

Numeracy

GRADE 4

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Numeracy in Grade 4

Grade 4 students are expected to integrate and apply the mathematical concepts and skills they have developed to complete a variety of simulations and real-life tasks, most often those proposed by their teachers. Students should also be increasingly able to find applications for numeracy and to collaborate in designing realistic problems.

The following briefly describes typical Grade 4 numeracy tasks. For quick reference, these examples have been grouped according to purpose. In practice, a single numeracy task or problem may often address more than one purpose.

MONEY TASKS

- ◆ Given a budget, select gifts for four friends or family members from a catalogue.
- ◆ Given a budget, choose food items from a menu and calculate the total amount they would cost.

CHANCE TASKS

- ◆ Analyze games and challenges involving chance (e.g., pulling coloured tiles out of a bag, using a spinner).

DATA ANALYSIS

- ◆ Poll classmates on simple topics such as favourite ice cream, fast food, or animal. Tally, graph, and interpret the results.
- ◆ Collaborate to create graphs showing distribution of some feature among students in the classroom (e.g., eye or hair colour; number of letters in first or last name), then independently interpret results and offer conclusions.

MEASUREMENT AND OTHER APPLICATIONS OF SHAPE AND SPACE

- ◆ Find and present problems that require determining the floor or wall area of a room in their home. (e.g., What would it cost to put carpet in your bedroom?)
- ◆ Prepare and present a travel itinerary using bus, train, or airline schedules.
- ◆ Design fenced areas of different shapes for a pet.
- ◆ Use a variety of ways to compare and express ages with a friend.

- ◆ Use compasses to make sketch maps of the school yard, their route to school, or a part of their community. Use the given directions to get from one point to another.
- ◆ Create a mini-orienteeing course for classmates or another class to follow.

Wherever possible, students should demonstrate numeracy through real situations and problems that can be solved in a variety of ways, and they should be expected to explain their procedures and results. In most cases, these tasks will require an extended amount of time. Relatively short questions with one correct procedure and answer do not provide sufficient evidence for effective performance assessment.

Quick Scale: Grade 4 Numeracy

This Quick Scale is a summary of the criteria described in detail in the Rating Scale that follows. These criteria may apply at any time of the year, depending when specific skills or concepts are introduced.

Aspect	Not Yet Within Expectations	Meets Expectations (Minimal Level)	Fully Meets Expectations	Exceeds Expectations
SNAPSHOT	<i>The student may be unable to complete the task without ongoing help; cannot follow procedures independently.</i>	<i>The work satisfies most basic requirements of the task, but it is flawed or incomplete in some way. The student may need some help.</i>	<i>The work is complete and accurate (may include minor errors). The student is able to develop a simple extension.</i>	<i>The work is complete, accurate, and efficient. The student may find an alternative or a shortcut, or develop an extension.</i>
CONCEPTS AND APPLICATIONS* - recognizing mathematics - grade-specific concepts, skills - patterns, relationships	- may be unable to identify basic concepts and procedures needed - work is inaccurate or incomplete - may need one-to-one support to identify simple patterns and relationships	- identifies some concepts and procedures needed - applies most relevant concepts and skills appropriately; some errors or omissions - identifies simple patterns and relationships if prompted (e.g., to make predictions)	- identifies concepts and procedures needed - applies relevant concepts and skills; may be somewhat inefficient or make minor errors - identifies, explains, and uses simple patterns and relationships	- identifies concepts and procedures needed; may propose alternative solutions - applies relevant concepts and skills efficiently; precise - identifies, explains, and uses patterns and relationships; may notice subtle patterns
STRATEGIES AND APPROACHES - procedures - estimates to verify solutions	- cannot break the task into stages, steps, or sections - unable to verify results or solutions	- tries to follow instructions; does not check or adjust procedures - needs help to verify results or solutions	- structures the task logically; may be inefficient - if asked, verifies results or solutions	- structures the task efficiently - may independently verify results or solutions
ACCURACY recording, calculations	may include major errors in recording or calculations	may include some recording or calculation errors; comparisons are generally reasonable	recording and calculations are generally accurate; may be minor errors	accurate recording and calculations, including units; may use mental math
REPRESENTATION AND COMMUNICATION - presenting work - constructing charts, diagrams, displays - explaining procedures, results	- work may be unclear and confusing - may omit or make major errors in tables, charts, displays, diagrams - may be unable to explain procedures and results	- work may be confusing in places - includes most required tables, charts, displays, and diagrams; some errors or omissions - explanations and conclusions may be incomplete; little mathematical language	- work is generally clear, easy to follow - required tables, charts, graphs, and diagrams are generally accurate; minor errors or omissions - offers logical explanations and conclusions; some mathematical language	- work is clear and easy to follow - required tables, charts, graphs, diagrams are accurate and complete - offers logical explanations and conclusions; uses mathematical language

* You may want to list key curriculum concepts or skills for a particular task.

Rating Scale: Grade 4 Numeracy

*These criteria may apply at any time of the year, depending when specific skills or concepts are introduced.**

Aspect	Not Yet Within Expectations	Meets Expectations (Minimal Level)
SNAPSHOT	<i>The student may be unable to complete the task without ongoing help; cannot follow procedures independently.</i>	<i>The work satisfies most basic requirements of the task, but it is flawed or incomplete in some way. The student may need some help.</i>
CONCEPTS AND APPLICATIONS** - recognizing mathematics - grade-specific concepts, skills - patterns, relationships	- may be unable to identify the basic concepts and procedures needed to solve problems or complete tasks that have been modelled in class - work is inaccurate or incomplete - may need one-to-one support to identify simple patterns and relationships	- identifies some of the concepts and procedures needed to solve problems or complete tasks that have been modelled in class - applies most relevant mathematical concepts and skills appropriately; work is incomplete or includes some errors - identifies simple patterns and relationships; may need help seeing how to use them (e.g., to make predictions)
STRATEGIES AND APPROACHES - procedures - estimates to verify solutions	- cannot break the task into stages, steps, or sections - unable to verify results or solutions by using estimation, inverse operations, or a calculator	- attempts to follow instructions; does not check or adjust procedures - needs help to use estimation, inverse operations, or a calculator to verify results or solutions
ACCURACY recording, calculations	may include major errors in recording or calculations (addition and subtraction to 10 000; multiplication of three-digit by one-digit numbers; division of two-digit by one-digit numbers)	may include some recording or calculation errors (addition and subtraction to 10 000; multiplication of three-digit by one-digit numbers; division of two-digit by one-digit numbers); comparisons are generally reasonable
REPRESENTATION AND COMMUNICATION - presenting work - constructing charts, diagrams, displays - explaining procedures, results	- work may be unclear and confusing - may omit required tables, charts, shapes, nets, bar graphs, pictographs; those provided may be inappropriate, inaccurate, or incomplete - may be unable to explain procedures and results; often illogical	- work may be confusing in places - includes most required tables, charts, shapes, nets, bar graphs, and pictographs, but may be incomplete or include some errors - explanations and conclusions may be incomplete; includes little mathematical language

* Student performance that falls within the wide range of expectations for Grade 4 generally matches the Level 2/3 descriptions in the reference set Evaluating Mathematical Development Across Curriculum.

**Some of the concepts and skills students are expected to apply in completing numeracy tasks are specific to the type of task. The shaded charts below the Rating Scale show some of the concepts and skills most likely to apply in Grade 4.

MONEY TASKS

- estimate, count, record collections of coins and bills up to \$100
- purchases and change up to \$100

CHANCE TASKS

- design and conduct simple probability experiments
- identify an outcome using terms *possible, impossible, certain, uncertain*
- compare outcomes using terms *equally, likely, more or less likely*

	Fully Meets Expectations	Exceeds Expectations
	<i>The work is complete and accurate (may include minor flaws or errors). The student is able to develop a simple extension of the same mathematical idea.</i>	<i>The work is complete, accurate, and efficient. The student may find an alternative or shortcut, or develop an extension or additional application of the same mathematical idea.</i>
	- identifies concepts and procedures needed to solve problems or complete tasks that have been modelled in class - applies relevant mathematical concepts and skills appropriately; may be somewhat inefficient or make minor errors or omissions - identifies, explains, and uses patterns and relationships (e.g., to make predictions)	- identifies concepts and procedures needed to solve problems or complete tasks; may propose alternative solutions or shortcuts that go beyond procedures modelled - applies relevant mathematical concepts and skills appropriately and efficiently; precise - identifies, explains, and uses patterns and relationships (e.g., to make predictions, create shortcuts); may notice subtle patterns
	- structures the task logically, breaking it into steps or stages, but may be inefficient - if asked, verifies results or solutions by using estimation, inverse operations, or a calculator	- structures the task efficiently, breaking it into logical steps or stages - may independently verify results or solutions by using estimation, inverse operations, or a calculator
	recording and calculations are generally accurate, including units; may include minor errors (addition and subtraction to 10 000; multiplication of three-digit by one-digit numbers; division of two-digit by one-digit numbers)	all recording and calculations are accurate, including units (exercise some tolerance for minor errors); may use mental math to arrive at a solution quickly
	- work is generally clear and easy to follow; may be somewhat untidy in places - required tables, charts, diagrams, or graphs are generally accurate, including labels and titles; may have minor errors or omissions, particularly in more complex tasks - offers logical explanations and conclusions; uses some mathematical language (e.g., <i>added up</i>, <i>estimated</i>, <i>equal</i>)	- work is clear and easy to follow - required tables, charts, diagrams, or graphs are accurate and complete, including labels and titles (may have minor errors, particularly in more complex tasks); may voluntarily include features that help to clarify the task or result - offers logical explanations and conclusions; uses appropriate mathematical language; often detailed and insightful

DATA ANALYSIS

- select appropriate sample or population
- collect first- and second-hand data
- create interval graphs or tables
- construct bar graphs and pictographs
- evaluate data collection processes

MEASUREMENT

- estimate, measure, compare quantities
- standard units: mm, cm, m, km, cm², m², ml, L, g, kg
- length, height, perimeter, circumference
- 24-hour clock; a.m., p.m.; years, decades, centuries, millenniums
- construct 2-D shapes, 3-D objects

OTHER APPLICATIONS OF SPACE AND SHAPE

- compare and contrast pyramids and prisms
- identify and sort quadrilaterals
- recognize and draw point, line, parallel lines, intersecting lines

Sample 1: Conducting Surveys (Data Analysis)

CONTEXT

This was the culminating activity in a data collection unit. During the unit, the teacher modelled and provided several opportunities for students to practise matching questions to a sample population, collecting data, and constructing and analyzing graphs.

MATHEMATICAL CONCEPTS

- ◆ select appropriate sample or population
- ◆ collect first- and second-hand data
- ◆ create interval graphs/tables
- ◆ construct bar graphs
- ◆ evaluate data collection processes

PROCESS

The class reviewed what they had learned about conducting surveys and communicating the results. The teacher explained that for this survey, each student would choose his or her own question and work independently to collect and display the data. The class brainstormed some possible questions.

Students then worked independently to:

1. Choose a survey topic.
2. Survey the sample population (usually their classmates) and tally the results.
3. Create a bar graph to display the data collected.
4. Analyze the data: write a short summary of the results (e.g., range, most frequent choice, number of people).
5. Evaluate the survey (e.g., comment on the sample and the data collection).
6. Post the work around the room for other students to view.

The class discussed what they had learned and commented on ways that their projects were similar and different. They also developed a list of “tips” for collecting and displaying data, which the teacher posted for future reference. For the remainder of the school year, the teacher encouraged students to look for situations where they could collect and report on data in other subject areas.

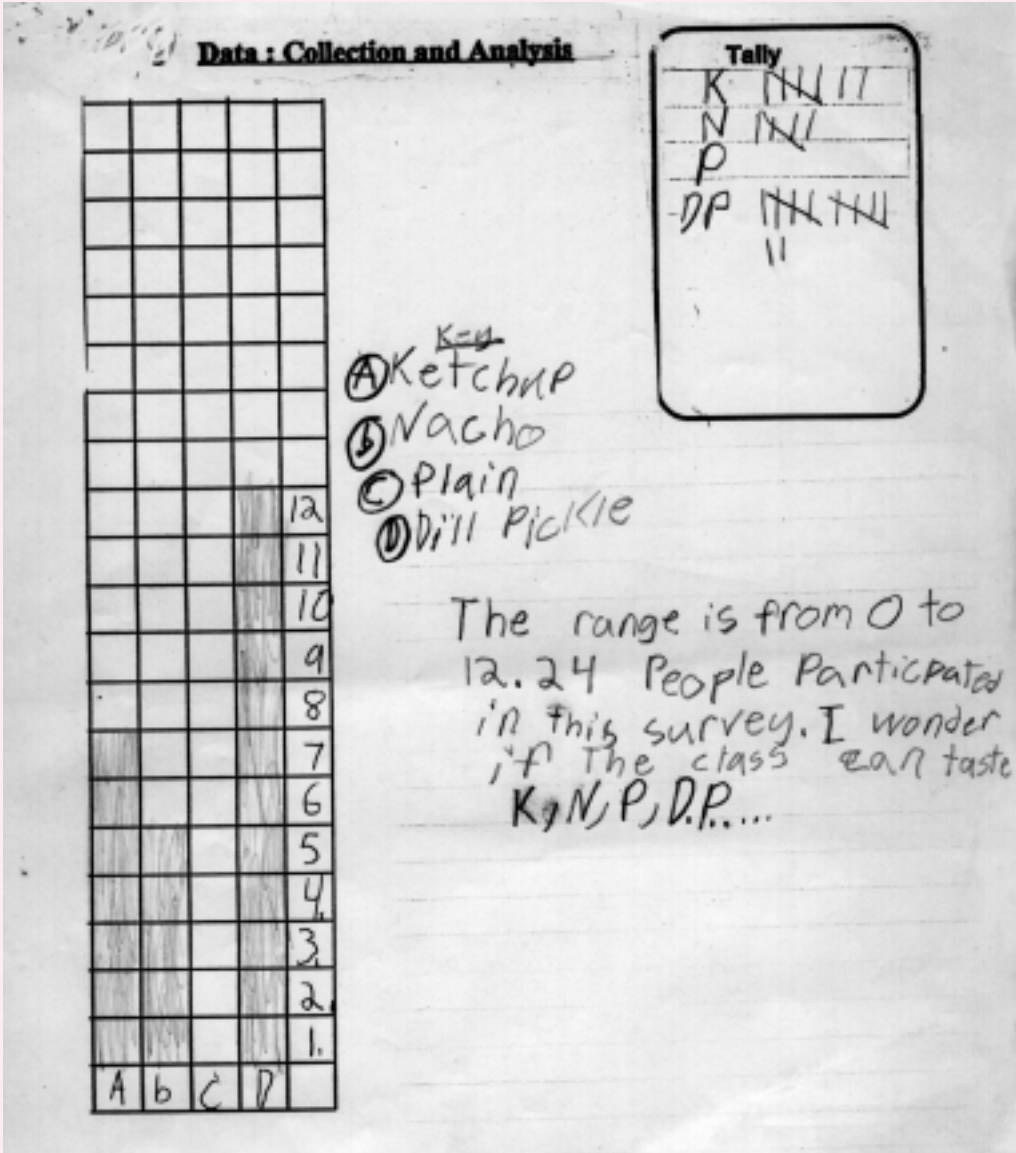
NOT YET WITHIN EXPECTATIONS

Teacher's Observations

This student needed help to choose a question, complete the survey, and present the results. The first two sentences are copied from a model the teacher provided.

- ◆ unable to complete the task without ongoing help
- ◆ bar graph is incomplete
- ◆ unable to explain procedures and results

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				



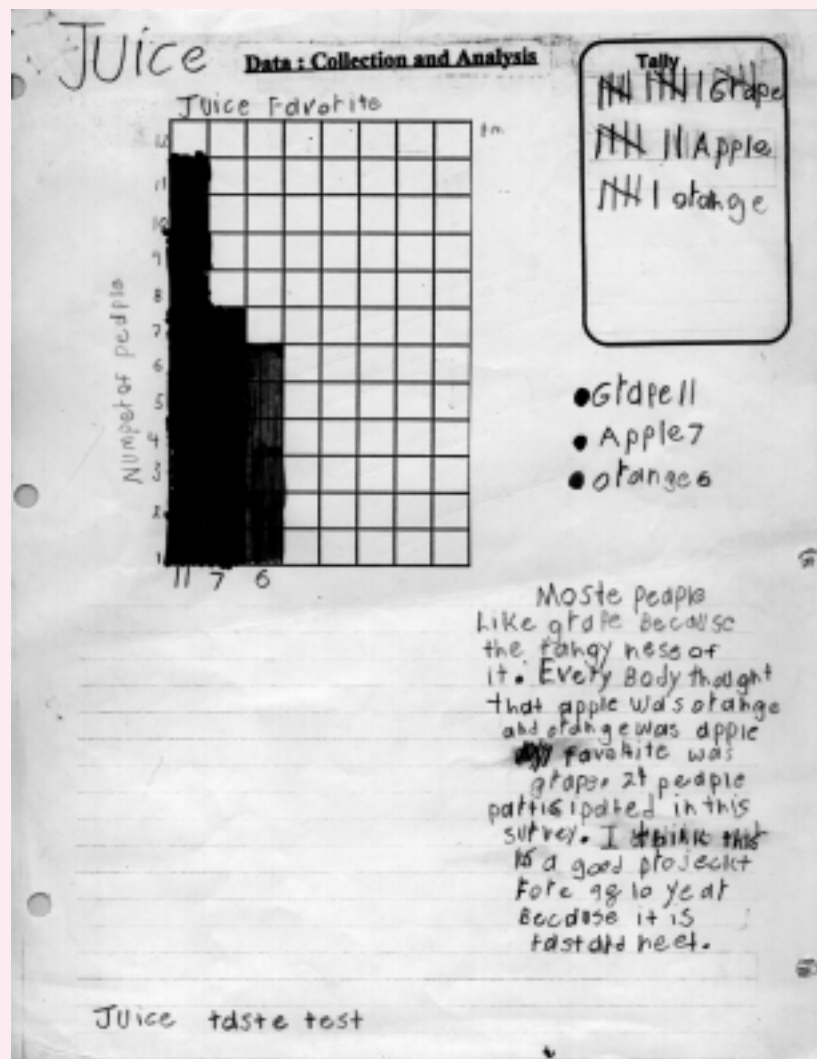
MEETS EXPECTATIONS (MINIMAL LEVEL)

Teacher's Observations

The data collection and display meets most basic requirements of the task, but the explanation is confusing and does not deal with the mathematical aspects of the task.

- ◆ identifies some of the concepts and procedures needed
- ◆ applies most relevant mathematical concepts and skills appropriately; work is incomplete
- ◆ required tables and graphs are generally accurate
- ◆ explanations and conclusions are incomplete

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				



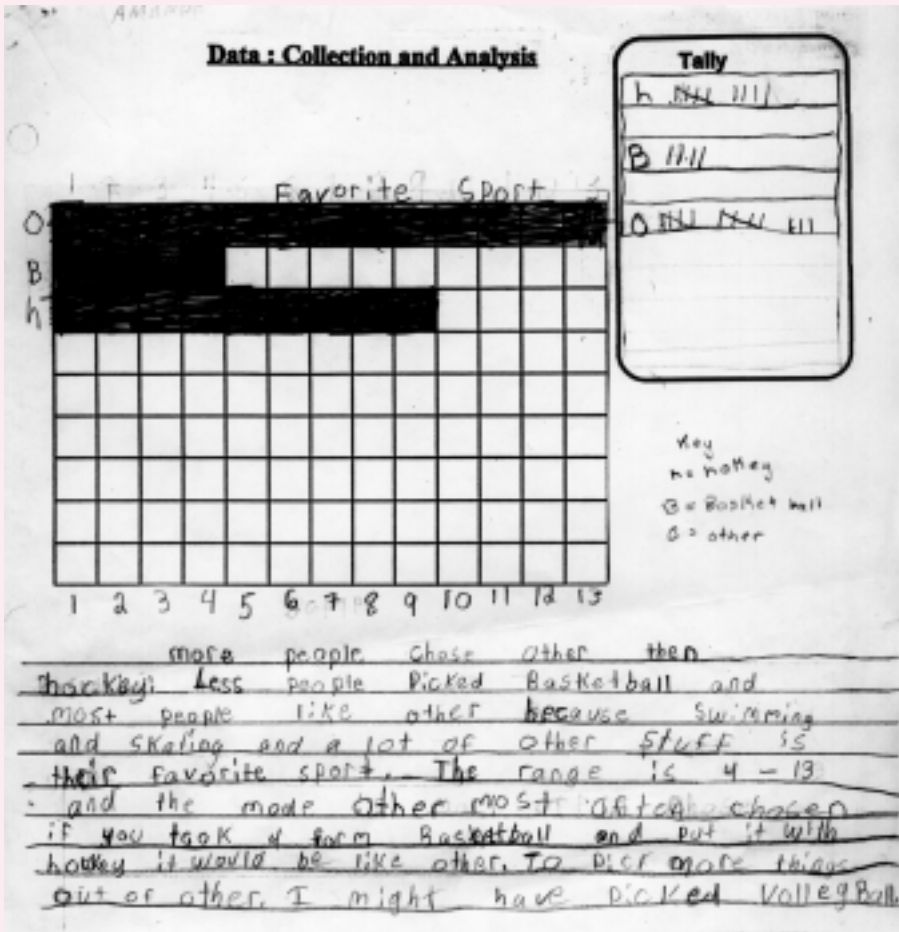
FULLY MEETS EXPECTATIONS

Teacher's Observations

The work addresses all parts of the task, but the recording categories do not allow for clear identification of a favourite sport (i.e., offered only hockey, basketball, other), and the graph is not well presented. In evaluating the data collection, the student recognizes that offering other options (e.g., volleyball) would have reduced the “other” category.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ identifies concepts and procedures needed
- ◆ applies relevant mathematical concepts and skills appropriately
- ◆ all recording and calculations are accurate
- ◆ work is generally clear and easy to follow; untidy in places
- ◆ offers logical explanations and conclusions; uses some mathematical language (e.g., *mode*)



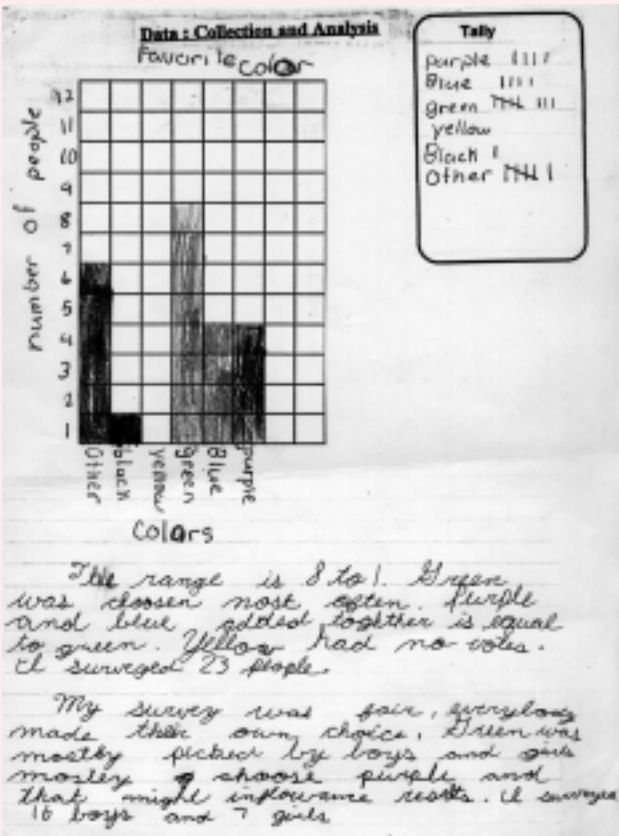
EXCEEDS EXPECTATIONS

Teacher’s Observations

The work is complete and includes a logical analysis of how the gender breakdown of the sample may have affected the result. The teacher noted that the student worked confidently and efficiently.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ applies relevant mathematical concepts and skills appropriately and efficiently
- ◆ identifies, explains, and uses patterns and relationships (e.g., notices differences between preference of girls and boys)
- ◆ all recording and calculations are accurate
- ◆ work is clear and easy to follow
- ◆ required tables and graphs are accurate and complete, including labels and titles; includes features that help to clarify the task or result (i.e., colour codes bars to match colours in the survey)
- ◆ offers logical explanations and conclusions; insightful (i.e., recognizes that imbalance in gender breakdown in the sample may have influenced results)



Sample 2: Designing a Pen for a Pet (Measurement)

CONTEXT

This activity was presented at the end of a unit on measurement.

MATHEMATICAL CONCEPTS

- ◆ construct shapes
- ◆ measure, compare shapes
- ◆ use and relate standard units: mm, cm, m, cm^2 , m^2
- ◆ length, width, perimeter, surface area
- ◆ number operations (addition, multiplication) on whole numbers

PROCESS

Students were asked to choose a pet and design three different fenced areas or “pens” for that pet. They were given the following specific directions:

- ◆ Draw each pen on graph paper. Each pen must have a perimeter (on the graph paper) of 64 cm. The shape of each pen must be different.
- ◆ After completing each pen, label all the dimensions.
- ◆ Determine the area of each pen, and write that information underneath each drawing.
- ◆ After considering the needs of your pet, decide which would be the best unit of measure (mm, dm, cm, m, or km) if you were to actually build your pen. Explain your reasoning.
- ◆ Decide which one of the three shapes would be best for your pet and explain your choice.

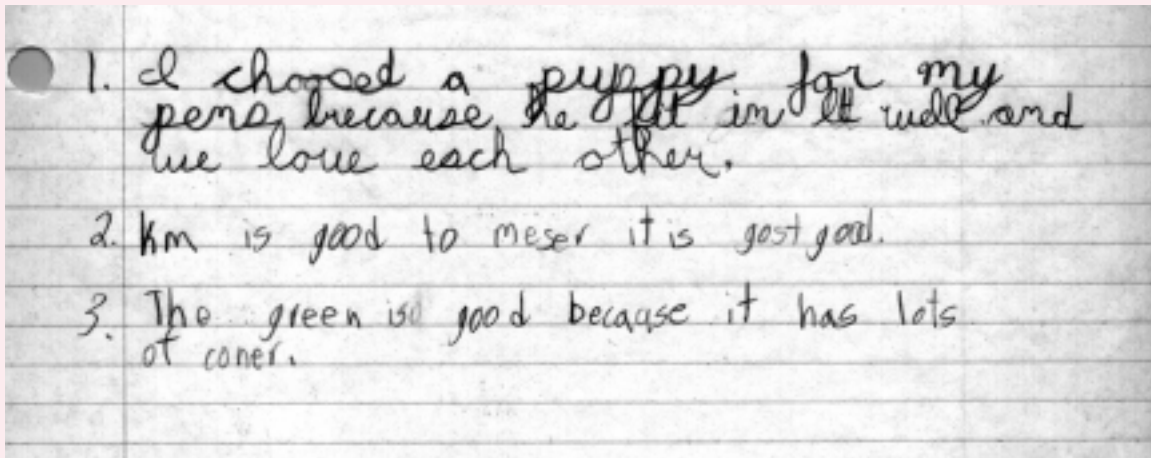
NOT YET WITHIN EXPECTATIONS

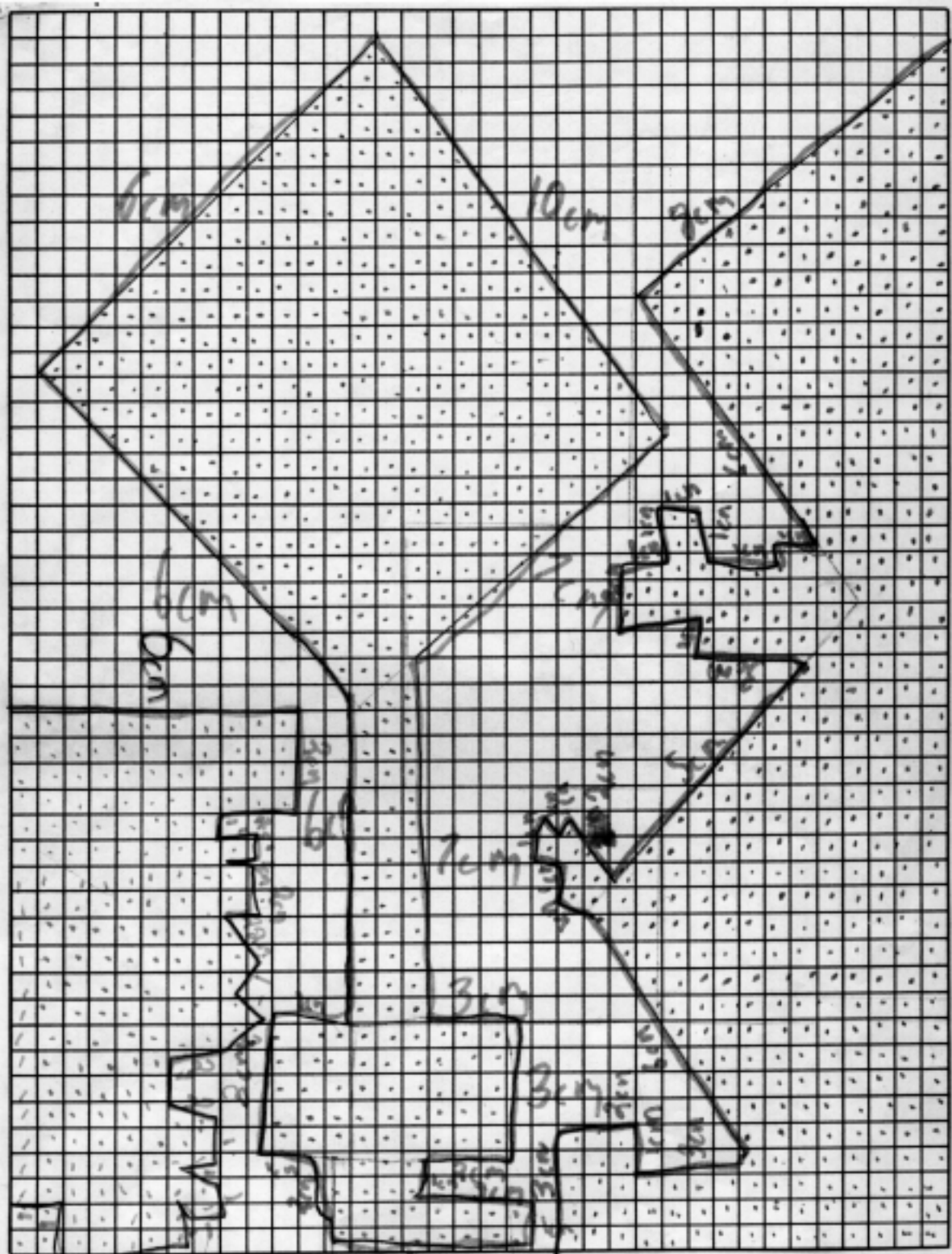
Teacher's Observations

The work is inaccurate in several places, omits key measurements, and shows no evidence of mathematical thinking. The student was unable to complete the task independently.

- ♦ work is inaccurate and incomplete
- ♦ unable to verify results or solutions
- ♦ includes major errors in recording and calculations (does not count units correctly)
- ♦ work is unclear and confusing; illogical

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				





MEETS EXPECTATIONS (MINIMAL LEVEL)

Teacher's Observations

The student needed some help from the teacher to complete the activity. The work satisfies most basic requirements of the task, but there are some errors in calculations of perimeter (i.e., the second pen is 52 cm in perimeter).

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ identifies some of the concepts and procedures needed (omits surface area)
- ◆ applies most relevant mathematical concepts and skills appropriately
- ◆ includes some calculation errors
- ◆ work is generally clear and easy to follow; somewhat untidy in places
- ◆ required diagrams are generally accurate, including labels; minor errors or omissions
- ◆ offers logical explanations and conclusions

Your task is to design 3 different pens that could be for a pet of your choice. To complete this task please do the following:

1. Draw each pen on the graph paper provided. Each pen must have a perimeter of 48 cm. The shape of each pen must be different.

2. After completing each pen, label all the dimensions.

3. Determine the area for each pen and write that information underneath each drawing.

4. What kind of pet did you choose for your pens?

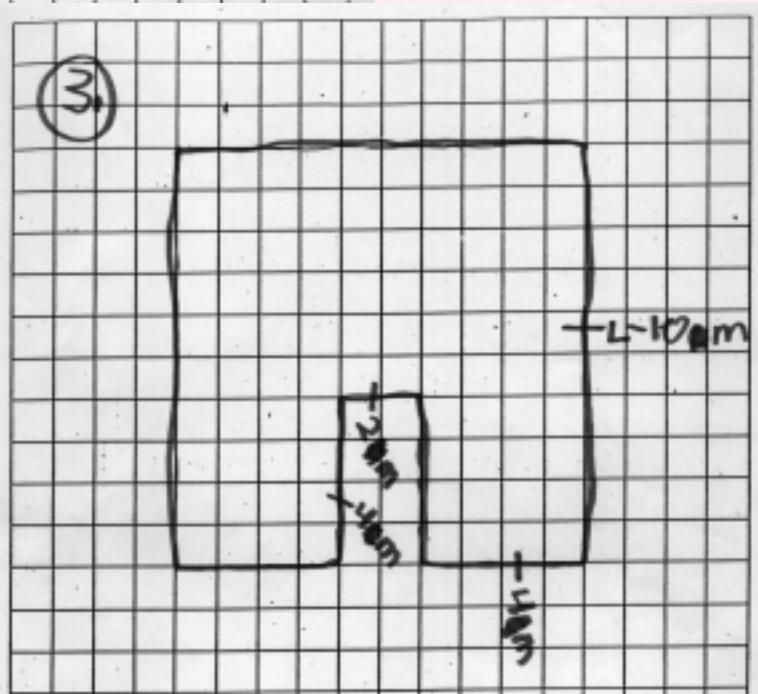
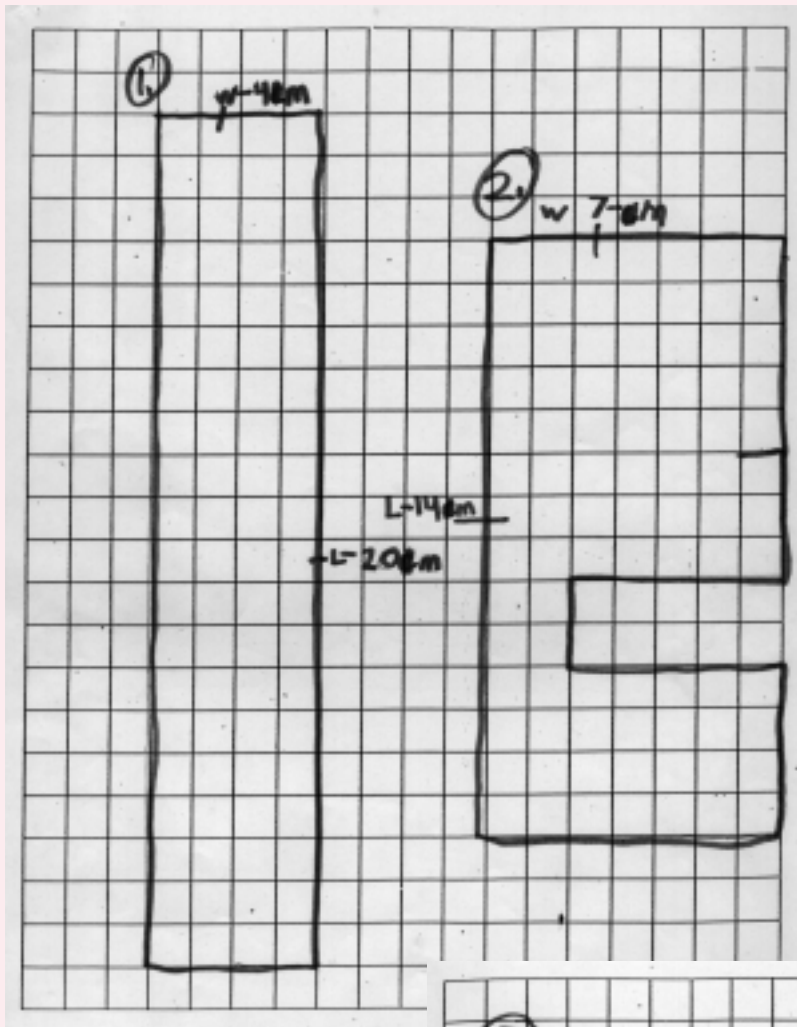
Snake

5. After considering the needs of your pet what would be the best unit of measure (mm, cm, m or km) to use when you build your "real" pen? Explain your reasoning.

I think mm, because it is a small snake but it will grow bigger

6. Which one of the 3 shapes do you think would be best for your pet? Please explain your choice.

I say my 3rd one would work best because it has the most room and it has 4 sides one snake can go on one side another snake can go on the other side or it could be food storage or babies room



FULLY MEETS EXPECTATIONS

Teacher's Observations

The work is clear, complete, and accurate.

- ◆ identifies concepts and procedures needed to solve problems or complete tasks that have been modelled in class
- ◆ applies relevant mathematical concepts and skills appropriately
- ◆ recording and calculations are accurate, including units
- ◆ work is generally clear and easy to follow; somewhat untidy in places
- ◆ required diagrams are generally accurate, including labels

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

Your task is to design 3 different pens that could be for a pet of your choice. To complete this task please do the following:

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2. After completing each pen, label all the dimensions.

3. Determine the area for each pen and write that information underneath each drawing.

4. What kind of pet did you choose for your pens?

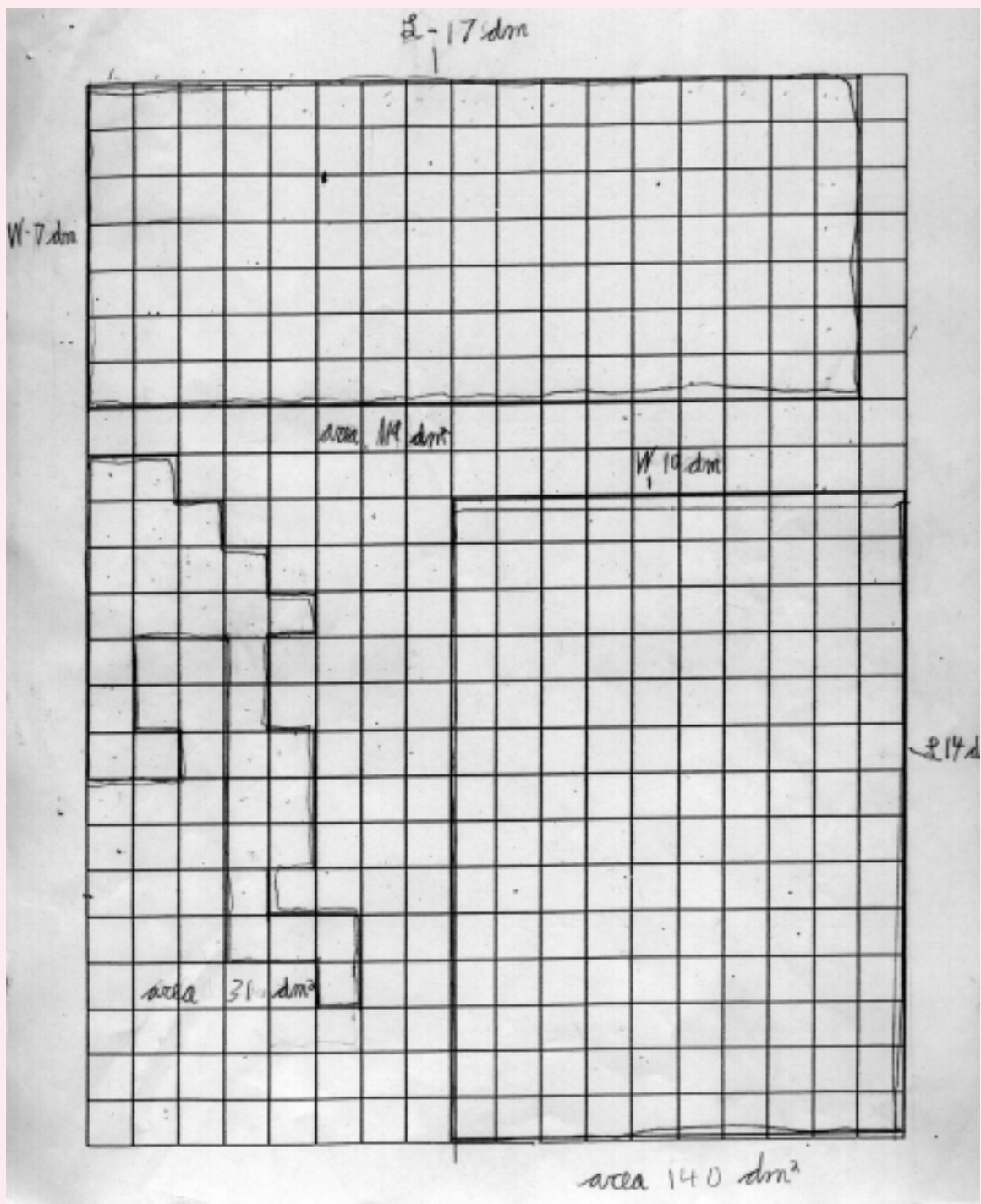
parrot

5. After considering the needs of your pet what would be the best unit of measure (mm, cm, m or km) to use when you build your "real" pen? Explain your reasoning.

It would be in dm because if it was in mm it would be so small and if it was in km it would be too big.

6. Which one of the 3 shapes do you think would be best for your pet? Please explain your choice.

I would choose the one with the area of 140 because the parrot would have more flight room.



EXCEEDS EXPECTATIONS

Teacher's Observations

The work is clear, detailed, and accurate. The teacher noted that the student worked confidently and efficiently, and independently figured out that the area of the first pen could be calculated by multiplying 12 x 12.

	Not Yet	Meets	Fully	Exceeds
SNAPSHOT				
CONCEPTS				
STRATEGIES				
ACCURACY				
REPRESENTATION				

- ◆ identifies concepts and procedures needed; proposes shortcuts that go beyond procedures modelled
- ◆ applies relevant mathematical concepts and skills appropriately and efficiently; precise
- ◆ all recording and calculations are accurate, including units; uses mental math to arrive at a solution quickly
- ◆ work is clear and easy to follow

