# Contents

**Introduction** 3  
Purpose of This Document 4  
Features of This Document 4  
The Tasks 5  
The Rubrics 5  
Development of the Tasks 7  
Assessment and Selection of the Samples 8  
Use of the Student Samples 8  
- Teachers and Administrators 8  
- Parents 9  
- Students 10

**Number Sense and Numeration / Geometry and Spatial Sense** 11  
Prin's Base Ten Candy Store 12  
The Task 12  
Expectations 12  
Prior Knowledge and Skills 13  
Task Rubric 14  
Student Samples 16  
Teacher Package 50

**Patterning and Algebra** 57  
What Are Rep-Tiles? 58  
The Task 58  
Expectations 58  
Prior Knowledge and Skills 59  
Task Rubric 60  
Student Samples 61  
Teacher Package 96

**Data Management and Probability** 103  
Brenda's Bike Shop 104  
The Task 104  
Expectations 104  
Prior Knowledge and Skills 105  
Task Rubric 106  
Student Samples 108  
Teacher Package 140

This publication is available on the Ministry of Education's website at http://www.edu.gov.on.ca.
In 1997, the Ministry of Education and Training published a new mathematics curriculum policy document for Ontario elementary students entitled The Ontario Curriculum, Grades 1–8: Mathematics, 1997. The new curriculum is more specific than previous curricula with respect to both the knowledge and the skills that students are expected to develop and demonstrate in each grade. The document contains the curriculum expectations for each grade and an achievement chart that describes four levels of student achievement to be used in assessing and evaluating student work.

The present document is part of a set of eight documents – one for each grade – that contain samples (“exemplars”) of student work in mathematics at each of the four levels of achievement described in the achievement chart. The exemplar documents are intended to provide assistance to teachers in their assessment of student achievement of the curriculum expectations. The samples represent work produced at the end of the school year in each grade.

Ontario school boards were invited by the Ministry of Education to participate in the development of the exemplars. Teams of teachers and administrators from across the province were involved in developing the assessment materials. They designed the performance tasks and scoring scales (“rubrics”) on the basis of selected Ontario curriculum expectations, field-tested them in classrooms, suggested changes, administered the final tasks, marked the student work, and selected the exemplars used in this document. During each stage of the process, external validation teams and Ministry of Education staff reviewed the tasks and rubrics to ensure that they reflected the expectations in the curriculum policy documents and that they were appropriate for all students. External validation teams and ministry staff also reviewed the samples of student work.

The selection of student samples that appears in this document reflects the professional judgement of teachers who participated in the project. No students, teachers, or schools have been identified.

The procedures followed during the development and implementation of this project will serve as a model for boards, schools, and teachers in designing assessment tasks within the context of regular classroom work, developing rubrics, assessing the achievement of their own students, and planning for the improvement of students’ learning.
The samples in this document will provide parents with examples of student work to help them monitor their children's progress. They also provide a basis for communication with teachers.

Use of the exemplar materials will be supported initially through provincial in-service training.

**Purpose of This Document**

This document was developed to:

- show the characteristics of student work at each of the four levels of achievement for Grade 5;
- promote greater consistency in the assessment of student work across the province;
- provide an approach to improving student learning by demonstrating the use of clear criteria applied to student work in response to clearly defined assessment tasks;
- show the connections between what students are expected to learn (the curriculum expectations) and how their work can be assessed using the levels of achievement described in the curriculum policy document for the subject.

Teachers, parents, and students should examine the student samples in this document and consider them along with the information in the Teacher's Notes and Comments/Next Steps sections. They are encouraged to examine the samples in order to develop an understanding of the characteristics of work at each level of achievement and the ways in which the levels of achievement reflect progression in the quality of knowledge and skills demonstrated by the student.

The samples in this document represent examples of student achievement obtained using only one method of assessment, called performance assessment. Teachers will also make use of a variety of other assessment methods and strategies in evaluating student achievement over a school year.

**Features of This Document**

This document contains the following:

- a description of each of three performance tasks (each task focuses on a particular strand or combination of strands), as well as a listing of the curriculum expectations related to the task
- a task-specific assessment chart (“rubric”) for each task
- two samples of student work for each of the four levels of achievement for each task
- Teacher's Notes, which provide some details on the level of achievement for each sample

---

1. In this document, parent(s) refers to parent(s) and guardian(s).
• Comments/Next Steps, which offer suggestions for improving achievement
• the Teacher Package that was used by teachers in administering each task

It should be noted that each sample for a specific level of achievement represents the characteristics of work at that level of achievement.

The Tasks

The performance tasks were based directly on curriculum expectations selected from The Ontario Curriculum, Grades 1–8: Mathematics, 1997. The tasks encompassed the four categories of knowledge and skills (i.e., problem solving; understanding of concepts; application of mathematical procedures; communication of required knowledge related to concepts, procedures, and problem solving), requiring students to integrate their knowledge and skills in meaningful learning experiences. The tasks gave students an opportunity to demonstrate how well they could use their knowledge and skills in a specific context.

Teachers were required to explain the scoring criteria and descriptions of the levels of achievement (i.e., the information in the task rubric) to the students before they began the assignment.

The Rubrics

In this document, the term rubric refers to a scoring scale that consists of a set of achievement criteria and descriptions of the levels of achievement for a particular task. The scale is used to assess students’ work; this assessment is intended to help students improve their performance level. The rubric identifies key criteria by which students’ work is to be assessed, and it provides descriptions that indicate the degree to which the key criteria have been met. The teacher uses the descriptions of the different levels of achievement given in the rubric to assess student achievement on a particular task.

The rubric for a specific performance task is intended to provide teachers and students with an overview of the expected product with regard to the knowledge and skills being assessed as a whole.

The achievement chart in the curriculum policy document for mathematics provides a standard province-wide tool for teachers to use in assessing and evaluating their students’ achievement over a period of time. While the chart is broad in scope and general in nature, it provides a reference point for all assessment practice and a framework within which to assess and evaluate student achievement. The descriptions associated with each level of achievement serve as a guide for gathering and tracking assessment information, enabling teachers to make consistent judgements about the quality of student work while providing clear and specific feedback to students and parents.

For the purposes of the exemplar project, a single rubric was developed for each performance task. This task-specific rubric was developed in relation to the achievement chart in the curriculum policy document.
The differences between the achievement chart and the task-specific rubric may be summarized as follows:

- The achievement chart contains broad descriptions of achievement. Teachers use it to assess student achievement over time, making a summative evaluation that is based on the total body of evidence gathered through using a variety of assessment methods and strategies.
- The rubric contains criteria and descriptions of achievement that relate to a specific task. The rubric uses some terms that are similar to those in the achievement chart but focuses on aspects of the specific task. Teachers use the rubric to assess student achievement on a single task.

The rubric contains the following components:

- an identification (by number) of the expectations on which student achievement in the task was assessed
- the four categories of knowledge and skills
- the relevant criteria for evaluating performance of the task
- descriptions of student performance at the four levels of achievement (level 3 on the achievement chart is considered to be the provincial standard)

As stated earlier, the focus of performance assessment using a rubric is to improve students' learning. In order to improve their work, students need to be provided with useful feedback. Students find that feedback on the strengths of their achievement and on areas in need of improvement is more helpful when the specific category of knowledge or skills is identified and specific suggestions are provided than when they receive only an overall mark or general comments. Student achievement should be considered in relation to the criteria for assessment stated in the rubric for each category, and feedback should be provided for each category. Through the use of a rubric, students' strengths and weaknesses are identified and this information can then be used as a basis for planning the next steps for learning. In this document, the Teacher's Notes indicate the reasons for assessing a student's performance at a specific level of achievement, and the Comments/Next Steps give suggestions for improvement.

In the exemplar project, a single rubric encompassing the four categories of knowledge and skills was used to provide an effective means of assessing the particular level of student performance in each performance task, to allow for consistent scoring of student performance, and to provide information to students on how to improve their work. However, in the classroom, teachers may find it helpful to make use of additional rubrics if they need to assess student achievement on a specific task in greater detail for one or more of the four categories. For example, it may be desirable in evaluating a written report on an investigation to use separate rubrics for assessing understanding of concepts, problem-solving skills, ability to apply mathematical procedures, and communication skills.
The rubrics for the tasks in the exemplar project are similar to the scales used by the Education Quality and Accountability Office (EQAO) for the Grade 3, Grade 6, and Grade 9 provincial assessments in that both the rubrics and the EQAO scales are based on the Ontario curriculum expectations and the achievement charts. The rubrics differ from the EQAO scales in that they were developed to be used only in the context of classroom instruction to assess achievement in a particular assignment.

Although rubrics were used effectively in this exemplar project to assess responses related to the performance tasks, they are only one way of assessing student achievement. Other means of assessing achievement include observational checklists, tests, marking schemes, or portfolios. Teachers may make use of rubrics to assess students’ achievement on, for example, essays, reports, exhibitions, debates, conferences, interviews, oral presentations, recitals, two- and three-dimensional representations, journals or logs, and research projects.

**Development of the Tasks**

The performance tasks for the exemplar project were developed by teams of educators in the following way:

- The teams selected a cluster of curriculum expectations that focused on the knowledge and skills that are considered to be of central importance in the subject area. Teams were encouraged to select a manageable number of expectations. The particular selection of expectations ensured that all students would have the opportunity to demonstrate their knowledge and skills in each category of the achievement chart in the curriculum policy document for the subject.

- The teams drafted three tasks for each grade that would encompass all of the selected expectations and that could be used to assess the work of all students.

- The teams established clear, appropriate, and concrete criteria for assessment, and wrote the descriptions for each level of achievement in the task-specific rubric, using the achievement chart for the subject as a guide.

- The teams prepared detailed instructions for both teachers and students participating in the assessment project.

- The tasks were field-tested in classrooms across the province by teachers who had volunteered to participate in the field test. Student work was scored by teams of educators. In addition, classroom teachers, students, and board contacts provided feedback on the task itself and on the instructions that accompanied the task. Suggestions for improvement were taken into consideration in the revision of the tasks, and the feedback helped to finalize the tasks, which were then administered in the spring of 2001.

In developing the tasks, the teams ensured that the resources needed for completing the tasks – that is, all the worksheets and support materials – were available.

Prior to both the field tests and the final administration of the tasks, a team of validators – including research specialists, gender and equity specialists, and subject experts – reviewed the instructions in the teacher and student packages, making further suggestions for improvement.
Assessment and Selection of the Samples

After the final administration of the tasks, student work was scored at the district school board level by teachers of the subject who had been provided with training in the scoring. These teachers evaluated and discussed the student work until they were able to reach a consensus regarding the level to be assigned for achievement in each category. This evaluation was done to ensure that the student work being selected clearly illustrated that level of performance. All of the student samples were then forwarded to the ministry. A team of teachers from across the province, who had been trained by the ministry to assess achievement on the tasks, rescored the student samples. They chose samples of work that demonstrated the same level of achievement in all four categories and then, through consensus, selected the samples that best represented the characteristics of work at each level of achievement. The rubrics were the primary tools used to evaluate student work at both the school board level and the provincial level.

The following points should be noted:

• Two samples of student work are included for each of the four achievement levels. The use of two samples is intended to show that the characteristics of an achievement level can be exemplified in different ways.

• Although the samples of student work in this document were selected to show a level of achievement that was largely consistent in the four categories (i.e., problem solving; understanding of concepts; application of mathematical procedures; communication of required knowledge), teachers using rubrics to assess student work will notice that students’ achievement frequently varies across the categories (e.g., a student may be achieving at level 3 in understanding of concepts but at level 4 in communication of required knowledge).

• Although the student samples show responses to most questions, students achieving at level 1 and level 2 will often omit answers or will provide incomplete responses or incomplete demonstrations.

• Students’ effort was not evaluated. Effort is evaluated separately by teachers as part of the “learning skills” component of the Provincial Report Card.

• The document does not provide any student samples that were assessed using the rubrics and judged to be below level 1. Teachers are expected to work with students whose achievement is below level 1, as well as with their parents, to help the students improve their performance.

Use of the Student Samples

Teachers and Administrators

The samples of student work included in the exemplar documents will help teachers and administrators by:

• providing student samples and criteria for assessment that will enable them to help students improve their achievement;

• providing a basis for conversations among teachers, parents, and students about the criteria used for assessment and evaluation of student achievement;
• facilitating communication with parents regarding the curriculum expectations and levels of achievement for each subject;
• promoting fair and consistent assessment within and across grade levels.

Teachers may choose to:
• use the teaching/learning activities outlined in the performance tasks;
• use the performance tasks and rubrics in the document in designing comparable performance tasks;
• use the samples of student work at each level as reference points when assessing student work;
• use the rubrics to clarify what is expected of the students and to discuss the criteria and standards for high-quality performance;
• review the samples of work with students and discuss how the performances reflect the levels of achievement;
• adapt the language of the rubrics to make it more “student friendly”;
• develop other assessment rubrics with colleagues and students;
• help students describe their own strengths and weaknesses and plan their next steps for learning;
• share student work with colleagues for consensus marking;
• partner with another school to design tasks and rubrics, and to select samples for other performance tasks.

Administrators may choose to:
• encourage and facilitate teacher collaboration regarding standards and assessment;
• provide training to ensure that teachers understand the role of the exemplars in assessment, evaluation, and reporting;
• establish an external reference point for schools in planning student programs and for school improvement;
• facilitate sessions for parents and school councils using this document as a basis for discussion of curriculum expectations, levels of achievement, and standards.

Parents
The performance tasks in this document exemplify a range of meaningful and relevant learning activities related to the curriculum expectations. In addition, this document invites the involvement and support of parents as they work with their children to improve their achievement. Parents may use the samples of student work and the rubrics as:
• resources to help them understand the levels of achievement;
• models to help monitor their children's progress from level to level;
• a basis for communication with teachers about their children's achievement;
• a source of information to help their children monitor achievement and improve their performance;
• models to illustrate the application of the levels of achievement.
**Students**

Students are asked to participate in performance assessments in all curriculum areas. When students are given clear expectations for learning, clear criteria for assessment, and immediate and helpful feedback, their performance improves. Students’ performance improves as they are encouraged to take responsibility for their own achievement and to reflect on their own progress and “next steps”.

It is anticipated that the contents of this document will help students in the following ways:

- Students will be introduced to a model of one type of task that will be used to assess their learning, and will discover how rubrics can be used to improve their product or performance on an assessment task.
- The performance tasks and the exemplars will help clarify the curriculum expectations for learning.
- The rubrics and the information given in the Teacher’s Notes section will help clarify the assessment criteria.
- The information given under Comments/Next Steps will support the improvement of achievement by focusing attention on two or three suggestions for improvement.
- With an increased awareness of the performance tasks and rubrics, students will be more likely to communicate effectively about their achievement with their teachers and parents, and to ask relevant questions about their own progress.
- Students can use the criteria and the range of student samples to help them see the differences in the levels of achievement. By analysing and discussing these differences, students will gain an understanding of ways in which they can assess their own responses and performances in related assignments and identify the qualities needed to improve their achievement.
Number Sense and Numeration / Geometry and Spatial Sense
Prin’s Base Ten Candy Store

The Task
This task required students to:
• use base ten materials and calculators to explore concepts of money, fractions, and decimals;
• classify and compare nets for solids, and choose an appropriate solid for a given purpose.

Students discovered how many different sizes of candy can be purchased for a stated amount of money, given specific money values for the candy flat (base ten flat, consisting of 100 units), candy long (consisting of 10 units), and candy one (a single unit). Students then showed ways of combining candy ones and longs to make one-quarter of a flat. Next, given an appropriate mass for each of the base ten candies, students showed how specified numbers of flats, longs, and ones could be combined to equal a stated mass. Finally, students analysed given designs to determine whether they were nets, and decided which of two solids could best be used as a container for the base ten candies.

Expectations
This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected expectations from two strands – Number Sense and Numeration, and Geometry and Spatial Sense. Note that the codes that follow the expectations are from the Ministry of Education’s Curriculum Unit Planner (CD-ROM).

Number Sense and Numeration
Students will:
1. select and perform computation techniques appropriate to specific problems involving whole numbers, decimals, and equivalent fractions, and determine whether the results are reasonable (5m7);
2. solve problems involving decimals and fractions, and describe and explain the variety of strategies used (5m8);
3. read and write decimal numbers to hundredths (5m26);
4. add and subtract decimal numbers to hundredths using concrete materials, drawings, and symbols (5m31);
5. explain their thinking when solving problems involving whole numbers, fractions, and decimals (e.g., explain why \( \frac{3}{6} \) is the same as \( \frac{1}{2} \) (5m35);

Geometry and Spatial Sense
Students will:
6. identify, describe, compare, and classify geometric figures (5m65);
7. use mathematical language effectively to describe geometric concepts, reasoning, and investigations, and coordinate systems (5m70);
8. identify nets for a variety of polyhedra from drawings while holding three-dimensional figures in their hands (5m71);
9. use mathematical language to describe geometric ideas (e.g., quadrilateral, scalene triangle) (5m82);
10. discuss ideas, make conjectures, and articulate hypotheses about geometric properties and relationships (5m85).

**Prior Knowledge and Skills**

To complete this task, students were expected to have some knowledge or skills relating to the following:

- using place value materials
- exploring with base ten blocks
- applying units of measure (mass, money) and exploring the relationships between them
- using fractions and decimals
- making or using charts and diagrams to record answers

*For information on the process used to prepare students for the task and on the materials and equipment required, see the Teacher Package reproduced on pages 50–56 of this document.*
## Task Rubric – Prin’s Base Ten Candy Store

<table>
<thead>
<tr>
<th>Expectations*</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem solving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2</td>
<td>– selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, 6</td>
<td>– demonstrates a limited understanding of fractions and decimals</td>
<td>– demonstrates some understanding of fractions and decimals</td>
<td>– demonstrates a general understanding of fractions and decimals</td>
<td>– demonstrates a thorough understanding of fractions and decimals</td>
</tr>
<tr>
<td></td>
<td>– shows a limited understanding of the properties of geometric figures</td>
<td>– shows some understanding of the properties of geometric figures</td>
<td>– shows a clear understanding of the properties of geometric figures</td>
<td>– shows a clear and in-depth understanding of the properties of geometric figures</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3, 4, 6, 8</td>
<td>– uses computations and mathematical procedures that include many errors and/or omissions</td>
<td>– uses computations and mathematical procedures that include some errors and/or omissions</td>
<td>– uses computations and mathematical procedures that include few errors and/or omissions</td>
<td>– uses computations and mathematical procedures that include few, if any, minor errors and/or omissions</td>
</tr>
<tr>
<td></td>
<td>– classifies nets for cubes and square-based pyramids with many errors and/or omissions</td>
<td>– classifies nets for cubes and square-based pyramids with some errors and/or omissions</td>
<td>– classifies nets for cubes and square-based pyramids with few errors and/or omissions</td>
<td>– classifies nets for cubes and square-based pyramids with few, if any, minor errors and/or omissions</td>
</tr>
<tr>
<td>Expectations*</td>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
<td>Level 4</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>5, 6, 7, 9, 10</strong></td>
<td>- uses mathematical language, notation, and illustrations to show solutions with limited clarity</td>
<td>- uses mathematical language, notation, and illustrations to show solutions with some clarity</td>
<td>- uses mathematical language, notation, and illustrations to show solutions clearly</td>
<td>- uses mathematical language, notation, and illustrations to show solutions clearly and precisely</td>
</tr>
<tr>
<td></td>
<td>- uses mathematical language and illustrations with limited clarity to describe the properties of geometric solids and the relationships of the solids to their nets</td>
<td>- uses mathematical language and illustrations with some clarity to describe the properties of geometric solids and the relationships of the solids to their nets</td>
<td>- uses mathematical language and illustrations clearly to describe the properties of geometric solids and the relationships of the solids to their nets</td>
<td>- uses mathematical language and illustrations clearly and precisely to describe the properties of geometric solids and the relationships of the solids to their nets</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on pages 12–13.

*Note: This rubric does not include criteria for assessing student performance that falls below level 1.*
Prin’s Base Ten Candy Store Level 1, Sample 1

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>10 ¢</td>
<td>1 ¢</td>
</tr>
</tbody>
</table>

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

   - $1 + 10¢ + 1¢ = $1.13
   - $90¢ + 10¢ + 1¢ = $1.13

2. Suppose you knew that you could only eat $\frac{1}{4}$ of a Candy-Flat.
   Show some ways to make $\frac{1}{4}$ of a Candy-Flat using Candy-Ones and Candy-Longs.

   - Is two longs and three units, five
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of
different assortments of candy.
The mass of each individual candy is shown below.

![Candy Flats 50 g, Candy Longs 5.0 g, Candy Ones 0.5 g]

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid
the same amount. When they looked inside the bags, Kim noticed that she had
12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show
your work.

![12 Longs Make 60 g]

4. Prin wanted to package candies in cardboard containers instead of Grab
Bags.

Some of the following two-dimensional designs can be folded to make three-
dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.

![Designs A to H]
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>net</th>
<th>non-net</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>D</td>
<td>C, E</td>
</tr>
<tr>
<td>6</td>
<td>#</td>
</tr>
</tbody>
</table>

b) How are Design D and Design F the same? How are they different?

- Both have 4 faces. D has 5 faces.
- Cube has 8 faces.

F

c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square based pyramid? Explain.

- I would recommend the cube because the pyramid is too small and cannot hold as much as the cube.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution (e.g., in question 1, uses base ten materials and addition to determine two possible combinations).

Understanding of Concepts
- The student demonstrates a limited understanding of fractions and decimals (e.g., in question 2, uses base ten illustrations to show \( \frac{1}{4} \) of 100 as 2 longs and 5 units, and as 2 groups of 11 plus 3 extra units).
- The student shows a limited understanding of the properties of geometric figures (e.g., in question 4b, makes one property connection (“faces”) between two figures).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include many errors and/or omissions (e.g., in question 1 and question 3, uses pictures and symbols with limited accuracy).
- The student classifies nets for cubes and square-based pyramids with many errors and/or omissions (e.g., in question 4a, classifies some designs accurately, but classifies three incorrectly; in question 4b, does not distinguish clearly between a net for a cube and a net for a square-based pyramid).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions with limited clarity (e.g., in question 2, “is two longs and five units.”, but the illustration is inaccurate).
- The student uses mathematical language and illustrations with limited clarity to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4b, “Both have Faces. D has 5 faces cube has 8 faces”; does not cite any differences between the designs).

Comments/Next Steps
- The student should continue to use diagrams to illustrate concepts and record ideas in problem-solving situations.
- The student needs to add more details to illustrations and use more accurate drawings, to demonstrate the thought process used to generate a solution.
- The student needs to expand written explanations, using more precise mathematical language.
- The student should use concrete materials to aid in problem-solving investigations.
- The student should refer to word charts or a personal dictionary for correct spellings.
Prin’s Base Ten Candy Store! Level 1, Sample 2

Exemplar Task

Prin’s candies come in 3 sizes:

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>$0.10</td>
<td>$0.01</td>
</tr>
</tbody>
</table>

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

2. Suppose you knew that you could only eat $\frac{1}{2}$ of a Candy-Flat.

Show some ways to make $\frac{1}{4}$ of a Candy-Flat using Candy-Ones and Candy-Longs.

I could buy 3 size of candy to buy from the Prin’s Base Ten Candy Store. The combination of three of the three size of candy I could buy 6 kind of Prin’s Candy from the Prin’s Base Ten candy.
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy. The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show your work.

Janice bag: Kim bag
of Candy of Candy:

4. Prin wanted to package candies in cardboard containers instead of Grab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.

- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>does</th>
<th>doesn't</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>E</td>
</tr>
</tbody>
</table>

b) How are Design D and Design F the same? How are they different?

- The both make a prism shape and the both called prism the name are triangle prism and square base prism.
- F and D are different because triangle prism have one square, and square base prism have a square like a cube but even make

c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square based pyramid? Explain.

Cube because the square based pyramid have most triangle, only it have one square, & the cube have 6 square to hold things.
Teacher’s Notes

Problem Solving
– The student selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution (e.g., in question 1, finds a few of the possible combinations; in question 3, applies an inaccurate patterning strategy, arriving at an inaccurate solution).

Understanding of Concepts
– The student demonstrates a limited understanding of fractions and decimals (e.g., in question 2, accurately shows ¼ of 100 in the top right diagram, but the illustrations and chart show a limited understanding of ways to make ¼ of 100 using base ten blocks).
– The student shows a limited understanding of the properties of geometric figures (e.g., in question 4b, “The both make a prism shape and the both called prism there name are triangle prism and square base prism”).

Application of Mathematical Procedures
– The student uses computations and mathematical procedures that include many errors and/or omissions (e.g., in question 1, shows a limited connection between the base ten materials and $1.13).
– The student classifies nets for cubes and square-based pyramids with many errors and/or omissions (e.g., in question 4a, classifies five nets correctly and one incorrectly, and omits two; in question 4b, does not distinguish clearly between a net for a cube and a net for a square-based pyramid).

Communication of Required Knowledge
– The student uses mathematical language, notation, and illustrations to show solutions with limited clarity (e.g., in question 2, “for the candy falls it 25. for the candy longs it 5. for the candy ones it 1.”).
– The student uses mathematical language and illustrations with limited clarity to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4c, “…the cube have 6 square to hold things.”).

Comments/Next Steps
– The student should continue to use charts to organize data.
– The student should restate problems in his or her own words in order to clarify understanding.
– The student needs to expand written explanations, using more precise mathematical language.
– The student needs to add more detail to illustrations in order to demonstrate the problem-solving process.
– The student should use concrete materials to aid in problem-solving investigations.
– The student should refer to word charts or a personal dictionary for correct spellings.
Prin’s Base Ten Candy Store!  

Prin’s candies come in 3 sizes:

Candy Flats  
$1.00

Candy Longs  
10¢

Candy Ones  
5¢

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

Exemplar Task

2. Suppose you knew that you could only eat $1 \frac{1}{4}$ of a Candy-Flat. Show some ways to make $\frac{1}{4}$ of a Candy-Flat using Candy-Ones and Candy-Longs.

I found what $\frac{1}{4}$ is because 25 goes into 100 4 times. Also $\frac{1}{4}$ and $\frac{25}{100}$ is the same.
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy. The mass of each individual candy is shown below.

Candy Flats 50 g  
Candy Longs 5.0 g  
Candy Oes 0.5 g

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show your work.

This is possible

\[ \begin{array}{c}
\text{Candy Flats} \\
\text{Candy Longs} \\
\text{Candy Oes}
\end{array} \]

\[ \begin{array}{c}
50 \ g \\
5.0 \ g \\
0.5 \ g
\end{array} \]

\[ z \ \text{candy ones} = 18 \]
4. Prin wanted to package candies in cardboard containers instead of Crab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.

A
B
C
D
E
F
G
H

4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A would turn into a cube</td>
</tr>
<tr>
<td>B</td>
<td>B is not a net</td>
</tr>
<tr>
<td>C</td>
<td>C is not a net</td>
</tr>
<tr>
<td>D</td>
<td>D is a square-based pyramid</td>
</tr>
<tr>
<td>E</td>
<td>E is a net</td>
</tr>
<tr>
<td>F</td>
<td>F is not a net</td>
</tr>
<tr>
<td>G</td>
<td>G is not a net</td>
</tr>
<tr>
<td>H</td>
<td>H is not a net</td>
</tr>
</tbody>
</table>

4b) How are Design D and Design F the same? How are they different?

D and F are very different. D is a square base pyramid. F is some kind of weird shape. I do not think they are the same. D has 8 vertices. F has
c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square based pyramid? Explain.

I think that Prins store should use the cube because it will hold more candies and one gram. A cube has 8 vertices and a pyramid has 5. The cube has 6 faces and the pyramid has 5 edges. The cube

Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution (e.g., in question 1 and question 3, uses drawings of base ten materials to solve problems with some success).

Understanding of Concepts
- The student demonstrates some understanding of fractions and decimals (e.g., in question 2, demonstrates that \( \frac{1}{4} \) of 100 is 25 using repeated base ten illustrations; in question 3, “2 candy ones = 1g”).
- The student shows some understanding of the properties of geometric figures (e.g., in question 4b, shows some understanding of the differences between the designs).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include some errors and/or omissions (e.g., in question 1, adds decimals correctly to find some combinations; in question 3, makes an error in adding decimals).
- The student classifies nets for cubes and square-based pyramids with some errors and/or omissions (e.g., in question 4a, classifies some nets correctly).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions with some clarity (e.g., in question 1, uses drawings and symbols to illustrate base ten materials, but omits a final answer).
- The student uses mathematical language and illustrations with some clarity to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4b, “D and F are very different. D is a square base pyramid. F is some kind of weird shape.”).
Comments/Next Steps
- The student should continue to try to use different problem-solving strategies.
- The student should explore and identify effective ways to use tables and charts to organize recorded work in problem-solving situations.
- The student needs to provide more detailed explanations for strategies and solutions.
- The student should refer to word charts or a personal dictionary for correct spellings.
Prin's Base Ten Candy Store Level 2, Sample 2

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

![Grid of candy flats and longs](image)

Candy Flats  $1.00
Candy Longs  $0.10
Candy Ones  $0.01

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

If I had $1.13 to spend at Prin’s Base Ten Candy Store, I would buy 1 candy flat, 1 candy long, and 8 candy ones. Because

- Candy Flats: $1.00
- Candy Longs: $0.10
- Candy Ones: $0.01

$1.00 + $0.10 + 8 * $0.01 = $1.13
2. Suppose you knew that you could only eat \( \frac{1}{4} \) of a Candy-Flat. Show some ways to make \( \frac{1}{4} \) of a Candy-Flat using Candy-Ones and Candy-Longs.

3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy. The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Oses</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show your work.

Janice: This is not possible because 21 candies adds up to 5.5 grams. So Prin’s store made a mistake for Janice.

Kim: This is possible because Kim has 60 grams with \( \frac{1}{5} \) of 60 g.
4. Pria wanted to package candies in cardboard containers instead of Grab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.

\[ \text{A} \quad \text{B} \]
\[ \text{C} \quad \text{D} \]
\[ \text{E} \quad \text{F} \]
\[ \text{G} \quad \text{H} \]

4a) Which designs are nets? Organize your information in a chart.

\begin{align*}
\text{Cubes} & \quad \text{Square Based Pyramids} \\
H & = \text{cube} \\
F & = \text{cube} \\
D & = \text{square based pyramids} \\
\end{align*}

These designs are all nets.

b) How are Design D and Design F the same? How are they different?

Different: 
- D is different because it is a square based pyramid. 
- F is different because it is a cube.

Similar: 
- Both are three-dimensional shapes.
- Both can be folded into a solid object.

I presented my conclusions by using a Venn diagram.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution (e.g., in question 1, uses illustrations, words, and computations to find some combinations).

Understanding of Concepts
- The student demonstrates some understanding of fractions and decimals (e.g., in question 2, demonstrates an understanding of \( \frac{1}{4} \) of 100: “5 halves of candy longs.”).
- The student shows some understanding of the properties of geometric figures (e.g., in question 4b, shows some understanding of the similarities and differences between the two designs).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include some errors and/or omissions (e.g., in question 1, makes minor errors in recording the addition of decimals).
- The student classifies nets for cubes and square-based pyramids with some errors and/or omissions (e.g., in question 4a, classifies some nets correctly).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions with some clarity (e.g., in question 2, uses a base ten diagram that partially explains \( \frac{1}{4} \) of 100; in question 3, states, without support, that 21 candies add up to 5.5 grams, and tries to show that 12 candies add up to 60 grams).
- The student uses mathematical language and illustrations with some clarity to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4b, uses some simple mathematical language such as “nets”, “cube”, “triangles”, and “square-based pyramid”).
Comments/Next Steps

- The student should identify, compare, and consider a variety of problem-solving strategies.
- The student should use charts and tables to organize ideas.
- The student should use more complex and precise mathematical language when explaining findings.
- The student should continue to use Venn diagrams to present similarities and differences.
Prin’s Base Ten Candy Store   Level 3, Sample 1

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>10¢</td>
<td>1¢</td>
</tr>
</tbody>
</table>

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

You can buy 10 different combinations of $1.13.

2. Suppose you knew that you could only eat $\frac{1}{4}$ of a Candy-Flat. (25)

Show some ways to make $\frac{1}{4}$ of a Candy-Flat using Candy-Ones and Candy-Longs.

<table>
<thead>
<tr>
<th>Candy-Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

I found 3 different ways to use $\frac{1}{4}$ of candy flats.
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of
different assortments of candy. The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid
the same amount. When they looked inside the bags, Kim noticed that she had
12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show
your work.

Yes this is possible.
What might of each 60 g
happened is that Kim
got more big candy and
Janice got like ones
more that big candy.

4. Prin wanted to package candies in cardboard containers instead of Grab
Bags.

Some of the following two-dimensional designs can be folded to make three-
dimensional containers.

- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th></th>
<th>Square Based</th>
<th>Pyramid</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>c)</td>
<td>b)</td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td>d)</td>
<td>e)</td>
<td></td>
</tr>
<tr>
<td>h)</td>
<td>g)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) How are Design D and Design F the same? How are they different?

- Different
  - One has 6 sides, one has 5
  - One folds up to a square based pyramid and one folds up to a cube
  - One has 8 corners, one has 5
- Same
  - They each have at least 1 square
  - They have flat faces - you can stack them

c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square based pyramid? Explain.

I would pick the cube because you can put more in it because it is bigger. It would be hard to open the square based pyramid so the cube would be easier to open. You can stack the squares on top of each other so you could carry more or they wouldn’t fall over. That is why I think that I would recommend the cube.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution (e.g., in question 1 and question 3, applies patterning strategy in organizing charts to solve problems successfully; in question 1, finds all 14 combinations).

Understanding of Concepts
- The student demonstrates a general understanding of fractions and decimals (e.g., in question 2, demonstrates that \(\frac{1}{4}\) of 100 equals 25, and uses a chart to show combinations of longs and ones equalling 25).
- The student shows a clear understanding of the properties of geometric figures (e.g., in question 4b, makes comparisons between the two designs based on “sides”, “folds”, and “faces”).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include few errors and/or omissions (e.g., in question 1, accurately calculates and charts all of the possible combinations totalling $1.13).
- The student classifies nets for cubes and square-based pyramids with few errors and/or omissions (e.g., in question 4a, accurately classifies all of the designs).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions clearly (e.g., in question 1 and question 3, demonstrates findings using charts and mathematical language).
- The student uses mathematical language and illustrations clearly to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4b, describes several similarities and differences between the cube and the square-based pyramid).

Comments/Next Steps
- The student should continue to apply patterning strategies to organize charts and diagrams in solving problems.
- The student needs to expand written explanations.
- The student should check to make sure that explanations match calculations.
Prin’s Base Ten Candy Store  Level 3, Sample 2

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

Candy Flats  $1.00
Candy Longs  10¢
Candy Ones   1¢

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

2. Suppose you knew that you could only eat \( \frac{1}{4} \) of a Candy-Flat. Show some ways to make \( \frac{1}{4} \) of a Candy-Flat using Candy-Ones and Candy-Longs.
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy. The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show your work.

This is possible because...

[Kim]
Candy longs 5.0 g each so \( \frac{12}{5} \) that equals 60 g
and is 12 candies.

[Janice]
Candy flat 50 g each so 1 candy flat plus
20 candy ones = 21 candies and 60 g.

4. Prin wanted to package candies in cardboard containers instead of Grab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>Net that worked</th>
<th>Net that did not work</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>C</td>
<td>E</td>
</tr>
<tr>
<td>D</td>
<td>G</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
</tr>
</tbody>
</table>

There were more nets that worked than there were nets that did not work.

b) How are Design D and Design F the same? How are they different?

D and F are the same because they both have squares and they both fold up to make a solid. They are different because D has triangles on it and D folds up to be a square based pyramid. F folds up to be a cube.

c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square based pyramid? Explain.

I would recommend the cube because I think a cube could hold more candy. A cube would be easier to get the candy out from it because you just take off the top and take some, but a square based pyramid you would have to take off the side and all the candy would fall out.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution (e.g., in question 1, applies a patterning strategy in organizing the chart, and identifies all but one of the possible combinations; does not provide a summary statement).

Understanding of Concepts
- The student demonstrates a general understanding of fractions and decimals (e.g., in question 2, uses base ten materials to illustrate 1/4 of 100).
- The student shows a clear understanding of the properties of geometric figures (e.g., in question 4c, knows that a cube holds more candy than a square-based pyramid).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include few errors and/or omissions (e.g., in question 3, performs accurate multiplication and addition calculations).
- The student classifies nets for cubes and square-based pyramids with few errors and/or omissions (e.g., in question 4a, accurately sorts “nets that work” and “nets that don’t work” on a chart; in question 4b, distinguishes accurately between a net for a cube and a net for a square-based pyramid).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions clearly (e.g., in question 1 and question 3, presents findings clearly using a chart and mathematical notation, respectively).
- The student uses mathematical language and illustrations clearly to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4c, uses illustrations to support the packaging of candies in a cube versus a square-based pyramid).

Comments/Next Steps
- The student needs to use a systematic list in order to discover all possible solutions.
- The student should expand written explanations for all responses.
Prin’s Base Ten Candy Store  Level 4, Sample 1

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>10¢</td>
<td>1¢</td>
</tr>
</tbody>
</table>

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

You could buy 14 different combinations of candy.

You add a dime each time (1¢), and subtract 10¢ from the 1 column (14).

Checking my answers:

<table>
<thead>
<tr>
<th>10¢</th>
<th>1¢</th>
<th>1 dollar</th>
<th>10¢</th>
<th>1¢</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2. Suppose you knew that you could only eat \( \frac{1}{4} \) of a Candy-Flat.

Show some ways to make \( \frac{1}{4} \) of a Candy-Flat using Candy-Ones and Candy-Longs.

You have to find the different ways to make \( \frac{1}{4} \) of 100 using candy longs and candy ones.

There are 3 ways to make \( \frac{1}{4} \) of 100 using candy ones and candy longs.

Horizontal ones

Vertical longs

Extra 25
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy. The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

\[ 50 \text{ g} + 10 \text{ g} = 60 \text{ g} \]

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show your work.

It is possible because Janice got 60 g but she just had more candy (she also got 12 more candies). Kim got 60 g as well but she got more candy (she also got 21 candies). It really doesn’t matter how the store didn’t make a mistake.

4. Prin wanted to package candies in cardboard containers instead of Grab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>Nets</th>
<th>Not Nets</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (cube)</td>
<td>B</td>
</tr>
<tr>
<td>C (pyramid)</td>
<td>E</td>
</tr>
<tr>
<td>D (pyramid)</td>
<td>G</td>
</tr>
<tr>
<td>F (cube)</td>
<td></td>
</tr>
<tr>
<td>H (cube)</td>
<td></td>
</tr>
</tbody>
</table>

b) How are Design D and Design F the same? How are they different?

- D: Square-based pyramid
  - 4 triangular faces
  - Base: Square
  - Has apex
  - Has edges
  - Has vertices

- F: Cube
  - 6 cubes, no base
  - Does not have a base
  - Does not have an apex
  - Has 12 edges
  - Has 8 vertices

- Similarities:
  - Both have 8 vertices.
  - Both have 12 edges.

- Differences:
  - D has a base and an apex, while F does not.
  - D has triangular faces, while F has square faces.

F) c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square-based pyramid? Explain.

I would recommend the cube because a square-based pyramid has an apex which if your filling it with candy ones it will have spaces leftover and that a bad idea because somebody could get [insert emoji]. If you cut off the top it will just have enough space for more candy.

On the other hand a cube is a good idea because candy is candy long and candy flats are cubes also you won’t have leftover spaces because a cube doesn’t come to a point. (it only has vertices.)
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution (e.g., in question 1, uses detailed, accurate charts and patterning strategies to reach and confirm accurate solutions).

Understanding of Concepts
- The student demonstrates a thorough understanding of fractions and decimals (e.g., in question 2, shows a thorough understanding of 1/4 of 100 using addition and multiplication).
- The student shows a clear and in-depth understanding of the properties of geometric figures (e.g., in question 4b, describes precisely the differences between designs D and F).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include few, if any, minor errors and/or omissions (e.g., in question 1 and question 3, uses addition and subtraction with a high degree of accuracy).
- The student classifies nets for cubes and square-based pyramids with few, if any, minor errors and/or omissions (e.g., in question 4a, classifies all of the designs accurately).

Communication of Required Knowledge
- The student uses mathematical language, notation, and illustrations to show solutions clearly and precisely (e.g., in question 1, “You add a dime each time (10 col.) and subtract 10¢ from the 1 column.”).
- The student uses mathematical language and illustrations clearly and precisely to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4b, uses a Venn diagram; in question 4c, uses illustrations).

Comments/Next Steps
- The student demonstrates a thorough understanding of fractions, decimals, and the properties of the geometric figures explored in the task.
- The student should continue to justify solutions to problems using charts, diagrams, and illustrations.
Prin’s Base Ten Candy Store  Level 4, Sample 2

Exemplar Task

Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

Candy Flats  $1.00
Candy Longs  10¢
Candy Ones  1¢

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy? Show all of your solutions.

There are 14 different combinations of the three sizes of candy I could buy.

2. Suppose you knew that you could only eat \( \frac{1}{4} \) of a Candy-Flat.

Show some ways to make \( \frac{1}{4} \) of a Candy-Flat using Candy-Ones and Candy-Longs.

There are 3 different ways of making \( \frac{1}{4} \) of a Flat. The 3 ways are:

- 2 longs and 5 ones,
- 1 long and 16 ones,
- 0 longs and 25 ones.

The pattern I see is that in the longs, you keep \(-1\) and in the ones, you keep on adding 10. Also the way that I do this is round and equivalent fraction as it but the denominator had to be 100 because there are 100 ones/pieces in a Flat and when I could tell how many pieces (longs/ones) I need to make ways so it. So I had to make 25 pieces with the longs and ones. So the three ways are:
- 2 longs and 5 ones,
- 1 long and 16 ones,
- 0 longs and 25 ones.
3. Prin’s Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of
different assortments of candy.

The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid
the same amount. When they looked inside the bags, Kim noticed that she had
12 candies and Janice had 21 candies.

Is this possible, or did Prin’s Candy Store make a mistake? Investigate. Show
your work.

Kim could have had different bags. Janice could have had a possible way.
This is possible for Kim to have 12 candies and Janice to have 21 candies
so each got 5 gms.

4. Pria wanted to package candies in cardboard containers instead of Grab
Bags.

Some of the following two-dimensional designs can be folded to make three-
dimensional containers.
- Some of the designs are nets for cubes.
- Some of the designs are nets for square-based pyramids.

- A
- B
- C
- D
- E
- F
- G
- H
4a) Which designs are nets? Organize your information in a chart.

<table>
<thead>
<tr>
<th>Design</th>
<th>Cube</th>
<th>Square-based Pyramid</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

- It's that shape
- It's not that shape

b) How are Design D and Design F the same? How are they different?

- They are same because they both make nets. Also, their base is with a square. Also, they have 3D shapes, and they both have vertices and edges. The way that they are different is D makes a square-based pyramid and F makes a cube. Also, D has 6 faces, and F has 5 faces. Also, D has 8 vertices, and F has 6 vertices. Also, D has 12 edges, and F has 8 edges.

48  The Ontario Curriculum – Exemplars, Grade 5: Mathematics

48  The Ontario Curriculum – Exemplars, Grade 5: Mathematics

c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square-based pyramid? Explain.

I would choose the square-based pyramid because it has more volume than the square-based pyramid. For example, you know that a square is bigger than a triangle so the space that's coloured in here has more extra room to put candies.
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution (e.g., in question 1 and question 3, uses detailed, accurate charts, calculations, and patterning strategies to solve the problems thoroughly).

Understanding of Concepts
– The student demonstrates a thorough understanding of fractions and decimals (e.g., in question 2, uses a detailed chart, base ten illustrations, and a written explanation to show $\frac{1}{4}$ of 100).
– The student shows a clear and in-depth understanding of the properties of geometric figures (e.g., in question 4b, provides accurate and detailed descriptions of similarities and differences between the designs).

Application of Mathematical Procedures
– The student uses computations and mathematical procedures that include few, if any, minor errors and/or omissions (e.g., in questions 1, 2, and 3, performs all calculations accurately).
– The student classifies nets for cubes and square-based pyramids with few, if any, minor errors and/or omissions (e.g., in question 4a, classifies all designs accurately).

Communication of Required Knowledge
– The student uses mathematical language, notation, and illustrations to show solutions clearly and precisely (e.g., in question 2, “...I found an equivalent fraction of $\frac{1}{4}$ but the denominator had to be 100 because there are 100 ones/pieces in a flat.”).
– The student uses mathematical language and illustrations clearly and precisely to describe the properties of geometric solids and the relationships of the solids to their nets (e.g., in question 4c, “the cube has more volume than the square-based pyramid.”).

Comments/Next Steps
– The student provides detailed responses that demonstrate a thorough understanding of fractions, decimals, and the properties of the geometric figures explored in the task.
– The student should continue to provide thorough evidence in the course of investigations.
– The student should proofread carefully, to eliminate spelling errors in mathematical terms.
Teacher Package

Mathematics Exemplar Task
Grade 5 – Number Sense and Numeration/Geometry and Spatial Sense

Title: Prin’s Base Ten Candy Store

Time requirements: 240 minutes (total)
- Pre-tasks – 40 minutes x 1
- Exemplar task – 50 minutes x 4
(The pre-tasks and exemplar task may be completed on four separate days. Time requirements are suggestions, and may vary.)

Description of the Task
In solving problems related to the sale of candy, students will use base ten materials and calculators to explore concepts of money, fractions, and decimals, and will show different combinations that equal a given total. Students will also classify and compare nets for solids, and choose an appropriate solid for a given purpose.

Expectations Addressed in the Exemplar Task

Note that the codes that follow the expectations are from the Ministry of Education’s Curriculum Unit Planner (CD-ROM).

Number Sense and Numeration
Students will:
1. select and perform computation techniques appropriate to specific problems involving whole numbers, decimals, and equivalent fractions, and determine whether the results are reasonable (5m7);
2. solve problems involving decimals and fractions, and describe and explain the variety of strategies used (5m8);
3. read and write decimal numbers to hundredths (5m26);
4. add and subtract decimal numbers to hundredths using concrete materials, drawings, and symbols (5m31);
5. explain their thinking when solving problems involving whole numbers, fractions, and decimals (e.g., explain why ½ is the same as ¼) (5m35);

Geometry and Spatial Sense
Students will:
6. identify, describe, compare, and classify geometric figures (5m65);
7. use mathematical language effectively to describe geometric concepts, reasoning, and investigations, and coordinate systems (5m70);
8. identify nets for a variety of polyhedra from drawings while holding three-dimensional figures in their hands (5m71);
9. use mathematical language to describe geometric ideas (e.g., quadrilateral, scalene triangle) (5m82);
10. discuss ideas, make conjectures, and articulate hypotheses about geometric properties and relationships (5m85).

Teacher Instructions

Prior Knowledge and Skills Required
Before attempting the task, students should have had experience with the following:
- using place value materials
- exploring with base ten blocks
- applying units of measure (mass, money) and exploring the relationships between them
- using fractions and decimals
- making or using charts and diagrams to record answers

The Rubric*
The rubric provided with this exemplar task is to be used to assess students’ work. The rubric is based on the achievement chart given on page 9 of The Ontario Curriculum, Grades 1–8: Mathematics, 1997.

Before asking students to do the task outlined in this package, review the concept of a rubric with them. Rephrase the rubric so that students can understand the different levels of achievement.

Accommodations
Accommodations that are normally provided in the regular classroom for students with special needs should be provided when the exemplar task is administered.

*The rubric is reproduced on pages 14–15 of this document.
Materials and Resources Required

- Rubric – one copy for each student
- For each group of 3-4 students:
  - 20 pennies, 4 nickels, 2 dimes
  - chart paper
  - markers

Pre-task 1
- Polyhedra (tetrahedron, rectangular prism, and triangular prism)
- Centimetre grid paper or square dot and isometric (triangular) dot paper
- Scissors
- Polydrons (if available) for the tetrahedron, the rectangular prism, and the triangular prism
- Students’ math journals
- Overhead projector or chart paper

Pre-task 2
- Polyhedra (tetrahedron, rectangular prism, and triangular prism)
- Centimetre grid paper or square dot and isometric (triangular) dot paper

Exemplar task
- Student package (see Appendix 1) – one copy for each student
- Base ten blocks (for an alternative, see Classroom Setup)
- Calculators
- Polyhedra (cubes and square-based pyramids)

Follow-up
- Polydron materials (if available – squares and triangles)
- Centimetre grid paper or isometric (triangular) dot paper

Classroom Set-up
- For pre-task 1, students work in groups of three or four, then gather for whole-class discussion.
- For pre-task 2, students work individually, then gather for whole-class discussion.
- For the exemplar task, students will need access to base ten blocks and ample space in which to use them. If base ten blocks are limited in number, you may want to have students work on the tasks in staggered periods of time, or have them use paper cut-outs. (See Appendix 2.) Students work individually and independently for the exemplar task.

Task Instructions

Introductory Activities
The pre-tasks are designed to review and reinforce the skills and concepts that students will be using in the exemplar task and to model strategies useful in completing the task.

Pre-task 1: Making Change
1. Arrange students in groups of three or four.
2. Distribute 20 pennies, 4 nickels, 2 dimes, chart paper, and markers to each group.
3. Ask the students: “In how many different ways can you make 20¢ using dimes, nickels, and pennies?” “How do you know when you have found all the ways?”
4. Allow students time for investigation. Have each group present its findings to the class.
5. Record general conclusions on chart paper as a class summary.

Your chart could look like this:

<table>
<thead>
<tr>
<th>Dimes</th>
<th>Nickels</th>
<th>Pennies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

Pre-task 2: Polyhedra
Students work individually for this pre-task.
1. Display three geometric solids: the tetrahedron, the rectangular prism, and the triangular prism.
2. Have each student choose one and draw the net of his or her chosen solid on centimetre grid paper or square dot or isometric (triangular) dot paper.
3. Ask each student to cut out and fold his or her net to make the chosen solid.
4. Have one student sketch his or her net on the board, the overhead, or chart paper.
5. Ask the students: “How many different nets for this solid can you find?” “How do you know when you have them all?”
6. Give the students time to draw the different nets for this solid.
7. Have the students display their nets on the overhead or on chart paper.
8. Proceed this way for the other two solids.
9. Have the students record their findings in their math journals.

Exemplar Task
1. Hand out the student packages. (See Appendix 1 for the worksheets containing the task the students will work on independently.)
2. Tell the students that they will work individually and independently to complete the assigned task.
3. Ensure that each student has free access to a calculator and to base ten blocks. (If the number of base ten blocks is limited, see Classroom Set-up.) Students should also have access to geometric solids (cube and square-based pyramid), which they can use in determining which designs form nets in question 4.
4. Remind the students about the rubric, and make sure that each student has a copy of it.
5. Set the students to work on the task.

Follow-up
- After students have completed the exemplar task, have a whole-group discussion in which students generate a list of all the different combinations for $1.13 that they found for the candy-store problem. Record the ideas on chart paper for display in the classroom.
- Discuss how students know that they have found all the possible combinations.
- Students could explore shapes other than those in the base ten set. For example, they could assign money values to certain pattern blocks and do similar investigations. Students would have to use fractions to decide the value of each piece.
- Have students explore all the possible nets for cubes and square-based pyramids using Polydron materials (if available) and square dot paper or isometric (triangular) dot paper.

Appendix 1

Exemplar Task
Prin’s Base Ten Candy Store!

Prin’s candies come in 3 sizes:

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>10¢</td>
<td>1¢</td>
</tr>
</tbody>
</table>

1. If you had $1.13, how many different combinations of the three sizes of candy could you buy?
   Show all of your solutions.
2. Suppose you knew that you could only eat $\frac{1}{4}$ of a Candy Flat.
   Show some ways to make $\frac{1}{4}$ of a Candy Flat using Candy Ones and Candy Longs.

3. Prin's Candy Store also sells Grab Bags. Each Grab Bag holds 60 g of different assortments of candy.
   The mass of each individual candy is shown below.

<table>
<thead>
<tr>
<th>Candy Flats</th>
<th>Candy Longs</th>
<th>Candy Ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 g</td>
<td>5.0 g</td>
<td>0.5 g</td>
</tr>
</tbody>
</table>

Kim and her friend Janice each bought a 60 g Grab Bag, and they each paid the same amount. When they looked inside the bags, Kim noticed that she had 12 candies and Janice had 21 candies.

Is this possible, or did Prin's Candy Store make a mistake? Investigate. Show your work.
4. Prin wanted to package candies in cardboard containers instead of Grab Bags.

Some of the following two-dimensional designs can be folded to make three-dimensional containers.
• Some of the designs are nets for cubes.
• Some of the designs are nets for square-based pyramids.

4a) Which designs are nets? Organize your information in a chart.

b) How are Design D and Design F the same? How are they different?
c) If you were to help Prin decide which type of container to use for packaging candies, would you recommend the cube or the square-based pyramid? Explain.
Patterning and Algebra
What Are Rep-Tiles?

The Task
This task required students to:
• explore numeric and geometric patterns;
• investigate how pattern blocks and other shapes can be used to form “rep-tiles”. (A rep-tile is an enlargement of a shape, created using replicas of the original shape.)

Students made and recorded enlargements (“rep-tiles”) of all the pattern block shapes, and described the patterns they found. Then they made and recorded enlargements of other shapes, and summarized their findings.

The pattern blocks the students worked with included the following: yellow hexagon, blue rhombus, beige rhombus, red trapezoid, green triangle, and orange square. (Some students referred to one or both of the rhombi as diamonds, and to the beige rhombus as white or brown.)

Expectations
This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected expectations from the Patterning and Algebra strand. Note that the codes that follow the expectations are from the Ministry of Education’s Curriculum Unit Planner (CD-ROM).

Students will:
1. recognize and discuss the mathematical relationships between and among patterns (5m91);
2. identify, extend, and create patterns in a variety of contexts (5m92);
3. analyse and discuss patterning rules (5m93);
4. create tables to display patterns (5m94);
5. apply patterning strategies to problem-solving situations (5m95);
6. recognize the relationship between the position of a number and its value (e.g., the first term is 1, the second term is 4, the third term is 7, and so on) (5m96);
7. pose and solve problems by applying a patterning strategy (e.g., what effect will doubling the first number have on the pattern?) (5m101);
8. analyse number patterns and state the rule for any relationships (5m102).
Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills relating to the following:

- tessellating (making a tiling pattern in which shapes are fitted together with no gaps or overlaps)
- exploring with pattern blocks
- recognizing numeric and geometric patterns
- looking for patterns in charts and tables
- stating rules for patterns found
- knowing the difference between similar and congruent (two figures are congruent if they have the same size and shape; the figures are similar if one is a larger or smaller version of the other, with identical angles and proportions)
- understanding enlargement
- knowing how to make a similar figure

For information on the process used to prepare students for the task and on the materials and equipment required, see the Teacher Package reproduced on pages 96–102 of this document.
### Task Rubric – What Are Rep-Tiles?

<table>
<thead>
<tr>
<th>Expectations*</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem solving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5, 7</td>
<td>- selects and applies a problem-solving strategy to determine which shapes can form a rep-tile, arriving at an incomplete or inaccurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a partially complete and/or partially accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a generally complete and accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2, 6, 8</td>
<td>- identifies and describes geometric and number patterns by providing limited explanations and illustrations</td>
<td>- identifies and describes geometric and number patterns by providing partial explanations and illustrations</td>
<td>- identifies and describes geometric and number patterns by providing appropriate and complete explanations and illustrations</td>
<td>- identifies and describes geometric and number patterns by providing appropriate and thorough explanations and illustrations</td>
</tr>
<tr>
<td></td>
<td>- shows limited understanding of similar shapes in a pattern involving rep-tiles</td>
<td>- shows some understanding of similar shapes in a pattern involving rep-tiles</td>
<td>- shows clear understanding of similar shapes in a pattern involving rep-tiles</td>
<td>- shows thorough understanding of similar shapes in a pattern involving rep-tiles</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>- creates and extends rep-tile patterns using pattern blocks and dot paper with many errors and/or omissions</td>
<td>- creates and extends rep-tile patterns using pattern blocks and dot paper with some errors and/or omissions</td>
<td>- creates and extends rep-tile patterns using pattern blocks and dot paper with few errors and/or omissions</td>
<td>- creates and extends rep-tile patterns using pattern blocks and dot paper with few, if any, minor errors and/or omissions</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3, 4, 8</td>
<td>- uses mathematical language and notation to describe and illustrate number and geometric patterns with limited clarity</td>
<td>- uses mathematical language and notation to describe and illustrate number and geometric patterns with some clarity</td>
<td>- uses mathematical language and notation to describe and illustrate number and geometric patterns clearly</td>
<td>- uses mathematical language and notation to describe and illustrate number and geometric patterns clearly and precisely</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on page 58.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.
What Are Rep-Tiles?  Level 1, Sample 1

Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.

b) Describe all the patterns you have found.

You go up by 1. For example...

rep-9 = 5  rep-15 = 6  rep-22 = 7  rep-30 = 8

It gets larger the more numbers you add to it.
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper – square or isometric paper.

b) What are some of the patterns you notice as new rep-tiles are created?

That the □ and the □ are hard to make and the △ are easy to make.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

- Pentagon

\[ \times \text{ did not work} \]
\[ \checkmark \text{ did work} \]
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy to determine which shapes can form a rep-tile, arriving at an incomplete or inaccurate solution (e.g., in question 2, explores some patterns incompletely or inaccurately, but finds the rep-tile pattern for the beige rhombus).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing limited explanations and illustrations (e.g., in question 2b, “the [blue rhombus] and the [hexagon] are hard to make and the [beige rhombus], [square], [trapezoid], [triangle] are easy to make.”).
- The student shows limited understanding of similar shapes in a pattern involving rep-tiles (e.g., in question 3, provides three growing patterns – the rectangle grows to a larger rectangle, but does not form a correct rep-tile).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with many errors and/or omissions (e.g., in question 1a, creates one correct rep-tile on dot paper).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns with limited clarity (e.g., in question 1b, “It gets larger the more numbers you add to it.”).

Comments/Next Steps
- The student should restate the problem in order to clarify understanding.
- The student should include charts, diagrams, numbers, or words to describe patterns.
- The student should explore the use of concrete materials to solve problems.
- The student needs to practise using dot paper to draw shapes and record findings of investigations.
- The student should continue his or her efforts to attempt all questions in a task.
Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1 square used 4 small squares ...

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper—square or isometric.

b) Describe all the patterns you have found.

I was adding 4 every time, because in the first one you added 4 blocks, to = 4 small squares.
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper – square or isometric paper.

b) What are some of the patterns you notice as new rep-tiles are created?

What I did was I started with 2 blocks and added 4 blocks and it = 6 blocks.
Then I had 6 blocks and added 4 blocks and it = 10 blocks.
Then I had 10 blocks and added 4 blocks and it = 14 blocks.
Then I had 14 blocks and added 4 blocks and it = 18 blocks.
Then I had 18 blocks and added 4 blocks and it = 22 blocks.

Now I end up with 22 blocks.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

First I started off with 2 triangles. Then I still had the 2 triangles and I added 2 more so it = 4. Then I still had the 4 and I added 2 more and that = 6. Then I still have 6 and I added 2 more to = 8. Then I still had 8 and added 2 more to = 10. Then I still had 10 and I added 2 more to = 12. And that's what I ended up with.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy to determine which shapes can form a rep-tile, arriving at an incomplete or inaccurate solution (e.g., in question 2, uses two shapes to form growing patterns, one of which is a two-step rep-tile).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing limited explanations and illustrations (e.g., in question 1b, incorrectly describes the number of blocks at the beginning of the pattern: “I was adding 4 every time. Because in the first one you added 4 blocks. To = 4 small squares.”).
- The student shows limited understanding of similar shapes in a pattern involving rep-tiles (e.g., throughout the task, tessellates various shapes in growing patterns, but does not demonstrate understanding that a rep-tile is an enlargement of the original shape).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with many errors and/or omissions (e.g., in question 1, extends and records the pattern in a consistent but incorrect way, resulting in only one correct rep-tile).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns with limited clarity (e.g., in question 3b, describes addition by twos of triangles, but does not clearly or accurately describe a rep-tile pattern).

Comments/Next Steps
- The student should use charts and diagrams to organize findings.
- The student should use pictures, words, or numbers to describe patterns.
- The student needs to explore and extend all possible patterns using all geometric shapes in solving the given problem.
- The student should explore growing patterns with a variety of materials (e.g., geoboards, pattern blocks, pentominoes, and appropriate computer programs).
- The student should continue his or her efforts to attempt all questions in a task.
Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.

b) Describe all the patterns you have found.

1. The area of the square gets bigger.
2. The perimeter of the square gets bigger.
3. Every square that you make you would add 1 more cube around the square that you are making, then the other one.
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper — square or isometric paper.

Note: The student wrote this answer on a blank sheet of isometric (triangular) dot paper. It has been inserted here for convenience.

b) What are some of the patterns you notice as new rep-tiles are created?

1. The area of the shape got bigger.
2. The perimeter got bigger every retile.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboards or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

1. The area got bigger every time.
2. The perimeter got bigger every time.
3. You can't to the outside of the shape.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a partially complete and/or partially accurate solution (e.g., in question 2, finds the rep-tile pattern for the triangle and rhombus pattern blocks, but does not mention the trapezoid or hexagon).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing partial explanations and illustrations (e.g., in questions 1a, 2a, and 3a, provides clear illustrations, but in questions 1b, 2b, and 3b, provides inadequate explanations with no supporting illustrations).
- The student shows some understanding of similar shapes in a pattern involving rep-tiles (e.g., in questions 1a, 2a, and 3a, correctly uses some pattern blocks and self-selected shapes to form rep-tiles).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with some errors and/or omissions (e.g., in question 2a, records three rep-tile patterns accurately on dot paper, but omits the trapezoid).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns with some clarity (e.g., uses simple language to explain observations and repeats the same findings for each task – in question 1b, “1. The area of the square get’s bigger. 2. The perimider of the square get’s bigger.”).

Comments/Next Steps
- The student needs to include charts and tables as well as labelled diagrams and words to describe geometric and numerical patterns.
- The student should elaborate on some findings by including specific examples.
- The student should use clear mathematical language to explain solutions.
- The student should continue to use pattern blocks to explore patterns and solve problems.
- The student should refer to word charts or a personal dictionary for correct spellings.
What Are Rep-Tiles? Level 2, Sample 2

Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper—square or isometric.

b) Describe all the patterns you have found.

I have found out that you draw the figure from before on your grid.
Then add a full side across the top and the side.

![Grid with rep-tiles]
Note: The student wrote this answer on a blank sheet of isometric (triangular) dot paper. It has been inserted here for convenience.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

I found out that you can't do an octagon, but you can do the rectangle and pentagon.

\[ \text{Rep 4} \]

\[ \text{Rep 9} \]
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a partially complete and/or partially accurate solution (e.g., in question 2, finds and records some of the rep-tile patterns; in question 3, explores the rectangle, pentagon, and octagon and finds and records the rep-tile pattern for the rectangle, but states inaccurately that “you can do the ... pentagon.”).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing partial explanations and illustrations (e.g., in question 1, provides a partial explanation of how the pattern grows: “I have found out that you draw the figure from before on your grid. Then add a full side across the top and the side.”).
- The student shows some understanding of similar shapes in a pattern involving rep-tiles (e.g., in question 2, uses pattern blocks to explore some similar shapes in growing patterns).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with some errors and/or omissions (e.g., in question 2a, records some patterns accurately on dot paper, but does not complete the trapezoid pattern, and omits one rhombus).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns with some clarity (e.g., in question 2b, uses language with some clarity: “The Things that I see are you square the number and it gets bigger”).

Comments/Next Steps
- The student should use clearer mathematical language and notation to describe mathematical solutions and the observed patterns.
- The student needs to create many different patterns, including numerical patterns using geometric shapes.
Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.

b) Describe all the patterns you have found.

- it goes \(2 \times 2, 3 \times 3, 4 \times 4, 5 \times 5\) etc.
- The first one is an odd \(n\), the 2nd is even, the 3rd is odd, the 4th is even, etc.
- These all squares
- You always add a column and a row
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper – square or isometric paper.
b) What are some of the patterns you notice as new rep-tiles are created?

- All the ones that worked had 3 or 4 sides.
- You always keep the same shape from the previous rep-tile and then add.
  ex rep-1 rep-4 rep-9 etc.

3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or grid paper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

  b) Summarize your findings below.

  - Most all triangles will work.
  - All rectangles will work.
  - Stage 1 is 1x1, stage 2 is 2x2, stage 3 is 3x3 etc.
  - You need a figure with 3 or 4 sides.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a generally complete and accurate solution (e.g., in question 2, applies a three-step rep-tile pattern for the pattern blocks that rep-tile, but does not mention the hexagon; in question 3, successfully explores shapes, but does not investigate any that do not form rep-tiles).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing appropriate and complete explanations and illustrations (e.g., in question 2b, identifies and describes several geometric patterns seen in the creation of rep-tiles; does not mention the pattern relationship between rep-tiles and square numbers).
- The student shows clear understanding of similar shapes in a pattern involving rep-tiles (e.g., in questions 3a and 3b, provides complete explanations and labeled illustrations for the created rep-tile patterns).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with few errors and/or omissions (e.g., in question 2a, creates and extends all patterns on dot paper).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns clearly (e.g., in question 1b, uses clear language to describe rep-tile patterns [“odd”, “even”, “you always add a column and a row”], and includes appropriate notation [“it goes to 2 x 2, 3 x 3, 4 x 4, 5 x 5 etc.”]).
Comments/Next Steps

- The student should continue to include charts, as well as diagrams, words, and numbers, to describe patterns and present findings.
- The student should continue to use clear language to describe mathematical solutions, elaborating on some findings with the use of specific examples.
- The student should continue to explore the possible patterns in a given question.
- The student should refer to word charts or a personal dictionary for correct spellings.
Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1 square unit

4 small squares

...
b) What are some of the patterns you notice as new rep-tiles are created?

One of the patterns I noticed was the first shape is always an uneven number, the second shape is even,
the third shape is uneven and the fourth shape is even.

For example: 1, 4, 16.

In each shape there is a pattern inside the triangle, there might be three triangle than in the second one there might be three and than six. For example:

In some of the shapes the amount of dots counts by the amount the first one started with. So if the first shape uses three dots, the next one will use 6 dots then 9 and then 15.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set.

You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

The two bottom shapes both have four points and corners. For example:

```
1 3
2 4
```

The two top shapes both use the same shape. The middle shape uses two of the shapes and the top one uses one. They both use this shape \( \triangle \)

I noticed that the top shape could easily become the middle shape if you added the same shape to the other side of the top one.

\( \square \) If you did that it would make the same shape as the middle shape.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a generally complete and accurate solution (e.g., in question 2, finds and records a four-step rep-tile pattern for most pattern blocks [both rhombi, the triangle, and the trapezoid], but does not mention the hexagon; in question 3, successfully explores self-selected shapes, but does not explore any that do not rep-tile).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing appropriate and complete explanations and illustrations (e.g., in question 2b, identifies and describes several geometric and number patterns; does not mention the relationship between the growing rep-tiles and square numbers).
- The student shows clear understanding of similar shapes in a pattern involving rep-tiles (e.g., in question 3a, accurately illustrates the repeating of two self-selected shapes to create rep-tiles, but also uses the square, which is a pattern block shape).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with few errors and/or omissions (e.g., in question 2, accurately creates and extends repeating patterns on dot paper).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns clearly (e.g., in question 1b, uses clear language, numbers, and labelled diagrams to describe and extend rep-tile patterns: “same length”, “one more”, “26mm”; in question 2b, clearly makes interesting observations; in question 3, provides a somewhat confusing discussion and presentation of the middle shape).

Comments/Next Steps
- The student needs to include charts, as well as diagrams and words, to describe patterns.
- The student should continue to use clear language and mathematical notation to describe solutions.
Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.

<table>
<thead>
<tr>
<th>square</th>
<th>number of squares</th>
<th>reptile order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2 x 2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3 x 3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4 x 4</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>5 x 5</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>6 x 6</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

b) Describe all the patterns you have found.

b) In order to go from 1 square to the next you start adding 3. If 1 square is 1, then 1 + 3 = 4, and so on.

---

86 The Ontario Curriculum – Exemplars, Grade 5: Mathematics
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper – square or isometric paper.

For triangles I did a rep 1, 4, 9, 16
For squares I did a rep 1, 4, 9 of a 1x1 square, a 2x2 square and a 3x3 square.
For diamonds I did a rep 1, 4, 9, I noticed they do not go good on square paper.
For parallelograms I did a rep 1, 4, 9.
For trapezoids I made a rep 1, 4, 9.
For hexagon I couldn’t make a pattern.

b) What are some of the patterns you notice as new rep-tiles are created?

a) I noticed that if a square is say a 1x1 square you multiply 1 by 1 to get an answer of 1 little square. I noticed that this also worked for a 2x2 square and a 3x3 square.

b) For the diamond I noticed that each time you add another section each time the sections go bigger by two as shown in the top right hand corner.

c) For the triangle I noticed that you start at 3 and keep adding 2 to what your adding e.g., 1+3=4 so the next triangle will have 4 triangles.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

The first shape I chose was a rectangle. I noticed that it turned out like a square next with a different length. Another shape I found was a circle. Triangle 5 output just to get from 1 to the next you start at three for the first one and keep on adding 2 to what your adding. I noticed the same pattern with the rectangle. Another shape I found was a right angle triangle. Found the same pattern as with the rectangle triangle.
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a thorough and accurate solution (e.g., in question 2, explores all of the pattern block shapes accurately; in question 3a, finds and records accurate rep-tile patterns for three self-selected shapes, and illustrates one shape that will not rep-tile).

Understanding of Concepts
– The student identifies and describes geometric and number patterns by providing appropriate and thorough explanations and illustrations (e.g., in questions 1b and 2b, includes charts, T-tables, illustrations, and examples of extensions of the pattern in order to support detailed and thorough explanations of rep-tile patterns, including the pattern relationship of rep-tiles and square numbers).
– The student shows thorough understanding of similar shapes in a pattern involving rep-tiles (e.g., in question 3a, uses self-selected shapes in patterns involving rep-tiles; in question 3b, compares rep-tiles made from rectangles and squares, and compares rep-tiles made from isosceles triangles and right-angle triangles).

Application of Mathematical Procedures
– The student creates and extends rep-tile patterns using pattern blocks and dot paper with few, if any, minor errors and/or omissions (e.g., in question 2a, accurately records five rep-tile patterns).

Communication of Required Knowledge
– The student uses mathematical language and notation to describe and illustrate number and geometric patterns clearly and precisely (e.g., throughout the task, uses charts, T-tables, illustrations, and clear, thorough mathematical language to explain and describe solutions; in question 2b, “For the diamond I noticed that each time you add another section, and each time the sections got bigger by two as shown in the top right hand corner.”).

Comments/Next Steps
– The student demonstrates a thorough understanding of the concept of rep-tiles.
– The student should continue to use charts, diagrams, and verbal explanations to support responses.
– The student should plan the layout of solutions to make them clearer.
– The student should refer to word charts or a personal dictionary for correct spellings.
What Are Rep-Tiles?  Level 4, Sample 2

Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

You add one at the top and one square on the side and fill the whole which makes a larger version of the square using replicas of that square.

1. a) Use Pattern Blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.
b) Describe all the patterns you have found.

<table>
<thead>
<tr>
<th>Stage</th>
<th># of Blocks</th>
<th>Algebraic Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>9</td>
<td>((2 \times 3) + 3) or (3 \times 3)</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>((3 \times 4) + 4) or (4 \times 4)</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>((4 \times 5) + 5) or (5 \times 5)</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
<td>((5 \times 6) + 6) or (6 \times 6)</td>
</tr>
<tr>
<td>7</td>
<td>49</td>
<td>((6 \times 7) + 7) or (7 \times 7)</td>
</tr>
<tr>
<td>20</td>
<td>400</td>
<td>((19 \times 20) + 20) or (20 \times 20)</td>
</tr>
</tbody>
</table>

All you do is multiply the number you would like to one less and add the first number you pick to multiply. If it or you multiply the number you picked to it, it is itself.

Ex: You want to know how many blocks there are in this square.
1) You multiply the # of block on the side to it is self. \(4 \times 4 = 16\)
2) And there is your answer.
Also the squares flip.

\[
\begin{array}{c}
20 \\
\times 20 \\
\hline
0 0 \\
+ 4 0 0 \\
\hline
9 0 0
\end{array}
\]
b) What are some of the patterns you notice as new rep-tiles are created?

I notice that the patterns I have created increase the same way as the square, and also some of the shapes I used increase in their same shape, like the triangle and the diamond.

Ex: 

```
original
rep-4
```

```
original
rep-9
```

The hexagon is one of the shapes which doesn’t make a bigger replica of it; it’s still looks more like a honeycomb.
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.

My findings are that a pentagon can increase the same way as a square, but the pentagon does not make a legal rep-tile if it’s self.

Ex: a square

<table>
<thead>
<tr>
<th>4 squares</th>
<th>4 squares</th>
</tr>
</thead>
</table>

Ex: a pentagon

| 4 pentagons |

Also the squares slide to make a legal rep-tile, a triangle flips and slides, but the pentagon flips down or up and slides to the sides.

The octagon doesn’t work because you must put a square in the middle to make them fit.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to determine which shapes can form a rep-tile, arriving at a thorough and accurate solution (e.g., in question 2a, explores all of the pattern block shapes accurately; in question 3a, thoroughly applies several rep-tile patterns, accurately finding which shapes can and cannot be used to form rep-tiles).

Understanding of Concepts
- The student identifies and describes geometric and number patterns by providing appropriate and thorough explanations and illustrations (e.g., in questions 1b and 2b, includes charts, T-tables, and illustrations to support detailed and thorough explanations of rep-tile patterns, and identifies the pattern relationship between rep-tiles and square numbers).
- The student shows thorough understanding of similar shapes in a pattern involving rep-tiles (e.g., in question 2, records several pattern block rep-tiles; in question 3, illustrates self-selected shapes that do and do not rep-tile).

Application of Mathematical Procedures
- The student creates and extends rep-tile patterns using pattern blocks and dot paper with few, if any, minor errors and/or omissions (e.g., in question 2a, accurately records all of the pattern block rep-tiles, and the non-rep-tiling pattern of the hexagons).

Communication of Required Knowledge
- The student uses mathematical language and notation to describe and illustrate number and geometric patterns clearly and precisely (e.g., uses charts, T-tables, illustrations, and mathematical language to clearly and thoroughly explain and describe solutions; in question 3b, “Also the squares slide to make a bigger replica, a triangle flips and slides, but the pentagon flips down or up and slides to the sides.”).
Comments/Next Steps
- The student’s clear, concise, and well-organized answers reflect a thorough understanding of the patterning concepts explored in this task.
- The student could use appropriate software to further explore mathematical relationships.
- The student should proofread his or her final product to check for correctness of language and spelling.
**Teacher Package**

**Mathematics Exemplar Task**  
**Grade 5 – Patterning and Algebra**  
**Teacher Package**

**Title:** What Are Rep-Tiles?  

**Time requirements:** 260 minutes (total)  
- Pre-tasks - 30 minutes x 2  
- Exemplar task – 50 minutes x 4  
(The pre-tasks and exemplar task may be completed on four separate days. Time requirements are suggestions, and may vary.)

**Description of the Task**

In this task, students will explore various number and geometric patterns using a variety of materials, including pattern blocks and dot paper. Students will investigate how pattern blocks and other shapes can be used to form “rep-tiles”. (A rep-tile of a shape is an enlargement of that shape, created by tiling with the original shape.) Students will record their findings, and describe the patterns they observe as they make the various rep-tiles.

**Expectations Addressed in the Exemplar Task**

Note that the codes that follow the expectations are from the Ministry of Education’s *Curriculum Unit Planner* (CD-ROM).

**Students will:**
1. recognize and discuss the mathematical relationships between and among patterns (5m91);  
2. identify, extend, and create patterns in a variety of contexts (5m92);  
3. analyse and discuss patterning rules (5m93);  
4. create tables to display patterns (5m94);  
5. apply patterning strategies to problem-solving situations (5m95);  
6. recognize the relationship between the position of a number and its value (e.g., the first term is 1, the second term is 4, the third term is 7, and so on) (5m96);  
7. pose and solve problems by applying a patterning strategy (e.g., what effect will doubling the first number have on the pattern?) (5m101);  
8. analyse number patterns and state the rule for any relationships (5m102).

**Teacher Instructions**

**Prior Knowledge and Skills Required**

Before attempting the task, students should have had experience with the following:
- tessellating (making a tiling pattern in which shapes are fitted together with no gaps or overlaps)  
- exploring with pattern blocks  
- recognizing numeric and geometric patterns  
- looking for patterns in charts and tables  
- stating rules for patterns found  
- knowing the difference between *similar* and *congruent*  
- understanding enlargement  
- knowing how to make a similar figure.

**The Rubric**

The rubric provided with this exemplar task is to be used to assess students’ work. The rubric is based on the achievement chart given on page 9 of *The Ontario Curriculum, Grades 1–8: Mathematics, 1997*.

Before asking students to do the task outlined in this package, review with them the concept of a rubric. Rephrase the rubric so that students can understand the different levels of achievement.

**Accommodations**

Accommodations that are normally provided in the regular classroom for students with special needs should be provided when the exemplar task is administered.

**Materials and Resources Required**

- Rubric – one copy for each student  
- Pre-task 1  
  - Pattern blocks  
  - Overhead projector  
  - Square and isometric (triangular) dot paper. *Note: These papers are also referred to as geopaper.*  
  - Chart paper  
  - Pencils

*The rubric is reproduced on page 60 of this document.*
Pre-task 2
- Square dot paper
- Square tiles and/or orange pattern blocks
- Overhead projector
- Paper and pencils

Exemplar task
- Student package (see Appendix 1)
- Square and isometric (triangular) dot paper. Note: These papers are also referred to as geopaper.
- Pattern blocks (as many as possible)
- Calculators as needed
- Geoboard (optional)
- Pencils

Classroom Set-up
- For the pre-tasks, students work in pairs at their desks and participate in whole-class discussions.
- For pre-task 1 and the exemplar task, students will need access to pattern blocks and room in which to use them. If pattern blocks are limited in number, you may want to have students work on the exemplar task in staggered periods of time.
- Students work individually and independently at their desks for the exemplar task.

Task Instructions

Introductory Activities
The pre-tasks are designed to review and reinforce the skills and concepts that students will be using in the exemplar task and to model strategies useful in completing the task.

Pre-task 1: Tessellation with Pattern Blocks (30 minutes x 1)
1. Distribute different-shaped pattern blocks to pairs of students. Ask the students to work in pairs to tessellate a surface with two different-shaped pattern blocks; for example, the square and the triangle.
   You may have to remind the students of the definition of tessellation: a tiling pattern in which shapes are fitted together with no gaps or overlaps.
   Have the students record their responses on geopaper. Encourage the students to discuss their findings.

2. Allow students time to explore their tessellation using the two different shapes. Ask students:
   - “What did you notice?”
   - “Could the tessellation have been done a different way with the pieces you selected?”
   - “How would the two tessellations be similar?”
   - “How would they be different?”
   Ask a student to volunteer to show his or her tessellation on the overhead. A second student can demonstrate a tessellation that uses different shapes from those used by the first volunteer. Encourage students to notice the similarities and differences in the two tessellations. Ask:
   - “How are these two tessellations similar?”
   - “How are they different?”
   For one of the tessellations, have a student who was not involved add to the tessellation. Ask the students responsible for the tessellation whether they agree or disagree. Have them give reasons for their responses.

3. Discuss applications of tessellating. Ask: “Where in our world do you see tessellations?” Examples might be bathroom tiles, ceiling tiles, and Escher’s works of art that focus on tessellations.

4. Have the students continue to work in pairs and try to tessellate with three different shapes, then four.
   Facilitate a whole-group discussion about their findings by asking:
   - “Was it always possible to tessellate?”
   - “Can you think of some shapes that will not tessellate? If you can, can you suggest why tessellation would not be possible?”
   Record the students’ observations on chart paper as a class summary.

Pre-task 2: Building Staircases (30 minutes x 1)
1. Use square tiles and/or orange pattern blocks to build a staircase.
   Begin by placing one square tile on the overhead and recording what it looks like on square dot paper (either on the overhead or on the board). Label the square as 1 step. Have the students do the same thing in pairs at their desks or tables.
   Without doing the next step on the overhead, say to the students: “Add squares to that first square to build a 2-step design”.

2. Have a pair of students explain what they did. Record the design on the overhead. For example:

   1 step  -------
   2 steps

3
3. Add a third and a fourth step on the overhead. Ask the students the following questions, and have them justify their responses:
- “In this staircase, which step is this?”
- “How many squares does the 3-step design have?”
- “How many squares do we need to add to make the next step?”
- “How many squares are in the 4-step design?”
- “In how many different ways can you arrive at the answer?”
- “How many squares will be in the 5-step design?”
- “How do you know?”

4. Allow for a brief discussion, and model the recording of information about the steps in a table. For example:

<table>
<thead>
<tr>
<th>Number of steps</th>
<th>Number of squares</th>
<th>Number of squares added to the design</th>
<th>Other things we noticed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

5. Have the students work with a partner and use square tiles to add more steps to the design. The students should record their work in a table and on square dot paper.

6. Encourage the students to look for and describe the number patterns in their tables and the geometric patterns on the square dot paper.

   The following are further questions for discussion:
   - “How many squares would it take to build a staircase with 25 steps?” “With 100 steps?”
   - “If you use 66 squares, how many steps would there be?”
   - “What were some of the number patterns you noticed?”
   - “What were some of the geometric patterns you noticed?”

Note:
- The formula for calculating the number of squares needed to build a staircase with a certain number of steps is \(n(n + 1) \div 2\). So, for a 25-step staircase, the number of squares needed is \(25(25 + 1) \div 2 = 325\). This formula is for your information only. It is not at an appropriate level for grade 5 students.
- If you use 66 squares, there would be 11 steps.

7. Have the students write about how finding patterns in this activity helped them solve the problem.

   Note: Some students may want to explore patterns of double-step staircases as well. For example:

   ![Double-step staircase]

Exemplar Task (50 minutes × 4)
1. Hand out the student package. (See Appendix 1 for the worksheets containing the task the students will work on independently.)
2. Tell the students that they will be working individually and independently to complete the assigned task.
3. Tell the students that they will be making enlargements (or “rep-tiles”) of given shapes.
4. Remind the students about the rubric, and make sure that each student has a copy of it.
5. Set the students to work on the task.

Follow-up
1. After the students have completed the exemplar task, have a whole-group discussion in which the students generate a list of all the rep-tile patterns that they found. Record the ideas on chart paper for display in the classroom.
2. Discuss how you could figure out the number of squares needed to build the 100th square.
3. Students could explore shapes other than those in the pattern block set. For example, can a rectangle “rep-tile”? How do you know?
Appendix 1

Exemplar Task

It is a simple problem to make a larger version of a square using replicas of that square. One enlargement uses 4 squares. The second square below is called a rep-4 version of the first because it uses 4 squares or simply a rep-4 (reptile order 4).

1. a) Use pattern blocks to extend this pattern to form the next four rep-tiles. Record your findings on the appropriate sheet of paper – square or isometric.

    1 square used
    4 small squares...

b) Describe all the patterns you have found.
2. Investigate forming rep-tiles with each pattern block. Record your rep-tiles on the appropriate sheet of paper—square or isometric paper.

b) What are some of the patterns you notice as new rep-tiles are created?
3. a) Other shapes, apart from those found in the pattern blocks set, can be used to form rep-tiles. Investigate forming rep-tiles from other shapes not found in the pattern blocks set. You may want to use geoboard or geopaper for your investigation. Record your answer on the appropriate sheet of paper – square or isometric paper.

b) Summarize your findings below.
Data Management and Probability
Brenda’s Bike Shop

The Task
This task required students to:
• select the type of graph to best represent data suggested by given graph titles;
• create a situation to match a graph;
• determine all the possible combinations, given three variables;
• create a probability situation described by a given fraction, and test the situation.

Students looked at four graphs about bicycles and matched each graph with a title, giving reasons for one of their choices. They then looked at a fifth graph, created a situation that suited the graph, and added information to the graph. Next, they determined all the possible combinations of bicycles, given specific choices of size, colour, and type. Finally, they solved a probability question about randomly selecting a bicycle, explained their reasoning, and created and tested a situation represented by the probability $\frac{1}{8}$.

Expectations
This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected expectations from the Data Management and Probability strand. Note that the codes that follow the expectations are from the Ministry of Education's Curriculum Unit Planner (CD-ROM).

Students will:
1. interpret displays of data and present the information using mathematical terms (5m109);
2. evaluate and use data from graphic organizers (5m110);
3. demonstrate an understanding of probability concepts and use mathematical symbols (5m111);
4. pose and solve simple problems involving the concept of probability (5m112);
5. evaluate data presented on tables, charts, and graphs, and use the information in discussion (e.g., discuss patterns in the data presented in the cells of a table that is part of a report on a science experiment) (5m120);
6. connect real-life statements with probability concepts (e.g., if I am one of five people in a group, the probability of being chosen is 1 out of 5) (5m121);
7. predict probability in simple experiments and use fractions to describe probability (5m122);
8. use tree diagrams to record the results of simple probability experiments (5m123);
9. use a knowledge of probability to pose and solve simple problems (e.g., what is the probability of snowfall in Ottawa during the month of April?) (5m124).
Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills relating to the following:

- constructing and interpreting graphs (bar, line, and circle graphs, and pictographs)
- labelling graphs
- using tree diagrams (for organizing combinations)
- making equivalent fractions
- expressing as a fraction the probability of an event happening
- investigating probability situations (e.g., using number cubes, coins, colour tiles, or spinners)

For information on the process used to prepare students for the task and on the materials and equipment required, see the Teacher Package reproduced on pages 140–44 of this document.
Task Rubric – Brenda’s Bike Shop

<table>
<thead>
<tr>
<th>Expectations*</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem solving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, 4, 9</td>
<td>- selects and applies a problem-solving strategy to explore different types of graphs, arriving at an incomplete or inaccurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a partially complete and/or partially accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a generally complete and accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a thorough and accurate solution</td>
</tr>
<tr>
<td></td>
<td>- selects and applies a problem-solving strategy to determine the possible outcomes, arriving at an incomplete or inaccurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a partially complete and/or partially accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a generally complete and accurate solution</td>
<td>- selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 3, 6, 7</td>
<td>- shows a limited understanding when identifying and describing types of graphs and their uses</td>
<td>- shows some understanding when identifying and describing types of graphs and their uses</td>
<td>- shows a clear understanding when identifying and describing types of graphs and their uses</td>
<td>- shows a thorough understanding when identifying and describing types of graphs and their uses</td>
</tr>
<tr>
<td></td>
<td>- shows a limited understanding of probability when using fractions</td>
<td>- shows some understanding of probability when using fractions</td>
<td>- shows a clear understanding of probability when using fractions</td>
<td>- shows a thorough understanding of probability when using fractions</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, 7, 8</td>
<td>- analyses and organizes data with limited clarity</td>
<td>- analyses and organizes data with some clarity</td>
<td>- analyses and organizes data clearly</td>
<td>- analyses and organizes data clearly and precisely</td>
</tr>
<tr>
<td></td>
<td>- creates charts and/or diagrams to conduct a probability investigation with many errors and/or omissions</td>
<td>- creates charts and/or diagrams to conduct a probability investigation with some errors and/or omissions</td>
<td>- creates charts and/or diagrams to conduct a probability investigation with few errors and/or omissions</td>
<td>- creates charts and/or diagrams to conduct a probability investigation with few, if any, minor errors and/or omissions</td>
</tr>
<tr>
<td>Expectations*</td>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
<td>Level 4</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5, 9</td>
<td>– uses mathematical language with limited clarity to describe and illustrate types of graphs</td>
<td>– uses mathematical language with some clarity to describe and illustrate types of graphs</td>
<td>– uses mathematical language clearly to describe and illustrate types of graphs</td>
<td>– uses mathematical language clearly and precisely to describe and illustrate types of graphs</td>
</tr>
<tr>
<td></td>
<td>– uses mathematical language and notation to describe and illustrate probability concepts with limited clarity</td>
<td>– uses mathematical language and notation to describe and illustrate probability concepts with some clarity</td>
<td>– uses mathematical language and notation to describe and illustrate probability concepts clearly</td>
<td>– uses mathematical language and notation to describe and illustrate probability concepts clearly and precisely</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on page 104.  
*Note: This rubric does not include criteria for assessing student performance that falls below level 1.*
Brenda’s Bike Shop  Level 1, Sample 1

Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop  D
Title 2: Types of Bicycles Students Could Own  C
Title 3: Interest in Bicycling  A
Title 4: Jason’s Riding Speed  B

b) Explain how you decided which title matched Graph D.

Because it looked like one month it was obvious then it went up stayed up the went down did not pick the other ones because none of them fit right number. I could of been I thought across some right.
2. Look at Graph E.

In the space below, create a situation that suits this graph.
Add appropriate information to the graph.

Bike Love

Graph E

Team A

Team B

Team C

Team D

Your situation:

Each team can have 2 people. Per team, 4 teams, one as
6 people one, team 2. Got 8 people done and
3 got 2 people done and really got 4 people done
and team A won with 8 people. Team came in 2. With Green
3 came in last with 3. With.

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:
- Large or Small frame (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected: A large green bicycle or a red Mountain Bike?

Explain your reasoning.

Both have a 50% chance so if I had to choose I wouldn’t care but if I had to I would pick the red mountain bike because many people like to ride them. I would not choose the other one because it is too big.

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

- Toys on a shelf: you get 1 for free out of 8

There was a thick, stuffed bear, music box, gum balls.

Test our your situation to make sure that the probability is \( \frac{1}{8} \)

You would get \( \frac{1}{2} \) of it, so it will be right.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies a problem-solving strategy to explore different types of graphs, arriving at an incomplete or inaccurate solution (e.g., in question 1b, uses imprecise criteria when using the process of elimination to match a title with graph D: “…it Don’t look right.”).
- The student selects and applies a problem-solving strategy to determine the possible outcomes, arriving at an incomplete or inaccurate solution (e.g., in question 3, uses a tree diagram with limited accuracy, finding 6 of the 24 combinations).

**Understanding of Concepts**
- The student shows a limited understanding when identifying and describing types of graphs and their uses (e.g., in question 2, describes the data displayed in “Bike race” as the number of people in the race).
- The student shows a limited understanding of probability when using fractions (e.g., in question 4, shades 1/8 of the diagram, but provides no evidence of how it is used to conduct a probability experiment).

**Application of Mathematical Procedures**
- The student analyses and organizes data with limited clarity (e.g., in question 4, does not test the situation created: “you would get 1/8 of it so it will Be right”).
- The student creates charts and/or diagrams to conduct a probability investigation with many errors and/or omissions (e.g., in question 3a, constructs a tree diagram, but does not include all variables).

**Communication of Required Knowledge**
- The student uses mathematical language with limited clarity to describe and illustrate types of graphs (e.g., in question 1b, “Because it looked like one month it was Down and then it went up stayed up the went Down.”).
- The student uses mathematical language and notation to describe and illustrate probability concepts with limited clarity (e.g., in question 3b, “Both have a 50 50 chance…i would pick the red mountain Bike… i hate green it it might Be to Big.”).

**Comments/Next Steps**
- The student needs to communicate ideas clearly using pictures, diagrams, and numbers, in addition to using words.
- The student should display, interpret, and analyse data in a variety of meaningful contexts.
- The student should identify different strategies for conducting probability experiments.
- The student should continue to connect real-life situations to mathematics.
- The student should refer to word charts or a personal dictionary for correct spellings.
Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop B
Title 2: Types of Bicycles Students Could Own C
Title 3: Interest in Bicycling A
Title 4: Jason’s Riding Speed D

b) Explain how you decided which title matched Graph D.

I matched Graph D with Jason’s Riding Speed. Because in Graph D, there was a speed chart and I know that because I have one.
2. Look at Graph E.

In the space below, create a situation that suits this graph.

Add appropriate information to the graph.

Graph E

<table>
<thead>
<tr>
<th>black</th>
<th>gold</th>
<th>brown</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bike Sales

\[
\text{bike} = 10
\]

Your situation: my solution is to sell their brown bikes and buy more bikes to come in.

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:

- Large or Small frames (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled:

<table>
<thead>
<tr>
<th>Size</th>
<th>Colours</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>large</td>
<td>Red</td>
<td>mountain bikes</td>
</tr>
<tr>
<td>large</td>
<td>Blue</td>
<td>Race bikes</td>
</tr>
<tr>
<td>large</td>
<td>green or black</td>
<td>Trick bikes</td>
</tr>
<tr>
<td>small</td>
<td>Red</td>
<td>Trick bikes</td>
</tr>
<tr>
<td>small</td>
<td>blue</td>
<td>Race bikes</td>
</tr>
<tr>
<td>small</td>
<td>green or black</td>
<td>mountain bikes</td>
</tr>
</tbody>
</table>
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected: A large green bicycle or a red Mountain Bike?

Explain your reasoning.

I think a large green bike because it would be less money for the bike store to give away.

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

The situation is probably the spinner would land on the 8 because the eighth is bigger than the one.

Test our your situation to make sure that the probability is \( \frac{1}{8} \)

There are eight kids on the baseball team. It is their championship game and 1 out of 8 is not there. So, the team had to forfeit.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies a problem-solving strategy to explore different types of graphs, arriving at an incomplete or inaccurate solution (e.g., in question 2, creates an incomplete situation to suit the graph; in question 1a, finds the correct title for graph D, although the rationale in question 1b is limited).
- The student selects and applies a problem-solving strategy to determine the possible outcomes, arriving at an incomplete or inaccurate solution (e.g., in question 3a, uses a chart to determine six of the possible combinations).

**Understanding of Concepts**
- The student shows a limited understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, displays limited reasoning in explaining choice: “I Matched Graph D with Jason’s Riding Speed Because in Graph D there was a speed chart and I know that because I have one”).
- The student shows a limited understanding of probability when using fractions (e.g., in question 4, identifies a spinner, but demonstrates limited knowledge of using fractions to describe probability: “...spiner would land on the 8 because the eighth is bigger than the one.”).

**Application of Mathematical Procedures**
- The student analyses and organizes data with limited clarity (e.g., in question 2, creates a situation which is limited).
- The student creates charts and/or diagrams to conduct a probability investigation with many errors and/or omissions (e.g., in question 3, creates an incomplete chart that combines two variables (“green or black”)).

**Communication of Required Knowledge**
- The student uses mathematical language with limited clarity to describe and illustrate types of graphs (e.g., in question 1b, uses limited mathematical language to explain the title choice for graph D).
- The student uses mathematical language and notation to describe and illustrate probability concepts with limited clarity (e.g., in question 3b, does not include probability language in the rationale for a large green bike as the appropriate choice: “I think a large green bike because it would be less money for the bike store to give away.”).

**Comments/Next Steps**
- The student should communicate ideas using pictures, diagrams, and numbers, in addition to words.
- The student should display, interpret, and analyze data in a variety of meaningful contexts.
- The student needs opportunities to use concrete materials to conduct probability investigations and determine outcomes.
Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop  
Title 2: Types of Bicycles Students Could Own  
Title 3: Interest in Bicycling  
Title 4: Jason’s Riding Speed

b) Explain how you decided which title matched Graph D.

I decided Interest in bicycling because it is the best.
2. Look at Graph E.

In the space below, create a situation that suits this graph.
Add appropriate information to the graph.

![Graph E](image)

Your situation:

If there's 20 people and your going by 2's, each category would have an even number. If you look at the graph you can see that the trick bike is the most popular. You can see that the trick bike is the most popular.
b) Based on the combinations you have listed above, Brenda will randomly select a
bicycle for a donation to a local charity.
Which of the following is more likely to be selected:
A large green bicycle or a red Mountain Bike?

Explain your reasoning.
A large green bike because most people
would use a large green than a red
mountain bike.

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

There are 8 adults who would
like a piece.

Test our your situation to make sure that the probability is \( \frac{1}{8} \)
you could use a spinner
that has \( \frac{1}{8} \).
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a partially complete and/or partially accurate solution (e.g., in question 1a, finds the correct title for graph C; in question 1b, labels the graph to show change over time, but the response is incorrect).
– The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a partially complete and/or partially accurate solution (e.g., in question 3a, creates a partial tree diagram with some correct combinations).

Understanding of Concepts
– The student shows some understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, partially labels the line graph, but inaccurately identifies “Intrest in bicikleying” as the appropriate title for graph D).
– The student shows some understanding of probability when using fractions (e.g., in question 4, provides a simple diagram and test: “you could use a spinner that has \( \frac{1}{8} \)).

Application of Mathematical Procedures
– The student analyses and organizes data with some clarity (e.g., in question 2, labels the graph, but the graph/scenario combination is confusing).
– The student creates charts and/or diagrams to conduct a probability investigation with some errors and/or omissions (e.g., in question 3, creates a partial tree diagram, and forms some of the possible combinations, but adds a third size (“Meduim”)).

Communication of Required Knowledge
– The student uses mathematical language with some clarity to describe and illustrate types of graphs (e.g., in question 1b, partially labels the graph to show an increase in interest over a three-day period, providing some support for the choice of the title “Intrest in bicikleying”).
– The student uses mathematical language and notation to describe and illustrate probability concepts with some clarity (e.g., in question 4, uses a picture to support the statement that “There are 8 adults who would like a peice.”).

Comments/Next Steps
– The student needs to communicate using pictures, diagrams, and numbers, in addition to using words.
– The student should continue exploring the various uses of different types of graphs.
– The student needs opportunities to use concrete materials to explore probability concepts.
– The student should refer to word charts or a personal dictionary for correct spellings.
1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop  C
Title 2: Types of Bicycles Students Could Own  A
Title 3: Interest in Bicycling  B
Title 4: Jason’s Riding Speed  D

b) Explain how you decided which title matched Graph D.

I decided which title matched Graph D by looking at all the graphs. And I knew that bar graphs aren’t used for that kind of information which narrowed it down to 2 graphs. Then I knew that it wasn’t likely that the circle graph was the right one, and so it was the one I had left.
2. Look at Graph E.

In the space below, create a situation that suits this graph.

Add appropriate information to the graph.

Graph E

Your situation:

Number of bikes sold every day for 4 days at BB’s Bike shop

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:

- Large or Small frames (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.

Large red mountain bike
Small red mountain bike
Large blue mountain bike
Small blue mountain bike
Large green mountain bike
Small green mountain bike
Large red trick bike
Small red trick bike
Large blue trick bike
Small blue trick bike
Large green trick bike
Small green trick bike
Large red race bike
Small red race bike
Large blue race bike
Small blue race bike
Large green race bike
Small green race bike
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected: a large green bicycle or a red mountain bike?

Explain your reasoning.

I think a large green bike will be chosen because there are more combinations that equal a large green bike than there are combinations that equal a red mountain bike.

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

There is a raffle that is in a school, in a class with 8 students. The raffle is only for the students in the class. Each student buys 1 ticket.

Test our your situation to make sure that the probability is \( \frac{1}{8} \)

you can’t test the situation.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a partially complete and/or partially accurate solution (e.g., in question 1, uses a process of elimination based on some reasoning to match a title to graph D).
- The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a partially complete and/or partially accurate solution (e.g., in question 3a, uses a list to generate many of the possible combinations).

Understanding of Concepts
- The student shows some understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, demonstrates some understanding of the use of graphs to display data in the justification for graph D: “I decided which title matched Graph D by looking at all the graphs, and I knew that bar graphs aren’t used for that kind of information....”).
- The student shows some understanding of probability when using fractions (e.g., in question 4, creates a situation involving eight students each buying one raffle ticket, but does not discuss the chances of winning).

Application of Mathematical Procedures
- The student analyses and organizes data with some clarity (e.g., in question 2, partially labels the graph and legend to correspond to the original data and the situation created).
- The student creates charts and/or diagrams to conduct a probability investigation with some errors and/or omissions (e.g., in question 3, creates a list that is missing some combinations).

Communication of Required Knowledge
- The student uses mathematical language with some clarity to describe and illustrate types of graphs (e.g., in question 1b, provides a partial explanation: “bar graphs aren’t used for that kind of information”).
- The student uses mathematical language and notation to describe and illustrate probability concepts with some clarity (e.g., in question 3b, “I think a large green bike will be chosen because there are more combinations that equil a large green bike than there are combinations that equil a red mountain bike.”).

Comments/Next Steps
- The student needs to label all the parts of a graph.
- The student needs to use mathematical language and notation to communicate ideas more clearly.
- The student should review answers, to ensure that they are complete.
Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop  
Title 2: Types of Bicycles Students Could Own  
Title 3: Interest in Bicycling  
Title 4: Jason’s Riding Speed  

b) Explain how you decided which title matched Graph D.

During class we took notes on different types of graphs and how one might use them. I chose the title “Jason’s Riding Speed” because Graph D is a line graph and we note on line graphs that a line graph is used when showing growth or lack of growth over a certain amount of time. The part that made me choose D was that it is used when showing SPEED over a certain amount of time. That is why I am choosing D as my answer.
2. Look at Graph E.
In the space below, create a situation that suits this graph.
Add appropriate information to the graph.

Graph E: Number of Cyclists Attending Marathons

Marathon #1
Marathon #2
Marathon #3
Marathon #4

Your situation:
The town of Well has been holding marathons for several years. To tally the number of riders attending these marathons, they then made a photograph.

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:
- Large or Small frames (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected: A large green bicycle or a red Mountain Bike?

Explain your reasoning.

A large green bicycle is more likely to be chosen. It is more likely to be chosen because you could have a large green mountain bike, trick bike or a racing bike so for a large green bike there are 3 combinations. There are only 2 combinations for a red mountain bike a small or a large. That is why a large green bike is more likely to get chosen.

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

S is allowed to pick out one treat from the candy tree. There are 16 choices. 11 she doesn’t like 3 are sold out and one is way too much money. So now there are eight choices left. She can’t choose between four brakes, jubes, chips, gummy, bottle pop, sour patch, apples, and coconuts. She puts all the Twinties in a bag and randomly picks one. The probability of getting gum is \( \frac{1}{8} \).

Test out your situation to make sure that the probability is \( \frac{1}{8} \).

I would pull out one candy 8 times if each time I got a different candy then the probability is \( \frac{1}{8} \) but sometimes you may come close to \( \frac{1}{8} \) easily on \( \frac{1}{8} \) or not even close to it.
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a generally complete and accurate solution (e.g., in question 1, uses the purpose of a line graph to select the title for graph D; in question 1a, mislabels graph C).
– The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a generally complete and accurate solution (e.g., in question 3a, creates a complete [but improperly constructed] tree diagram to clearly illustrate all the possible bicycle combinations; in question 3b, accurately explains that there are three combinations that include a large green bicycle and only two that include a red mountain bicycle).

Understanding of Concepts
– The student shows a clear understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, demonstrates why speed should be recorded on a line graph).
– The student shows a clear understanding of probability when using fractions (e.g., in question 4, creates a situation that clearly represents the probability of getting different candy as $\frac{1}{8}$).

Application of Mathematical Procedures
– The student analyses and organizes data clearly (e.g., in question 2, clearly labels the graph, “Number of Cyclists Attending Marathons”, and includes a tally chart in addition to an accurate analysis of the data).
– The student creates charts and/or diagrams to conduct a probability investigation with few errors and/or omissions (e.g., in question 3, creates a tree diagram that contains all of the possible combinations but that is organized incorrectly).

Communication of Required Knowledge
– The student uses mathematical language clearly to describe and illustrate types of graphs (e.g., in question 1b, “a line graph is used when showing growth or lack of growth over a certain amount of time”).
– The student uses mathematical language and notation to describe and illustrate probability concepts clearly (e.g., in question 3b, says that a large green bike is “more likely” to be chosen, and supports the position by identifying the correct number of possible “combinations”; in question 4, writes a clear explanation of the situation, but adds a confusing test).

Comments/Next Steps
– The student should continue to use charts, tables, graphs, and diagrams to record findings of investigations.
– The student should make further use of pictures and numbers to record and communicate ideas in all investigations.
Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop  C
Title 2: Types of Bicycles Students Could Own  A
Title 3: Interest in Bicycling  B
Title 4: Jason’s Riding Speed  D

b) Explain how you decided which title matched Graph D.

I decided that the title for graph D was Jason’s riding speed because it shows that he went faster for a certain amount of time then rode at a consistent speed without stopping for about 3/4 of the bike ride. Then he slowed down.

Jason’s Riding Speed

This chart shows that Jason was consistent but slowed down at the end.

How Consistently Jason Rode
2. Look at Graph E.

In the space below, create a situation that suits this graph.
Add appropriate information to the graph.

Graph E

<table>
<thead>
<tr>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>🚴   🚴   🚴   🚴   🚴</td>
<td>🚴   🚴   🚴   🚴   🚴</td>
<td>🚴   🚴   🚴   🚴   🚴</td>
<td>🚴   🚴   🚴   🚴   🚴</td>
</tr>
</tbody>
</table>

Your situation: The situation is how many miles Jason rode each day of the week. This chart shows that Jason rode 3 miles on Mon, 4 miles on Tues, 1 mile on Wed, and 2 miles on Thurs. Each bike represents 1 mile.

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:
- Large or Small frames (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Rac Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.

1. Large red mountain bike
2. Large red race bike
3. Large red trick bike
4. Large blue mountain bike
5. Large blue race bike
6. Large blue trick bike
7. Large green mountain bike
8. Large green race bike
9. Large green trick bike
10. Large black mountain bike
11. Large black race bike
12. Large black trick bike
13. Small red mountain bike
14. Small red race bike
15. Small red trick bike
16. Small blue mountain bike
17. Small blue race bike
18. Small blue trick bike
19. Small green mountain bike
20. Small green race bike
21. Small green trick bike
22. Small black mountain bike
23. Small black race bike
24. Small black trick bike
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected: A large green bicycle or a red Mountain Bike?

Explain your reasoning.

I think that Brenda would pick a large green bicycle randomly because there are 3 large bicycles and only two red mountain bikes. That means green has a better chance of being picked for a donation to a local charity.

4. Create a situation to represent the following probability: $\frac{1}{8}$

My situation is a draw. Each girl has a chance of being picked to win a bike.

Test our situation to make sure that the probability is $\frac{1}{8}$.

The probability for each girl to get picked is $\frac{1}{8}$ chance because there are 8 girls and each of them has a chance of being picked.


**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a generally complete and accurate solution (e.g., in question 1a, matches the graphs and the titles correctly; in question 1b, provides a reasonable explanation for matching title 4 to graph D).
- The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a generally complete and accurate solution (e.g., in question 3a, uses a systematic list to accurately determine all 24 possible combinations; in question 4, explains but does not test the situation created).

**Understanding of Concepts**
- The student shows a clear understanding when identifying and describing types of graphs and their uses (e.g., in question 1, links Jason’s Riding Speed to a line graph through both a reasonable analysis and a labelled diagram).
- The student shows a clear understanding of probability when using fractions (e.g., in question 4, uses a diagram of eight children participating in a draw, clearly showing that each child’s chance of winning the draw is $1/8$).

**Application of Mathematical Procedures**
- The student analyses and organizes data clearly (e.g., in question 2, labels the graph clearly and analyses appropriately).
- The student creates charts and/or diagrams to conduct a probability investigation with few errors and/or omissions (e.g., in question 3, does not use a chart or diagram, but lists all possible combinations).

**Communication of Required Knowledge**
- The student uses mathematical language clearly to describe and illustrate types of graphs (e.g., in question 1b, uses a labelled chart and an explanation to analyse Jason’s speed at various intervals).
- The student uses mathematical language and notation to describe and illustrate probability concepts clearly (e.g., in question 3b: “Brenda would pick a large green [bike] randomly because there are 3 large green bicycles and only two red mountain bikes. That means green has a better chance of being picked”).

**Comments/Next Steps**
- The student should explore tree diagrams as a way of presenting data.
- The student needs to make greater use of charts and numbers to present findings.
Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop C
Title 2: Types of Bicycles Students Could Own A
Title 3: Interest in Bicycling B
Title 4: Jason’s Riding Speed D

b) Explain how you decided which title matched Graph D.

I matched D to Jason’s Riding Speed because the dots were low at first but the graph is higher and higher until it finally drops quickly after it has reached its climax. This is because on a bike you start out slow but then, gradually, you begin to pick up speed until you get so fast that you slow down and finally stop.
2. Look at Graph E.

In the space below, create a situation that suits this graph.

Add appropriate information to the graph.

Graph E

<table>
<thead>
<tr>
<th>Favourite Types of Bikes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stunt Bikes</td>
</tr>
<tr>
<td>Speed Bikes</td>
</tr>
<tr>
<td>Double Bikes</td>
</tr>
<tr>
<td>Mountain Bikes</td>
</tr>
</tbody>
</table>

Your situation:

When 20 people were surveyed on their favorite type of bikes out of four variables: Stunt Bikes, Speed Bikes, Double Bikes, or Mountain Bikes, six people chose Stunt Bikes, eight people chose Speed Bikes, two people chose Double Bikes and four people chose Mountain Bikes. This is what my graph represents.

3. a) Bikes are assembled at Brenda's Bike Shop using three variables:

- Large or Small frames (size)
- Red or Blue or Green or Black (frame colours)
- Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity.
Which of the following is more likely to be selected:
A large green bicycle or a red Mountain Bike?

Explain your reasoning.

It is more likely that she will select a large green bike because there are more of them than small mountain bikes. Given the possible combinations, there are three ways you can have a large green bike.
She can get a large green mountain bike, a large green racing bike, and a large green truck bike, which means she has a three in twenty-four chance of getting a large green bike.

But, given the possible combinations, you can only get a small red mountain bike and a large red mountain bike, which means you only have a 2 in 24 chance (or 1 in 12) of getting a red mountain bike. (See page 5)*

4. Create a situation to represent the following probability: \( \frac{1}{8} \)
If you have four kinds of cars (a corvet, a mustang, an escort, and a mustang) and four colors (red, black, purple and green), there is a \( \frac{1}{8} \) chance that a black or purple porche will be broken into (one of them will be).

Test your situation to make sure that the probability is \( \frac{1}{8} \)
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a thorough and accurate solution (e.g., in question 1, accurately and appropriately matches graphs and titles, and uses a clear description to justify the title for graph D).
– The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a thorough and accurate solution (e.g., in question 3, uses a systematic and complete tree diagram to accurately determine the probability of selecting a large green bicycle).

Understanding of Concepts
– The student shows a thorough understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, describes the line graph appropriately and, in the diagram, correctly identifies the variables on the x-axis and y-axis).
– The student shows a thorough understanding of probability when using fractions (e.g., in question 4, creates a situation in which a selection of \(\frac{2}{16}\) cars can be simplified to \(\frac{1}{8}\)).

Application of Mathematical Procedures
– The student analyses and organizes data clearly and precisely (e.g., in question 2, analyses the situation and labels the graph clearly and precisely).
– The student creates charts and/or diagrams to conduct a probability investigation with few, if any, minor errors and/or omissions (e.g., in question 3, creates a correctly constructed tree diagram containing all possible combinations).

Communication of Required Knowledge
– The student uses mathematical language clearly and precisely to describe and illustrate types of graphs (e.g., in question 1b, clearly labels the line graph and explains its appropriateness to title 4 using words such as “gradually”, “slow”, and “fast”).
– The student uses mathematical language and notation to describe and illustrate probability concepts clearly and precisely (e.g., in question 3b, uses mathematical notation and words, such as “three in twenty-four (or 1 in 8) chance”, and further justifies the explanation by referring to the tree diagram in question 3a).

Comments/Next Steps
– The student demonstrates a high degree of ability in interpreting and using data from graphic organizers.
– The student should add detail to the answer in question 1b – he or she could include reasons for rejecting the other three titles.
Brenda’s Bike Shop  Level 4, Sample 2

Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda’s Bike Shop

Title 2: Types of Bicycles Students Could Own

Title 3: Interest in Bicycling

Title 4: Jason’s Riding Speed

b) Explain how you decided which title matched Graph D.

I decided Graph D matched the title Jason’s riding speed because if he goes 10 kilometers an hour at first, it would show it on that particular chart. On that chart it also shows that he went really fast; then he slowed down.

I didn’t pick the circle graph because it doesn’t show anything to do with speed. It would be for interest in bikes.

I didn’t pick the 2 bar graphs because they don’t show anything to do with speed either. They would be good for types of bicycles or sales, just like the titles are in the titles they gave to us.
2. Look at Graph E.

In the space below, create a situation that suits this graph.

Add appropriate information to the graph.

<table>
<thead>
<tr>
<th>Kind of Bikes</th>
<th>Number of Bikes Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mountain Bikes</td>
<td>10 bikes</td>
</tr>
<tr>
<td>Trick Bikes</td>
<td>8 bikes</td>
</tr>
<tr>
<td>Race Bikes</td>
<td>2 bikes</td>
</tr>
<tr>
<td>Normal Bikes</td>
<td>4 bikes</td>
</tr>
</tbody>
</table>

Graph E: How many bikes get sold.

Your situation:

The graph is about people who bought different kinds of bikes. The information given was the bikes. In the legend I made each bike represent 2 bikes. For the mountain bikes, there was 10 bikes sold. For the trick bikes, there was 8 bikes sold. For the race bikes, there was 2 bikes sold. For the normal bikes, there was 4 bikes sold. I made this chart like this because I thought it would make more sense.

3. a) Bikes are assembled at Brenda’s Bike Shop using three variables:
   - Large or Small frame (size)
   - Red or Blue or Green or Black (frame colours)
   - Mountain Bikes or Race Bikes or Trick Bikes (types)

Show all the possible combinations of size, colour, and type of bikes that can be assembled.
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is most likely to be selected: A large green bicycle or a red Mountain Bike?

Explain your reasoning.

A large green bike because there are 3 large green bikes, and only 2 red mountain bikes. Example:

Large Green
Mountain bike

Large Green
Race bike

Large Green
Trick bike = \frac{3}{24}

Example: for red mountain bikes.

Small Red
Mountain bike

Large Red
Mountain bike = \frac{2}{24}

4. Create a situation to represent the following probability: \( \frac{1}{8} \)

My situation is about bikes. What is the probability of getting a small green race bike?

I would test my situation by using a tally chart. You would pick out numbers from a hat? You also know that the probability is \( \frac{1}{8} \) because one small piece of paper would be \( \frac{1}{8} \) of the mountain bike

That something is \( \frac{1}{8} \) because there are \( \frac{1}{8} \) pieces of paper altogether.

That is how you get \( \frac{1}{8} \).
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy to explore different types of graphs, arriving at a thorough and accurate solution (e.g., in question 1a, makes appropriate choices, and, in question 1b, justifies them in the analysis of the title in relation to other types of graphs).
- The student selects and applies an appropriate problem-solving strategy to determine the possible outcomes, arriving at a thorough and accurate solution (e.g., in question 3, uses a tree diagram that accurately outlines all of the possible combinations, and accurately determines that the probability of getting a large green bicycle is \(\frac{3}{24}\), and the probability of getting a red mountain bicycle is \(\frac{2}{24}\)).

**Understanding of Concepts**
- The student shows a thorough understanding when identifying and describing types of graphs and their uses (e.g., in question 1b, refers to bar graphs as more appropriate for demonstrating types and sales of bicycles, and writes, “I didn’t pick the circle graph because it doesn’t show anything to do with speed. It would be for interest in bikes.”).
- The student shows a thorough understanding of probability when using fractions (e.g., in question 4, creates a diagram identifying the eight different possibilities, and explains that the chance of getting one of the possibilities is 1 out of 8).

**Application of Mathematical Procedures**
- The student analyses and organizes data clearly and precisely (e.g., in question 2, clearly and thoroughly presents the situation and the data, and performs an accurate and detailed analysis).
- The student creates charts and/or diagrams to conduct a probability investigation with few, if any, minor errors and/or omissions (e.g., in question 3, creates an accurate and well-organized tree diagram).

**Communication of Required Knowledge**
- The student uses mathematical language clearly and precisely to describe and illustrate types of graphs (e.g., in question 1b, describes the uses of various types of graphs: “I didn’t pick the 2 bar graphs because they don’t show anything to do with speed either! They would be good for types of bicycles or Sales...”).
- The student uses mathematical language and notation to describe and illustrate probability concepts clearly and precisely (e.g., in question 3b, correctly identifies the probabilities as \(\frac{3}{24}\) and \(\frac{2}{24}\); in question 4, clearly demonstrates the role of a numerator and a denominator in describing probability).

**Comments/Next Steps**
- The student demonstrates a thorough understanding of probability and skilful interpretation of data throughout the task.
- The student needs to summarize the results of each investigation.
Teacher Package

Mathematics Exemplar Task
Grade 5 – Data Management and Probability

Title: Brenda’s Bike Shop

Time requirements: 240 minutes (total)
- Pre-task 1 – 40 minutes x 1
- Pre-task 2 – 40 minutes x 1
- Exemplar task – 40 minutes X 4
(The pre-tasks and exemplar task may be completed on four separate days. Time requirements are suggestions, and may vary.)

Description of the Task
Students will investigate a variety of data management and probability tasks related to bicycles. They will select the type of graph to best represent data suggested by given graph titles; will create a situation to match a graph; will determine all the possible combinations, given three variables; will solve a probability question; will create a probability situation described by a given fraction; and will test the situation to confirm the probability.

Expectations Addressed in the Exemplar Task
Note that the codes that follow the expectations are from the Ministry of Education’s Curriculum Unit Planner (CD-ROM).

Students will:
1. interpret displays of data and present the information using mathematical terms (5m109);
2. evaluate and use data from graphic organizers (5m110);
3. demonstrate an understanding of probability concepts and use mathematical symbols (5m111);
4. pose and solve simple problems involving the concept of probability (5m112);
5. evaluate data presented on tables, charts, and graphs, and use the information in discussion (e.g., discuss patterns in the data presented in the cells of a table that is part of a report on a science experiment) (5m120);
6. connect real-life statements with probability concepts (e.g., if I am one of five people in a group, the probability of being chosen is 1 out of 5) (5m121);
7. predict probability in simple experiments and use fractions to describe probability (5m122);
8. use tree diagrams to record the results of simple probability experiments (5m123);
9. use a knowledge of probability to pose and solve simple problems (e.g., what is the probability of snowfall in Ottawa during the month of April?) (5m124).

Teacher Instructions
Prior Knowledge and Skills Required
Before attempting the task, students should have had experience with the following:
- constructing and interpreting graphs (bar, line, and circle graphs, and pictographs)
- labelling graphs
- using tree diagrams (for organizing combinations)
- making equivalent fractions
- expressing as a fraction the probability of an event happening
- investigating probability situations (e.g., using number cubes, coins, colour tiles, or spinners)

The Rubric*
The rubric provided with this exemplar task is to be used to assess students’ work. The rubric is based on the achievement chart given on page 9 of The Ontario Curriculum, Grades 1–8: Mathematics, 1997.

Before asking students to do the task outlined in this package, review with them the concept of a rubric. Rephrase the rubric so that students can understand the different levels of achievement.

Accommodations
Accommodations that are normally provided in the regular classroom for students with special needs should be provided when the exemplar task is administered.

*The rubric is reproduced on pages 106–107 of this document.
Materials and Resources Required
- Rubric – one copy for each student

Pre-task 1
- Chart paper and markers for each group

Pre-task 2
- Colour tiles
- Small envelopes or bags or containers
- Graph paper

Exemplar task
- Student package (see Appendix 1) - one copy for each student

Classroom Set-up
- For the pre-tasks, organize the classroom so that students can work in pairs or in small groups, and then participate in whole-group discussion.
- Students work individually and independently to complete the exemplar task.

Task Instructions

Introductory Activities
The pre-tasks are designed to review and reinforce the skills and concepts that students will be using in the exemplar task and to model strategies useful in completing the task.

Pre-task 1: Class Fund-raiser (40 minutes x 1)
1. Have students work in pairs to investigate the following situation:

   Class Fund-raiser
   All 30 students in a class were asked: “Do you want to run a fund-raising activity next month?”

2. Have the pairs of students prepare their responses on chart paper. Students can then present the responses in small groups and defend their thinking.

Pre-task 2: Colour Tile Draw (40 minutes x 1)
1. Give each group of students (pairs or groups of three) one container with 3 colour tiles of one colour, 3 colour tiles of a second colour, and 3 colour tiles of a third colour.
2. Students take turns drawing out 2 colour tiles, and recording the results for 20 draws.
   Make sure that students know they must replace the tiles after each draw of 2 tiles.
3. After 20 draws, have the students graph their results using a bar graph.
4. Now have the students predict the number of times they will draw 2 tiles of the same colour in 40 draws.
   Students should use their graphs to help them predict the results of 40 draws.
5. As a whole-class follow-up, have students determine all of the possible colour combinations in this investigation. The combinations could be recorded using a chart, a tree diagram, or some other pictorial/numeric representation.

Exemplar Task (40 minutes x 4)
1. Hand out the student packages. (See Appendix 1 for the worksheets containing the task the students will work on independently.)
2. Tell the students that they will be working individually and independently to complete the assigned task.
3. Remind the students about the rubric, and make sure that each student has a copy of it.
4. Set the students to work on the task.

Follow-up
Have students share their probability situations for 1/8 (question 4 of the exemplar task) with a partner and test the situations to make sure they work. Ask the students to work in pairs to create a new situation with a probability involving a different fraction. Students could use the computer to produce their situation in a final form (which might include text, tables, graphs, and/or illustrations). The class can then publish a booklet of probability situations related to a range of fractions. This booklet could be shared with other classes in the school, who might test some of the situations.
Appendix 1

Exemplar Task

1. Look at the four graphs about bicycles.

Graph A

Graph B

Graph C

Graph D

a) Match each graph to a title and record in the space below:

Title 1: Monthly Sales of Bikes at Brenda's Bike Shop _______
Title 2: Types of Bicycles Students Could Own _______
Title 3: Interest in Bicycling _______
Title 4: Jason's Riding Speed _______

b) Explain how you decided which title matched Graph D.
2. Look at Graph E.

   In the space below, create a situation that suits this graph.

   Add appropriate information to the graph.

   Graph E

   Your situation:

3. a) Bikes are assembled at Brenda's Bike Shop using three variables:

   • Large or Small frames (size)
   • Red or Blue or Green or Black (frame colours)
   • Mountain Bikes or Race Bikes or Trick Bikes (types)

   Show all the possible combinations of size, colour, and type of bikes that can be assembled.
b) Based on the combinations you have listed above, Brenda will randomly select a bicycle for a donation to a local charity. Which of the following is more likely to be selected:
A large green bicycle or a red mountain bike?
Explain your reasoning.

4. Create a situation to represent the following probability: $\frac{1}{8}$

Test our your situation to make sure that the probability is $\frac{1}{8}$.
The Ministry of Education wishes to acknowledge the contribution of the many individuals, groups, and organizations that participated in the development and refinement of this resource document.