Evidence 2

Stage 5.1 Year 9 Area and Surface Area Unit Overview

Area and Surface Area Year 9 5.1 Unit Overview		
Working mathematically outcomes: • uses appropriate terminology, diagrams and symbols in mathematical contexts MA5.1-1WM • selects and uses appropriate strategies to solve problems MA5.1-2WM • calculates the areas of composite shapes, and the surface areas of rectangular and triangular prisms MA5.1-8MG		
Duration: 12 x 60 minute lessons		
Lesson No.	Content / Syllabus Outcomes	Teaching Strategies
1	Stage 4 Outcomes Working Mathematically: – Uses formulas to calculate the areas of quadrilaterals and circles, and converts between units of area MA4-13MG – Applies Pythagoras' theorem to calculate side lengths in right-angled triangles, and solves related problems MA4-16MG Content outcomes: – Choose appropriate units of measurement for area and convert from one unit to another – Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving – Find areas of trapeziums, rhombuses and kites – Use Pythagoras' theorem to find the length of an unknown side in a right-angled triangle	1. **Formative Assessment** Discussion questions: 'What do we know about area? What does it measure?' Write / draw up ideas brainstormed by students and include: • The concept of 2D shapes • Units of measurement and the correct way to read them e.g. cm^2 is read as 'square centimetre(s)' • What information is needed in order to calculate area and what other strategies might we use in order to determine this information (e.g. Pythagoras theorem). • Area formulas students may remember 2. **Literacy strategy** Hand out word bingo (see Appendix A) and glossary table (see Appendix B) 3. **Formative Assessment** Revision worksheet (see Appendix C) 4. **Class handout** – Area formulae (see Appendix D) Go through handout with the class 5. Example questions - Calculating areas of trapeziums, rhombuses and kites
2	Stage 4 outcomes – Find areas of rectangles, triangles and parallelograms – Find areas of trapeziums, rhombuses and kites – Select and use the appropriate formula to find the area of any of the special quadrilaterals – Find the areas of quadrants, semicircles and sectors	1. Start-up question on area e.g. calculate the area of a trapezium 2. Examples on calculating the area of a sector and special quadrilaterals 3. **Area Worksheet** (see Appendix E)

Observational technique aimed at identifying students' prior knowledge and readiness to learn

This column shows my ability to select and organise content into a learning program

3	– Identify different possible dissections for a given composite figure and select an appropriate dissection to facilitate calculation of the area – Calculate the areas of composite figures by dissection into triangles, special quadrilaterals, quadrants, semicircles and sectors	1. **Discussion** Show diagram of a house floor plan (see Appendix F) and ask the class how they would find the total area of the floor in order to lay carpet down. Use either an overhead projector or Smart Board so students can come to the board and draw possible dissections over the diagram. 2. **Smart Notebook file** (see Appendix G) - Examples of calculating area of composite shapes. - Ask students to come to the board and draw possible dissections 3. **Practical Activity** – Composite Shapes (see Appendix H) **Differentiation**: The activity caters for needs of students who are typically visual or kinaesthetic learners.
4	– Identify different possible dissections for a given composite figure and select an appropriate dissection to facilitate calculation of the area – Calculate the areas of composite figures by dissection into triangles, special quadrilaterals, quadrants, semicircles and sectors – Apply properties of geometrical shapes to assist in finding areas of composite figures – Calculate the area of an annulus	1. Start-up activity **Think-Pair-Share:** calculate the area of a composite figure by using geometrical properties and the subtraction of simpler areas. Students are to: - Think about the problem independently - Pair with another student to brainstorm strategies - Share with the class ideas of how to solve the problem. 2. Example questions -Calculating the area of composite figures using both addition and subtraction of simple areas. - Encourage students to consider both methods, addition and subtraction of simpler figures, and determine the most effective strategy - Define an annulus 3. **Textbook Exercise** (see Appendix I) Select appropriate questions for students according to time **Differentiation**: Advanced students may be extended by deriving a formula for calculating the area of an annulus given its diagram. Provide a scaffold on the board for finding the area of composite figures to assist students who are struggling.
5	– Solve a variety of practical problems involving the areas of quadrilaterals and composite shapes	1. Problem Solving – **SMART Notebook File** (see Appendix J) **Literacy strategy:** Example of worded problem on the board. Explain Newman's five basic processes of solving a worded problem and describe useful steps to assist students in solving them. Use the duel page display in SMART Notebook to show these steps

Provides an opportunity for inquiry-based learning by beginning with a real-life scenario and posing a problem

Effective use of ICT

Caters for visual learners

Caters for kinaesthetic learners

Use as a means of formative assess.

This activity develops students' literacy skills and problem-solving skills

Standard 1.5

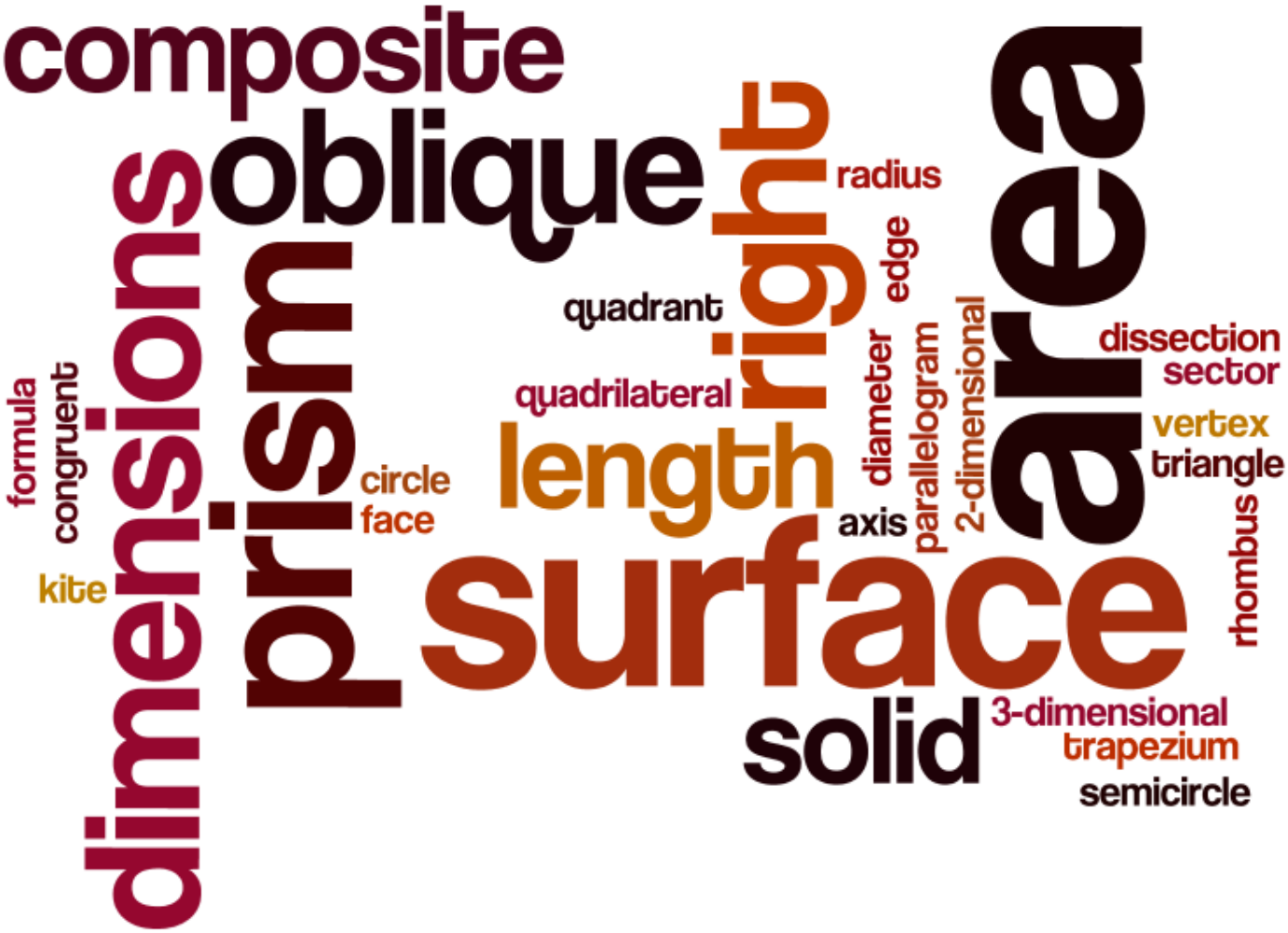
		while analysing each example question with the class. Ask students to share their steps with class. 2. **Textbook Exercise** – Area Application (see Appendix K) **Differentiation**: Assist students with answering practical problems using Newman's prompts (see Appendix L) ← Improves students' literacy skills
6	– Introduction to surface area – Identify the edge lengths and the areas making up the surface area of rectangular and triangular prisms – Distinguish between right and oblique prisms Students are engaging in experiential learning by investigating surface area hands-on through a process of trial and error then reflecting on their experience	1. **Group investigation activity** – Introduction to Surface Area (see Appendix M) **Differentiation**: Group students of similar ability and provide extra support or guidance to those groups who need it. Encourage peer teaching within groups. Extension question is provided to challenge advanced students. 2. **Formative Assessment:** Class discussion on the investigation activity - Groups share strategies and are encouraged to reflect on what worked and what didn't - Introduce the concept of surface area and how it's calculated - Define the net of a solid and demonstrate cutting one of the tissue boxes to show students its net 3. Define types of 3D solids and properties of prisms – Right and oblique prisms – Define edge lengths and faces, vertices 4. Ask students to bring in a cardboard example of a 3D solid from home to class next lesson e.g. tissue boxes, cereal boxes, toothpaste packets, Toblerone packets etc.
7	– Identify the edge lengths and the areas making up the 'surface area' of rectangular and triangular prisms – Visualise and sketch the nets of right prisms – Visualise rectangular and triangular prisms in different orientations	1. Revise properties of 3D shapes Define words to describe the different faces of solids e.g. top, front, sides and bottom 2. **Pair activity** (see Appendix N) ← Allows for peer support Investigating 3D solids 3. **Discussion** ← Students practise communication skills Ask pairs to share their work with the class to show all students nets of various solids Highlight that there may be several ways to draw a net of the same solid 4. **ICT activity** (see Appendix O) Quick interactive game for students to investigate nets and revise different views of an object
8	– Identify the edge lengths and the areas making up the 'surface area' of rectangular and triangular prisms	1. Example questions Calculating the surface area of prisms using their nets. 2. **Worksheet** – Solids and Nets (see Appendix P)

	– Visualise and name a right prism, given its net – Recognise whether a diagram represents a net of a right prism – Visualise and sketch the nets of right prisms – Find the surface areas of rectangular and triangular prisms, given their net – Calculate the surface areas of rectangular and triangular prisms	3. **Formative Assessment** – Exit Slip (see Appendix Q)
9	– Find the surface areas of rectangular and triangular prisms, given their net – Calculate the surface areas of rectangular and triangular prisms	1. Example questions Calculating the surface area of rectangular and triangular prisms 2. **Geogebra Activity** (see Appendix R) ICT resource
10	– Apply Pythagoras's theorem to assist with finding the surface areas of triangular prisms – Solve a variety of practical problems involving the surface areas of rectangular and triangular prisms	1. Example question Applying Pythagoras' theorem to assist with finding the surface area of a triangular prism 3. Provide approx. 3 similar questions on the board for students to answer 4. Example question - Practical problem involving surface area - Reinforce literacy - Revise helpful problem solving steps 3. **Textbook exercise** (see Appendix S) Practical problems involving surface area
11	– Solve a variety of practical problems involving the surface areas of rectangular and triangular prisms – Adjustment lesson	1. Students to complete the textbook exercise on practical problems involving surface area 2. Allowance for disruptions to schedule. 3. Students can use this time to revise the topic and complete any unfinished class work. 3. Groups may work together to create summary posters. ← Opportunity to address any misconceptions
12	Summative Assessment	**Summative assessment**: Topic test (see Appendix T)

APPENDIX A

Teacher Instructions - Word Bingo

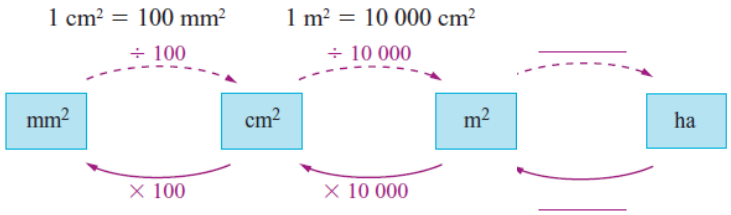
- Each student receives the handout below to glue in their workbook at the beginning of the topic.
- Students cross off each term as they are brought up and discussed in class.
- Every time a student crosses a word off their bingo list, they must write the word's definition (or draw a diagram) in their glossary table.
- Once a student has crossed off all terms, they notify the teacher in order to win the topic's bingo game and collect their prize!



APPENDIX C

Revision Exercise

1. Complete the following diagram.



2. Use the diagram to convert between the following measurements:

a) 8 m^2 to cm^2
$= 8 \times 10\,000$
$= \_\_\_ cm^2$

b) 0.04 cm^2 to mm^2
$= \_\_\_ \times \_\_\_$
$= \_\_\_ mm^2$

c) 14 000 mm^2 to cm^2
$= 14\,000 \div \_\_\_$
$= \_\_\_ cm^2$

d) 530 cm^2 to m^2
$= 530 \div \_\_\_$
$= \_\_\_ m^2$

3. Complete these conversions.

a) 0.06 cm^2 = _____ mm^2

b) 182 000 cm^2 = _____ m^2

c) 12.2 m^2 = _____ cm^2

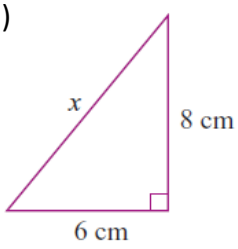
d) 0.23 ha = _____ m^2

e) 9 000 000 m^2 = _____ ha

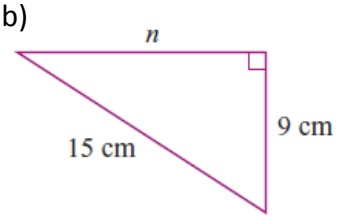
f) 0.25 m^2 = _____ mm^2

4. Using Pythagoras' Theorem, find the length of the unknown side.

a)

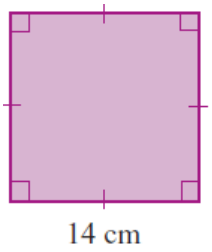


b)

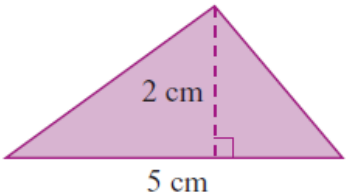


5. Identity each shape and calculate its area. Answer the following in your workbook.

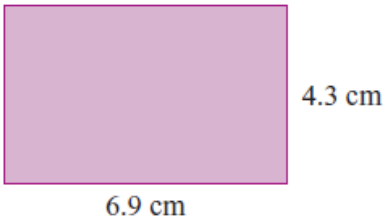
a)



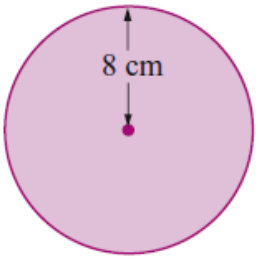
b)



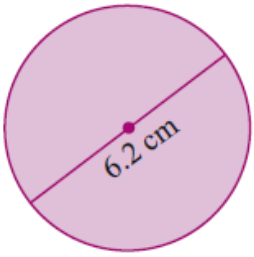
c)



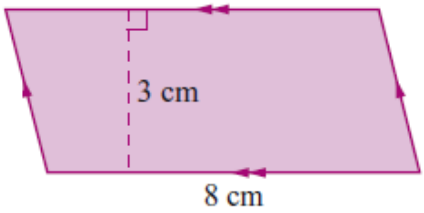
d)



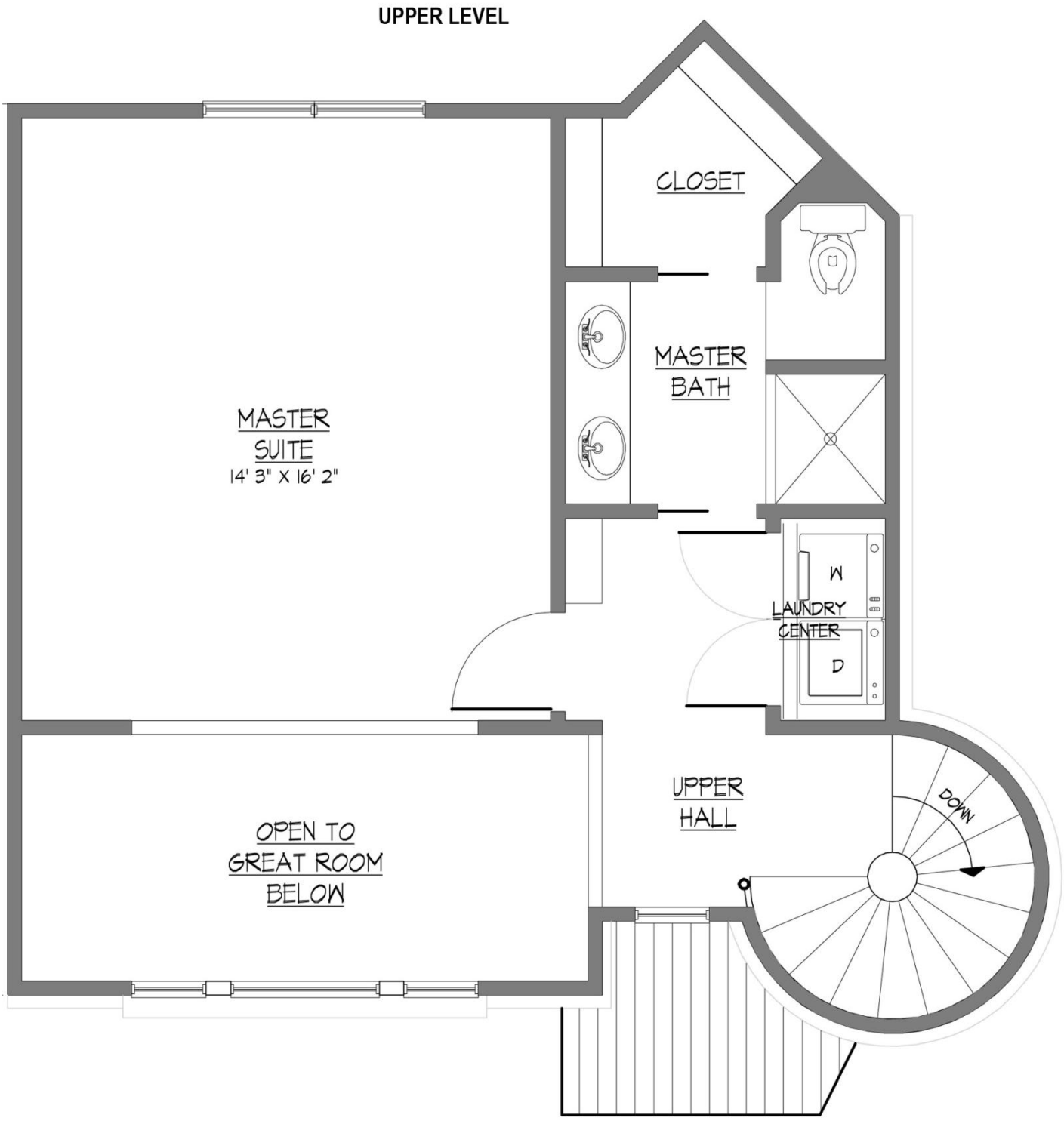
e)



f)



APPENDIX F


UPPER LEVEL
CLOSET
MASTER
BATH
MASTER
SUITE
14' 3" X 16' 2"
W
LAUNDRY
CENTER
D
UPPER
HALL
DOWN
OPEN TO
GREAT ROOM
BELOW

APPENDIX H

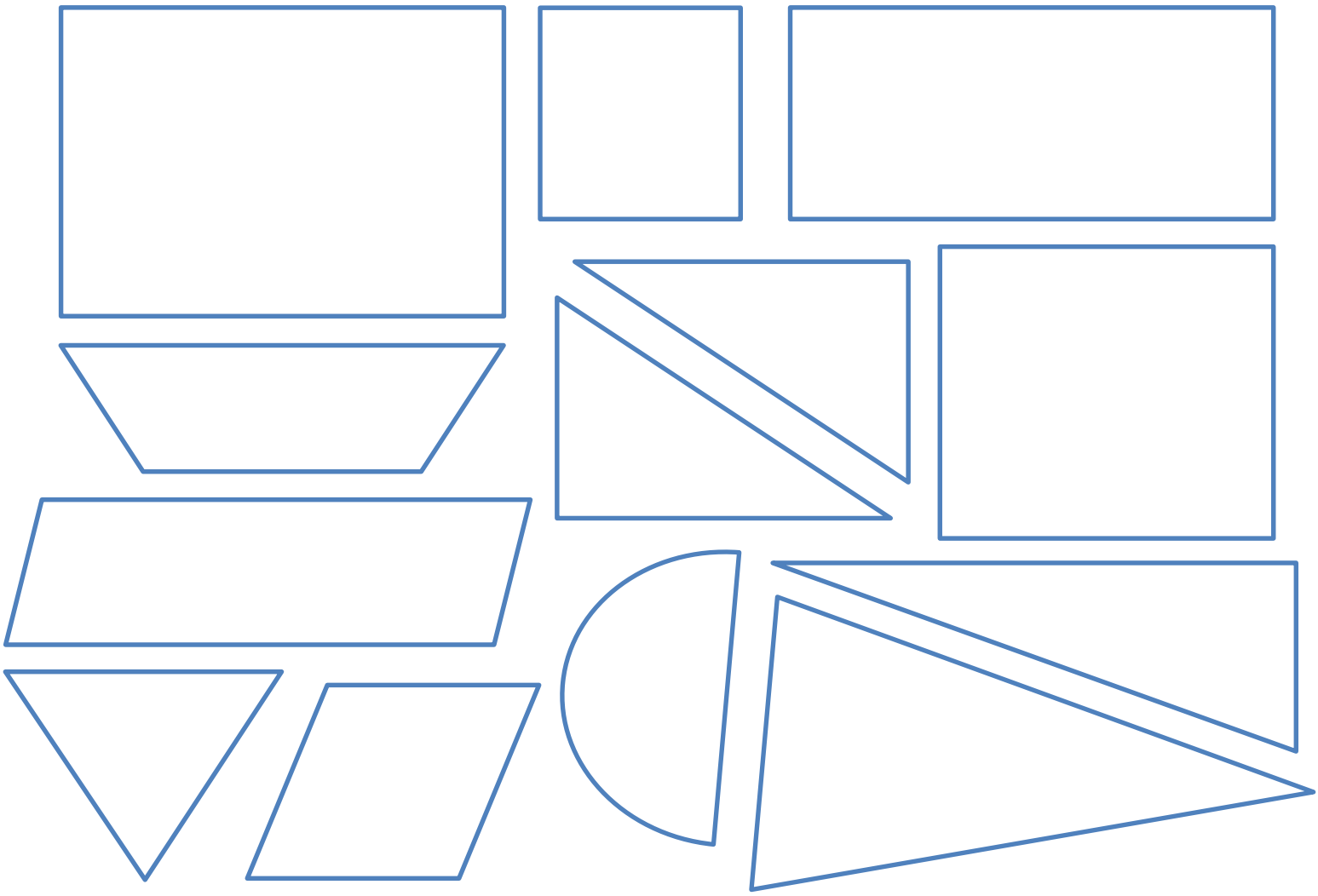
Teacher Instructions

Materials:

- Laminated/cardboard 2D shape cut-outs of various sizes. Include squares, rectangles, triangles, parallelograms, rhombuses, circles and trapeziums template provided below
- Centimetre grid paper

Activity:

Distribute three shapes to each student and ask them to use their shapes to make a composite figure. Then have students trace their figures onto grid paper so that they can find the area of their composite figure in square centimetres. Ask the class to stand up and find a partner around the room to swap figures. Students can then calculate the area of their partners' composite figure. Repeat, so that students calculate the area of several composite figures made by other students in the class.



APPENDIX L

The Australian educator Anne Newman suggested five significant prompts to help determine where errors may occur in students' attempts to solve written problems. Assist students by asking the following questions as they attempt the problems in the textbook exercise: Area Applications (Appendix K).

1. **Please read the question to me. If you don't know a word, leave it out.**

2. **Tell me what the question is asking you to do.**

3. **Tell me how you are going to find the answer.**

4. **Show me what to do to get the answer. "Talk aloud" as you do it, so that I can understand how you are thinking.**

5. **Now, write down your answer to the question.**

These five questions clearly link to the five processes involved in solving a written mathematics problem that were explained to the class:

1.Reading the problem	Reading
2. Comprehending what is read	Comprehension
3. Carrying out a transformation from the words of the problem to the selection of an appropriate mathematical strategy	Transformation
4. Applying the process skills demanded by the selected strategy	Process skills
5. Encoding the answer in an acceptable written form	Encoding

NSW Department of Education and Communities, 2011, *Curriculum Support*, accessed 13 May 2014, <http://www.curriculumsupport.education.nsw.gov.au/secondary/mathematics/numeracy/newman/index.htm>.

APPENDIX M

SURFACE AREA: GROUP INVESTIGATION ACTIVITY

Materials needed:

- Tissue box
- Wrapping paper
- Scissors
- Ruler

Task:

You have been invited to a birthday party and must wrap your present with no overlap of paper. In groups of 3-4 students, work together to find out exactly how much wrapping paper is needed to wrap your present. You should express your answer in square centimetres.

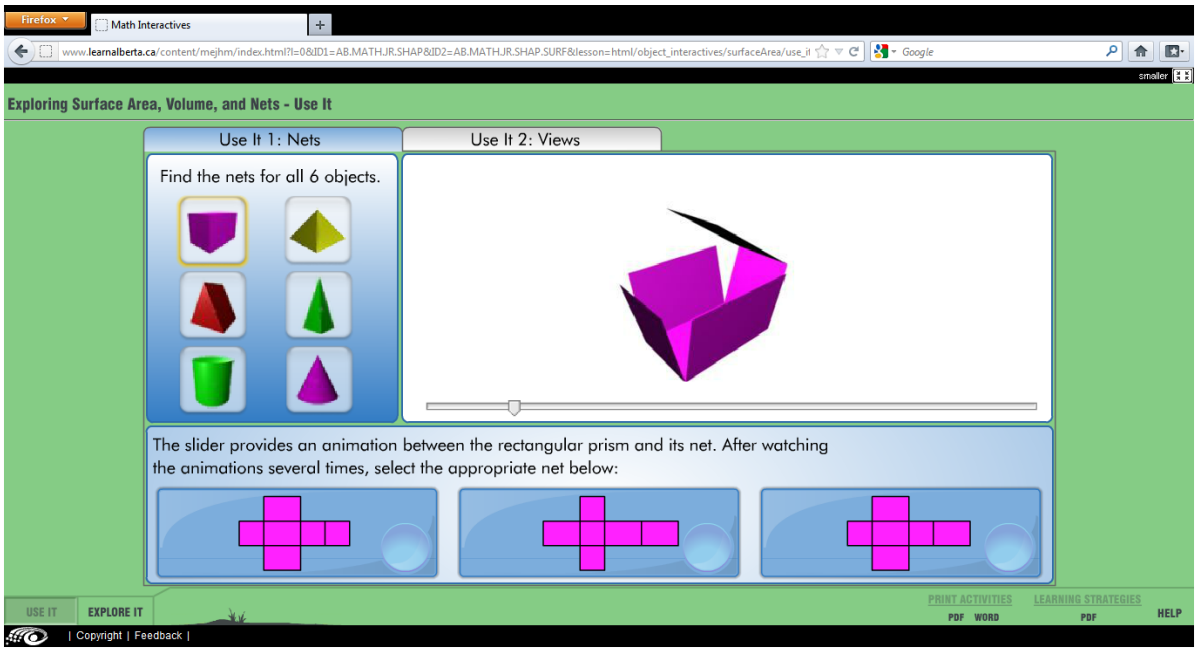
CHALLENGE QUESTION: Cut out the top lid of your tissue box so that you now have an open box. If you had to cover the entire tissue box again so that no cardboard was showing, calculate how much wrapping paper you would need.

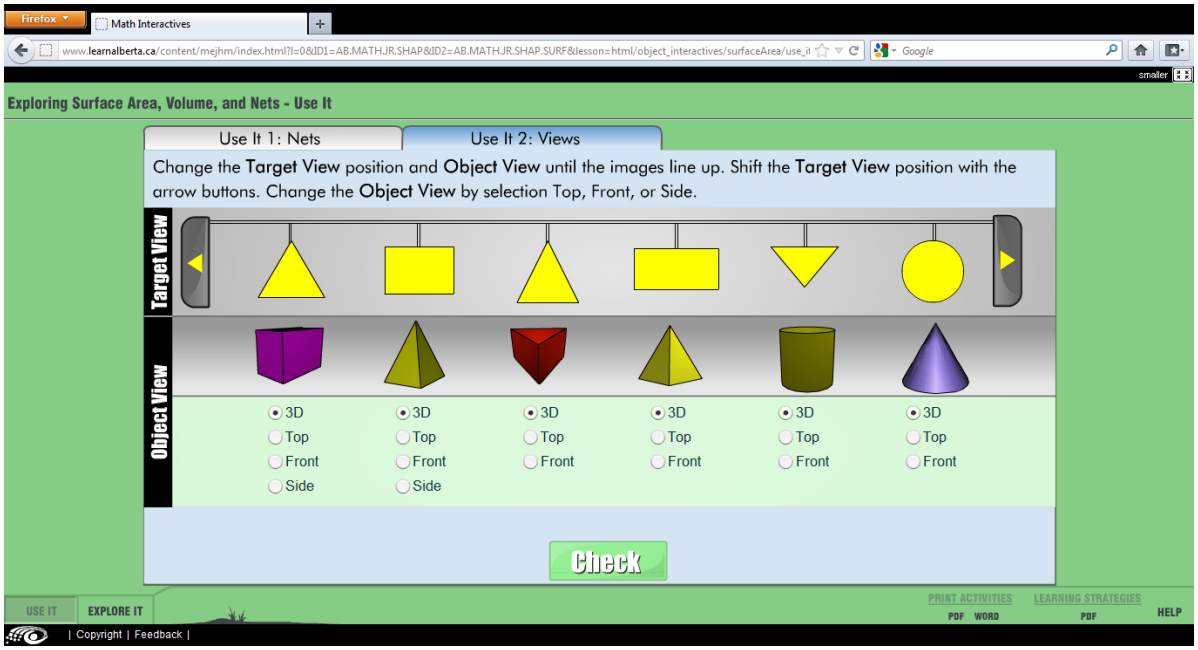
APPENDIX O

Please refer to email for the link to this activity.

Website: Maths Interactives > Shape and Space > Surface Area and Volume > Exploring Surface Area, Volume, and Nets (Object Interactive)

http://www.learnalberta.ca/content/mejhm/index.html?l=0&ID1=AB.MATH.JR.SHAP&ID2=AB.MATH.JR.SHAP.SURF&lesson=html/object_interactives/surfaceArea/use_it.html





APPENDIX Q

EXIT SLIP

Name: _____

One thing I learned today was…

_____

_____

_____

One thing I already knew…

_____

_____

_____

One thing I still want to learn more about…

_____

_____

_____

Please circle yes or no

I can easily match a solid to its net	YES / NO
I can visualise and sketch the net of a rectangular prism	YES / NO
I can visualise and sketch the net of most prisms	YES / NO
I know the difference between a right and oblique prism	YES / NO
I can calculate the surface area of a prism given its net	YES / NO