Numeracy Performance Standards Revision

Instructions for Field-Testing

Context

Over the past year, the Ministry has been working with math educators to update the BC Numeracy Performance Standards to ensure that they are aligned with the current curriculum, while continuing to build on the extensive work that many BC districts, schools, teachers, and inquiry groups have already done.

The revised standards will feature:

- One scale for each of grades 1-3; 4-6; 7-9; 10-12, with space to indicate the specific **strands** and **key concepts** that are being assessed in specific cases.
- Tasks/sample sets at each grade (we anticipate having a minimum of two tasks/student sample sets – and at least one of these will feature **number**)

Field-testing Procedures

Some tasks and samples have been developed as prototypes for field-testing. The prototypes start to show what the final product will look like. These tasks and student samples may or may not be selected for the final version of the standards. It is critical that these prototypes be field-tested by students and teachers.

We currently have prototypes available for Grades 1 to 9. Prototypes for Grades 10 to 12 will be forthcoming.

Each prototype includes:

(1) Quick Scale
(2) Designation of the key concepts involved
(3) Task description
(4) One sample at each of the four levels of performance
(5) The teacher's observations for each sample
(6) The small 'logo' form of the scale showing which level(s) each aspect was rated as.

- We need teachers and students to try the prototype tasks. For example, using one of the tasks with a class; then using the scale and samples to try to assess the results gives the best possible insight into how they are working. Another example is that a group of teachers get together to work through the prototype at their grade level as a form of Pro-D.

- Provide specific, concrete feedback. For example, if you don't agree with the placement of a sample, please be as specific as possible about why and where you think it should be rated. Use the attached *Prototype Feedback Questions* to provide focused feedback.

- Send your comments and any additional student exemplars from your field testing to the Ministry. We'd like to hear from you by **September 30, 2011**.

- These prototypes are being circulated as widely as possible, so please feel free to share them with others.

What's Next?

- We will be working on similar prototypes for grades 10, 11 and 12 and would welcome any contributions.

- We need to keep adding to the task/sample sets for Grades 1 to 9. We aim to have two sets per grade for the published materials eventually. We would welcome task/sample sets, especially in patterns and relations, shape and space, statistics and uncertainty.

- If you have something suitable, please either post it on the Moodle site at http://www.learnnowbc.ca/educators/default.aspx, or contact Jiemei Li at Jiemei.Li@gov.bc.ca or Nancy Walt at Nancy.Walt@gov.bc.ca

Numeracy Performance Standards Revision

Prototype Feedback Questions

1. What suggestions do you have about the use of the numeracy performance standards? Are these materials easy for teachers to use?

2. Are the rating scales easy to apply to samples of student work? What improvements are needed?

3. Is the task grade/age-appropriate? Provide your opinion and comments.

4. What suggestions do you have for improving the student samples in the prototype? Do you agree with the rating? If not, what is the rating and rationale for the rating?

5. Would you suggest other samples that better exemplify the performance levels?

6. Are these materials helpful to discuss with students and parents? In what ways?

7. Would you like to contribute new tasks/samples?

Please send your comments and materials by **September 30, 2011** to Jiemei Li

- by email at Jiemei.Li@gov.bc.ca
- by mail at: Student Assessment Branch, PO Box 9143 Stn Prov Govt
  Victoria, BC V8W 9H1

or post them on the Moodle at http://www.learnnowbc.ca/educators/default.aspx

Thank you!

Numeracy Performance Standards, Grade 9 Prototype

Quick Scale: Numeracy Performance Standards (Grades 7-9)

Task: _____ GRADE ____

Strand	Key concepts required by this task (see IRP p. 16)

	Not Yet Within Expectations	**Meets Minimal Expectations**	**Fully Meets Expectations**	**Exceeds Expectations**
Snapshot	• *Does not meet basic requirements of the task without close, ongoing assistance. No adequate explanation.*	• *Satisfies basic requirements for most parts of the task; some important aspect is flawed or incomplete. Partial explanation.*	• *Satisfies basic requirements for all parts of the task; reaches a reasonable solution. (may be minor flaws.)*	• *Thoroughly satisfies requirements of the task; solution is well-developed and justified; shows insight; often innovative.*
Concepts and Connections - recognizes the math; applies appropriate concepts [R] [V] [CN] - explains/demonstrates relevant concepts; makes connections [R]	• Does not identify or apply concepts and procedures needed • Does not show understanding of relevant concepts; explanations are incomplete or illogical	• Identifies/applies concepts/procedures needed for most parts of task (may not be best choice) • Shows partial understanding of relevant concepts; explanations may be incomplete	• Identifies/applies concepts and procedures needed for all parts of task • Shows understanding of relevant concepts; explanations are logical and complete	• Identifies/ applies a wide range of concepts and procedures including those that have not been recently taught • Shows thorough understanding; explanations are insightful
Problem-solving and reasoning -selects and uses appropriate strategies to analyze, solve and create problems [PS] [V] [T] - uses estimation strategies [ME] - verifies and justifies that results are reasonable [R]	• Does not use appropriate strategies to analyze and solve problems • No evidence of estimation strategies (answers are often highly improbable) • Does not verify results or solutions	• Uses some appropriate strategies to analyze and solve problems • Some evidence of estimation; may be somewhat ineffective (some answers reasonable) • May verify parts of results/solution; often needs direction	• Uses appropriate strategies to analyze and solve problems • Uses estimation strategies appropriately; most answers are reasonable • Verifies and justifies results or solutions (may be inefficient; imprecise)	• Uses highly effective, often innovative, strategies to analyze and solve problems • Uses estimation strategies effectively; answers are reasonable (high precision) • Verifies and justifies results or solutions efficiently; precise
Procedures - accurate and precise in recording, substitutions, calculations, units, and symbols [C] - fluent; efficient in applying procedures including mental math [ME]	• Limited accuracy in applying procedures. • Inefficient; struggles (e.g., false starts; repeats; little evidence of mental math strategies)	• Partially accurate; some errors • Inconsistent; fluent with some procedures but inefficient or not demonstrated in others	• Generally accurate with some minor errors or omissions • Follows most procedures appropriately; uses mental math strategies	• Accurate and precise; very few if any minor errors/ omissions • Uses range of procedures and mental math strategies fluently and efficiently; may find own 'shortcuts'
Representation and Communication -communicates mathematically including mathematical language [C] -includes appropriate graphics; representations (e.g., charts, tables, graphs, diagrams; sketches) [V]	• Does not explain procedures and results clearly; key information missing • Omits required graphics or representations and/or does not construct them appropriately; many omissions; serious flaws	• Partially explains procedures; results; parts are confusing, vague, incomplete • Constructs most required graphics; representations; some features are seriously flawed/ incomplete (e.g., not to approximiate scale)	• Explains results and procedures clearly using some math'llanguage • Constructs required graphics and/or representations appropriately; may have minor errors or flaws (e.g., missing labels or dimensions)	• Explains procedures and results precisely; uses mathematical langauge • Constructs required graphics and/or representations effectively and accurately

Used for major tasks, projects, or ongoing observations.

Creating a Sculpture

Context: This task features surface area of 3-D objects and surface area of composite objects. Students are asked to design the model for a "sculpture" using what they know about the surface area of common 3-D objects. The surface areas of the starting objects are defined but the type of objects are not given, allowing students to choose the objects they will use and to work backward to the surface area of the faces of those objects. In part 2 of this task, students calculate the maximum possible surface area for the composite object and then the minimum possible surface area for the model of the final sculpture. This second part of the task gives a good indicator of conceptual understanding of surface area of composite objects – and how it is affected when the objects are rotated.

NOTE: This task has been adapted from the work of Marian Small and Amy Lin – More Good Questions – Great Ways to Differentiate Secondary Math Instruction. Teachers College Press, 2010.

Grade: 9

PLO's: C2 – determine the surface area of composite 3-D objects to solve problems

[C, CN, PS, R, V]

Process:

Before Pose the following problem at the end of a unit involving surface area of 3-D objects. Make materials available to students (ie: boxes and cans, 3-D objects, multi-link cubes) to support them in visualizing and building models of their 3-D objects. Encourage students to find as many possible solutions as they can to the problem.

During The task includes a list of criteria for success. Encourage students to refer to this list and ensure they are including all their thinking and all their calculations. It is important that students include diagrams that show their process for calculating the surface area of their final composite object. Their strategies for arriving at the maximum and minimum surface areas are also important to include.

After	Have students ensure their work is complete, including numbers, words, pictures and any diagrams or tables that may help to illustrate how they solved the problem(s).

Creating a Sculpture

A large sculpture will be built at the front entrance of your high school to honour the importance of creativity in Math and Science. The sculpture will be created by combining two individual 3-D objects into one composite object. You have been asked to submit a design for the sculpture.

You need to start by creating a miniature model of the final design. You have been given 2 objects to work with.

The surface area of the first object is 24 cm^2.

The surface area of the second object is 22 cm^2.

Part 1

What might the surface area of your final composite object be? How many ways can you find?

Part 2

Using these 2 objects, what is the **maximum** surface area you can create?

Using these 2 objects, what is the **minimum** surface area?

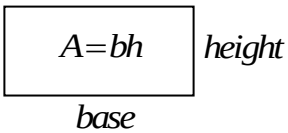
Important information for completing the task:

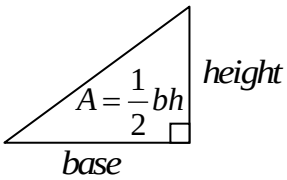
A composite object is an object made from 2 or more objects, such as **rectangular prisms, triangular prisms, pyramids, tetrahedrons or trapezoidal prisms**, etc. The objects must touch on a face, not on a vertex.

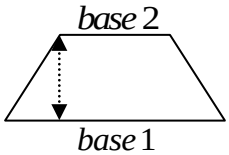
To succeed at this task, you must:

- Include sketches of your miniature model for the final sculpture.
- Include measurements.
- Calculate the surface area of your miniature model.
- Include all of your calculations.
- Explain your thinking using diagrams, charts, formulas, etc.
- Describe your strategies.

Here are some formulae that might help:







$$A = \frac{(b_1 + b_2)h}{2}$$

NOT YET WITHIN EXPECTATIONS

Teacher's Observations

- Student did not understand the task; found the factors of 22 and 24 rather than making connections to surface area of an object.
- Could not make connections to the idea of "surface area of a composite object"

	NYM	MM	FM	Ex
OVERALL Snapshot				
Concepts Connections				
Prob-Solving Reasoning				
Procedures				
Represent'n Commun				

- Does not meet basic requirements of the task
- Does not recognize or apply concepts needed
- Shows little understanding of relevant concepts; No explanations.
- Does not use appropriate strategies
- Correctly finds factors of 24 and 22.

March 7 2011

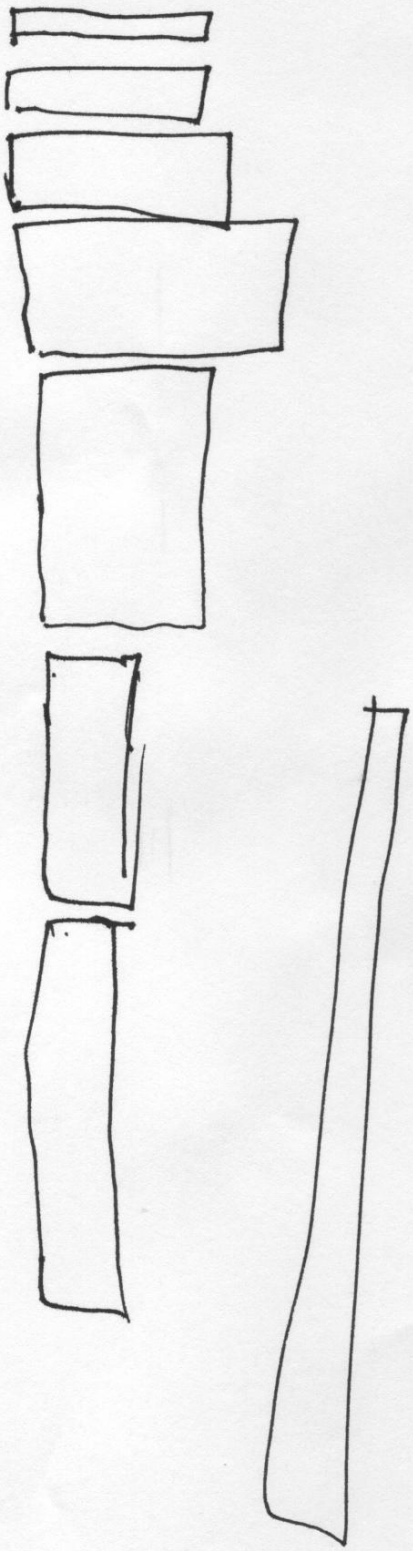
1) 22 cm^2

2) 24 cm^2

24x1
12x2
8x3.
6x4
4x6
3x8
2x12
1x24

1x22=22
2x11=22

1 24
2



MEETS EXPECTATIONS (MINIMAL LEVEL)

Teacher's Observations

- Student used multi-links to construct their objects as well as their composite object. The blocks helped the student to be able to rotate the image and visualize the side surfaces.
- He created a non-standard object with the cubes for the second object.

	NYM	MM	FM	Ex
OVERALL Snapshot				
Concepts Connections				
Prob-Solving Reasoning				
Procedures				
Representation Commun'n				

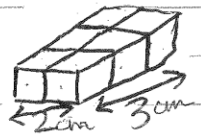
- Satisfies requirement for parts of the task, but incomplete
- Applies concepts needed for most parts of the task
- Uses some appropriate strategies for part of the task; describes a basic strategy for finding the surface area by counting "all the little squares".
- Follows some procedures accurately (division)
- Incomplete: does not complete the task, finding the minimum surface area.

March 9th, 2011

Creating a object

SA of 1 box = 1cm

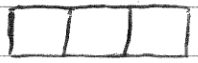
Object #1:



Front View


=2

Left View


=3

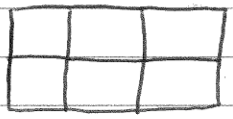
Right View


=3

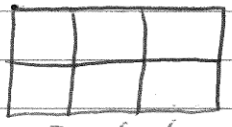
Back View


=2

Bottom View


=6

Top View


=6

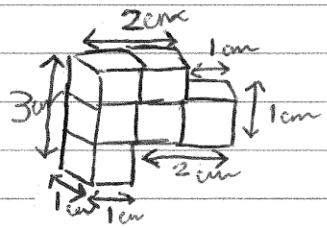
$2+2+3+3+6+6 = 22\text{cm}^2$

or

$4+6+12 = 22\text{ cm}^2$

Total SA = 22 cm^2
(object #1)

Object #2:

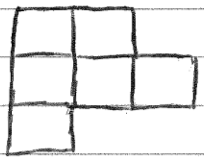


$6+6+3+3+3+3 = 24\text{cm}$

or

$12+6+6 = 24\text{cm}^2$

Front View


=6

Left View

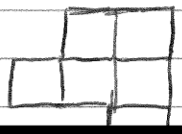

=3

Right View


=3

Total Surface Area = 24cm
(Object #2)

Back View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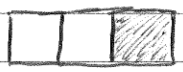
Bottom View


=3

Top View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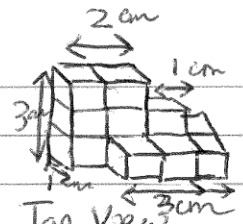
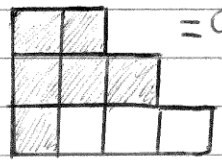
Combined object:

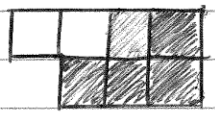


Front View



=9

Top View



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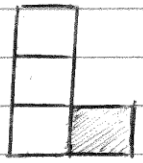
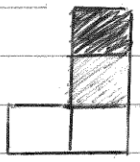
Left View



=4

Right View



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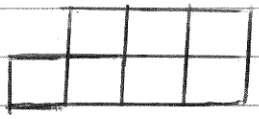
Bottom View



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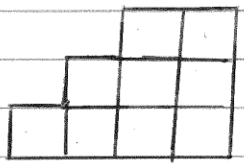
Back View



=9

$9+7+4+4+9+7=40cm^2$

or

$8+14+18=40cm^2$

Total SA = $40cm^2$

For my combined object, I layed out drawings of each of the sides of my figure so it would be easier to count up all of the little squares (side measurements). My strategy was to basiclly count up all of the squars to find the surface area.

FULLY MEETS EXPECTATIONS

Teacher's Observations

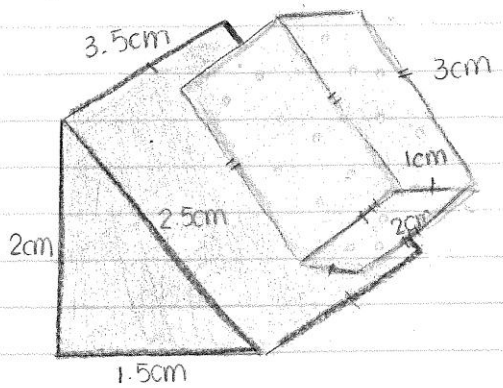
- Student used a complex object as one of her 2 objects – a triangular prism.
- Could accurately determine the dimensions of a triangular prism for which the surface area was $24cm^2$ (used Pythagoras to do so).

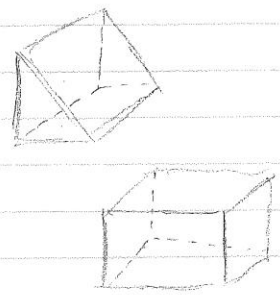
	NYM	MM	FM	Ex
OVERALL Snapshot				
Concepts Connections				
Prob-Solving Reasoning				
Procedures				
Represent'n Commun				

- Student completes the task accurately.
- Chooses appropriate strategies
- Includes one possible answer for the task rather than many.
- Student describes, in general terms, how to maximize and minimize the surface area of composite objects.

block 2-1
march 9

Creating a Sculpture:





Finding the surface area...

→ Triangular Prism:

1. 2 Triangles:
   - $2 \times 1.5 \div 2 = 1.5cm$ $\boxed{3cm}$
   - $2 \times 1.5 \div 2 = 1.5cm$
2. 3 Rectangles:
   - (Right): $2.5 \times 3.5 = 8.75cm$ $\boxed{21cm}$
   - (Left): $2 \times 3.5 = 7cm$
   - (Bottom): $1.5 \times 3.5 = 5.25cm$

IN TOTAL: $21 + 3 = 24 cm^2$

→ Rectangular Prism

1. (Top / Bottom): $(3 \times 1) \times 2$ (for each) $= 6$ cm
2. (Front / Back): $(3 \times 2) \times 2 = 12cm$ $= \boxed{22cm}$
3. (Sides): $(2 \times 1) \times 2 = 4$ cm

IN TOTAL: $22cm^2$

Flip to back

→ 2 Shapes combined together:

- Triangular Prism.

  (Based on the calculations on the front, the S.A. is $24cm^2$)

  so, $24cm^2$ is the Surface Area of the Triangular Prism.

- Rectangular prism

  (Based on the calculations on the front, the S.A is $22cm^2$)

  so, since the Bottom face of the prism is overlapping with the triangular prism, we don't have to calculate those 2 sides

Therefore

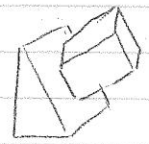
22cm - 6cm

= 16cm + 24cm

2 SHAPES IN TOTAL: 24cm + 16cm = $40cm^2$

Maximum Surface Area:

→



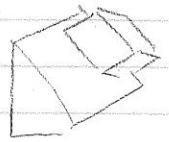
Surface Area:

22cm − 4cm

= 18cm + 24 cm

IN TOTAL: 24cm + 18 cm = $42cm^2$

Minimum surface Area



Surface Area:

$22cm^2$ − 6cm

= 16cm + 24cm

IN TOTAL: 16cm + 24cm = $40cm^2$

Note: To get the maximum surface area, we need to put the smallest side to overlap, so that we only take away a small amount.

To get the minimum surface area, we need to put the largest sid
to overlap so that we take away a large amount

EXCEEDS EXPECTATIONS

Teacher's Observations

	NYM	MM	FM	Ex
OVERALL Snapshot				
Concepts Connections				
Prob-Solving Reasoning				
Procedures				
Represent'n Commun				

- Thoroughly satisfies all parts of the task, including multiple possible options for the individual objects as well as their possible composite surface areas.
- Solution is well-developed and justified
- Shows thorough understanding; explanations are insightful
- Uses appropriate strategies; adds complexity to the task
- Uses procedures efficiently and flexibly
- Explains procedures and results precisely; uses mathematical language
- Communicates a developed understanding of surface area of composite objects and makes an important generalization regarding the maximum and minimum possible SA for this object.

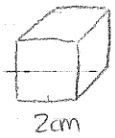
Creating a Sculpture

- 2 objects : # 1 SA = 24 cm²
  # 2 SA = 22 cm²

Part 1 : What might the surface area of the final composite object be? How many ways can you find?

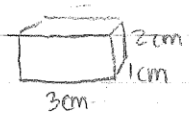
Part 2 : What is the maximum SA you can find?
What is the minimun SA you can find?

Object 1 :



- cube - $2^2(6) = 24cm^2$

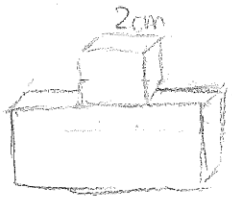
Object 2 :



- rectangular prism - $3\times2(2) + 2\times1(2) + 1\times3(2) = 22c$
front/back sides top/bottom

Biggest part 2

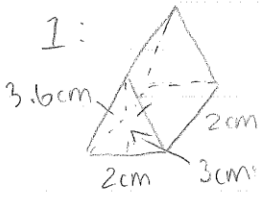
=



SA = cube = * subtract 2×1(2)/top + bottom because of overlap *
= 20cm²
rectangular prism = 22cm²
= $\boxed{42cm^2}$

part 1

Object 1 :

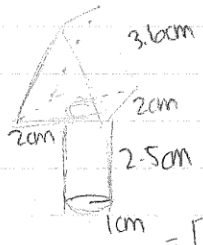


- triangular prism
front/back → 2×3 = 6cm²
left/right → 2×3.6(2) = 14.4 cm²
bottom → 2×2 = 4cm² ∴ 24.4cm²

Object 2 :

- cylinder
circles → $\pi 1^2 (2) = 6.28 cm^2$
[illegible]

smallest
part 2



SA = cylinder * subtract circles / 6.28cm because of overlap *
= 15.72 cm²
triangular prism = 24 cm²
= $\boxed{39.72\ cm^2}$

part 1

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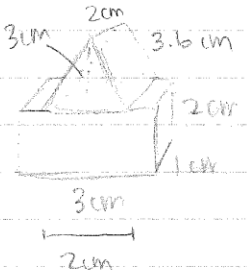
biggest
part 2



SA = * subtract 1×2 (2) / overlap of bottom of triangular prism *
→ 22 + 24 - 4 = $\boxed{42\ cm^2}$

part 1

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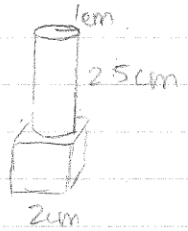
smallest
part 2



SA = * subtract circles / 6.28cm because of overlap *
→ 22 + 24 - 6.28 = $\boxed{39.72\ cm^2}$

part 1

4 ways

part 1

I know that it's the maximum SA if the overlap SA is the smallest possible. Thats because for every object, you add 22 and 24 and then subtract the overlap. So if the overlap is very small the final SA will be closer to 46cm². I know it's the minimum SA if the overlap SA is the biggest because then you subtract a bigger # from 46 cm².