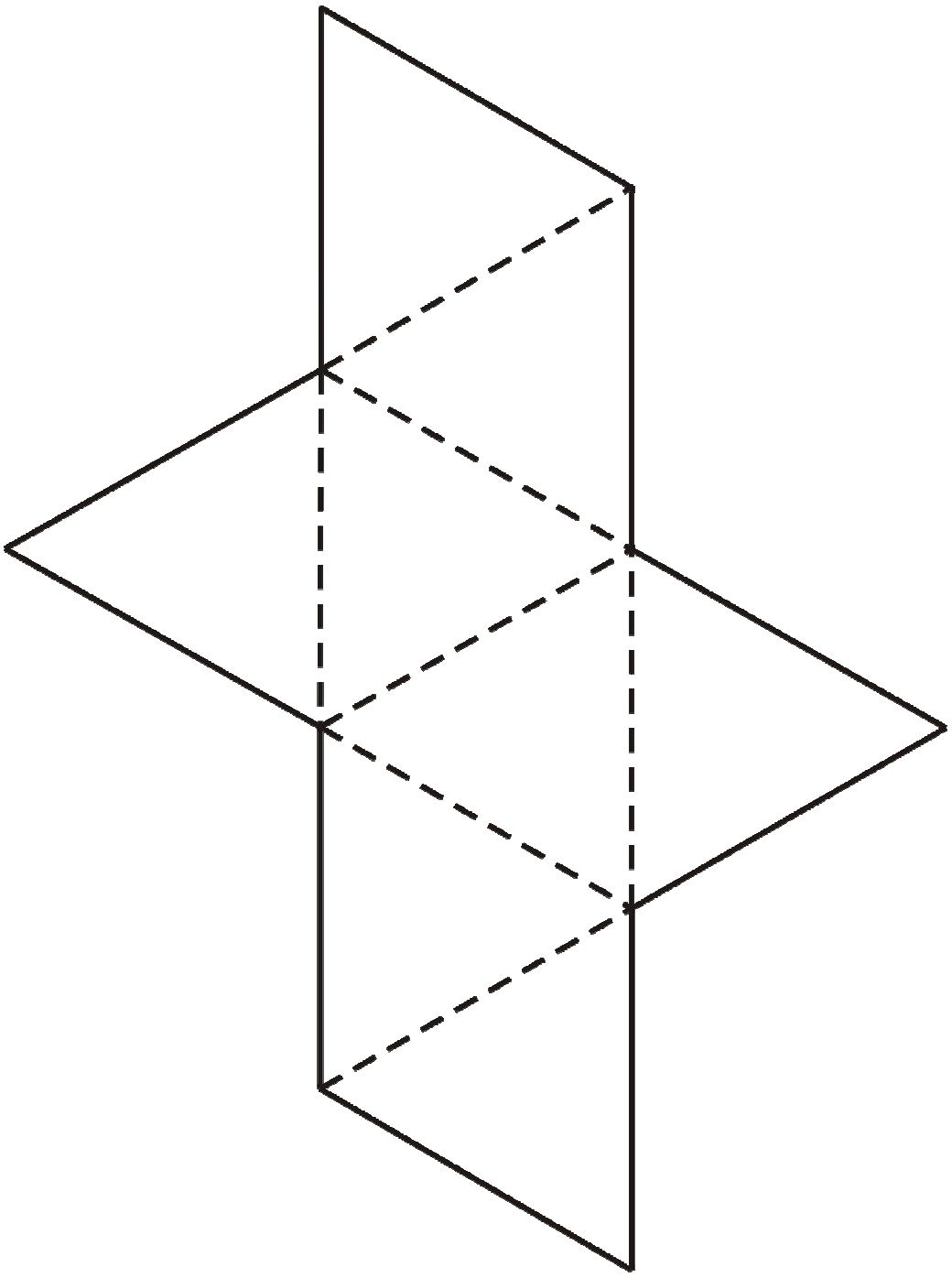
B.3.2: Nets for Platonic Solids (continued)

Cube



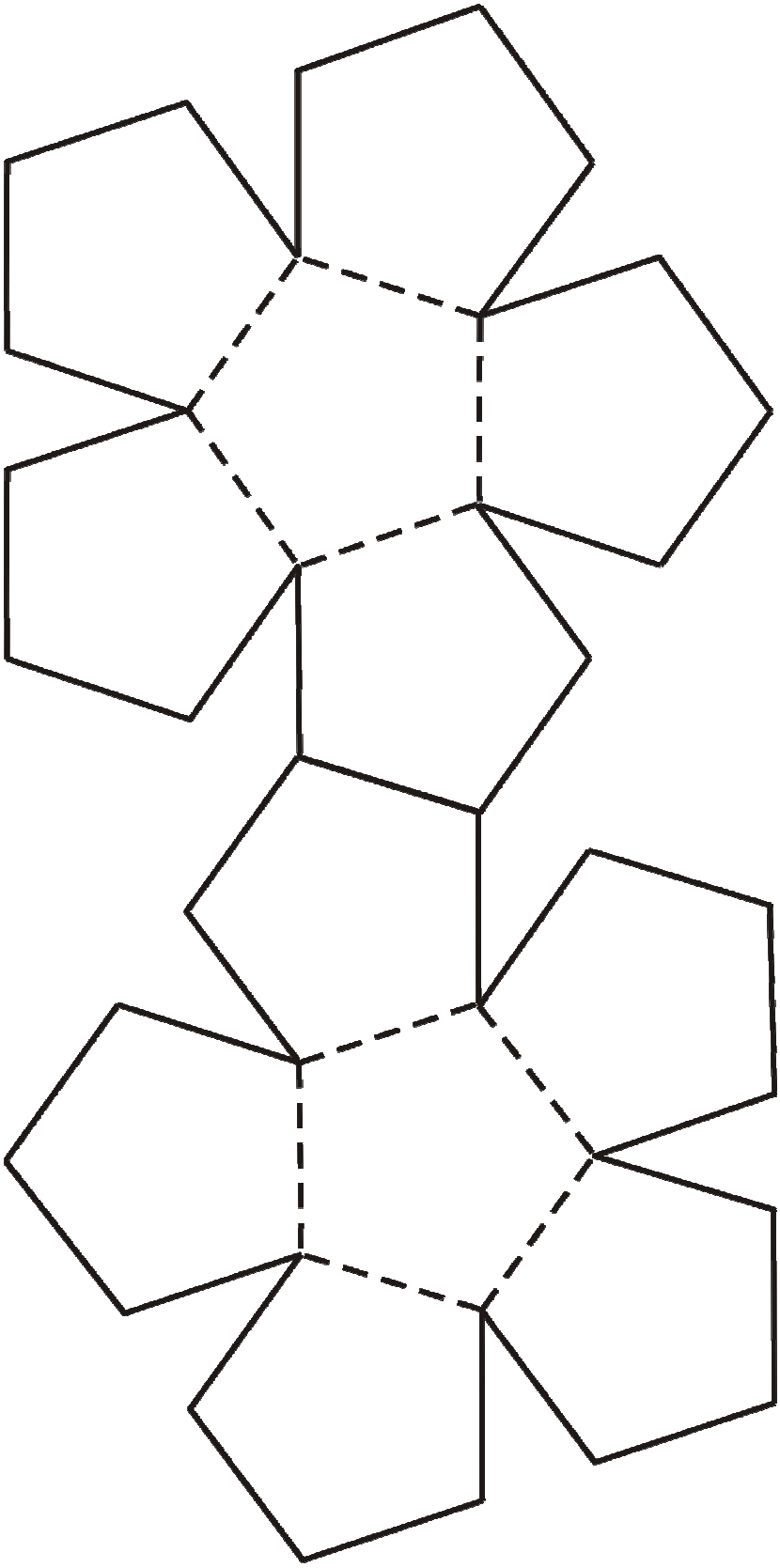
B.3.2: Nets for Platonic Solids (continued)

Octahedron



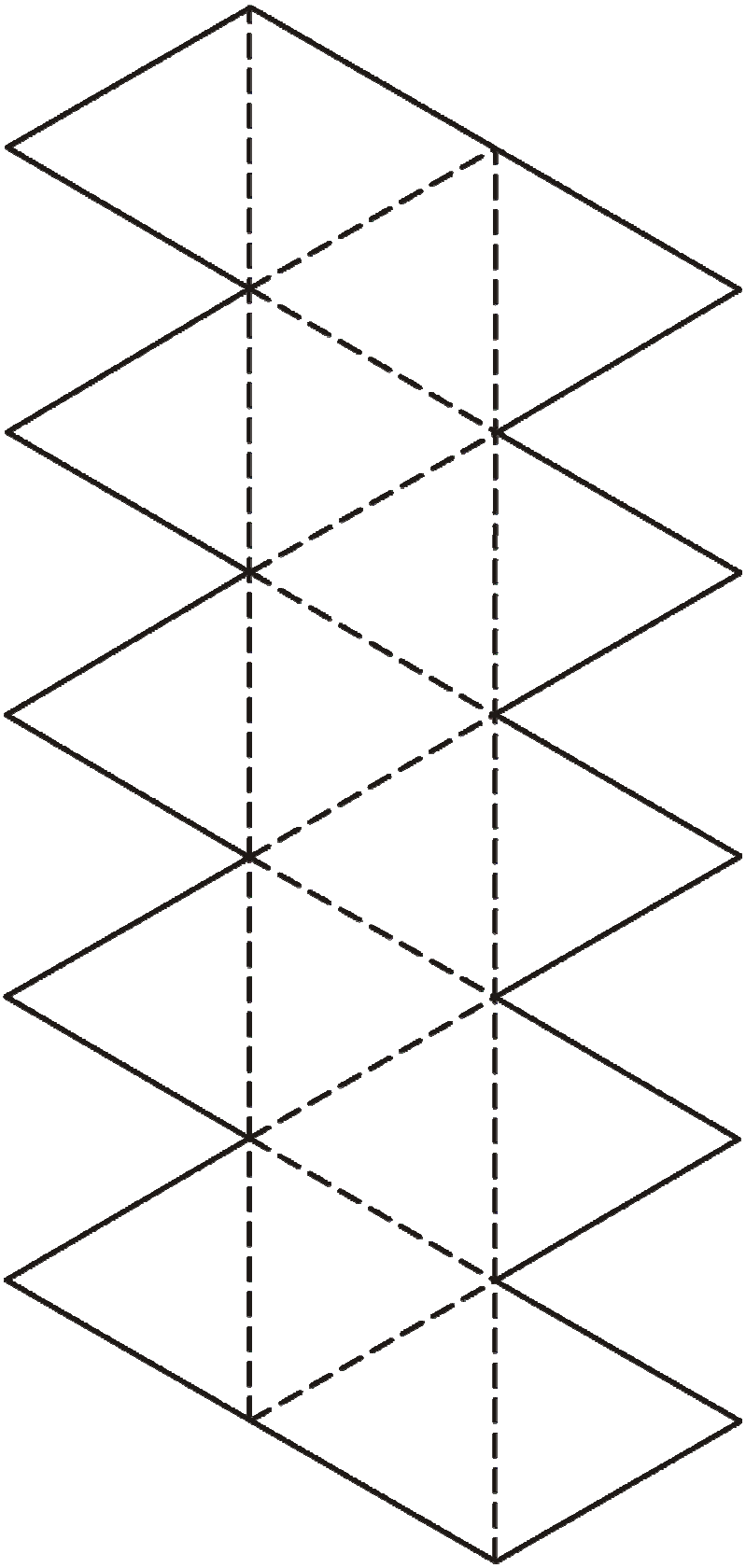
B.3.2: Nets for Platonic Solids (continued)

Dodecahedron



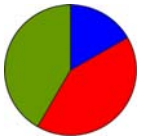
B.3.2: Nets for Platonic Solids (continued)

Icosahedron



Unit B: Day 4: Surface Area of Right Prisms with Parallelogram Bases (Grade 7) Investigating Area of Cylinders (Grade 8)

Grades 7 and 8



Math Learning Goals

- **Grade 7:** Determine the surface area of right prisms with parallelogram bases, using concrete materials.
- **Grade 8:** Develop the formula for surface area of a cylinder, using concrete materials.

Materials

- cylinders
- nets of prisms with parallelogram bases
- BLM B.4.1

Assessment Opportunities

Minds On…

Whole Class → Discussion

Display several of the nets created during Day 1. Ask:

- Does every solid have a net?
- Can surface area be calculated from any net? (*yes*)
- What might the general formula for surface area of a prism be? (*area of the base + area of the top + area of all the rectangular faces*)

Grade 7 students begin their task (see **Action!**).

Students in Grade 7 would benefit from having several different nets of parallelogram-based prisms to examine. Include rhombus bases as well.

Grade 8 Students → Visualization

Ask: What does the net of a cylinder look like? Examine a can with an attached paper label. Point out the can's circular top and bottom. Cut the paper from the can to demonstrate that it is in the shape of a rectangle. Students should recognize that the net of a cylinder includes two circles and one rectangle.

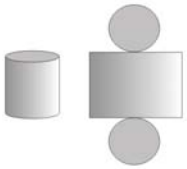
A collection of cans with labels or cylinders that can be disassembled will help students in Grade 8 visualize the rectangular and circular parts of the cylinder net.

Action!

Pairs → Visualization and Investigation

Grade 7: Using the net of a prism with a parallelogram base, develop a formula for its surface area.

Grade 8: Using the net of a cylinder (BLM B.4.1), develop a formula for the surface area of a cylinder. Write the formula in words first, then as an algebraic expression.



Surface Area of a Cylinder

= 2 × (Area of circular top) + (Area of the rectangular-shaped curved face)

= 2 × (πr^2) + (circumference of circle × height of cylinder)

= 2 × (πr^2) + ($2 \pi r \times h$)

Some students in Grade 8 may need help to visualize that the circumference of the circle is one of the sides of the rectangle. Reassemble the net of the cylinder to make this more obvious for students.

Learning Skills/Exhibition/Checkbric: Observe students as they work through the investigation (see checkbric BLM B.1.2). **Note:** This is the fourth of several days that these same skills can be observed during this unit.

Consolidate Debrief

One Grade at a Time (Grade 7 followed by Grade 8) → Reflecting

Grade 7: Students share their findings. Discuss how the formula differs if the parallelogram is a rhombus. How do the surface area formulas of rectangle-based and square-based prisms compare to parallelogram-based and rhombus-based prisms?

Grade 8: Students present their formulas in words and symbols. They should be able to generate the formula in words when they need it, rather than memorize the formula. Students should visualize the net of the cylinder and connect the parts of the net to the parts of the verbal formula.

Concept Practice

Home Activity or Further Classroom Consolidation

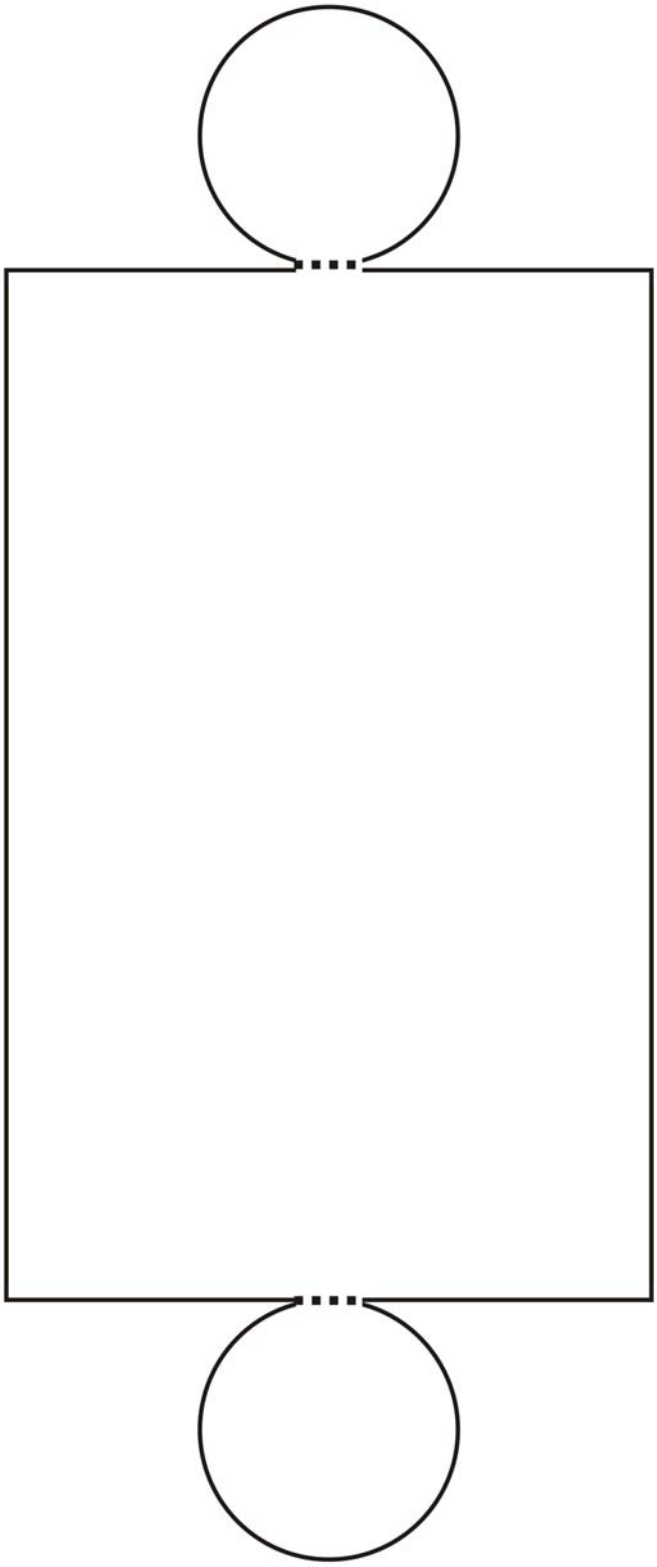
Grade 7: Complete the practice questions.

Grade 8: In your math journal, use diagrams, words, and math symbols to write instructions about how to determine the surface area of a cylinder. Include instructions for finding surface area of a cylinder with an open top.

Provide students in Grade 7 with appropriate practice questions.

B.4.1: Net of a Cylinder

Grade 8



Unit B: Day 5: Surface Area of Right Prisms with Trapezoid Bases (Grade 7) Surface Area of Cylinders (Grade 8)

Grades 7 and 8

Math Learning Goals

- Grade 7: Determine the surface area of right prisms with trapezoid bases, using concrete materials
- Grade 8: Calculate the surface area of cylinders, using concrete materials.

Materials

- cylinder tubes
- trapezoid-based prisms

Assessment Opportunities

Minds On…

Small Groups (Mixed-Grade Groupings) → **Peer Tutoring**

Choose one of the homework problems assigned in the previous lesson. Students compare solutions and the method used. Students in Grade 8 act as peer tutors, as needed in their groupings.

Grade 7 → Think/Pair/Share

Individually, students brainstorm on paper everything they can about trapezoids. After sharing with a partner, they add to their list items mentioned by the partner. The Grade 7 class brainstorms a complete list, including the formula for area.

Grade 8 Pairs → Investigation

Using a cylindrical tube such as a potato chip can, take measurements to determine the surface area needed for the cardboard (the curved face) and the aluminium and foil needed for the bottom and top. Determine the total surface area of the tube.

Compare students' solutions for the tube surface area. Discuss reasons why solutions might be slightly different for the same cylinder. Stress the need for accuracy in taking measurements. Review the method for finding surface area of a cylinder.

Many students in Grade 8 will measure the circumference rather than calculate it.

Action!

Grade 7 Pairs → Visualizations and Investigation

Students use the trapezoid-based prisms created during Day 1 to determine a formula for calculating the surface area of a trapezoid-based prism. Students sketch the net of the prism, and then develop the surface area formula, using words and mathematical symbols.

Grade 8 Pairs → Visualizations and Investigation

Students use a cylinder and determine its surface area, using two different methods:

Method 1: Measure only the diameter of the circular top and the height of the cylinder.

Method 2: Measure only the circumference of the circular top and the height of the cylinder.

Compare the two solutions.

Learning Skills/Exhibition/Checkbric/Rubric: Observe students as they work through the investigation (see Checkbric B.1.2). **Note:** This is the fifth of several days that these same skills can be observed during this unit.

Some students in Grade 8 may need help to determine the diameter knowing only the circumference. Make links with solving equations to see that $C = \pi d$ can be written as $d = \frac{C}{\pi}$.

In everyday situations this is how you would calculate the diameter of a pillar or tree trunk.

Consolidate Debrief

One Grade at a Time (Grade 7 followed by Grade 8) → **Reflecting**

Grade 7: Students verbally present their method for determining surface area of a trapezoid-based prism. Compare this method to finding surface area of other prisms. Does the general formula for surface area apply for a trapezoid-based prism?

Grade 8: Students explain how to determine the diameter (or radius) given the circumference. Describe everyday situations where this calculation would be used.

Grade 7:
The general formula for surface area of a prism is: area of the base + area of the top + area of all the rectangular faces.

Home Activity or Further Classroom Consolidation

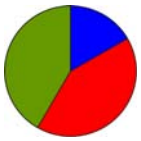
Exploration

Complete the practice questions.

Provide students in Grades 7 and 8 with appropriate practice questions.

Unit B: Day 6: Surface Area of Prisms whose Bases are Composite Figures

Grades 7 and 8



Math Learning Goals

- Build prisms with bases that are composite figures and calculate the surface area, including circles. (Grades 7 and 8)
- Solve problems that require conversion between metric units of area.

Materials

- BLM B.6.1
- construction paper
- scissors, tape, glue

Assessment Opportunities

Minds On…

Whole Class → Discussion

Students describe basic building designs in terms of prisms, e.g., a barn with a peaked roof might be described as a rectangular prism topped with a triangular prism. (Grade 8: The silo is a cylinder.) Use geosolids to demonstrate how two prisms can be joined to form one solid.

Any composite shape can be made into a right prism. Use the method on BLM B.1.3 to sketch a right prism with any type of polygon base. Help students to visualize that the prism can be viewed "lying down" or "sitting upright."

Small Groups → Brainstorm

Brainstorm a list of objects that are made up of a combination of two or more right prisms. (Grade 8: Include circles and cylinders in your list.)

Whole Class → Sharing

Compile a list on the board or chart paper of familiar objects that are made up of combinations of right prisms. Students can make quick sketches to illustrate their object. Discuss how surface area would be calculated for a composition of more than one solid.

Action!

Whole Class → Instructions

Use an overhead of BLM B.6.1 to present the task (Grade 7: designs "T" and Grade 8: designs "P"). Students need to recognize that the T or P is a composite figure. Encourage students to suggest several different methods for decomposing the T or P into smaller figures to calculate the surface area.

Other letters of the alphabet are suitable for this activity (I, L, O, F, H, U, V). You may wish to choose a letter that is more appropriate to your school name, or allow students to create their own initials.

Pairs → Design

Students work on their designs and calculation of surface area.

Processes and Learning Skills/Exhibition/Rubric: Observe small groups of students as they work through the activity.

Extension: If the students at Trillium Park School decide to make a large plastic storage box in the shape of a T or P for the Kindergarten playground, determine possible dimensions, surface area and amount of paint required to cover the surface if 1 litre covers 12 m^2.

Some students may wish to use computer software to design the polygon face of their letter.

Consolidate Debrief

Whole Class → Four Corners Presentation

Pre-select four students to display models of different sizes (two Ps and two Ts). The four students each move to a different corner of the classroom. Use a Four Corners activity to have students with models of similar sizes re-group together and compare their surface area solutions. Surface areas will not be the same, but should be approximately equal in models of the same size.

Students review other pairs calculations and suggest revisions.

Home Activity or Further Classroom Consolidation

Reflection

Write a journal entry about a question that you still have about the surface area of prisms.

Skills Practice

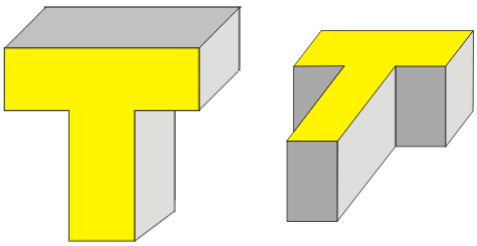
Complete practice questions.

Provide students with appropriate practice questions.

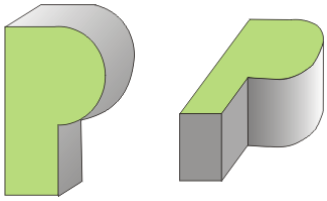
B.6.1: Designing a Gift Box

The Grades 7 and 8 students at Trillium Park School want to design gift boxes in the shape of "T" and a "P" to present to a guest speaker. They want to use heavy cardboard for each of the faces.

The finished gift boxes will look like this:



Grade 7 Design: "T"



Grade 8 Design: "P"

1. Design and build a gift box.

   You can create a net with all of the faces attached, or you can build the prism by adding one face at a time. Tape the faces together to avoid making tabs.

2. Provide an analysis of your design on a piece of paper. Include:

   a) a drawing of your gift box on dot paper. Label the dimensions on your diagram.

   b) a formula that will calculate the total surface area of your box;

   c) a calculation of the amount of cardboard needed to make the gift box.

Math Learning Goals

- Apply knowledge and understanding of surface area of prisms with polygon bases.

Materials

- geosolids
- BLM B.7.1, B.7.2

Assessment Opportunities

Minds On…

Whole Class → Brainstorm

Students discuss the decomposition of complex solids.

Make geosolids available as a visualization aid. Use an example of a triangular prism roof (Grade 7) or half-cylinder roof (Grade 8) sitting on rectangular prism base.

Action!

Individual → Assessment

Discuss the instructions on BLM B.7.1 (Grade 7) and BLM B.7.2 (Grade 8). Students complete the task.

Give students an opportunity to clarify instructions, so they understand what the question is asking.

Curriculum Expectations/Observation/Anecdotal Notes: Circulate and help students, as needed. Note strengths, area for improvement, and next steps to give oral feedback. Collect student work and score, using the Checkbric on BLM B.7.1 or BLM B.7.2.

Students can highlight to mark the corresponding instructions on the BLM as you describe the assessment.

Consolidate Debrief

Whole Class → Reflection

Students share their methods and results orally.

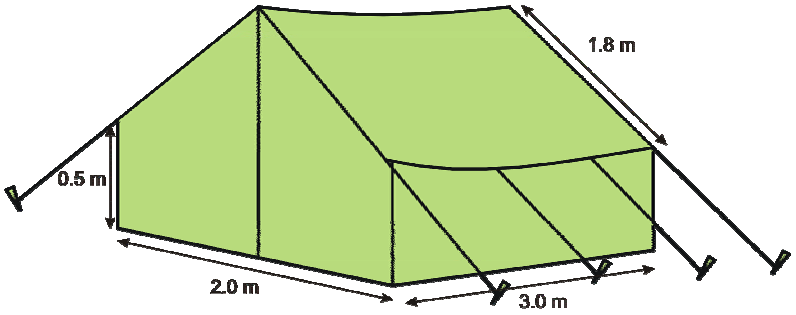
Home Activity or Further Classroom Consolidation

Access Prior Knowledge

Choose a **Home Activity** that will help prepare for the next unit of study.

B.7.1: Tents

Grade 7



This 2-person tent comes in a variety of light colours that will not attract mosquitoes. Our tents are totally waterproof. This unique design allows occupants plenty of room for two sleeping bags and gear. You can even stand in the tent!

Footprint: 2.0 m × 3.0 m
Centre Height: 2.0 m
Straight Side Height: 0.5 m
Slant Height: 1.8 m
Price: $210.00
Item No. 39583749

Use the information on this advertisement to determine:

1. The amount of material used to make the tent.

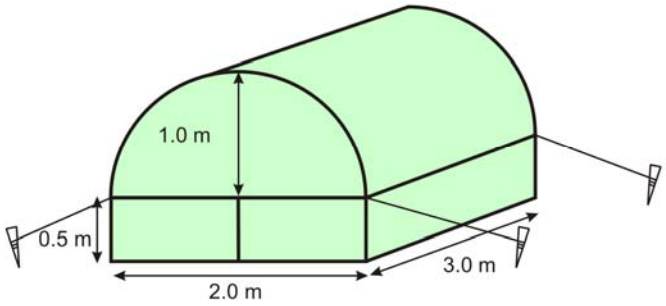
2. The amount of floor space per person.

Checkbric

Criteria	Level 1	Level 2	Level 3	Level 4
Computing and carrying out procedures				
Making convincing arguments, explanations, and justifications				
Integrating narrative and mathematical forms				
Representing a situation mathematically				
Selecting and applying problem-solving strategies				

B.7.2: Tents

Grade 8



This 2-person tent comes in a variety of light colours that will not attract mosquitoes. Our tents are totally waterproof. This unique design allows occupants plenty of room for two sleeping bags and gear. You can even stand in the tent!

Footprint: 2.0 m × 3.0 m
Centre Height: 1.5 m

Price: $210.00
Item No. 39583750

Use the information on this advertisement to determine:

1. The amount of material used to make the tent.

2. The amount of floor space per person.

Checkbric

Criteria	Level 1	Level 2	Level 3	Level 4
Computing and carrying out procedures				
Making convincing arguments, explanations, and justifications				
Integrating narrative and mathematical forms				
Representing a situation mathematically				
Selecting and applying problem-solving strategies				