Unit 7
Surface Area and Volume

Grade 10 Applied

Lesson Outline

BIG PICTURE

Students will:

- perform everyday conversions between the imperial system and the metric system to solve problems involving surface areas and volumes of three-dimensional figures as they apply to a variety of occupations.

Day	Lesson Title	Math Learning Goals	Expectations
1, 2	For Good Measure	• Brainstorm situations where students have seen and used the imperial system. • Group units taken from the imperial and metric system as measures of mass, volume, length, or temperature. • Take measurements around the school using the imperial system. • Discover unit relationships within the imperial system. • Perform everyday conversion of length and volume, within the imperial system, using a variety of methods, e.g., conversion table.	MT3.01, MT3.02 CGE 7f
3	Estimates and Conversions	• Identify the best metric estimate of an object. • Identify the best imperial estimate of an object. • Associate common objects with measure, e.g., given one object, suggest the most appropriate imperial measure to use. • Construct a conversion table, e.g., create posters that display conversion factors, for conversions between imperial and metric measures.	MT3.02 CGE 7f, 7i
4	Proposing the Park	• Conduct placemat activity to access students' prior knowledge of perimeter and area. • Solve problems relating to the perimeter and area of plane figures in the context of an occupation, using imperial measure when appropriate. • Solve composite perimeter and area problems, using imperial measure, as appropriate.	MT3.01 CGE 4b
5	Job Opportunity	• Solve area and perimeter problems that require conversions between the imperial and metric system.	MT3.01, MT3.02 CGE 4b
6	Is the Net Up or Down?	• Determine the surface area of a pyramid through investigation, e.g., use the net of a square-based pyramid to determine that the surface area is the area of the square base plus the areas of the four congruent triangles.	MT3.03 CGE 5b
7	It's About Surface Area	• Find the surface area of several objects. • Relate surface area to finding the area of composite 2-D shapes. • Discuss nets, introduce software, e.g., TABS+, to draw nets.	MT2.03, MT3.04 CGE 3c, 5a
8	Problems Involving the Surface Area of Prisms and Pyramids	• Solve problems relating to the surface area of prisms and pyramids, e.g., provide students with the dimensions of a local landmark and ask them to calculate the amount of paint that would be need to be applied to the exterior. • Discuss the use of the Pythagorean theorem to solve volume and surface area problems.	MT2.03, MT3.04 CGE 4b

Day	Lesson Title	Math Learning Goals	Expectations
9	Firing on All Cylinders	• Review formulas for the circumference and area of a circle which will be needed to solve problems involving the surface areas of cylinders. • Solve problems requiring the surface area of cylinders.	MT3.04 CGE4b, 5b
10	Surface Area of Combined Shapes	• Solve surface area problems involving prisms, pyramids, and cylinders, including combinations of these figures, using the metric or imperial system, as appropriate.	MT3.04 CGE 4b
11, 12	Shapes To Go! Pump Up the Volume	• Activate prior knowledge about volume. • Solve problems involving the volume of prisms, pyramids, cylinders, cones, and spheres, including combinations of these figures, using the metric or imperial system, as appropriate, e.g., provide students with the dimensions of a helium balloon and have them calculate the volume of gas needed to inflate it.	MT3.04 CGE 5b
13	Solving for a Variable in Measurement Problems	• Activate prior knowledge about the concepts of a variable and solving for a variable in the first degree. • Determine the value of a variable in the first degree in the context of a problem, using a measurement formula. • Solve related problems.	MT1.01, MT1.02, MT3.04 CGE 5b
14–16	Design Project	• Choose a project such as: Design and create a three-dimensional package for an object of your choice, measurements in the imperial and metric system to be included or research and report on three careers in Ontario that use the imperial system of measurement. • Present to the class a sample from another discipline that requires the use of the imperial system of measure, e.g., building, cooking, sewing. • Explain the reason for the need to use imperial measure. • Work on the project. • Present their projects to the class.	MT3.01, MT3.02, MT3.04 CGE 3e, 4b, 4f, 5b, 5e
17	Summative Assessment	**Note:** A summative performance task is available from the members only section of the OAME web site www.oame.on.ca	
18	Jazz Day		

Unit 7: Day 1 : For Good Measure

MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Brainstorm situations where students have seen and used the imperial system. • Group units taken from the imperial and metric systems as measures of length, area, or volume. • Take measurements around the school using the imperial system.	**Materials** • Measuring tapes with imperial units (in., ft.) • Yard sticks • Calculator • BLM 7.1.1, BLM 7.1.2, BLM 7.1.3 • Set of "Imperial Cards" per pair

			Assessment Opportunities
Minds On…	**Whole Class/Pairs → Exploration** Hand out to each pair of students a set of "Imperial Cards" (BLM 7.1.3). Students will sort the cards and complete the table on BLM 7.1.1. On the blackboard (or similar place, e.g. interactive white board), have the words and symbols for various types of imperial units (inch, foot, yard, mile, square inch, square foot, square yard, square mile, cubic inch, cubic foot, cubic yard, cubic mile, ounce, pound). Prepare a table on the board with the following headings: LENGTH, AREA, VOLUME, and MASS. Ask students, in pairs, to fill in the table from BLM 7.1.1. As they are putting the units in the appropriate columns, students must also state an object that could be measured using that specific unit, e.g. Feet (extension cord). As a whole class, share their sorted units of measure and examples.		
Action!	**Pairs → Investigation** Students will be measuring the common items around the classroom/school stated in BLM 7.1.2 using the imperial system. Students will investigate using the imperial measuring devices, as well as a calculator to fill in BLM 7.1.2. **Mathematical Process (Selecting Tools and Computational Strategies)/ Observation/ Anecdotal Comments**: Observe the students' technique with using imperial measuring devices and their choice of units when measuring the objects.		Be sure that students are familiar with the area formula for a rectangle (A = l x w) and the volume formula for a rectangular prism (V = l x w x h).
Consolidate Debrief	**Whole Class → Communication** Students will be asked to fill in a Master Table of BLM 7.1.2 at the front of the class. More than one student can be chosen for each item to compare and to look for discrepancies, which may trigger a class discussion. Initiate a discussion about the importance of estimating measurements in the real world. Direct students to focus on careers they may be familiar with, such as carpentry, architectural design, engineering, etc.		
	Home Activity or Further Classroom Consolidation Students will write a reflection on their ability to estimate measurements in imperial and metric units. They should consider the following questions: How did you go about estimating the given measurements? Did your estimates become more accurate with practice, why or why not? Were you surprised by the accuracy or inaccuracy of your estimates? How will your improved estimation skills help you in your everyday life?		

7.1.1: Imperial Measurements

Refer to the many different measuring units on the board at the front of the room. Your job is to take those measurement units and place them in the appropriate column below. **Don't forget to also write the name of an object that could be measured in that unit beside the unit**.

Length	Area	Volume	Mass

7.1.2: Measure This!

In the following table you will see many common school items. Your job is to estimate what you think the measurement of that item will be and then measure the item with the devices that are provided. It's important that you take a really good estimate before you measure. To keep things simple, you can estimate to the closest ½ unit (for example, if you are estimating the length of your arm, you might guess 1 ½ feet, 2 feet or 2 ½ feet).

ITEM	ESTIMATE	ACTUAL
Classroom Door Height	_____ ft.	_____ ft.
Blackboard Height	_____ ft.	_____ ft.
Blackboard Width	_____ yd.	_____ yd.
Textbook Width	_____ in.	_____ in.
Textbook Thickness	_____ in.	_____ in.
Volume of Locker	_____ ft^3.	_____ ft^3.
↳ height	_____ ft.	_____ ft.
↳ width	_____ ft.	_____ ft.
↳ depth	_____ ft.	_____ ft.
Length from your classroom door to the door next door.	_____ yd.	_____ yd.

7.1.3: Imperial Cards

Cut cards (one set), shuffle and place in an envelope.

inch	**foot**	**yard**
mile	**square inch**	**square foot**
square yard	**square mile**	**cubic inch**
cubic foot	**cubic yard**	**cubic mile**
ounce	**pound**	**gallon**
ton	**acre**	**pint**

Unit 7: Day 2 : For Good Measure

MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Discover unit relationships within the imperial system. • Perform everyday conversions of length and volume, within the imperial system, using a variety of methods, e.g. Conversion table.	**Materials** • BLM 7.2.1, BLM 7.2.2 (teacher notes)

				Assessment Opportunities
	Minds On…	**Whole Class → Discussion/Demonstration** Introduce the story "Flatland" by Edward Abbott to the class. This could either be an excerpt from the movie by the same name (released 2007), the book or a book website. Students as a whole class will discuss the lines, 2-dimensional shapes and 3-dimensional objects and how these are measured. Pose Questions: What is AREA? What is VOLUME? What's the difference between area and volume? Why do we use a unit like feet to measure the distance from one end of the class to the other, but we use squared feet to measure the area of the classroom floor and we use cubic feet to measure the amount of water that it would take to fill the entire classroom?		http://www.geom.uiuc.edu/~banchoff/Flatland/
	Action!	**Pairs /Individual → Investigation** On the board, have the following units DRAWN to scale and clearly labeled (inch, foot, yard, square inch, squared foot, squared yard, cubic inch, cubic foot, cubic yard). Distribute BLM 7.2.1 and have students fill in the estimate portion of the table individually and then compare their estimates with a partner. **Mathematical Process (Representing)/Observation/Anecdotal Comments**: Circulate the classroom and observe student estimates. Questions can be asked.		*Teacher Tip:* Construct a model of a cubic yard with yard sticks and a cubic foot with 12" rulers. Many dice measure approx. one cubic inch.
	Consolidate Debrief	**Whole Class → Sharing** Create a master of BLM 7.2.1 using chart paper (or something similar). Take up BLM 7.2.1 asking students to share their estimates (more than one student can give an estimate for each conversion). Reveal actual measurement conversions and have students copy them into their copy of BLM 7.2.1. The class will now have two conversion tables for referencing – their own personal one and the chart paper that can be posted in the classroom.		Refer to BLM 7.2.2 (teacher notes) for actual measurement conversions. Students can refer to the units drawn on the board.
		Home Activity or Further Classroom Consolidation Pose the following question: There are only three countries that have not adopted the standard metric units of measurements: Liberia, Myanmar and the U.S.A. The United States, for example, uses the imperial units of measurement. Research the advantages and disadvantages of using the imperial and metric units of measurements. From your findings, state whether you think the world should use only the metric system. Explain why or why not?		

7.2.1: Imperial Decisions

Fill in the following table by completing the ESTIMATE column first. When you have finished filling in the middle column, the actual conversions will be revealed.

IMPERIAL CONVERSION	ESTIMATE	ACTUAL
Inches to Feet How many inches are in ONE foot?		_____ in. = 1 ft.
Feet to Yards How many feet are in ONE yard?		_____ ft. = 1 yd.
Square inch to Square foot How many square inches are in a square foot?		_____ in^2 = 1 ft^2
Square foot to Square yard How many square feet are in ONE square yard?		_____ ft^2 = 1 yd^2
Cubic inch to Cubic foot How many cubic inches are in ONE cubic foot?		_____ in^3 = 1 ft^3
Cubic foot to Cubic yard How many cubic feet are in ONE cubic yard?		_____ ft^3 = 1 yd^3

7.2.2: Imperial Decisions - Teacher Notes

IMPERIAL CONVERSION	ESTIMATE	ACTUAL
Inches to Feet How many inches are in ONE foot?		12 in. = 1 ft.
Feet to Yards How many feet are in ONE yard?		3 ft. = 1 yd.
Square inch to Square foot How many square inches are in a square foot?		$144\ in^2 = 1\ ft^2$
Square foot to Square yard How many square feet are in ONE square yard?		$9\ ft^2 = 1\ yd^2$
Cubic inch to Cubic foot How many cubic inches are in ONE cubic foot?		$1728\ in^3 = 1\ ft^3$
Cubic foot to Cubic yard How many cubic feet are in ONE cubic yard?		$27\ ft^3 = 1\ yd^3$

Unit 7: Day 3 : Estimates and Conversions

MFM2P

Minds On: 10 Action: 30 Consolidate:35 Total=75 min	**Description/Learning Goals** • Identify the best metric estimate of an object. • Identify the best imperial estimate of an object. • Associate common objects with measure, e.g. given one object, suggest the most appropriate imperial measure to use. • Construct a conversion table, e.g. create posters that display conversion factors, for conversions between imperial and metric measures.	**Materials** • Chart Paper (opt.) • BLM 7.3.1, BLM 7.3.2, BLM 7.3.3, BLM 7.3.4. (teacher notes), BLM 7.3.5 (checklist)

			Assessment Opportunities
Minds On…	**Small Heterogeneous Groups → Exploration** Discuss the historical origin of common length measurements. What is a foot? What about a furlong? A metre? In groups, students will determine their own inch, foot, yard, etc. using BLM 7.3.1 as a guide. Students may come up with their own measurement units.		
Action!	**Pairs/Whole Class → Investigation** Have many different units – both metric and imperial - DRAWN to scale and clearly labeled on the board or on chart paper. Point out everyday items in the classroom (e.g. textbooks, windows, door, filing cabinet, etc.) Pose Questions: Which one of these units on the board would be best to describe the height of the door? Which one of these units at the front would be best to describe the amount of space in this classroom? Students will work on BLM 7.3.2 in pairs. Together they will fill in the middle column of the table. Make sure to go through the example provided in the first row highlighted in blue. The value in the middle column is an estimate and therefore may or may not be the correct answer. **Mathematical Process (Selecting Tools and Computational Strategies)/ Observation/Anecdotal Comments:** Observe students to ensure they are properly selecting the appropriate tools for the given measurements. Take note of their ability to take accurate measurements with the selected tool.		*Teacher Tip:* Construct models of the cubic units to show the class. Encourage students to elaborate on their answers and explain why they chose one unit over another.
Consolidate Debrief	**Whole Class → Discussion** With the whole class, get students to fill in the ESTIMATE column of the table on the board or on chart paper. When they have completed their task, reveal the actual conversions. While students are copying down the actual conversions, a Master version of BLM 7.3.2 can be filled out on the chart paper. This can be posted in the room and used as a reference conversion table. Students should now have their own completed conversion table, BLM 7.3.2.		Refer to BLM 7.3.4 (teacher notes) for actual measurement conversions.
Concept Practice	**Further Classroom Consolidation** Distribute BLM 7.3.3 to each student and go over the Ratio Method for converting units (there are two examples to go over). Students can then work on the questions in BLM 7.3.3 on their own. Students can use their newly created conversion table and the Ratio Method to do their own conversions from metric to imperial and vice versa. **Mathematical Process (Problem Solving)/Assignment/Checklist:** BLM 7.3.3 can be collected and used as formative assessment. Students can also be given similar questions on a unit test or quiz.		Refer to BLM 7.3.5 for checklist.

7.3.1: Body Parts

INCH — Originally was the length of three barley grains placed end to end. Distance from tip of thumb to first knuckle, or from first to second knuckle on index finger.

My INCH = _____ INCHES

FOOT — Length of foot from longest toe to heel

My FOOT = _____ INCHES

YARD — Distance from tip of nose to end of thumb with arm outstretched (cloth merchants, King Henry I)

My YARD = _____ INCHES

HAND — Width of one hand, including the thumb (height of horses)

My HAND = _____ INCHES

CUBIT — Length from point of bent elbow to middle fingertip (Egyptian pyramids, Noah's ark)

My CUBIT = _____ INCHES

BRACCIO — Italian for "an arm's length" (Da Vinci's parachute)

My BRACCIO = _____INCHES

FATHOM — From the Anglo-Saxon word for "embrace," it was the length of rope held between two hands with the arms outstretched. (sailors)

My FATHOM = _____ INCHES

PACE — Length of a single step. In Roman times one pace was a double step, and our MILE came from the Latin mille passuum, meaning 1000 paces.

My PACE = _____ INCHES

7.3.2: A Question of Converting

CONVERSION	ESTIMATE	ACTUAL
Centimetres to Inches How many cm are in ONE inch?	3	_____ cm = 1 in.
Centimetres to Inches How many cm are in ONE inch?		_____ cm = 1 in.
Decimetre to Feet How many dm are in ONE foot?		_____ dm = 1 ft.
Meters to Yards How many meters are in ONE yard?		_____ m = 1 yd.
Cubic centimetres to Cubic inches How many cubic cm are in ONE cubic inch?		_____ cm^3 = 1 in^3
Meters to Feet How many meters are in ONE foot?		_____ m = 1 ft.
Meters to Yards How many meters are in ONE yard?		_____ m = 1 yd.
Squared centimetres to Square inches How many squared cm are in ONE square inch?		_____ cm^2 = 1 in^2
Squared meters to Squared feet How many squared meters are in ONE square foot?		_____ m^2 = 1 ft^2
Squared meters to Squared yards How many squared meters are in ONE squared yard?		_____ m^2 = 1 yd^2
Meters cubed to Yards cubed How many cubic meters are in ONE cubic yard?		_____ m^3 = 1 yd^3
Cubic decimetres to Cubic feet How many cubic dm are in ONE cubic foot?		_____ dm^3 = 1 ft^3

7.3.3: Convertible Numbers

Let's practice converting some numbers from metric to imperial units (and vice versa).

How many meters are there in 13 yards?

1. yards : meters
2. 1 : 0.9144 (X 13 / x 13)
3. 13 : _____

0.9144 x 13 = 11.8872

Therefore there are about 11.89 meters in 13 yards.

> This is a technique called the Ratio Method of converting. It consists of three steps:
> 1. Set up a ratio in words.
> 2. Use the conversion table
> 3. Create equivalent ratio

Let's try another!

How many squared inches are there in 9 squared centimetres?

Ratio → inches^2 : cm^2

Conversion Factor → 1 : 6.45 (x 1.395)

Equivalent Ratio → _____ : 9

1 x 1.395 = 1.395 in^2

Therefore there are 1.395 in^2 in 9 cm^2.

7.3.3: Convertible Numbers (Continued)

Try the following conversions using your conversion table and the Ratio Method (or any method of your choice).

If you bought a 24 foot ladder, how many meters would it be?	**How many squared feet is a house that measures 42 squared meters?**
If a bag of salt holds 150 cubic inches, how many cubic centimetres does it hold?	**The length of a CFL football field is 160 yards from end-zone to end-zone. How many meters long is the field?**
Joe is 1.75 meters tall. How many feet tall is Joe?	**One can of paint is enough to paint 500 squared feet. How many squared meters can you paint with this one can?**

7.3.4: A Question of Converting - Teacher Notes

CONVERSION	ESTIMATE	ACTUAL
Centimetres to Inches How many cm are in ONE inch?	3	2.54 cm = 1 in.
Centimetres to Inches How many cm are in ONE inch?		2.54 cm = 1 in.
Decimetres to Feet How many dm are in ONE foot?		3.048 dm = 1 ft.
Meters to Yards How many meters are in ONE yard?		0.9144 m = 1 yd.
Cubic centimetres to Cubic inches How many cubic cm are in ONE cubic inch?		$16.39\ cm^3 = 1\ in^3$
Meters to Feet How many meters are in ONE foot?		0.3048 m = 1 ft.
Meters to Yards How many meters are in ONE yard?		0.9144 m = 1 yd
Squared centimetres to Square inches How many squared cm are in ONE square inch?		$6.45\ cm^2 = 1\ in^2$
Squared meters to Squared feet How many squared meters are in ONE square foot?		$0.0929\ m^2 = 1\ ft^2$
Squared meters to Squared yards How many squared meters are in ONE squared yard?		$0.84\ m^2 = 1\ yd^2$
Meters cubed to Yards cubed How many cubic meters are in ONE cubic yard?		$0.76\ m^3 = 1\ yd^3$
Cubic decimetres to Cubic feet How many cubic dm are in ONE cubic foot?		$28.32\ dm^3 = 1\ ft^3$

7.3.5: Checklist

The following checklist can be used to gauge student progress and understanding of imperial and metric unit conversions.

Estimates and Conversions **Name** _____ **Class** _____

- ☐ Student is comfortable using the Ratio Method when converting units
- ☐ Student can complete the activity with minimal dependence on the teacher and/ or peers
- ☐ Student is able to use proper mathematical vocabulary
- ☐ Work is neat, organized and legible
- ☐ Few mistakes are made throughout students' work
- ☐ Student is able to show the process involved in converting and calculating each problem solution
- ☐ Student shows a clear understanding of the concepts introduced and practiced in class

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- ☐ Student shows a clear understanding of the concepts introduced and practiced in class

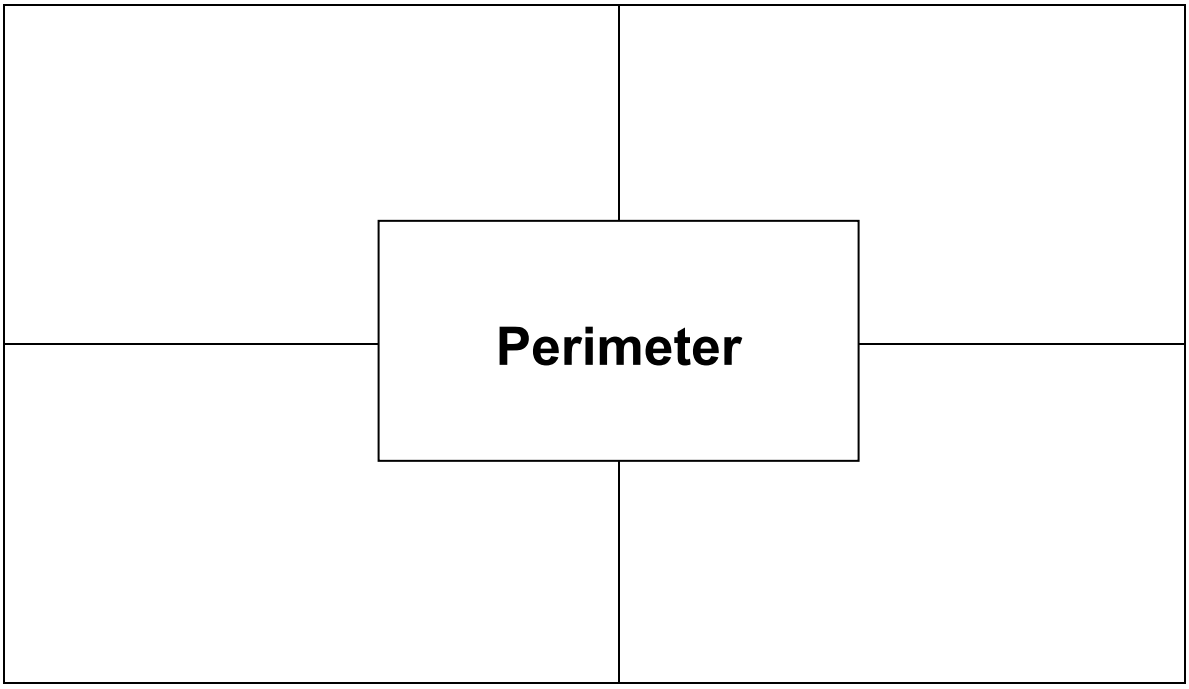
Unit 7: Day 4: Proposing the Park

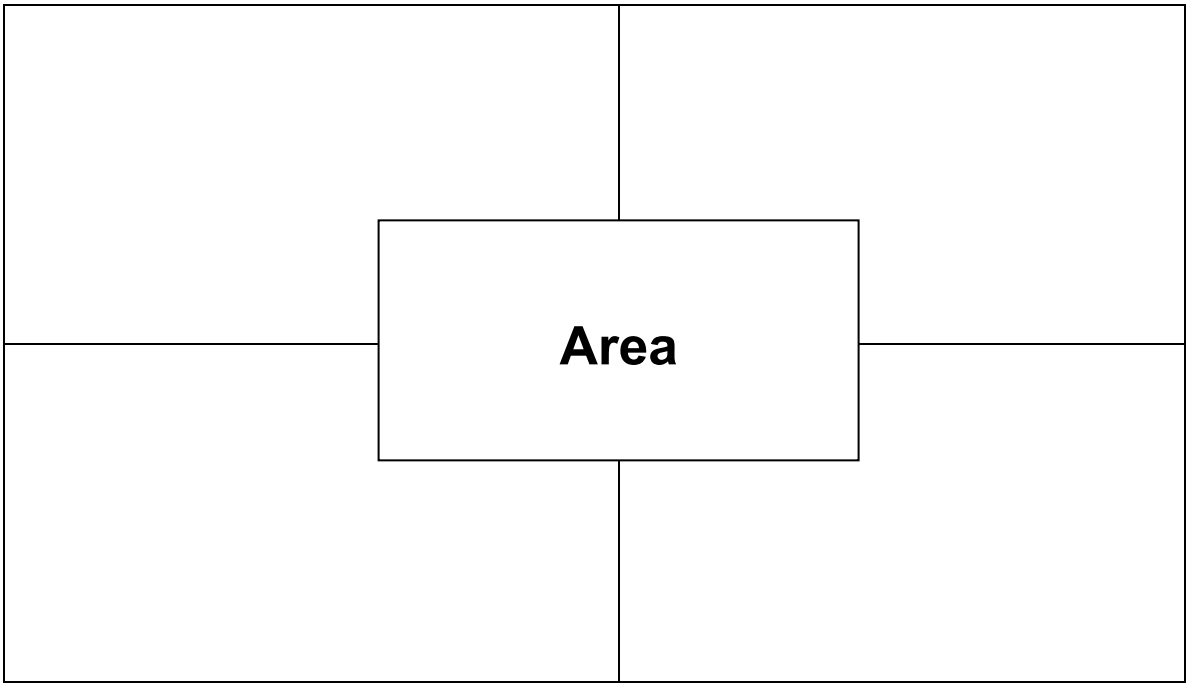
MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Conduct placemat activity to access students' prior knowledge of perimeter and area. • Solve problems relating to the perimeter and area of plane figures in the context of an occupation, using imperial measure when appropriate. • Solve composite perimeter and area problems, using imperial measure, as appropriate. • Solve area and perimeter problems that require conversions between the imperial and metric system.	**Materials** • Formula Sheet • Interactive White Board or data/ overhead projector (opt.) • BLM 7.4.1, BLM 7.4.2, BLM 7.4.3, BLM 7.4.4 (rubric)

			Assessment Opportunities
Minds On…	**Small Groups → Exploration** Students will complete the placemat activity using BLM 7.4.1 to activate prior knowledge of perimeter and area. Students will complete BLM 7.4.2 if necessary to review conversions and to use for problem solving. Alternatively, they may use their chart, BLM 7.3.3 and the classroom chart created in that lesson. Introduce the next activity, BLM 7.4.3. Connections can be made to landscaping related careers and how mathematics is used in the field. Students may need to review the Pythagorean Theorem as it pertains to right angle triangles.		Landscape Architect career information http://www.collegegrad.com/careers/proft02.shtml
Action!	**Small Homogeneous Groups → Guided Exploration** Place students in homogeneous groups. Before beginning, the students should look over the drawing of the park. Emphasis should be placed on reading and interpreting the dimensions of the drawing. Groups start working on part A from BLM 7.4.3. Most students will draw two vertical lines to create two triangles, a semi-circle and a rectangle. However, you may have students draw one vertical line to create a trapezoid, semi-circle and triangle. As a result, they may not need all of the squares provided to complete the task in BLM 7.4.3. Students will then move on to part B from BLM 7.4.3. Circulate to make sure that students are not adding all three sides of triangles if they only need two or if they are including the diameter of the semi-circle. **Mathematical Process (Selecting Appropriate Tools and Strategies)/ Content Expectations/ Rubric:** Assess whether students are able to select the appropriate strategy when choosing the number of sides to include in the perimeter calculation of a composite function. Also, they should recognize that many plane figures could be a compilation of several basic shapes.		*Teacher Tip:* Use an overhead of the drawing or display the drawing on an interactive white board and have students demonstrate the different dimensions using their pencil or fingers. The radius of the semi-circle is in feet; students need to convert to yards. Discuss that you can't buy partial rolls of sod or partial hedges; therefore the students need to round up to the nearest roll and/or hedge. Refer to BLM 7.4.4 for rubric Circulate to make sure students are dividing 216 by 3 prior to finding the cost of the hedge.
Consolidate Debrief	**Whole Class → Sharing** As a whole class, have students share their strategies and solutions. Solution: 312 rolls of sod and 216 hedge plants. Have students complete part C, the cost. You may want to take up or have them submit selected parts of the activity at the end of class.		
Concept Practice	**Home Activity or Further Classroom Consolidation** Students will complete BLM 7.4.2. Students will also need to finish BLM 7.4.3 if necessary.		

7.4.1: Placemat: Perimeter and Area





For more information, examples and support on how to administer a placemat activity refer to either of the following resources:

Think Literacy: Cross-Curricular Approaches, Grades 7-10
Small Group Discussions: Place Mat
MATHEMATICS (pgs. 66-71)

http://oame.on.ca/main/files/thinklit/PlaceMat2.pdf

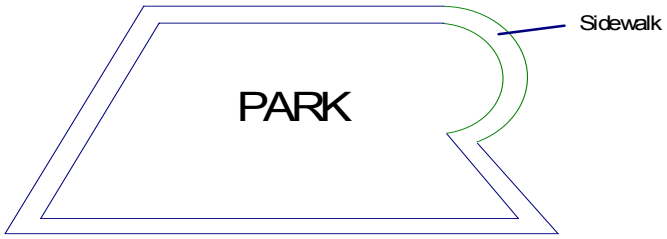
7.4.2: Let's Convert!

Part A: Complete the conversions in the chart below

1 in	_____cm
1 ft	_____cm
1 ft^2	_____cm^2
1 m (100 cm)	_____in
1 m	_____ft
1 m^2	_____ft^2
1 yds	_____ ft
1 yds^2	_____ ft^2
1 kg	_____lbs
1 kg	_____grams
_____kg	1 lbs
1 ft^3	_____cm^3
1 m^3	_____cm^3
1 m^3	_____ft^3

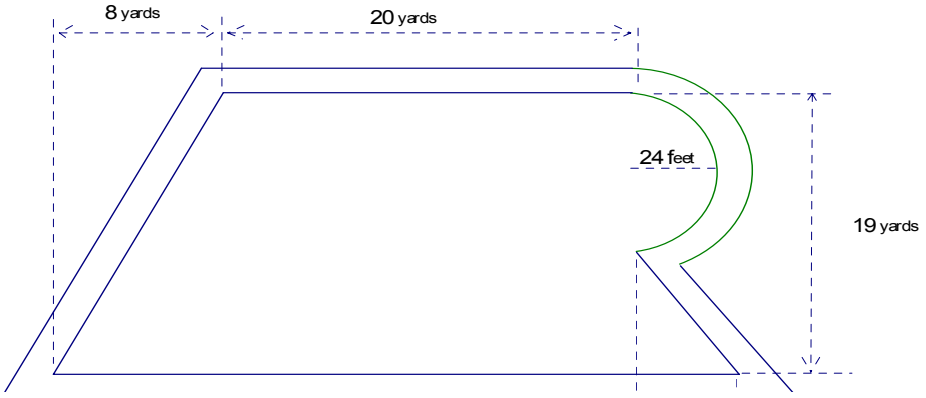
7.4.3: Proposing the Park

Sham City, has asked your landscaping company to submit a proposal estimating the cost of completing the construction of a memorial park. Your company needs to sod the park as well as plant a small hedge along the *inside* of the paved sidewalk that is located around the parks' perimeter.



Project A: The Sod

Below is a sketch of the park with its corresponding dimensions. Note that the uniform paved sidewalk surrounding the green space is 1.5 yards wide.



To determine the amount of sod required, you will need to find the total area of the park. Since you know how to find the areas of basic shapes (e.g. circles, rectangles and triangles), you should try to break up the park into basic shapes and determine the areas of each.

1. Examine the inside area that is to receive sod. Draw line segments that will break up the field into basic shapes (you may have duplicated shapes).

7.4.3: Proposing the Park (Continued)

2. Draw the basic shapes in the space below. Be sure to include the dimensions of each shape. You may or may not use all of the space provided below.

Basic Shape 1:_____	Basic Shape 2: _____
Basic Shape 3:_____	Basic Shape 4: _____

3. Determine the area for each of your basic shapes drawn above, to 1 decimal place.

Area Basic Shape 1:_____	Area Basic Shape 2: _____
Area Basic Shape 3:_____	Area Basic Shape 4: _____

7.4.3: Proposing the Park (Continued)

4. Calculate the total area of the park that will receive sod, to 1 decimal place. State your solution using the following units:

(i) square feet

(ii) square meters

5. If each roll of sod covers 16 square feet, how many rolls of sod need to be ordered to complete the job.

6. Sham City must use a special fertilizer for their grass to grow due to their northern climate. This fertilizer comes in 15lb bags that cover 250 m^2 of new laid sod. How many bags of fertilizer will be required to cover the lawn?

Project B: The Hedge

To determine the total amount of hedging needed, we need to calculate the total perimeter of the park. Recall that the small hedges are to be planted along the *inside* of the path

7.4.3: Proposing the Park (Continued)

1. In the spaces below, draw the basic shapes that were found in Part A.

Basic Shape 1:_____	Basic Shape 2: _____
Basic Shape 3:_____	Basic Shape 4: _____

2. Using a different colour pencil, highlight the sides of each shape that will receive hedging.

3. In the spaces below, calculate the length of each coloured side you found in the previous question (Question 2 above).

Perimeter Basic Shape 1:_____	Perimeter Basic Shape 2: _____
Perimeter Basic Shape 3:_____	Perimeter Basic Shape 4: _____

7.4.3: Proposing the Park (Continued)

4. Find the total perimeter of the park that is to receive hedging. State your solution using the following units:

   (i) feet

   (ii) meters

5. If each 'hedge plant' takes up 1.5 feet, how many 'hedge plants' are needed to surround the park?

Part C: The Cost

The local nursery is selling the exact hedge you have chosen for the park. The sale price for the hedge is $12 per linear meter. Also, the sod price is $2.50 for a roll. If you have to pay 13% tax, what would be the total cost for the sod and hedge?

7.4.4: Proposing the Park - Rubric

Thinking-'Reasoning and Proving'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Degree of clarity in explanations and justifications in reporting	Explanations and justifications are partially understandable	Explanations and justifications are understandable by me, but would likely be unclear to others	Explanations and justifications are clear for a range of audiences	Explanations and justifications are particularly clear and detailed
Making inferences, conclusions and justifications	Justification of the answer presented has a limited connection to the problem solving process and models presented	Justification of the answer presented has some connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented	Justification of the answer has a direct connection to the problem solving process and models presented, with evidence of reflection
Application-'Connecting'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Communication-'Communicating'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use
Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use

Unit 7: Day 5 : Job Opportunity

MFM2P

Minds On: 10 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Solve area and perimeter problems that require conversions between the imperial and metric system. Note that Lesson 7.5 is a continuation of Lesson 7.4. As a result, these lessons can be combined, depending on any time constraints that may exist.	**Materials** • BLM 7.5.1, BLM 7.5.2 (rubric)

			Assessment Opportunities
Minds On…	**Small Heterogeneous Groups → Exploration** Students will meet with their groups and revisit the activity 'Proposing the Park' from Lesson 7.4. They should be given the opportunity to check their solutions either with other groups or with solutions posted on the board. Time will be given for each group to correct any errors they may have made.		This activity reinforces and develops peer mentoring, self assessment and reflection abilities. *Teacher Tip:* Discuss irrigation systems and explain the difference between a 'drip' system and a 'soaker' system. See web site for help.http://www.leevalley.com/garden/page.aspx?c=2&p=10383&cat=2,2280,49657,49739
Action!	**Whole Class → Discussion** Hand out BLM 7.5.1 and introduce the new scenario. In this discussion, emphasize that there may be some conversions of measurements from imperial to metric and vice versa. **Small Heterogeneous Groups → Activity** In their groups, student will complete parts A and B from BLM 7.5.1. Attempt to use the same groupings used in Lesson 7.4. **Mathematical Process (Problem Solving, Connecting & Reflecting) /Observation/Anecdotal Comments.** Observe students making the connection that conversions of several measurements must be completed prior to the final product being started. Pose questions asking students if their conversions and answers are realistic given the context of the problem.		
Consolidate Debrief	**Whole Class → Report** Students will complete part C from BLM 7.5.1. Each group will submit their proposals. See BLM 7.5.2 for rubric. **Mathematical Process (Reasoning and Proving /Communicating / Connecting) /Assignment/Rubric.** Groups will submit their 'Job Opportunity' activity, including their proposal, to be assessed using the rubric provided within BLM 7.5.2. Students will be evaluated based on their ability to communicate their findings, make connections between a real life situation and mathematics and provide information to back-up their conclusions.		
Application	**Home Activity or Further Classroom Consolidation** Assign several other problems that need conversions from metric to imperial.		

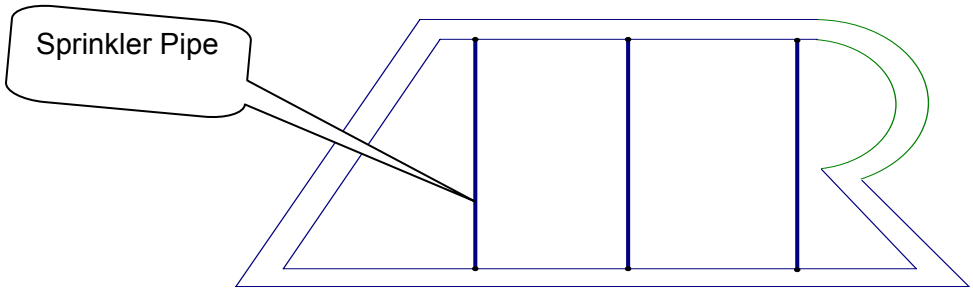
7.5.1: Job Opportunity

Your proposal for the memorial park in Sham City has been carefully reviewed. They were so impressed with the plan that they have decided to also have you install an irrigation system throughout the park. They need a cost proposal from you to see if they can afford this 'drip' and 'soaker' system in addition to the cost of the sod and hedges.

Note: You will need to refer to your answers from the previous lesson activity for Sham City to complete this cost proposal.

Part A: The SOD

1. There is a by-law in Sham City that states that all city parks must have an underground 'drip' sprinkler system. The city gives you the design below that indicates approximately where the plastic underground pipes must go.



a) If pipes come in 5 m lengths, how many pipes need to be purchased for the underground sprinkler system?

b) What will the cost be if each length costs $7.19?

7.5.1: Job Opportunity (Continued)

c) The sod requires plenty of water for optimal growth. The ratio of 1 m^3 of water for every 25 m^2 of sod is needed daily. How many cubic meters of water are required daily for the sod to grow?

d) If it costs the city \$0.03/ft^3 of water, how much will it cost to water the park daily?

Part B: The Hedge

1. To make sure the hedge receives enough water, the city needs to place an underground irrigation system that is made specifically for hedges, called a 'soaker line'. Its price is \$1.83 per linear meter. Determine the cost of the irrigation system for the hedge.

Part C: The Proposal

Complete a proposal to Sham City. Your proposal should be one paragraph. Be sure to include the following:

- The amount of sod and hedging needed in metric units
- The cost of the sod and hedging.
- The cost of the entire irrigation system needed for the sod and hedge.
- Summarize the proposal with a total cost.

Included with your proposal paragraph should be a drawing of the park labeled in metric units. This will be handed in to the teacher to be assessed.

7.5.2: Job Opportunity - Rubric

Thinking-'Reasoning and Proving'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Degree of clarity in explanations and justifications in reporting	Explanations and justifications are partially understandable	Explanations and justifications are understandable by me, but would likely be unclear to others	Explanations and justifications are clear for a range of audiences	Explanations and justifications are particularly clear and detailed
Making inferences, conclusions and justifications	Justification of the answer presented has a limited connection to the problem solving process and models presented	Justification of the answer presented has some connection to the problem solving process and models presented	Justification of the answer presented has a direct connection to the problem solving process and models presented	Justification of the answer has a direct connection to the problem solving process and models presented, with evidence of reflection
Application-'Connecting'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Communication-'Communicating'				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
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Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use

Unit 7: Day 6 : Is the Net Up or Down?

MFM2P

Minds On: 20 Action: 40 Consolidate:15 Total=75 min	**Description/Learning Goals** • Determine the surface area of a pyramid through investigation (e.g. use the net of a square-based pyramid to determine that the surface area is the area of the square base plus the area of the four congruent triangles).	**Materials** • Interactive White Board • Data Projector • Computer • BLM 7.6.1, BLM 7.6.2

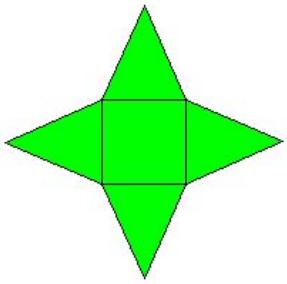
				Assessment Opportunities
	Minds On…	**Whole Group → Exploration** Either using an interactive white board (e.g. SMART board) or a data projector, have the class complete the activity from the GSP file called U7.6-PythagoreanTheoremdemo.gsp. This will prepare the students for the 'Action!' section by activating prior knowledge of the Pythagorean Theorem.		Complete U7.6-Pythagorean Theoremdemo.gsp as a class.
	Action!	**Pairs → Investigation** Students are to complete part A from BLM 7.6.1 in pairs. Circulate to make sure students are correctly identifying the 5 shapes in the net: the square and 4 identical triangles. Students should have a total sum of 85 ft^2. Once students have completed part A, they will move on to part B, the investigation of the surface area of the net. Ask students the following: Does the formula obtained in part B work for a rectangular prism? Introduce part A of BLM 7.6.2 and support students in finding a method that will determine the surface area of a **rectangular-base** pyramid, such as the procedure used in part B of BLM 7.6.1. Students should realize that a rectangular-base pyramid consists of a rectangle, and two pairs of identical triangles, i.e. **SA = (lw) + (b_1h_{s1}) + (b_2h_{s2}).** **Mathematical Process (Connecting & Representing)/Observation/ Anecdotal Comments:** Observe students making the connection that the surface area of a square-base pyramid is the sum of the area of the base and its triangular sides. Furthermore, take note of student connections and formula representation of the rectangular-base pyramid.		If you have access to an interactive white board or a data projector and internet access, you may want to demonstrate the 'folding of the net' from the website http://www.mste.uiuc.edu/pavel/java/pyramid/ *Teacher Tip:* Incorporating manipulatives can strengthen and support understanding. Using Frameworks or GeoSolids would be ideal for this lesson.
	Consolidate Debrief	**Think/ Pair/ Share → Practice** Students will independently work on part B from BLM 7.6.2. Students will compare answers with a partner and discuss the strategy they chose to solve the problem with. Peer mentoring and collaboration should be encouraged. Once students have discussed their strategies and solutions, the solution can be written on the board. Pairs may volunteer to share their solution and how they solved the problems. If students went about solving the problems using different methods, encourage them to contribute to the take-up discussion.		Make sure students realize they need to use the Pythagorean Theorem to calculate slant height. Circulate to make sure students do not include the base of the pyramid in their calculations for question 2.
	Concept Practice	**Further Classroom Consolidation** Students will perform the following inquiry: Find a specific example of a rectangular-base pyramid (including square-base pyramids) in the real world. Explain why this shape may have been chosen as opposed to other shapes (e.g. Increased stability). Post your example on the class bulletin board.		

7.6.1: Is the NET Up or Down?

Some say the surface area of a **square-based pyramid** is equal to the sum of the areas of a square and four identical triangles. Let's Investigate.

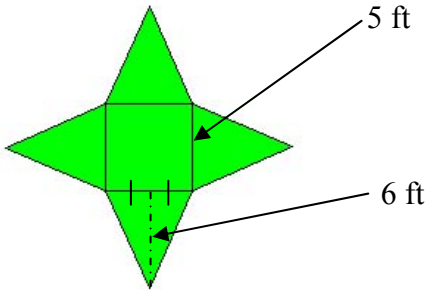
Part A: The NET

1. Examine the following net. Identify & label the square and the 4 identical triangles.



2. To calculate the area of this 2 dimensional net, we need to:
   a. First, find the area of the square, using

$$A_{square} = (length)(width)$$



   b. Second, find the area of one triangle, using

$$Area_{triangle} = \frac{(lendth\,of\ base)(height\,of\ triangle)}{2}$$

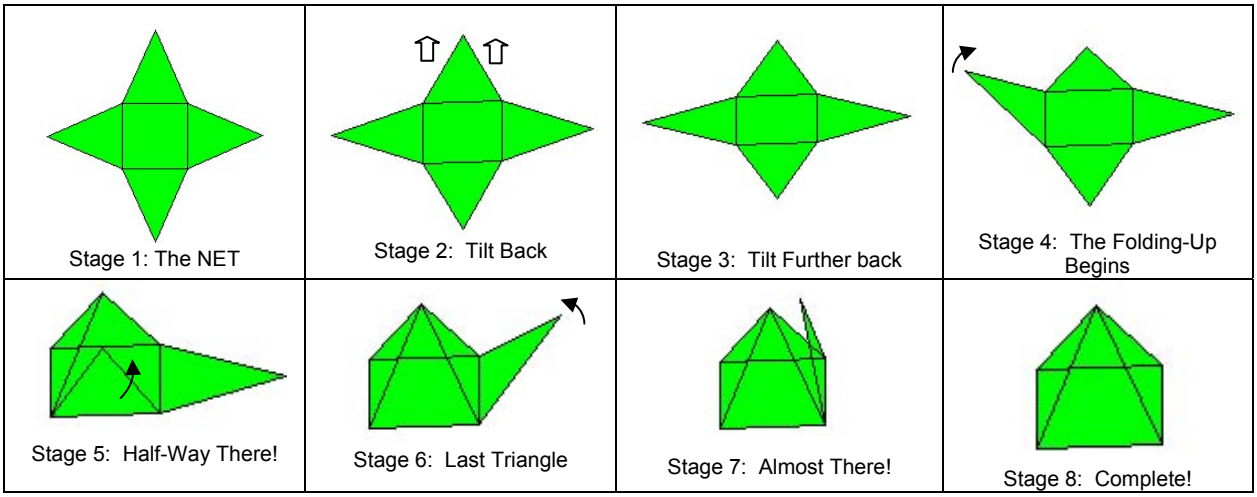
   c. The next step is to multiply the area of the triangle by 4. Explain why you think this step is necessary.
   .

   d. Finally, the total area of the net is the sum of the areas of the square and the triangles. Determine the total area.

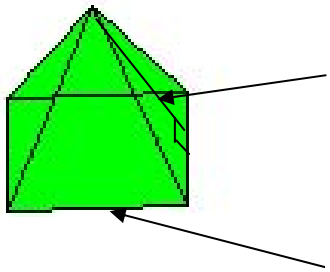
7.6.1: Is the NET Up or Down? (Continued)

Part B: The Folding-Up of the Net!

1. Now we are going to fold the net to create a square-based pyramid. Follow the stages below.



2. Take the 'stage 8' diagram and locate the measurements from part A on the pyramid.



___ft

This is called the **slant height** of the pyramid, h_s, which bisects the base.

___ft

This is the base of the pyramid, *b*

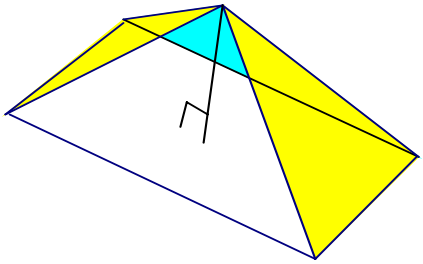
3. Create a formula to find the surface area of any square-based pyramid using '*b*' for the length of the base and 'h_s' for the length of the slant height. Use the equation format below as a guide.

$$\mathbf{SA}_{\text{square-based pyramid}} = (\quad)^2 + 4(\qquad)$$

7.6.2: Rectangular-Based Pyramids

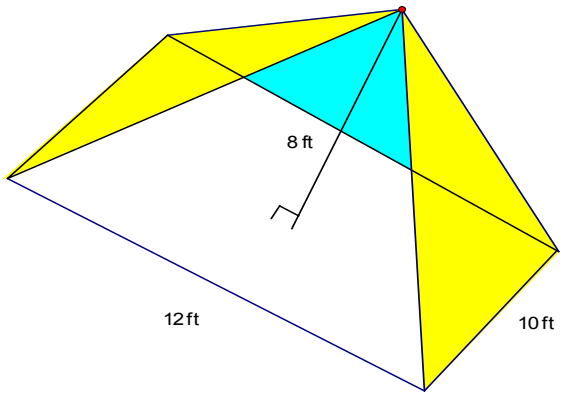
Part A: Rectangular Base Formula

- Identify the slant heights, length and width of the rectangular base.
- Create a formula to calculate the surface area of a rectangular-based pyramid.
- Sketch the net of this rectangular-based pyramid.



Part B: Rectangular Base Surface Area

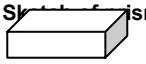
- Determine the slant heights of each triangle with the help of the Pythagorean Theorem.
- Calculate the total surface area of the object.



Unit 7: Day 7 : It's About Surface Area

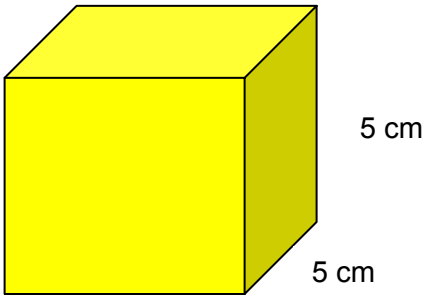
MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Find the surface area of several objects. • Relate surface area to finding the area of composite 2-D shapes. • Discuss and draw nets.	**Materials** • Linking cubes • BLM 7.7.1, BLM 7.7.2, BLM 7.7.3, BLM 7.7.4 (Isometric dot paper)

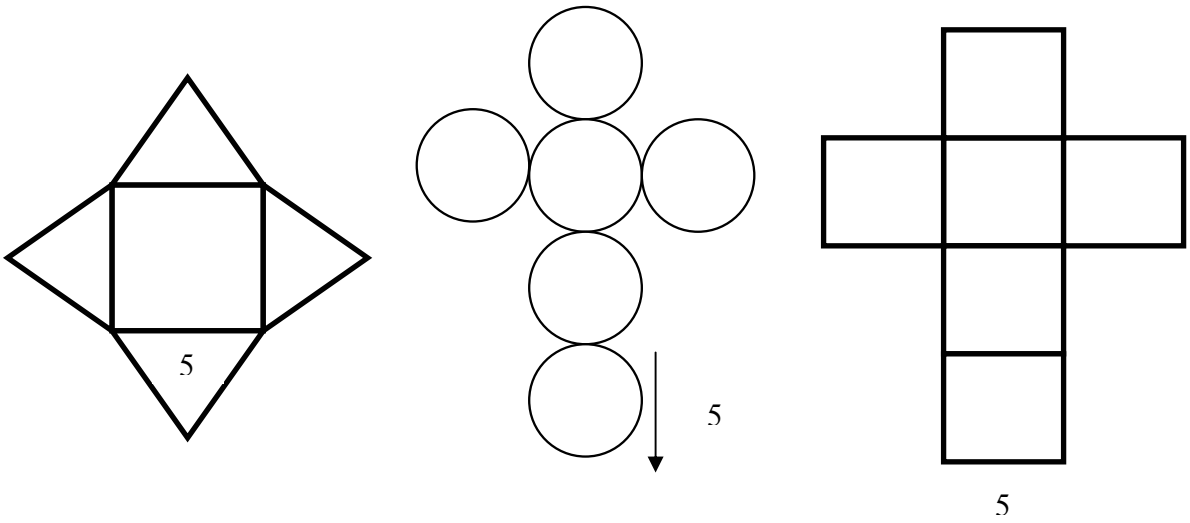
		Assessment Opportunities
Minds On…	**Pairs/Whole Class → Exploration** Students will be looking at a picture of a rectangular prism (a cube) and determining which of a series of nets would build the prism. Distribute BLM 7.7.1 and ask students to discuss with a partner which net makes the most sense for the given prism. To conclude, the activity can be discussed with the whole class. Pose Questions: How do you know you are right? What 3-D shapes would the other nets form and how do you know?	
Action!	**Small Heterogeneous Groups → Investigation/Demonstration** Students will be working with 27 linking cubes and forming as many different rectangular prisms as possible. The activity should be modelled with 8 linking cubes for the class to see. Show the 2 different rectangular prisms that can be made with the 8cubes [4 x 2 x 1; 2 x 2 x 2]. Calculate the surface area of each prism by counting the number of faces. Each surface of the linking cube represents 1 square unit. Distribute BLM 7.7.2. Students will be repeating the demonstration using 27 linking cubes instead of 8. They will need to form 3 different rectangular prisms, then draw them using isometric dot paper, BLM 7.7.4. Students will then be asked to sketch the three shapes, determine the number of faces, and calculate the area of each face. **Mathematical Process (Connecting)/Observation/Anecdotal Comments**: Take note of the students' ability to make the connections between the individual surfaces of a 3-D shape and their relationship to the surface area of the entire 3-D shape.	An example of a problem posed in BLM 7.7.2 **Sketch of prism**  Height: 1 unit Depth: 3 units Length: 9 units **Surface Area** 78 units^2 **Number of Faces** 6 **Area of each face recorded then added.** 27, 27, 9, 9, 3, 3 27+27+9+9+3+3 = 78.
Consolidate Debrief	**Whole Class → Discussion** With the whole class, go over BLM 7.7.2. Initiate a discussion stressing the importance of the last question: What do you notice about the 2nd and 4th column? They should be led to the realization that surface area is really just the sum of the areas of the different surfaces on a 3-D shape.	
Application	**Further Classroom Consolidation or Home Activity** Students will work through BLM 7.7.3. First, they should number the shapes on the net from 1 to 5 and then find the area of each shape. When finished, students can determine the surface area of the shape and identify the 3-D shape that the net forms. **Mathematical Process (Connecting)/Observation/Anecdotal Comments**: Assess how well students are able to make the connection between the individual areas on a net and the surface area of the 3-D shape.	

7.7.1: Which Net?

Take a look at the rectangular prism.



a) Which one of the following nets below would create this prism? Circle your choice.



b) Explain how you know that you are right.

c) Find the area of each shape in the net that you selected.

7.7.2: Cuboid Creations

You will be given 27 linking cubes. Your mission is the following.

a) Using all 27 linking cubes, create three *different* rectangular prisms that can be made.

b) Using the isometric dot paper provided, draw each of your creations. Please note that one of your creations will not be able to be drawn because of size limitations.

c) Fill in the following table for your three creations:

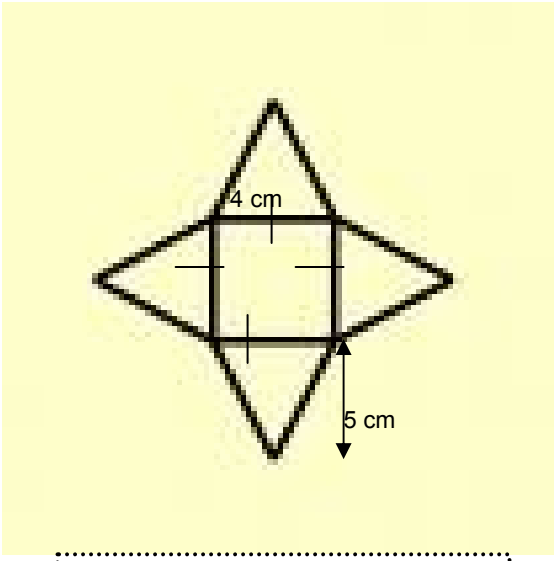
3-D Sketch of prism (with dimensions labelled)	Surface Area (count the squares)	Number of Surfaces	Area of each surface recorded and added up.

d) What do you notice about the 2nd and 4th column?

e) Write your own definition for Surface Area based on what you answered in d).

7.7.3: Net Worth

Take a look at the following net.



Recall that the formula for finding the area of a triangle is:
$A = (b \times h) \div 2$

a) Number the shapes in the above net from 1 to 5.

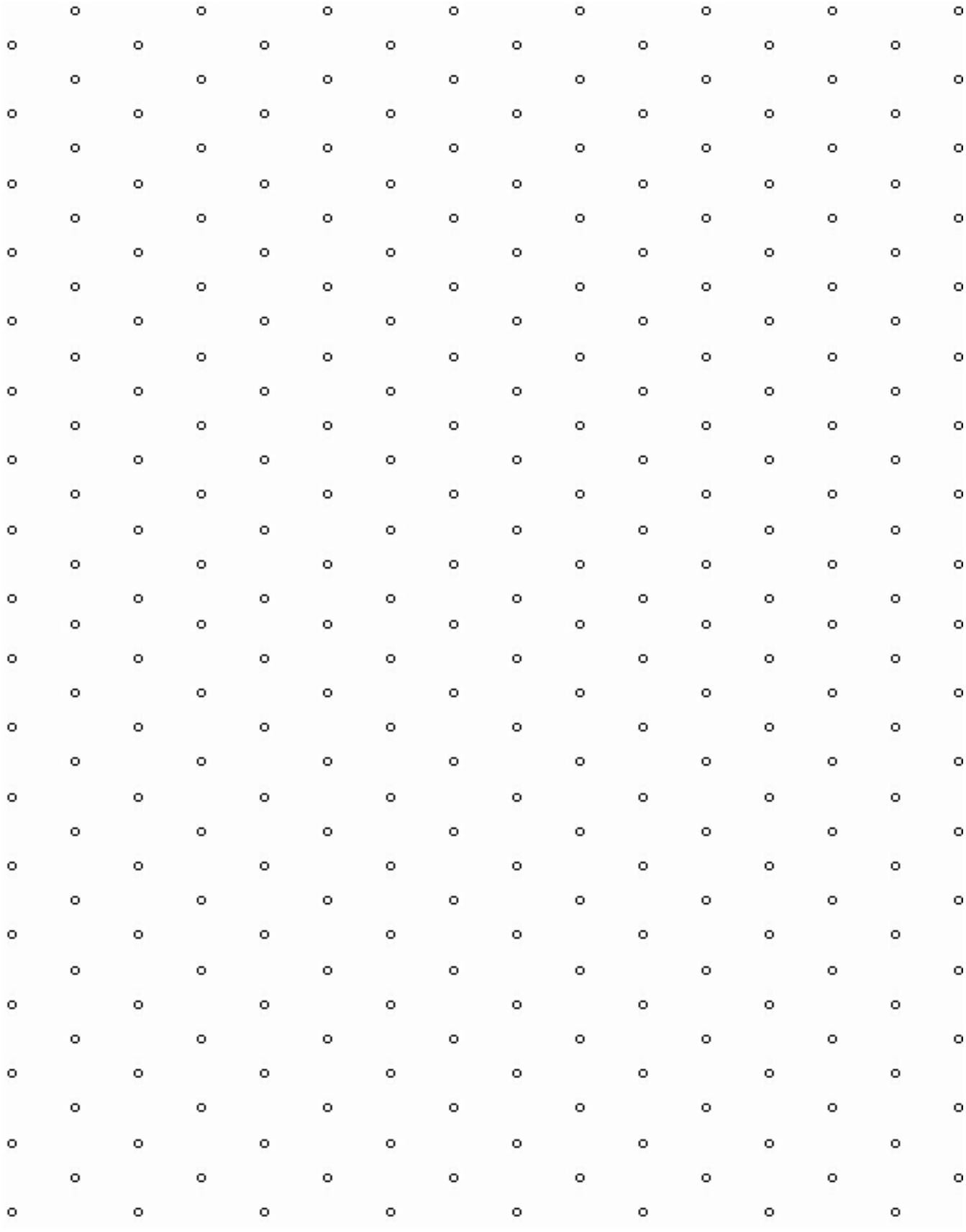
b) Using the chart below, calculate the area of each shape in the above net.

Shape	Area Calculations
1	
2	
3	
4	
5	

c) What 3-D shape would be formed by this net?

d) What would the surface area of this 3-D shape be?

7.7.4: Isometric Dot Paper



Unit 7: Day 8 : Problems Involving the Surface Area of Prisms & Pyramids

MFM2P

Minds On: 15 Action: 45 Consolidate:15 Total=75 min	**Description/Learning Goals** • Solve problems relating to the surface area of prisms and pyramids. • Discuss the use of the Pythagorean Theorem to solve surface area problems.	**Materials** • Set of 3-D solids or polydrons • BLM 7.8.1, BLM 7.8.2, BLM 7.8.3, BLM 7.8.4 (rubric)

			Assessment Opportunities
Minds On…	**Individual → Exploration** Draw the following units to scale on card stock for students to cut out and use: 1 mm^2, 1 cm^2, 1 $inch^2$. Draw the following units to scale on the board for students to see: 1 ft^2, 1 m^2, 1 yd^2. On BLM 7.8.1, students will see different objects from around the room. Their goal is to select the best area unit from the list and to estimate the area of the object. **Mathematical Process (Reasoning and Proving)/Peer evaluation/ Anecdotal Comments**: Students can exchange their choices and estimates with a partner and the partner can decide what they think of the other's estimate.		
Action!	**Pairs/Individual → Problem Solving** Students will be given 15 minutes to discuss BLM 7.8.2 with a partner. After 15 minutes, students will have 30 minutes to complete BLM 7.8.2 individually. **Mathematical Process (Problem Solving)/Assignment/Rubric**: Students will be evaluated based on their ability to select appropriate problem solving strategies to determine the surface area of prisms and pyramids. A rubric is provided so that BLM 7.8.2 can be collected and evaluated.		Students can use conversion tables from previous lessons if necessary. Refer to BLM 7.8.4 for rubric.
Consolidate Debrief	**Whole Class → Investigation** Take a set of 3-D solids and hold each one up to the class. Ask students how many surfaces each of the solids has and ask them to name the shapes of the surfaces that comprise the 3-D solids. Save the cylinder and sphere for last and attempt to get some good dialogue about these shapes.		For example: The square-based pyramid has 5 surfaces - 4 of those surfaces are triangles and one is a square.
	Home Activity or Further Classroom Consolidation Assign BLM 7.8.3 for practice calculating the surface area of rectangular - based pyramids. Emphasize that is one of the many examples of how surface area calculations are used in real life when dealing with building structures and tents.		

7.8.1: Pick a Square, Any Square

On the board, you should see many different sized squares labelled with a unit.

For each of the items in the chart below, select the square unit that you think would be best for describing the *size* of the item. Once you have selected the square unit, make an estimate as to how many squares you think could fit inside the item.

Item	Best Square Unit	Estimated Size (Area)
Classroom Floor		
Front of Math Textbook		
Thumbnail		
Blackboard/Interactive White Board		
One Classroom Window		
Classroom Door		
Clock in Class		

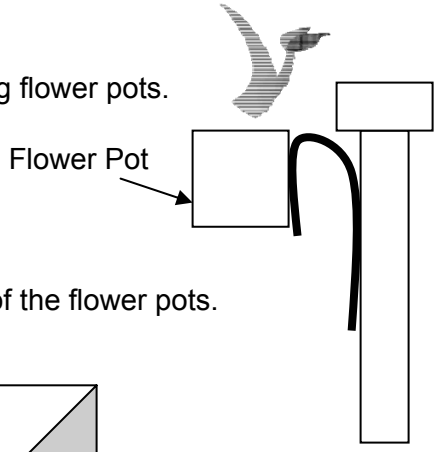
Exchange your chart with a partner when instructed. There is a chart below for your partners' comments.

Partner's Name _____

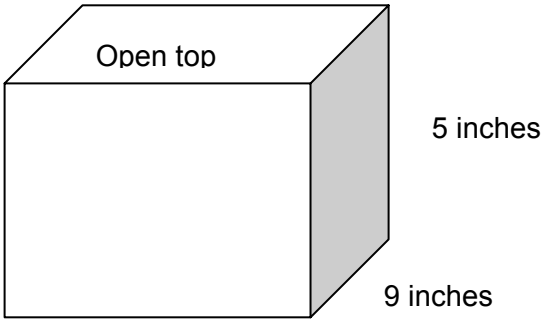
Item	Comments (do you agree with your partners' estimates)
Classroom Floor	
Front of Math Textbook	
Thumbnail	
Blackboard/ Interactive White Board	
One Classroom Window	
Classroom Door	
Clock in Class	

7.8.2: Planter's Dilemma

Joe is going to paint his hanging flower pots.



Here is a close up look at one of the flower pots.



1. How much paint would Joe need (in square inches) to paint the outside of ONE flower pot?

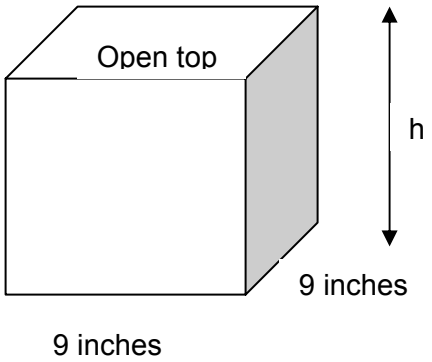
2. How many **square feet** of paint is needed?

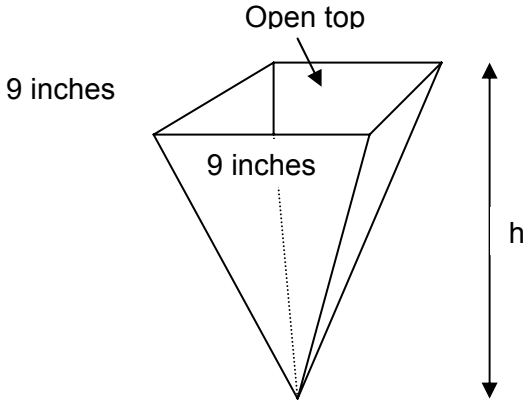
Note: You may need to refer to one of your conversion tables that was made earlier in the unit.

7.8.2: Planter's Dilemma (Continued)

3. If one quart of paint is enough to paint 10 ft^2, how many quarts will Joe need to buy in order to paint his **10** flower pots?

4. Joe has some other decisions to make about his flower pots. Take a look at two of the other flower pots that Joe could have bought.





What would the height of the each of these two flower pots have to be in order to need exactly TWICE as much paint as one of Joe's current flower pots?

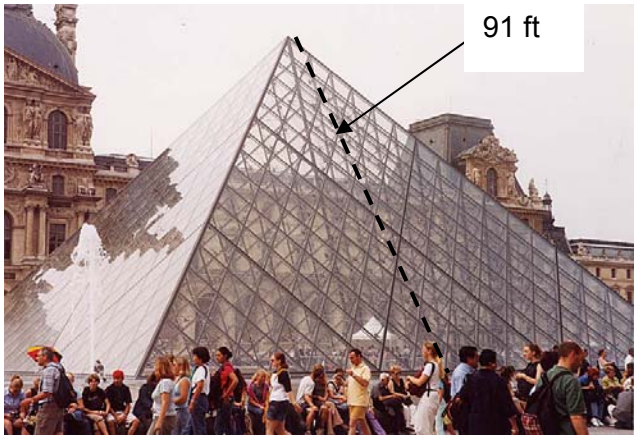
7.8.2: Planter's Dilemma (Continued)

4 (continued).

Square Based Prism	Square Based Pyramid

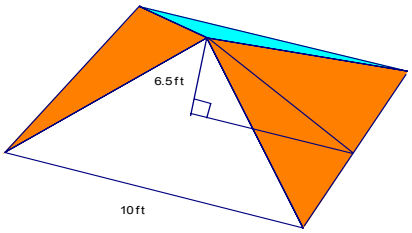
7.8.3: Applications

1. Find the area of the floor and the amount of glass used to build the latest addition to the entrance of the Louvre, the world-famous museum in Paris, France. Its base measures 116 ft long.



5H http://www.guide-to-symbols.com/pyramid/

2. A tent that has a square base and a height of 6.5 ft needs a canvas cover.



a. Identify the base, b and the slant height, h_s.

b. Is there another calculation you need to complete prior to using the surface area formula for square-based pyramids? Explain.

c. Calculate the h_s for the tent.

e. Determine the amount of canvas needed to cover the tent (Hint: The floor of the tent is not made of canvas!).

7.8.4: Planter's Dilemma Rubric

Selecting Computational Strategies				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Select and use strategies to solve a problem	Selects and applies appropriate strategies, with major errors, omissions, or mis-sequencing	Selects and applies appropriate strategies, with minor errors, omissions or mis-sequencing	Selects and applies appropriate strategies, accurately, and logically sequenced	Selects and applies the most appropriate strategies, accurately and logically sequenced
Communicating				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use
Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use
Integration of narrative and mathematical forms of communication	Either mathematical or narrative form is present, but not both	Both mathematical and narrative forms are present, but the forms are not integrated	Both mathematical and narrative forms are present and integrated	A variety of mathematical forms and narrative are present, integrated and well chosen
Connecting				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

Unit 7: Day 9 : Firing on All Cylinders

MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Review formulas for the circumference and area of a circle which will be needed to solve problems involving the surface areas of cylinders. • Solve problems involving the surface area of cylinders.	**Materials** • Geometric Solids of Cylinders • Computer Lab with Printer and Geometer's Sketchpad • Scissors • BLM 7.9.1, BLM 7.9.2, BLM 7.9.3, BLM 7.9.4

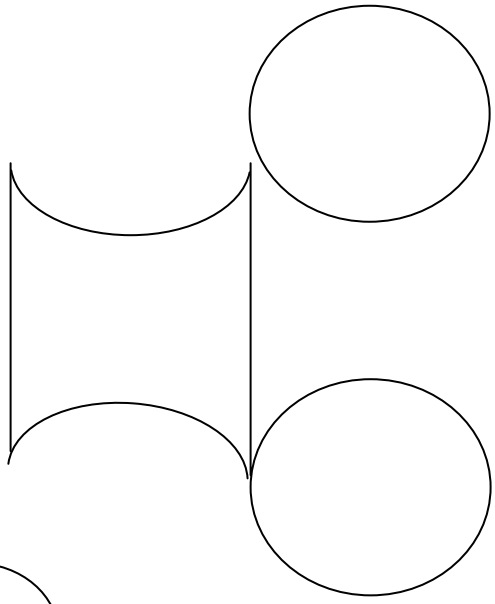
				Assessment Opportunities
	Minds On…	**Individual → Exploration** Students will be looking at 3 nets and trying to decide which net will form a cylinder. BLM 7.9.1 contains 3 nets, only one of which produces a cylinder. Students are to select one of the nets, cut it out and attempt to build a cylinder. Guide the students toward understanding that a cylinder is actually formed from a rectangle and two circles.		*Teacher Tip:* Display various model cylinders with different dimensions around the room for students to handle and explore.
	Action!	**Individual → Exploration** Students will be using Geometer's Sketchpad to attempt to construct, print, cut out and assemble two cylinders. The total surface area of their two cylinders must be within 5 cm^2 of 100 cm^2, 150 cm^2, 200 cm^2, 250 cm^2, or 300 cm^2. BLM 7.9.2 gives the students a workspace to keep track of the constructions they make on Sketchpad. Students will construct a rectangle and two circles and then measure the areas of the three shapes using the *measure* command in GSP. Once they have a total surface area within 5 cm^2 of the above areas, they will cut out the shapes and see if it makes a cylinder. By doing this, they will hopefully come to realize that the width of the rectangle MUST be equal to the circumference of the constructed circles. Use BLM 7.9.4 for student instructions on using GSP. **Mathematical Process (Reasoning and Proving)/ Activity/ Observation**: Observe students and take note of their ability to make hypotheses, form conjectures and test the validity of their thoughts.		Assembly of cylinder will consist of taping the rectangle to form the middle section and checking to see that the two circles fit the base and top. The goal of 'Action!' is to get students to realize that the rectangle they construct must have a width that is equal to the circumference of the circle on the base or top. They may actually construct circles and rectangles on GSP that have areas that add up to what they want, BUT the circles will not fit properly onto the base and top.
	Consolidate Debrief	**Whole Class → Connecting** With the whole class, take a rectangular piece of paper and wrap it around the curved middle section of a cylinder. Direct the class to conclude that a cylinder is composed of two circles and a rectangle with the width of the rectangle being equal to the circumference of the circle and the height of the rectangle being equal to the height of the cylinder. This can be connected to the formula for the surface area of a cylinder: $SA = 2\pi r^2 + 2\pi rh$		
	Concept Practice	**Home Activity or Further Classroom Consolidation** Students will complete BLM 7.9.3 by finding the surface area of the two cylinders provided. **Learning Skills (Work Habits)/ Homework Check/ Anecdotal Comments:** Be sure that students are using the formula correctly and applying the formula in a way that shows the area of two circles and rectangle. Take note of homework completion and quality.		Students can refer to their notes for clarification.

7.9.1: Cylinder Nets

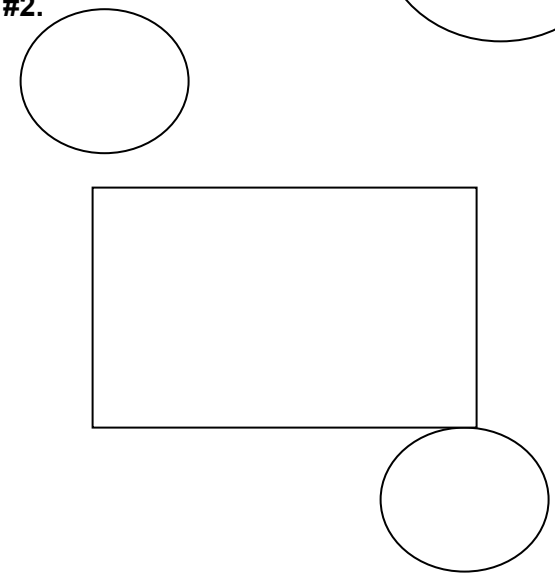
Your Challenge:

Take a look at the three drawings below. Only one of them can be cut out and turned into a cylinder. Select the one that you think will form the cylinder. Cut it out to see if you made the right choice. If you did, you should be able to assemble a cylinder.

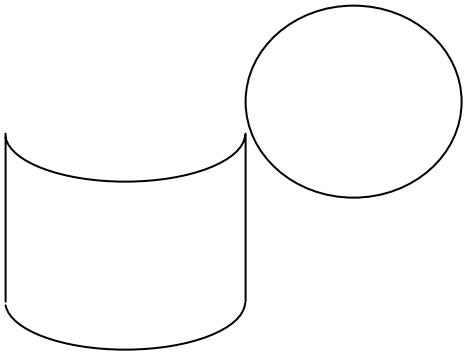
Option #1.



Option #2.



Option #3.



7.9.2: Constructing Cylinders

Use the following table to keep track of different cylinders you attempt to construct using Geometer's Sketchpad. Once you get one that works, circle it, cut it out and see if it makes a cylinder.

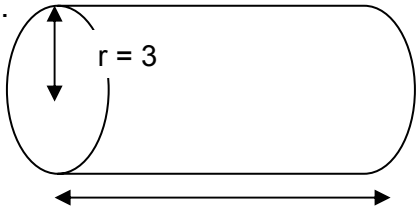
#	Radius of the Circle on top	Circumference of the Circle $C=2\pi r$	Area of Both Circles Combined $A = \pi r^2$	Dimensions of the Rectangle	Area of the Rectangle $A = l \times w$	Total Area of the Cylinder
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Describe any strategies that you used.

7.9.3: Cylinder Surfaces

Below you will find two cylinders. You need to calculate their total surface areas.

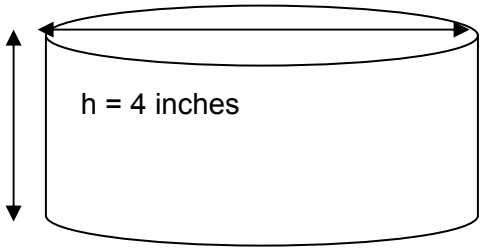
1.



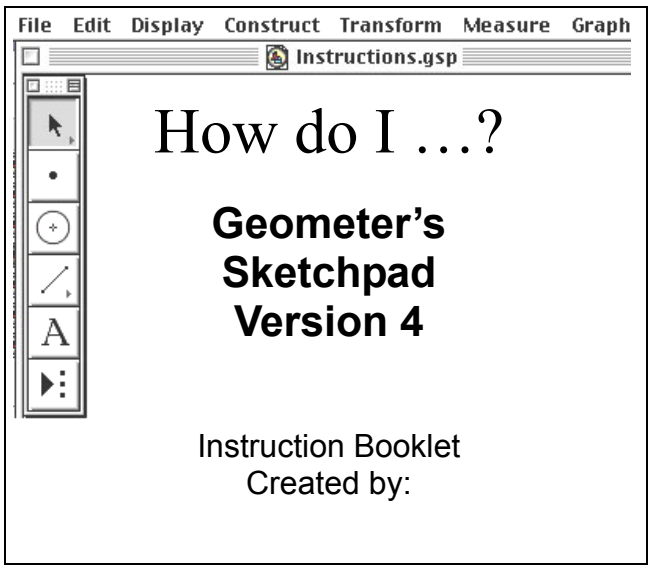
h= 12 cm

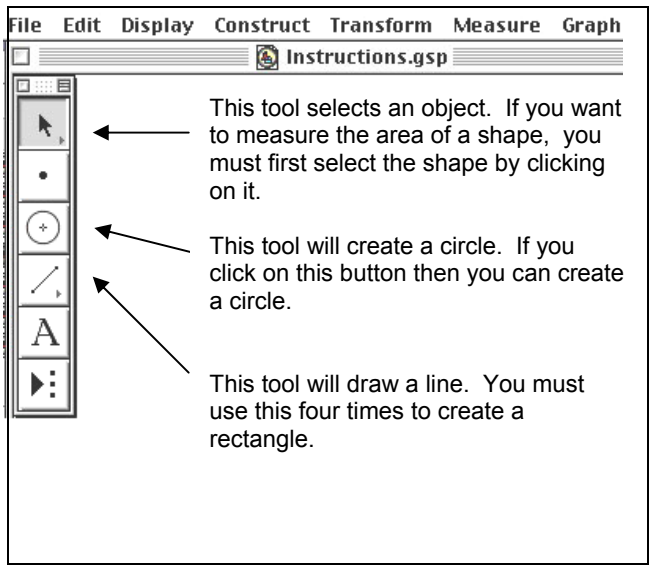
2.

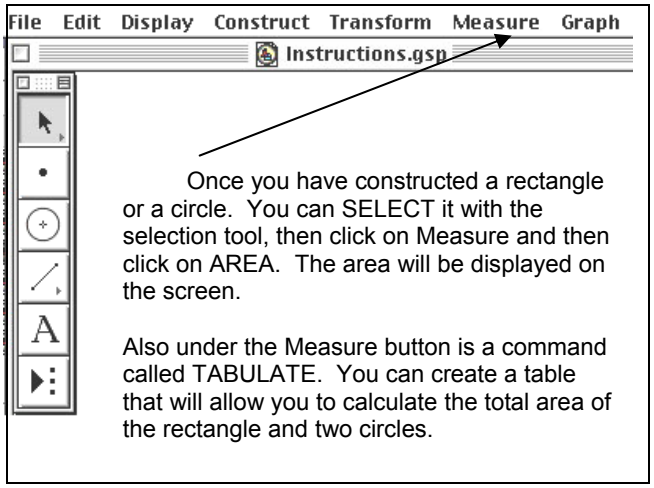
d = 22 inches

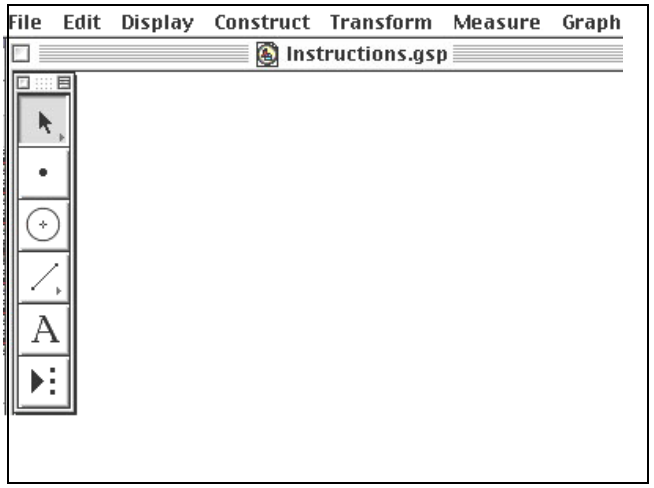


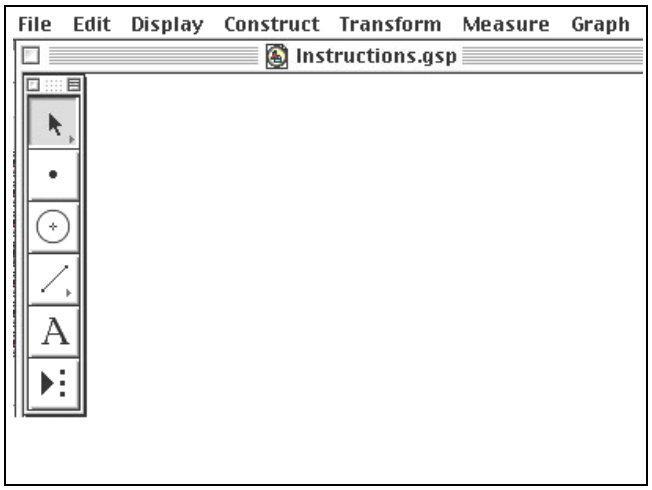
7.9.4: GSP Instructions for Students

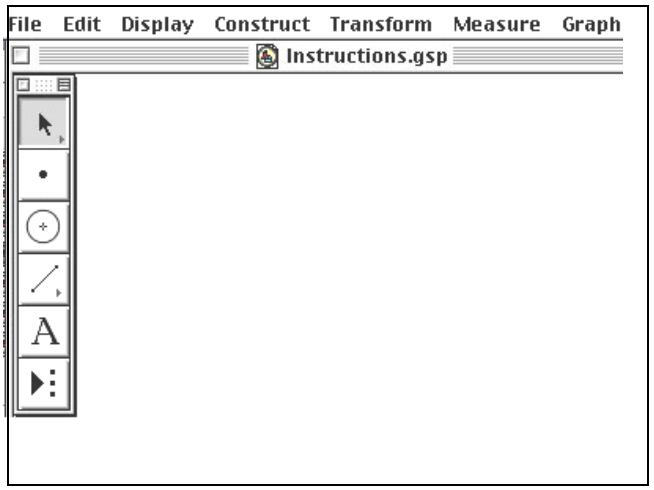












Unit 7: Day 10 : Surface Area of Combined Shapes

MFM2P

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Description/Learning Goals** • Solve surface area problems involving prisms, pyramids, cylinders, including combinations of these figures using the metric or imperial system as appropriate.	**Materials** • 3-D Solids • BLM 7.10.1, BLM 7.10.2 (rubric)

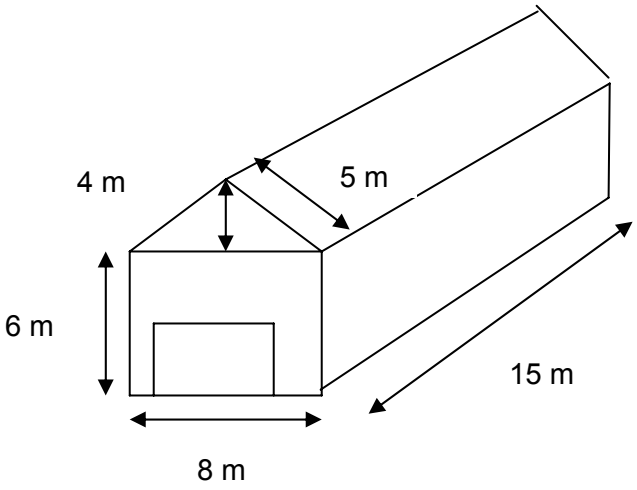
			Assessment Opportunities
Minds On…	**Whole Class → Exploration** Take a model cube and a model square-based pyramid and pass it around the class. Ask students to write down how they are alike and how they are different. Note: Through this activity, students will count how many surfaces each of the 3-D objects has. Next, put the square based pyramid on top of the cube. Show it and ask how many surfaces there are. Why is it not 6 + 5 = 11? Explore this with the class. Do the same with: 1. A rectangular prism and a triangular prism 2. Two cylinders		When assigning groups, make sure you assign a broad spectrum of abilities to each group. *Teacher Tip:* Have each pair submit only one copy for assessment/ evaluation Refer to BLM 7.10.2 for rubric.
Action!	**Pairs → Investigation** Students will be working through BLM 7.10.1 for practice solving surface area problems. The problem requires the students to find the surface area of a composite 3-D figure. The barn-house in the question is composed of a rectangular prism with a triangular prism on top of it. The silo is a cylinder. **Mathematical Process (Problem Solving)/ Assignment/ Rubric**: Students will be developing, selecting, and applying a variety of strategies in this investigation. This investigation can be used as formative assessment.		
Consolidate Debrief	**Whole Class → Presentation: Communication** Individual students can be randomly selected to present the solution strategy that their group employed. This is a class presentation that can be directed with discretion in a variety of fashions. Synthesize the key points from each group's presentation and tie everything together.		
Reflection	**Home Activity or Further Classroom Consolidation** Assign the following design activity: Combine three or more shapes, including prisms, pyramids and cylinders, to make an interesting garden sculpture. Use appropriate units (metric or imperial) to labels its dimensions. Find the total surface area.		

7.10.1: Old McDonald

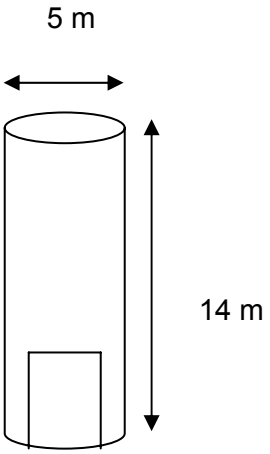
Old McDonald wants to paint his barn-house and silo. The entire barn-house and silo will be painted red, EXCEPT for the two doors – those will be painted white. Be aware that it is not possible to paint the bottom of the barn-house and silo.

Note: A silo is a structure for storing 6Hbulk materials such as grain, 7Hcoal, 8Hcement, 9Hcarbon black, wood chips, food products and 10Hsawdust.

Here is what the barn-house and silo looks like:



The door of the barn-house has dimensions of 5 m wide by 4 m tall.



The door of the silo has dimensions of 3 m wide by 5 m tall.

1. a) What is the area of the **barn-house door** that will be painted white?

b) What is the area of the **barn-house** that will be painted red?

7.10.1: Old McDonald (Continued)

2. a) What is the area of the **silo door** that needs to be painted white?

b) What is the area of the **silo** that will be painted red?

3. a) What is the **total** surface area that will be painted red?

b) What is the **total** surface area that will be painted white?

4. a) What would the answer to 3a) be in squared feet?

b) What would the answer to 3b) be in squared feet?

7.10.1: Old McDonald (Continued)

5. If one can of paint will cover a total of 1000 ft^2:
   (a) How many cans of white paint will Old McDonald need to buy?

   (b) How many cans of red paint will Old McDonald need to buy?

   (c) How many paint cans will Old McDonald need to buy in total?

7.10.2: Old McDonald - Rubric

Selecting Computational Strategies				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Select and use strategies to solve a problem	Selects and applies appropriate strategies, with major errors, omissions, or mis-sequencing	Selects and applies appropriate strategies, with minor errors, omissions or mis-sequencing	Selects and applies appropriate strategies, accurately, and logically sequenced	Selects and applies the most appropriate strategies, accurately and logically sequenced
Communicating				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Ability to read and interpret mathematical language, charts, and graphs	Misinterprets a major part of the information, but carries on to make some otherwise reasonable statements	Misinterprets part of the information, but carries on to make some otherwise reasonable statements	Correctly interprets the information, and makes reasonable statements	Correctly interprets the information, and makes subtle or insightful statements
Correct use of mathematical symbols, labels, units and conventions	Sometimes uses mathematical symbols, labels and conventions correctly	Usually uses mathematical symbols, labels and conventions correctly	Consistently uses mathematical symbols, labels and conventions correctly	Consistently and meticulously uses mathematical symbols, labels and conventions, recognizing novel opportunities for their use
Appropriate use of mathematical vocabulary	Sometimes uses mathematical vocabulary correctly when expected	Usually uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly when expected	Consistently uses mathematical vocabulary correctly, recognizing novel opportunities for its use
Integration of narrative and mathematical forms of communication	Either mathematical or narrative form is present, but not both	Both mathematical and narrative forms are present, but the forms are not integrated	Both mathematical and narrative forms are present and integrated	A variety of mathematical forms and narrative are present, integrated and well chosen
Connecting				
Criteria	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Make connections among mathematical concepts and procedures	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections
Relate mathematical ideas to situations drawn from other contexts	Makes weak connections	Makes simple connections	Makes appropriate connections	Makes strong connections

Unit 7: Day 11: Shapes To Go!

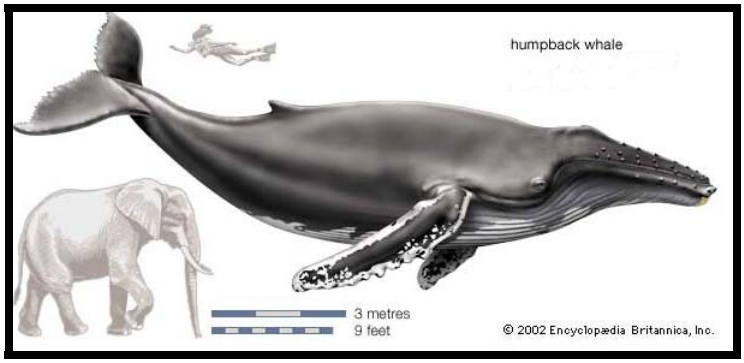
MFM2P

Minds On: 10 Action: 50 Consolidate:15 Total=75 min	**Description/Learning Goals** • Activate prior knowledge about volume. • Solve problems involving the volume of prisms, pyramids, cylinders, cones, and spheres, including combinations of these figures, using the metric or imperial system, as appropriate.	**Materials** • Book: *Counting on Frank* • Refer to BLM 7.11.6 for full list of materials • BLM 7.11.1, BLM 7.11.2, BLM 7.11.3, BLM 7.11.4, BLM 7.11.5, BLM 7.11.6 (Teacher Notes)

			Assessment Opportunities
Minds On…	**Small Heterogeneous Groups → Connect to Literature** Read the book 'Counting on Frank' by Rod Clement aloud. Divide the class into small heterogeneous groups. Provide each student with a copy of BLM 7.11.1 activity sheet. Each group will complete the activity sheet. As a whole class, they will share their solutions.		Student may use their notebooks or previous lesson activities to help them complete BLM 7.11.1.
Action!	**Small Heterogeneous Groups → Carousel** Create 4 numbered stations and provide each station with sufficient copies of the corresponding problem from BLM 7.11.3. Supply each station with a copy of the formula sheet in BLM 7.11.2. Assign a group of students to work at each station. Direct groups to move to the next station after a set amount of time. Students must have their own copy of each problem solution. When all of the problems are completed, place the final answers on the board. Students will check to see if their solutions are correct. Give an opportunity for students to re-attempt solving problems with incorrect answers. **Learning Skills (Teamwork)/Observation/Anecdotal Comments:** Assess the students' ability to choose the appropriate strategy when selecting the correct formula to use and the appropriate operation for each problem. Circulate to observe students. Take note of student participation and collaboration in a team when solving problems.		*Teacher Tip:* When assigning groups, make sure you assign a broad spectrum of abilities to each group. The Formula sheet can also be found on the EQAO website http://www.eqao.com under 'Student Resources' Students can refer to BLM 7.11.2 to remind them of the volume formulas for various 3-D objects.
Consolidate Debrief	**Whole Class → Guided Problem Solving** Students will work though BLM 7.11.4 as a class. This activity introduces problem solving involving combinations of 3-D objects.		Refer to BLM 7.11.6 for important teacher notes and a full list of materials for each carousel station.
Concept Practice	**Home Activity or Further Classroom Consolidation** Students will complete a mind map on area and volume. Using BLM 7.11.5, they will be responsible for brainstorming the similarities and differences between the volume and area of 3-D objects. During the next lesson, students may want to share and record their ideas on a class mind map that can be posted for future reference.		

7.11.1: Count on Frank

One of the facts shared in the book 'Counting on Frank' is that only ten humpback whales would fit in his house. When answering the questions below, use either metric or imperial units.



1. How big is the average humpback whale (estimate)?

2. What type of box can we fit the whale in (e.g. rectangular, triangular, cylindrical or other)?

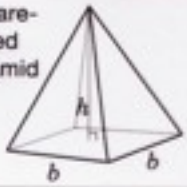
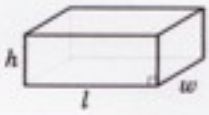
3. What size of box would you need to fit one whale?

4. Determine the dimensions of the box.

5. Imagine ten of these boxes, how much space would that fill?

6. How big is the house?

7.11.2: Formulas to Know!

Geometric Figure	Volume
Cylinder 	$V = (\text{area of base})(\text{height})$ $V = \pi r^2 h$
Sphere 	$V = \frac{4}{3}\pi r^3$ or $V = \frac{4\pi r^3}{3}$
Cone 	$V = \frac{(\text{area of base})(\text{height})}{3}$ $V = \frac{1}{3}\pi r^2 h$ or $V = \frac{\pi r^2 h}{3}$
Square-based pyramid 	$V = \frac{(\text{area of base})(\text{height})}{3}$ $V = \frac{1}{3}b^2 h$ or $V = \frac{b^2 h}{3}$
Rectangular prism 	$V = (\text{area of base})(\text{height})$ $V = lwh$
Triangular prism 	$V = (\text{area of base})(\text{height})$ $V = \frac{1}{2}blh$ or $V = \frac{blh}{2}$

OCTOBER 2007

7.11.3: Shapes to Go!

STATION 1

Part A

Using an Interactive White Board or laptop, you will be investigating the volume of a rectangle.

GETTING STARTED!
(i) Open the website

11Hhttp://www.learner.org/interactives/geometry/
(ii) Click on the '*Surface Area and Volume'* Tab

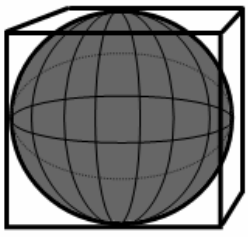
Read through the introduction and then answer the questions provided.

When finished, scroll down and select the 'Find Volume of Another Prism' option.
Fill in the chart provided below.

Prism	# of unit cubes forming the base	Layers needed to fill prism	Volume of prism
1			
2			
3			
4			

Part B

Determine the volume of empty space that is in the box that holds exactly a basketball ball with a diameter of 18 inches.



7.11.3: Shapes to Go!

STATION 2

Your goal is to show how the volume of a cone is related to the volume of a cylinder.

Your task:

1. Compare the base of the cone with the base of the cylinder. What do you notice?

2. Compare the height of the cone to the height of the cylinder. What do you notice?

3. How many times do you think you would be able to fill the cone with water and pour it into the cylinder before it overflows? Fill in the blanks below. Fill in the bolded components after you perform the experiment.

Guess: _____ **Actual:** _____

Therefore, the volume of a cylinder is _____ times greater than the volume of a cone.

LETS TRY IT!

i. Fill the cone full with water.
ii. Empty the water from the cone into the cylinder.
iii. Repeat until the cylinder is completely full (keep track of how many times it takes).

4. From your findings, come up with a formula for the volume of a cone using the volume of a cylinder as a base.

7.11.3: Shapes to Go!

STATION 3

Your goal is to show how the volume of a square-based pyramid is related to the volume of a cube.

Your task:

1. Compare the base of the cube with the base of the pyramid. What do you notice?

2. Compare the height of the cube to the height of the pyramid. What do you notice?

3. How many times do you think you would be able to fill the pyramid with water and pour it into the cube before it overflows? Fill in the blanks below. Fill in the bolded components after you perform the experiment.

Guess: _____ **Actual:** _____

Therefore, the volume of a cube is _____ times greater than the volume of a pyramid.

LETS TRY IT!

i. Fill the pyramid full with water.
ii. Empty the water form the pyramid into the cube.
iii. Repeat until the cube is completely full (keep track of how many times it takes).

4. From your findings, come up with a formula for the volume of a pyramid using the volume of a cube as a base.

7.11.3: Shapes to Go!

STATION 4

Imagine a steaming hot summers day and you run into the house after a long bike ride. You rush to the kitchen and open the cupboard to see only two glasses remaining. One is tall and thin and the other is short and wide. You are so relieved because, thanks to your math classes, you are confident that you can choose the glass that holds the most amount of juice.

1. Take a look at the glasses at your station. Which glass would you choose to quench your thirst? Using what you have learned about the volume of 3-D objects, justify your choice.

LETS EXPERIMENT!

i. Fill the taller glass to the top with water.
ii. Transfer the water from the taller glass to the shorter glass.

Are you surprised at what you see?

2. Using the measurement device provided, calculate the volume of both the tall and short glasses.

3. Compare your height and radius measurements of the glasses.
   a) What do you notice?

   b) Does height or radius have a greater effect on the volume of a cylinder? Why?
   (HINT- Refer to the volume formula for a cylinder)

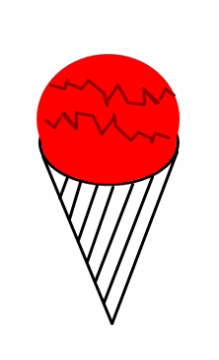
4. Most people would say that the volume of the taller glass exceeds the volume of the shorter glass. Why might they have this perception?

7.11.4: Two Shapes Are Better Than One

Solve **two** of the following three problems. Please show all of your work.

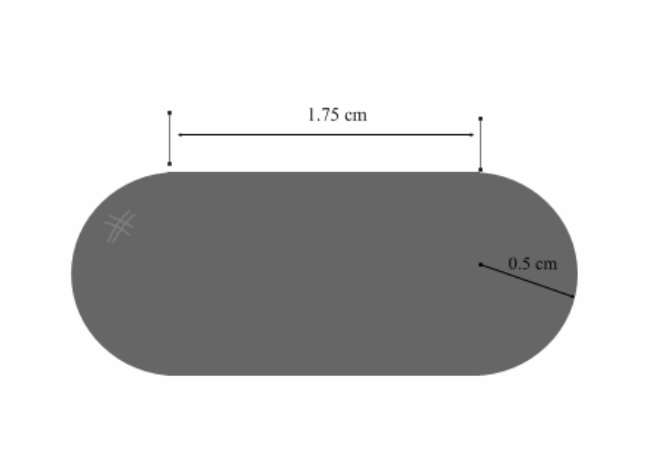
Problem 1

Determine the volume of ice-cream if the diameter of the scoop is 10 cm and the height of the cone is 20 cm. What possible assumptions are made when solving this problem?



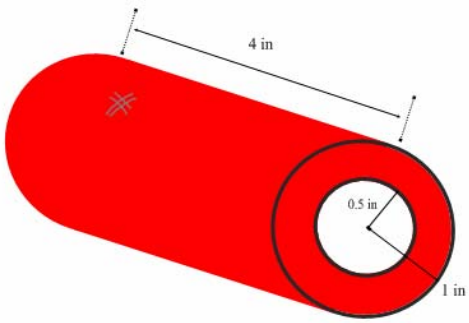
Problem 2

Determine the volume of medicine that will fill the following capsule. What possible assumptions are made when solving this problem?



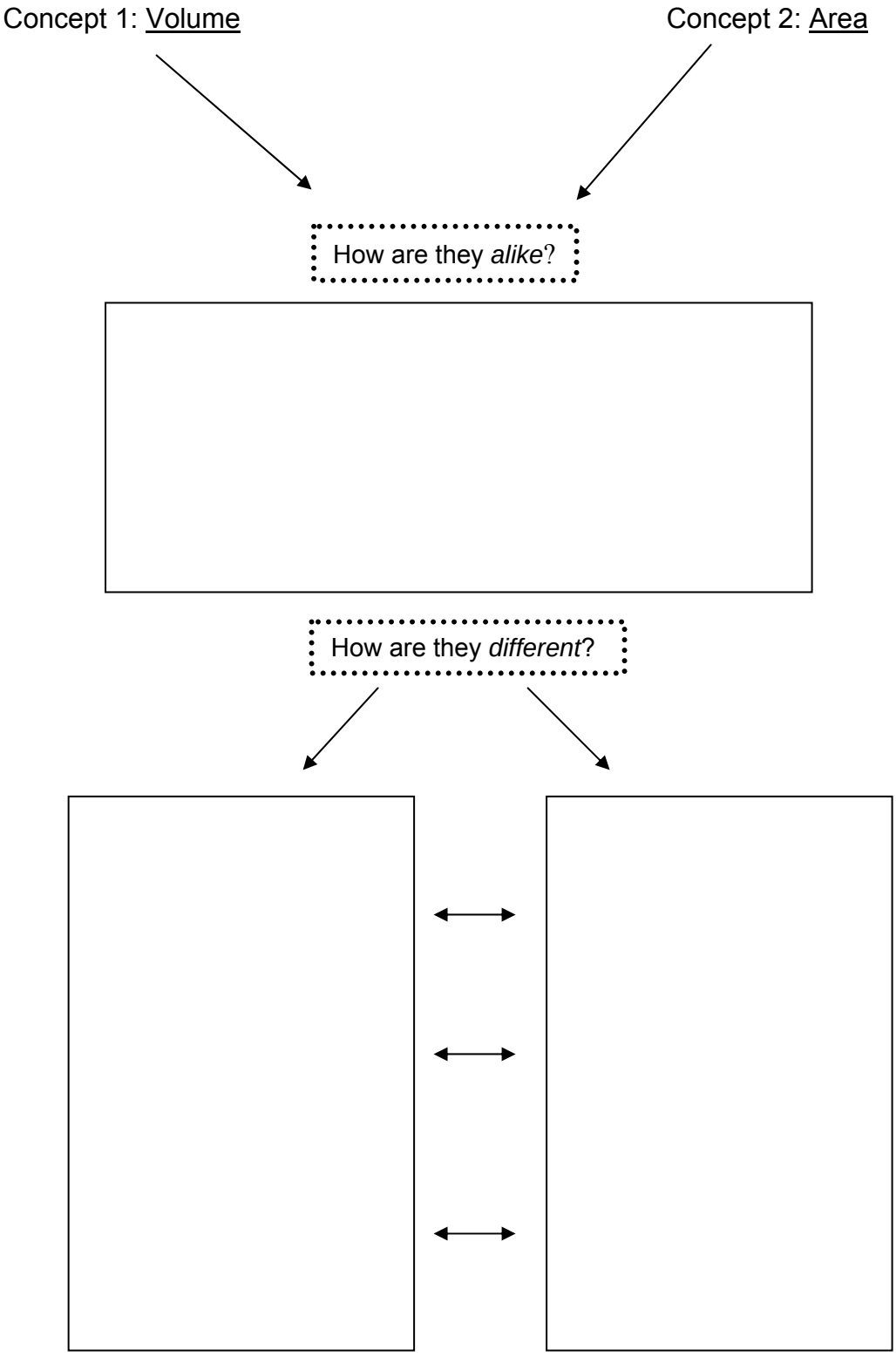
Problem 3

Determine the volume of cake that is surrounding the cream filling.



7.11.5: Mega Mind Map!

Comparing Concepts- Volume & Area



7.11.6: Teacher Notes

The following is a list of materials for each station of the Carousel:

STATION 1

- Laptop with internet access
- Interactive White Board (optional)

STATION 2

- GeoSolids 3D cone
- GeoSolids 3D cylinder
- Water
- Food colouring (optional)

IMPORTANT NOTE: The base of the cone and cylinder must be the same dimensions (identical radius).

STATION 3

- GeoSolids 3D square- based pyramid
- GeoSolids 3D cube
- Water
- Food colouring (optional)

IMPORTANT NOTE: The base of the pyramid and cube must be the same dimensions (identical length).

STATION 4

- A tall glass with approximate dimensions: radius- 1.5 inches, height- 8 inches
- A short glass with approximate dimensions: radius- 2 inches, height- 5 inches
- A ruler or other measuring device
- Water
- Food colouring (optional)

Unit 7: Day 12: Pump Up the Volume!

MFM2P

Minds On: 5

Action: 60

Consolidate: 10

Total=75 min

Description/Learning Goals

- Solve problems involving the volume of prisms, pyramids, cylinders, cones, and spheres, including combinations of these figures, using the metric or imperial system, as appropriate.

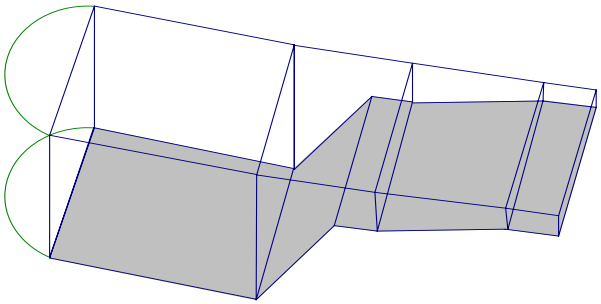
Materials

- BLM 7.12.1, BLM 7.12.2, BLM 7.12.3 (teacher notes)

			Assessment Opportunities
Minds On…	**Whole Class → Summarizing/Brainstorming** Have students share and clarify the highlights of their mind map activity. Discuss how the mind map could be used to help them solve problems involving volume and area. Lead students into a brainstorming session that explores what the side view of an in-ground pool would look like. On the board, have students draw different types of side profiles of pools that they have seen or gone swimming in. These can be residential pools or municipal pools.		Students should be prepared to make necessary connections for solving more than two 3-dimensional objects in a problem. *Teacher Tip:* When assigning groups, assign a broad spectrum of abilities to each group. As students work, ensure that units are being properly converted from metric units into feet when necessary. Students may need some help with the diagram in step 1 of BLM 7.12.2. See BLM 7.12.3 (teacher notes) for drawing and solutions to problems.
Action!	**Pairs → Exploration** In pairs, students will work through BLM 7.12.1. Circulate to ensure each pair understands the break-up of the pool into its basic 3-dimensional shapes. Also note that question 4 requires the conversion of metric units into feet. Students might break-up the pool by eliminating any trapezoidal prisms. If they choose this method, there is a blank spot in the chart in BLM 7.12.1 to include the additional shape. When each pair has determined the total volume, check to see if they calculated the answer to be 261 021 ft^3. With this answer, each group can begin working on BLM 7.12.2. **Mathematical Process (Problem Solving)/Learning Skills (Teamwork)/ Observation/ Anecdotal Comments:** Assess students' ability to see the parts of a whole object concept. Circulate to observe and take notes of student participation/contribution in a team when solving problems.		
Consolidate Debrief	**Whole Class → Lets Pool Our Answers!** Sketch the chart from question 5 of BLM 7.12.1 on the board. Assign each pair of students a letter A-G. Allow them to put their solution in the corresponding square, labeled A-G, on the board. Work as a class to show that the volume of the individual 3-D shapes A-G, sum to the total volume of the pool. Students who solved the problem by eliminating trapezoidal prisms can explain their approach. Discuss how and why this method has the same solution.		
Concept Practice	**Home Activity or Further Classroom Consolidation** Assign the following creative activity: Design your uniquely shaped dream pool. Describe how you would go about finding the volume of the pool. Note that you do not have to do any calculations, so be creative!		

7.12.1: Pumping Up the Volume

Solving problems dealing with three-dimensional objects is similar to pulling a puzzle apart; pieces need to be thought of separately. The following swimming pool problem illustrates this.

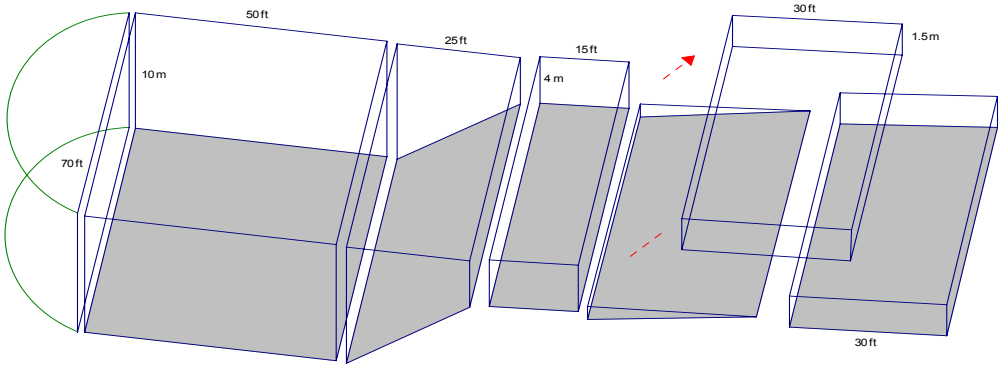


Part A: Pool Volume

Determine the volume of water, in cubic feet, needed to fill the above municipal swimming pool.

Steps

1. Break up your three-dimensional object into the basic objects; such as cylinders, rectangular and triangular prisms etc. This will make determining the volume of these objects much simpler.



2. One method of breaking up the object is shown above. The pool has been broken into seven objects. How many other ways could you break up the pool?

3. Label each section of the pool shown in step 1 above with the letters A, B, C, D, E, F and G, and identify the geometric shapes.

A: _____ B:_____ C:_____ D:_____

E: _____ F:_____ G:_____

4. The problem asks you to determine the volume in cubic feet. Are there any lengths that need to be converted? If so, convert them.

7.12.1: Pumping Up the Volume (Continued)

5. Calculate the volume for each section. Use the space below to organize your work.

Object A	Object B
Object C	Object D
Object E	Object F
Object G	

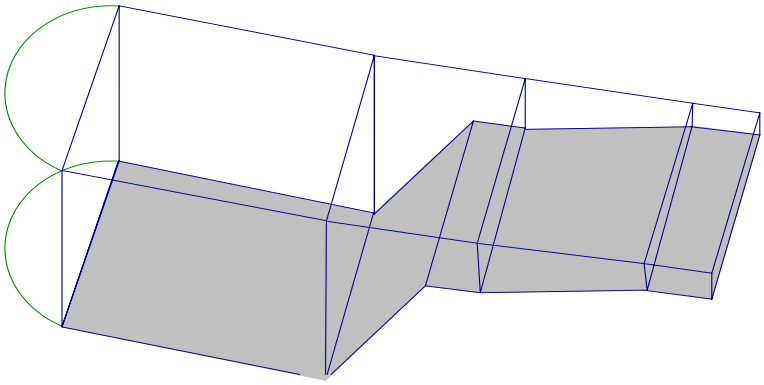
6. Determine the total volume of the swimming pool, in cubic feet.

7.12.2: Pool Management

The building code indicates that when filling swimming pools, there must be a 6-inch gap between the water level and the top of the pool (at ground level). Using your results from '**7.11.1: Pumping Up the Volume',** calculate the volume of water that is needed to fill the pool so that it can meet the building code.

Steps

1. Sketch the volume of the space that will not have water.



2. Label the dimensions needed.

3. Calculate the total volume of water that will be in the pool if the building code is to be followed.

4. The chlorine to water ratio is 130 grams to 10 000L. If chlorine is purchased in 130 gram bags, determine the amount of chlorine that is needed, in kilograms, to chlorinate the pool ($1\ ft^3 = 28.3168$ Litres).

7.12.3: Pool Management - Teacher Notes

BLM 7.12.1

4. The problem asks you to determine the volume in cubic feet. Are there any lengths that need to be converted? If so, convert them.

$10m \cong 32.8\ ft$

$4m \cong 13.1\ ft$

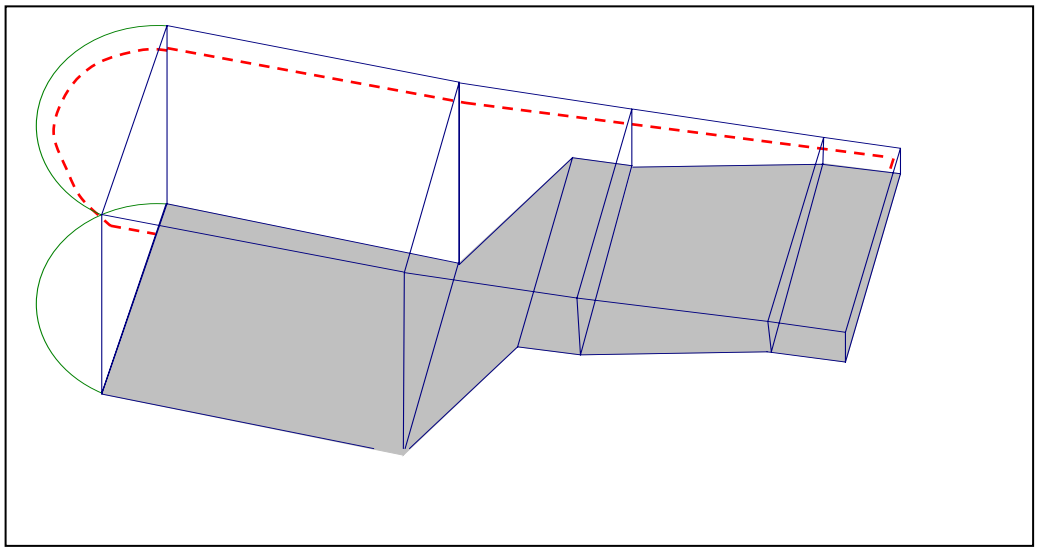
$1.5m \cong 4.9\ ft$

5.

Object A 63 114 ft^3	Object B 114800 ft^3
Object C 40162.5 ft^3	Object D 13755 ft^3
Object E 10290 ft^3	Object F 8610 ft^3
Object G 10290 ft^3	

6. 261 021 ft^3

BLM 7.12.2



3. 261 021.5 – 6212.11 ft^3 = 254 809.39 ft^3

4. 130 grams: 10 000L
Since 28.3168L= 1ft^3
Thus 130g = 353.14 ft^3
Number of 130 grams of chlorine = 254809.39 ÷ 353.14 = 721.55 of 130 gram bags of chlorine
Thus 721.55 × 130 grams = 93801.95 grams of chlorine

Therefore, 93.8 kg of chlorine is needed

Unit 7: Day 13 : Solving for a Variable in Measurement Problems

MFM2P

Minds On: 15 Action: 50 Consolidate: 10 Total=75 min	**Description/Learning Goals** • Activate prior knowledge about the concepts of a variable and solving for a variable in the first degree. • Determine the value of a variable in the first degree in the context of a problem, using a measurement formula. • Solve related problems.	**Materials** • BLM 7.13.1, BLM 7.13.2, BLM 7.13.3 • Calculators

				Assessment Opportunities
Minds On…	**Pairs → Exploration** Students will be deciding on the steps required to isolate a given variable in two-step, first degree equations. BLM 7.13.1 has six different equations with twelve steps written below. Students must decide which steps belong with which equation and then decide on the order that the steps should be written under the equation. Keep in mind that the goal of the activity is to have the students record the steps that would be necessary to isolate the variable.			
Action!	**Pairs → Investigation** Using BLM 7.13.2, students will be attempting to isolate the variable in six different situations, each of which is in the context of a measurement problem. The students will need to decide on the given information and substitute it into the proper measurement formula. Then they will have to isolate the unknown variable. **Mathematical Process (Selecting Tools and Computational Strategies)/ Activity/Observation**: Students will be selecting appropriate computational strategies in order to isolate a variable. Students should be monitored to see if they are following the proper steps to isolate a variable.			
Consolidate Debrief	**Whole Class → Discussion** Teacher should have an example on the board that requires the isolation of a variable. Pose Questions: How many steps it is going to take to isolate the variable? How do you know [however many operations are in the equation]? Which steps must be done first, …second,…third…in order to isolate the variable?			*Teacher Tip:* BEDMAS backwards is one way that students can remember the order of steps to isolate for a variable
Concept Practice	**Home Activity or Further Classroom Consolidation** Students will choose to solve one out of the four problems provided in the BLM 7.13.3 R.A.F.T activity. They should be encouraged to choose based on their interests and comfort level with the problem. **Learning Skills (Work Habits)/ Homework Check/ Anecdotal Comments:** These questions can be collected and evaluated or taken up as a class with a quiz to follow.			R.A.F.T activities are effective forms of differentiated instruction.

7.13.1: Feeling Isolated

Look at the following equations. Next, look at the steps that are at the bottom of the page. You need to put the steps under the correct equation, in the correct order. The steps should be listed in such a way that you would be able to isolate the variable by following these steps.

Equation: 22 = 3x + 7	**Equation: 6t – 8 = 34**
Equation: m/2 + 6 = 18	**Equation: -21 = 3 – 8z**
Equation: 4k – 5 = -25	**Equation: x/4 + 9 = -1**

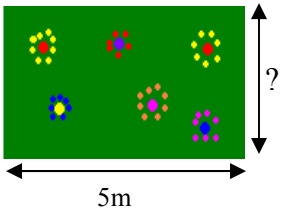
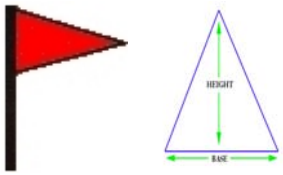
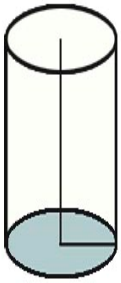
Steps

Subtract 3	Divide by 3
Add 8	Subtract 7
Multiply by 2	Subtract 6
Subtract 9	Divide by negative 8
Divide by 4	Multiply by 4
Divide by 6	Add 5

7.13.2: Solving Measurement Problems

The area of a rectangle is 72 cm^2. The length is 3 cm. What is the width?	The area of a triangle is 32 cm^2. The base of the triangle is 4 cm. What is the height?
Here is the formula for the area of a trapezoid: $A = [(a + b) \times h] \div 2$ If the Area is 19.5 cm^2; a = 7 cm and b = 6 cm, what is the height of the trapezoid?	The volume of a cylinder is given by the formula $V = \pi r^2 h$. If the radius of the cylinder is 8 inches and the volume is 2411.52 in^3, what is the height of the cylinder?
The volume of a rectangular prism is 120 cm^3. The length of the base is 6 cm and the height of the prism is 10 cm. What is the width of the base of the prism?	The Volume of a square-based pyramid is given by the formula $\frac{1}{3}(l \times w) \times h$ [where l is the length of the square base, w is the width of the square base and h is the height of pyramid]. If the base has a side length of 6 cm, and the volume is 396 cm^3, what is the height?

7.13.3: Don't Feel Isolated

Role	Audience	Format	Topic
Landscape Architect	Customer	Mrs. Rose wants a rectangular shaped garden planted off the back of her house. She can only afford to plant flowers in an area of $15m^2$. She really wants the garden to be 5m in length. How far from the house will the garden stick out?	Rectangle 
School Sports Team Manager	School Council	You are designing a flag for the upcoming Football Game. Tradition says that the flag must be triangular. The base of the flag has to be 15 inches and you only have enough material to cover an area of 150 square inches. What will be the height of the flag according to these restrictions?	Triangle 
Packaging Designer	Candy Manufacturer	A brand new sugary treat has been invented. The volume of one candy is 1.6 cm^3 and its radius is 1 cm. How long would you need the cylindrical package of candy to be if you need 20 candies to fit in one tube?	Cylinder 
Carpenter	Contractor	An entertainment unit needs to be built for a new home. The cabinet has to have a volume of 1.01 m^3 so it can hold the TV and stereo that the owners recent purchased. In order to fit the space provided, both the height and length of the unit have to be1.2 m. How far will the unit stick out from the wall when complete?	Rectangular Prism