The Ontario Curriculum – Exemplars
Grade 2

Mathematics

Samples of Student Work: A Resource for Teachers

2002
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This publication is available on the Ministry of Education's website at [http://www.edu.gov.on.ca](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 parents1 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 2;
- 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

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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
Creating Symmetrical Designs

The Task
The task required students to:
• investigate fractions, using pattern blocks;
• draw lines of symmetry that result from placing pattern blocks side by side.

Students compared two fractions, using pattern blocks; stated which fraction was larger; and gave reasons for their answers. They divided a hexagon into fractional parts. Then they placed pattern blocks side by side to form shapes that had a line of symmetry, and they drew the line of symmetry. Finally, they used pattern blocks to make a design, and showed the reflection of the design in different ways.

Expectations
This task gave students the opportunity to demonstrate 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. compare proper fractions using concrete materials (2m3);
2. represent and explain halves, thirds, and quarters as part of a whole and part of a set using concrete materials and drawings (e.g., colour 2 out of 4 circles) (2m19);
3. compare two proper fractions using concrete materials (e.g., use pattern blocks to show that the relationship of 3 triangles to 6 triangles is the same as that of 1 trapezoid to 2 trapezoids because both represent half of a hexagon) (2m20).

Geometry and Spatial Sense
Students will:
4. investigate the attributes of three-dimensional figures and two-dimensional shapes using concrete materials and drawings (2m61);
5. understand key concepts in transformational geometry using concrete materials and drawings (2m63);
6. use language effectively to describe geometric concepts, reasoning, and investigations (2m65);
7. demonstrate an understanding of a line of symmetry in a two-dimensional shape by using paper folding and reflections (e.g., using paint-blot pictures, red plastic mirrors) (2m76);
8. determine a line of symmetry of a two-dimensional shape by using paper folding and reflections (e.g., in a transparent mirror) (2m77).
Prior Knowledge and Skills
To complete this task, students were expected to have some knowledge or skills relating to the following:

• representing halves, thirds, and quarters
• exploring reflections with a red plastic mirror
• tracing, stamping, or sticking shapes onto paper
• determining a line of symmetry for a two-dimensional shape
• manipulating concrete materials (e.g., pattern blocks)
• drawing pattern block shapes on pattern block paper

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 57–64 of this document.
## Task Rubric – Creating Symmetrical Designs

<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, 4</td>
<td>selects and applies a problem-solving strategy that may not be recognizable or appropriate to investigate the attributes of two-dimensional shapes</td>
<td>selects and applies an appropriate problem-solving strategy to investigate the attributes of two-dimensional shapes</td>
<td>selects and applies some appropriate problem-solving strategies to investigate the attributes of two-dimensional shapes</td>
<td>selects and applies the most appropriate problem-solving strategies, modifies known strategies, and/or creates new strategies to investigate the attributes of two-dimensional shapes</td>
</tr>
<tr>
<td></td>
<td>provides solutions that are incomplete or inaccurate</td>
<td>provides solutions that are partially complete and/or partially accurate</td>
<td>provides complete and accurate solutions</td>
<td>provides thorough and accurate solutions</td>
</tr>
<tr>
<td></td>
<td>uses limited information in the problem to compare fractions</td>
<td>uses some relevant information in the problem to compare fractions</td>
<td>uses relevant information in the problem to compare fractions</td>
<td>uses all the relevant information in the problem to compare fractions</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5, 7</td>
<td>demonstrates a limited understanding of symmetry by providing incomplete or inaccurate explanations and drawings of symmetrical shapes and lines of symmetry</td>
<td>demonstrates some understanding of symmetry by providing partially complete and/or partially accurate explanations and drawings of symmetrical shapes and lines of symmetry</td>
<td>demonstrates a general understanding of symmetry by providing complete and accurate explanations and drawings of symmetrical shapes and lines of symmetry</td>
<td>demonstrates a thorough understanding of symmetry by providing detailed and accurate explanations and drawings of symmetrical shapes and lines of symmetry</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2, 3, 8</td>
<td>compares proper fractions, making many errors and/or omissions</td>
<td>compares proper fractions, making some errors</td>
<td>compares proper fractions, making few errors</td>
<td>compares proper fractions, making few, if any, minor errors</td>
</tr>
<tr>
<td></td>
<td>determines a line of symmetry, making many errors</td>
<td>determines a line of symmetry, making some errors</td>
<td>determines a line of symmetry, making few errors</td>
<td>determines a line of symmetry, making few, if any, minor errors</td>
</tr>
<tr>
<td>Expectations*</td>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
<td>Level 4</td>
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<td>---------------</td>
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<tr>
<td>6</td>
<td>– uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation with limited clarity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– describes sketches and diagrams, using limited mathematical language with limited clarity</td>
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<tr>
<td></td>
<td>– uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation with some clarity</td>
<td></td>
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<tr>
<td></td>
<td>– describes sketches and diagrams, using mathematical language with some clarity</td>
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<tr>
<td></td>
<td>– uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly</td>
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<tr>
<td></td>
<td>– describes sketches and diagrams, using mathematical language clearly</td>
<td></td>
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<tr>
<td></td>
<td>– uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly and precisely</td>
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<td></td>
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<tr>
<td></td>
<td>– describes sketches and diagrams, using mathematical language clearly and precisely</td>
<td></td>
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</tbody>
</table>

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

*Note: This rubric does not include criteria for assessing student performance that falls below level 1.
Creating Symmetrical Designs  Level 1, Sample 1

**Exemplar Task**

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

   - A
   - B
   - C

Use fractions, words, or pictures to explain your choice.

I picked (C) because It's The Shape of a piece of cake

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

Sue can share her cake with 7 friends

\[
\frac{1}{7}
\]
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you.
Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.

I know it has a line of symmetry because on the other side there was the same.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry? Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I drew the reflection by looking at the other side and copying the picture on the other side.
Comments/Next Steps
- The student needs to hear and use the mathematics vocabulary appropriate for this grade level (e.g., rhombus, fraction, one-fourth, or one-quarter).
- The student should talk about the processes followed in investigations before writing them down and needs to be taught to include relevant details to support statements made when answering questions.
- The student needs to use concrete materials in connection with three- and two-dimensional geometry and with fractions.
Creating Symmetrical Designs  Level 1, Sample 2

Exemplar Task

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

![Pattern blocks A, B, and C]

Use fractions, words, or pictures to explain your choice.

I chose this piece because it's just right for me.

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

There are 4 different ways that you can do it. This is my favorite way.
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you. Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.

I know my shape has a line of symmetry because when you look at it you see the same thing on each side.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy that may not be recognizable or appropriate to investigate the attributes of two-dimensional shapes (e.g., in question 1, the choice is based on personal preference).
- The student provides solutions that are incomplete or inaccurate (e.g., in question 2, states that there are four ways to share the cake but illustrates only one, without using fractions).
- The student uses limited information in the problem to compare fractions (e.g., in question 1, does not consider the size or shape of the pieces in order to compare them).

Understanding of Concepts
- The student demonstrates a limited understanding of symmetry by providing incomplete or inaccurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in question 4, inaccurately uses a reflection of pattern blocks in a mirror to show a line of symmetry instead of arranging three pattern blocks in shapes having a line of symmetry).

Application of Mathematical Procedures
- The student compares proper fractions, making many errors and/or omissions (e.g., in question 2, draws only one example of a cake divided into thirds, and does not record fractions).
- The student determines a line of symmetry, making many errors (e.g., in question 3a, draws a line of symmetry but uses too many pattern blocks to make the shape).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation with limited clarity (e.g., in question 3b, his or her response is unclear: “when you look at it you see the same thing on each side”).
- The student describes sketches and diagrams, using limited mathematical language with limited clarity (e.g., uses limited and unclear mathematical language in questions 3b and 5b in describing lines of symmetry and reflections).
Comments/Next Steps
- The student could create a math dictionary and use it when completing written responses.
- The student should include relevant details to support statements made when answering questions.
- The student could use pre-cut shapes for recording solutions to investigations and may benefit from having parts of the written answers transcribed.
**Exemplar Task**

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

   Use fractions, words, or pictures to explain your choice.

---

2. This is Sue’s cake.

   How many friends could share this cake? Explain your answer using pictures, words, and fractions.

   
   [Handwritten text: $2 \frac{1}{2} = 1$ Hexagon.]
   
   [Handwritten text: 6 people can share because I know triangles would be it because 6 triangles make a hexagon.]
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you. Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.

I t h as the same thing eacb side. It h as a line in the middle.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I flipped them and when was don I made another paten.

Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to investigate the attributes of two-dimensional shapes (e.g., in question 1, draws a picture and uses words to justify why piece A would be chosen: “I won’t A because it is bigger than 2 triangles”).
- The student provides solutions that are partially complete and/or partially accurate (e.g., in question 1, only compares shapes A and C, and uses a fraction only to describe shape A).
- The student uses some relevant information in the problem to compare fractions (e.g., in question 1, says that “½ is bigger than B or C”, and in question 2, says “2 ½ = 1 Hexagon” [i.e., two halves equal one hexagon]).

Understanding of Concepts
- The student demonstrates some understanding of symmetry by providing partially complete and/or partially accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., the shapes in question 3a are not symmetrical, but this lack of symmetry may be the result of copying error).

Application of Mathematical Procedures
- The student compares proper fractions, making some errors (e.g., in question 2, recognizes that “6 triangles make a hexagon”, but does not label the pieces as fractions and unclearly notes that the hexagon would equal “2 ½”).
- The student determines a line of symmetry, making some errors (e.g., in question 4, draws two lines of symmetry that are correct, but does not use the three pattern blocks as directed).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation with some clarity (e.g., in question 3b, uses words and a picture to show that the shape has a line of symmetry).
- The student describes sketches and diagrams, using mathematical language with some clarity (e.g., in question 5b, “I flipped them and when was don I made another paten”).
Comments/Next Steps
- The student needs repeated opportunities to investigate fractions.
- The student needs to develop an understanding of the connection between fraction pieces and fraction symbols.
- The student needs to solve problems that focus on lines of symmetry.
Exemplar Task
The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

Use fractions, words, or pictures to explain your choice.

I would like B because if I put 1/3 of C pieces together, it would make 1/2.

I picked B because it fills my stomick up with

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

6 people can share Sue’s cake.
C

I used 6 triangles, little ones.
I put them together to make a hexagon the fraction \( \frac{6}{6} \).

D

3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you.
Draw your shape and show the line of symmetry.
b) Explain how you know it has a line of symmetry.

I know the line of symmetry because when the blocks attach in the middle that's where the line of symmetry is.

4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.
5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to investigate the attributes of two-dimensional shapes (e.g., in question 1, compares the cake pieces to justify the choice made).
- The student provides solutions that are partially complete and/or partially accurate (e.g., in question 1, chooses piece B because “it fills my stomach up with cake”).
- The student uses some relevant information in the problem to compare fractions (e.g., in question 1, suggests putting both triangles together to make piece B).

Understanding of Concepts
- The student demonstrates some understanding of symmetry by providing partially complete and/or partially accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in question 3b, identifies lines of symmetry but explains the location of a line of symmetry as “when the blocks attach in the middle”, and does not record how both parts of the figure must be congruent or must match).

Application of Mathematical Procedures
- The student compares proper fractions, making some errors (e.g., in question 2, notes that “6 people can share Sue’s cake”, but incorrectly labels the pieces of the cake $\frac{1}{6}, \frac{2}{6},$ and so on).
- The student determines a line of symmetry, making some errors (e.g., in question 4, uses more than three pattern blocks to create a line of symmetry).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation with some clarity (e.g., in question 2, uses pictures of the people, a diagram of the cake, and a summary statement to explain the answer).
- The student describes sketches and diagrams, using mathematical language with some clarity (e.g., in question 5b, the explanation is partially clear, although the diagram is incorrect).
Comments/Next Steps
- The student needs to share written responses with peers to improve the clarity of his or her answers.
- The student should include more precise mathematical language in written answers (e.g., in question 1, the names of the shapes could have been included).
- The student needs to solve problems such as the ones in this task to help to develop a clearer understanding of lines of symmetry and lines of reflection.
- The student should refer to word charts or a personal dictionary for the correct spelling of words.
Exemplar Task
The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

Use fractions, words, or pictures to explain your choice.

I would like A because A is the biggest piece that is left. A is a half of a cake. If I had two A’s it would be a whole. Three B’s would make the whole cake. Three C’s would make the whole cake.

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

If I took a triangle and put them on the hexagon six people would be allowed to the birthday party. If I had a diamond I would have three people allowed to the birthday party. If I had a hot dog on the hexagon and I put it on the hexagon, two people would come to the party. If I had a hexagon and put it on the hexagon, one person could come.
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you.
Draw your shape and show the line of symmetry.

---

b) Explain how you know it has a line of symmetry.

It has a line of symmetry because both sides are equal. The red mirror makes a mirror shape on the other side. The colour, shape, size, & position have to be the same. When I put the red mirror on the line of symmetry both sides will match and when you fold it on the line of symmetry the shapes will be the same. When you put the red mirror on the line of symmetry, you will see the reflection on the other side.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I knew how I drew the reflection because I put the hexagon on the line and slid the hexagon. Then I took the half of a hexagon and slid it over to the right side. Then I took the triangle and slid it over. I slid all of the shapes over two times. Then I made it under two times too! Another way I know is I put the red mirror on the line and look threw the mirror and traced on the other side.

Teacher’s Notes

Problem Solving
- The student selects and applies some appropriate problem-solving strategies to investigate the attributes of two-dimensional shapes (e.g., in question 1, draws diagrams and uses fractions to compare the pieces).
- The student provides complete and accurate solutions (e.g., in question 1, identifies the chosen piece by circling it, and explains the relationship of the A, B, and C pieces to the whole hexagon).
- The student uses relevant information in the problem to compare fractions (e.g., in question 2, determines the number of each shape that is required to create a hexagon in order to find how many people could share the cake).

Understanding of Concepts
- The student demonstrates a general understanding of symmetry by providing complete and accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in question 3b, states, “The red mirror makes a mirror shape on the other side” and “When I put the red mirror on the line of symmetry both side will match and when you fold it on the line of symmetry the shapes will be the same”).

Application of Mathematical Procedures
- The student compares proper fractions, making few errors (e.g., in question 1, correctly uses fractions to compare the shapes that represent the cake pieces).
- The student determines a line of symmetry, making few errors (e.g., in question 4, omits the triangle in example 1).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly (e.g., represents fractions as words (“half”), as symbols (½), and as pictures to clearly explain the choice of cake piece in question 1).
- The student describes sketches and diagrams, using mathematical language clearly (e.g., in question 3b, clearly describes the shape as symmetrical, using the words “same”, “shape”, and “size”).
Comments/Next Steps
- The student needs to develop a better understanding of flips, slides, and turns and to use appropriate language in describing these transformations.
**Exemplar Task**

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

Use fractions, words, or pictures to explain your choice.

My choice would be A because it has \( \frac{1}{2} \) of the cake while \( \Diamond B \) has \( \frac{1}{2} \) and \( \Diamond C \)\( \frac{2}{3} \) so I would not choose \( \Diamond B \) because \( \frac{1}{2} \) is smaller than \( \frac{1}{2} \)

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

You could share it with 2\( \frac{5}{6} \) so \( \frac{6}{5} \) which is \( \frac{3}{5} \) and 3 people which is \( \frac{3}{5} \)

2. This is Sue’s cake.
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you. Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.

I know there is a line of symmetry when A) I can split it into halves equally and B) when you can fold it and it is folded perfectly and it matches.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I drew the reflection by moving the blocks around.

I used the mirror to get the reflection.

Teacher’s Notes

Problem Solving
- The student selects and applies some appropriate problem-solving strategies to investigate the attributes of two-dimensional shapes (e.g., in question 1, uses words, diagrams, and fractions to compare the shapes representing the pieces of cake).
- The student provides complete and accurate solutions (e.g., in questions 3a and 3b, provides many illustrations and a complete explanation).
- The student uses relevant information in the problem to compare fractions (e.g., in question 2, uses pictures, words, and fractions to show three different ways the cake could be shared).

Understanding of Concepts
- The student demonstrates a general understanding of symmetry by providing complete and accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in question 3a, draws six shapes and correctly determines the lines of symmetry, although in the shapes numbered 3 and 6, he or she puts together shapes and identifies lines of symmetry that are less obvious).

Application of Mathematical Procedures
- The student compares proper fractions, making few errors (e.g., in question 2, explains how the cake could be shared with two people, “which is split into $\frac{2}{2}$’s 6 people, which is split into $\frac{3}{3}$’s and 3 people which is split into $\frac{3}{3}$’s”).
- The student determines a line of symmetry, making few errors (e.g., in question 4, records four possible solutions).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly (e.g., in questions 1 and 3b).
- The student describes sketches and diagrams, using mathematical language clearly (e.g., in question 3b, explains that there is a line of symmetry when “A: I can split it in half equally and B: when you can fold it and it is folded perfectly and it matches”).
Comments/Next Steps
- The student needs to elaborate on some answers by including pictures or more thorough explanations (e.g., in question 1, provides a clear and thorough answer, but in question 5b provides a very brief answer with no supporting pictures, diagrams, or mathematical language).
- The student should continue to create complex shapes and identify the line or lines of symmetry.
Exemplar Task

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

A  B  C

Use fractions, words, or pictures to explain your choice.

I would prefer piece (A) because it's the biggest piece.

A = $\frac{1}{2}$

2. This is Sue's cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

Six friends could share this cake because there are 6 parts.

Three friends could share this cake.

Two friends could share this cake.
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you.
Draw your shape and show the line of symmetry.

3. b) Explain how you know it has a line of symmetry.

My new shape has a line of symmetry because the line divides the shape into equal pieces with the same size and shape.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

I got 5 ways.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I drew the reflection by using the red plastic mirror and I did it by drawing the reflection then I did the real one.

Teacher’s Notes

Problem Solving
- The student selects and applies the most appropriate problem-solving strategies, modifies known strategies, and/or creates new strategies to investigate the attributes of two-dimensional shapes (e.g., in question 1, shows three different ways of sharing the cake and demonstrates the equivalence of B and C).
- The student provides thorough and accurate solutions (e.g., in question 2, provides a complete solution by including pictures of the cake, summarizing sentences, and numerical representations).
- The student uses all the relevant information in the problem to compare fractions (e.g., in question 2, provides a complete solution with diagrams).

Understanding of Concepts
- The student demonstrates a thorough understanding of symmetry by providing detailed and accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in questions 3a and 4, all of the diagrams accurately show the lines of symmetry).

Application of Mathematical Procedures
- The student compares proper fractions, making few, if any, minor errors (e.g., in question 1, recognizes that shape A = ½, B = ⅓, and C = ⅓, and correctly identifies A as the largest fraction).
- The student determines a line of symmetry, making few, if any, minor errors (e.g., in question 5, shows two different lines of symmetry, correctly labelling the lines of reflection).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly and precisely (e.g., throughout the activity the student’s use of words, pictures, and numerical representations clearly illustrates his or her reasoning and understanding of geometric concepts).
- The student describes sketches and diagrams, using mathematical language clearly and precisely (e.g., in question 2).
**Comments/Next Steps**

- The student should use pattern blocks and other manipulative materials to create designs that increase in complexity and should begin to identify less obvious lines of symmetry.
Creating Symmetrical Designs  Level 4, Sample 2

Exemplar Task
The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

A  B  C

Use fractions, words, or pictures to explain your choice.

I want to eat piece A because it is the biggest.
It is $\frac{1}{2}$ of the cake.

$\frac{1}{2}$

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.

I could share the cake with 6 friends.
Each friend would get $\frac{1}{6}$.

I could share the cake with 3 friends.
Each friend would get $\frac{1}{3}$.

I could share the cake with 2 friends.
Each friend would get $\frac{1}{2}$.
3. a) Choose **two different pattern blocks**. Put the pattern blocks together to **make a new shape that has a line of symmetry**.

Use your red plastic mirror to help you.
Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.

*It has a line of symmetry because each side is the same size and shape.*
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

I put the Mira across the pattern blocks first and then I put the Mira up and down and drew the reflection.

Teacher’s Notes

Problem Solving
- The student selects and applies the most appropriate problem-solving strategies, modifies known strategies, and/or creates new strategies to investigate the attributes of two-dimensional shapes (e.g., in question 1, notes important information, reasons logically, and draws diagrams).
- The student provides thorough and accurate solutions (e.g., demonstrates several different ways to share the cake in question 2).
- The student uses all the relevant information in the problem to compare fractions (e.g., in question 2, provides a complete solution, including diagrams).

Understanding of Concepts
- The student demonstrates a thorough understanding of symmetry by providing detailed and accurate explanations and drawings of symmetrical shapes and lines of symmetry (e.g., in question 3b, describes what constitutes a line of symmetry and uses a diagram).

Application of Mathematical Procedures
- The student compares proper fractions, making few, if any, minor errors (e.g., the comparison of fractions in questions 1 and 2 is thorough and accurate).
- The student determines a line of symmetry, making few, if any, minor errors (e.g., in questions 3b and 4, there are minor errors in the drawing of the lines of symmetry, but the student demonstrates understanding of a line of symmetry in the combination of drawings and written explanations).

Communication of Required Knowledge
- The student uses pictures, words, and/or diagrams to describe geometric concepts, reasoning, and processes of investigation clearly and precisely (e.g., effectively and accurately uses words, pictures, and diagrams throughout the task).
- The student describes sketches and diagrams, using mathematical language clearly and precisely (e.g., in question 2, describes diagrams by using fractions and mathematical language that is clear and precise).
**Comments/Next Steps**
- The student needs to incorporate more mathematical language in written responses.
- The student should continue to solve problems where shapes are arranged to create complex designs.
- The student would benefit from having pre-cut shapes or shape stamps to use for recording designs.
Title: Creating Symmetrical Designs

Time Requirements:
- 25–30 minutes to complete Pre-task 1
- 15–20 minutes to complete Pre-task 2
- 15–20 minutes to complete Pre-task 3
- 50 minutes to complete the exemplar task

Description of the Task

The task will require students to:
- investigate fractions, using pattern blocks;
- draw lines of symmetry that result from placing pattern blocks side by side.

Students will compare two fractions, using pattern blocks; state which fraction is larger; and give reasons for their answers. They will divide a hexagon into fractional parts. Then they will place pattern blocks side by side to form shapes that have a line of symmetry, and they will draw the line of symmetry. Finally, they will use pattern blocks to make a design, and will show the reflection of the design in different ways.

Mathematics Exemplar Task
Grade 2 – Number Sense and Numeration, and Geometry and Spatial Sense

Teacher Package

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. compare proper fractions using concrete materials (2m3);
2. represent and explain halves, thirds, and quarters as part of a whole and part of a set using concrete materials and drawings (e.g., colour 2 out of 4 circles) (2m19);
3. compare two proper fractions using concrete materials (e.g., use pattern blocks to show that the relationship of 3 triangles to 6 triangles is the same as that of 1 trapezoid to 2 trapezoids because both represent half of a hexagon) (2m20).

Geometry and Spatial Sense
Students will:
4. investigate the attributes of three-dimensional figures and two-dimensional shapes using concrete materials and drawings (2m61);
5. understand key concepts in transformational geometry using concrete materials and drawings (2m63);
6. use language effectively to describe geometric concepts, reasoning, and investigations (2m65);
7. demonstrate an understanding of a line of symmetry in a two-dimensional shape by using paper folding and reflections (e.g., using paint-blot pictures, red plastic mirrors) (2m76);
8. determine a line of symmetry of a two-dimensional shape by using paper folding and reflections (e.g., in a transparent mirror) (2m77).

Teacher Instructions

Prior Knowledge and Skills Required
To complete this task, students should have some knowledge or skills related to the following:
- representing halves, thirds, and quarters
- exploring reflections with a red plastic mirror
- tracing, stamping, or sticking shapes onto paper
- determining a line of symmetry for a two-dimensional shape
- manipulating concrete materials (e.g., pattern blocks)
- drawing pattern block shapes on pattern block paper
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 in the administration of the exemplar task.

Classroom Set-up

For the investigation of the assigned tasks, the following classroom organization is recommended:

- Pre-task 1 – small-group work areas at tables or desks, then a whole-group work area on the floor or carpet
- Pre-tasks 2 and 3 – individual workspaces
- Exemplar task – individual workspaces at desks or tables

Materials and Resources Required

Before students attempt a particular task, provide them with the appropriate materials from among the following:

- copies of the student package for each student
- writing instruments (pencils, erasers)
- pattern blocks (Students will need access to a variety of pattern block shapes – approximately 20 in total. Place tubs or bins of pattern blocks in a spot that is easily accessible to small groups of students.)
- page of hexagons (Appendix 2)
- red plastic mirrors
- pieces of white paper
- markers
- rulers
- scissors
- cut-out shapes (see Appendix 3)
- pattern block paper (Appendix 4)

General Instructions

Setting the Stage

All the student work is to be completed in its entirety at school.

Students are to work in small groups and in a whole-class grouping to complete the pre-task activities. Students are to work individually and independently to complete the exemplar task.

When students are completing the introductory activities, provide prompts to get them started or to extend their investigations. Recording the prompts serves as a reminder of the conversation that occurred between you and the student. These notes provide valuable information that will allow you to plan the next steps for both individual and group instruction.

Observing the Process

As students are working on the tasks, have them explain what they are doing. Having students explain their work orally reveals deep mathematical thinking that cannot always be seen in the written work of primary students. Where students do provide written work and it cannot be easily read, transcribe that work at the side of the student’s page. In this space also, record any observations or comments the student makes that will be helpful in assessing the level of the student work.

Posting a Word List

It would be useful to post a chart listing mathematical language that is currently being developed or used during the task. Such a chart will provide the students with a resource to use when communicating their mathematical learning. Words that you may include for this task are: symmetry, same, mirror, size, shape, reflection.

The Pre-tasks

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.

*The rubric is reproduced on pages 14–15 of this document.
Task Instructions

Introductory Activities

**Pre-task 1: Working with Pattern Blocks (25–30 minutes)**
1. Organize the students into small groups. Give each group several handfuls of pattern blocks.
2. Ask each group to represent the shape of the yellow hexagon by using other pattern blocks. Have one student from each group record the group’s responses on the sheet with the hexagonal shapes (see Appendix 2).
3. Regroup on the carpet or floor to discuss the students’ findings. You may use the following prompts:
   - “What did you find out?”
   - “How many different ways are there to make the hexagon?”
4. There may be differences in the number of solutions. Explore the possible reasons with the students, and have the students suggest ways of representing each of the combinations.

**Pre-task 2: Working With a Red Plastic Mirror and Drawings on Paper (15–20 minutes)**
1. Keeping the class together on the carpet or floor, distribute to each student a piece of white paper, a red plastic mirror, and a marker.
2. Ask the students to draw a worm on their paper. Then have them use a red plastic mirror to explore the following scenarios: “How long can you make the worm?” “How short can you make the worm?” Encourage the students to extend the worm with the red plastic mirror and then trace the reflection behind the red plastic mirror to make the worm longer and/or shorter.
3. Pose this problem: “Make a worm that is ____ cm long.”
4. Note: Students may wish to explore additional drawings on paper at this time. For example, “Draw a puddle. Make it shrink. Make it grow. How big can you make it?”

**Pre-task 3: Investigating Symmetry in Cut Paper Shapes (15–20 minutes)**
1. Give each child the two cut shapes from Appendix 3. Present the following scenario:
   “These two pieces should be attached. Put them together so that the shape has a line of symmetry. Use your red plastic mirror to check to see if you are right.”
2. Instruct the students to look for other ways of using the two pieces to make shapes with a line of symmetry.
3. Record the shapes with a line of symmetry that the students discovered.

Exemplar Task (50 minutes)
1. Distribute a copy of the student package to each student.
2. Tell the students that in the following task they will use pattern blocks to (a) compare and explore fractions and (b) make designs that have a line of symmetry.
3. Make sure that each student has the necessary pattern blocks pieces before him or her, and a large, flat surface on which to work.
4. The problem that the students will solve independently is provided in the worksheets in Appendix 1.
Appendix 1: Student Worksheets

The hexagon represents a cake.

The other pattern blocks represent pieces of the cake.

1. Which piece(s) would you prefer to have: A or B or C?

Use fractions, words, or pictures to explain your choice.

2. This is Sue’s cake.

How many friends could share this cake? Explain your answer using pictures, words, and fractions.
3. a) Choose two different pattern blocks. Put the pattern blocks together to make a new shape that has a line of symmetry.

Use your red plastic mirror to help you. Draw your shape and show the line of symmetry.

b) Explain how you know it has a line of symmetry.
4. How many different ways can you put the three pattern blocks together to make a shape with a line of symmetry?

Show each way by tracing and drawing the line of symmetry.

5. Choose three different pattern blocks. Arrange them side by side on the pattern block paper to make a design.

a) Show different ways of showing the reflection of your design.
b) Explain how you drew the reflection.

Appendix 2: Hexagons (for Pre-task 1)

Provide one page for each small group.
Appendix 3: Shapes for Investigating Symmetry (for Pre-task 3)

Provide one of each shape to every student.

Appendix 4: Pattern Block Paper
Patterning and Algebra
**Growing Patterns**

**The Task**

This task required students to:
- make a growing pattern by using interlocking cubes;
- describe the pattern they made;
- investigate a classmate’s growing pattern;
- extend a classmate’s pattern.

For the first part of the task, students each made a pattern, drew it, wrote the pattern rule, and then described the pattern in such a way that someone else could determine the next term. They then looked at the numbers in their pattern to see what addition pattern was evident in it. For the second part of the task, students each drew a classmate’s pattern and the next term, wrote the pattern rule, and compared their own pattern with the classmate’s.

**Expectations**

This task gave students the opportunity to demonstrate 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. identify, extend, and create number, geometric, and measurement patterns, and patterns in their environment (2m82);
2. explore patterns and pattern rules (2m83);
3. identify relationships between and among patterns (2m84);
4. recognize that patterning results from repeating an operation (e.g., addition), using a transformation (slide, flip, turn), or making some other change to an attribute (e.g., position, colour) (2m85);
5. describe and make models of patterns encountered in any context (e.g., wallpaper borders, calendars), and read charts that display the patterns (2m86);
6. identify patterns (e.g., in shapes, sounds) (2m87);
7. relate growing and shrinking patterns to addition and subtraction (2m92);
8. explain a pattern rule (2m93);
9. given a rule expressed in informal language, extend a pattern (2m94).
**Prior Knowledge and Skills**

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

- creating growing and shrinking patterns from a variety of materials
- discussing and explaining pattern rules
- exploring addition and subtraction in patterns
- extending existing patterns

*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 93–98 of this document.*
## Task Rubric – Growing Patterns

<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</td>
<td>uses a problem-solving strategy to identify, extend, and create growing patterns, arriving at an incomplete or inaccurate solution</td>
<td>uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a partially complete and/or partially accurate solution</td>
<td>uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a generally complete and accurate solution</td>
<td>uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, 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>4, 7</td>
<td>shows a limited understanding of the relationship between growing patterns and addition</td>
<td>shows a partial understanding of the relationship between growing patterns and addition</td>
<td>shows a clear understanding of the relationship between growing patterns and addition</td>
<td>shows an in-depth understanding of the relationship between growing patterns and addition</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 3, 9</td>
<td>creates and extends patterns, making many errors and/or omissions</td>
<td>creates and extends patterns, making some errors and/or omissions</td>
<td>creates and extends patterns, making few errors and/or omissions</td>
<td>creates and extends patterns, making few, if any, minor errors or omissions</td>
</tr>
<tr>
<td></td>
<td>identifies simple relationships between and among patterns (e.g., in question 2c, has some problems describing how patterns are the same or different)</td>
<td>identifies some of the relationships between and among patterns (e.g., in question 2c, describes a few similarities and differences between the two patterns)</td>
<td>identifies many of the relationships between and among patterns (e.g., in question 2c, describes several similarities and differences between the two patterns)</td>
<td>identifies almost all the relationships between and among patterns (e.g., in question 2c, makes a comparison of the two patterns that is detailed and accurate and includes all concepts)</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>uses words, pictures, and/or diagrams with limited clarity and/or accuracy to describe and explain the growing-pattern rule</td>
<td>uses words, pictures, and/or diagrams with some clarity and/or accuracy to describe and explain the growing-pattern rule</td>
<td>uses words, pictures, and/or diagrams clearly and accurately to describe and explain the growing-pattern rule</td>
<td>uses words, pictures, and/or diagrams clearly, accurately, and precisely to describe and explain the growing-pattern rule</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on page 66. Note that, although all of the expectations listed there were addressed through instruction relating to the task, student achievement of expectations 2, 5, and 6 was not assessed in the final product.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.
Growing Patterns

1. a) Use interlocking cubes to make a pattern that grows.

   Your growing pattern should grow at least 4 times.

   Draw your growing pattern below.

b) My patterning rule is:

   [Handwritten text: $I \text{ old 5 each time}$]
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

By /5 and 5 each time.

d) Look at the numbers in your pattern.

How are they like adding?
You just add 5 each time.

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is: add one each time.
c) Compare your pattern with your classmate’s pattern.
How are they alike? We both have red.
How are they different? One and mine is by 5.

Teacher’s Notes

Problem Solving
- The student uses a problem-solving strategy to identify, extend, and create growing patterns, arriving at an incomplete or inaccurate solution (e.g., uses pictures to record the patterns).

Understanding of Concepts
- The student shows a limited understanding of the relationship between growing patterns and addition (e.g., in question 1c, states “By 5 and 5 each Tim”, and in question 1d, states, “You just add 5 on each Tim”, indicating some understanding that the pattern is growing by 5).

Application of Mathematical Procedures
- The student creates and extends patterns, making many errors and/or omissions (e.g., in question 1a, does not always add 5 to each term).
- The student identifies simple relationships between and among patterns (e.g., in question 2c, comments that the cubes used in each pattern are the same colour, and attempts to compare the numbers of cubes by which the pattern grows each term).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams with limited clarity and/or accuracy to describe and explain the growing-pattern rule (e.g., the explanations in questions 1b, 1c, and 2b are very brief and use only words to illustrate the statements).

Comments/Next Steps
- The student needs to compare growing patterns and addition.
- The student needs to create patterns and describe them orally before writing about them.
- The student needs to see other student samples that use a variety of pictures, numbers, and/or diagrams to support the answers.
- The student should review his or her recorded responses to check for accuracy.
- The student should refer to word charts or a personal dictionary for the correct spelling of words.
Growing Patterns  
Level 1, Sample 2

A

Growing Patterns

1. a) Use interlocking cubes to make a pattern that grows.
   
   Your growing pattern should grow at least 4 times.
   
   Draw your growing pattern below.

B

b) My patterning rule is: \( \text{I added by } \frac{1}{3} \)
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

I started with a cube.

d) Look at the numbers in your pattern.

How are they like adding?

it grows

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is: adding 3 more each.
Problem Solving
- The student uses a problem-solving strategy to identify, extend, and create growing patterns, arriving at an incomplete or inaccurate solution (e.g., uses cubes to create the growing patterns for questions 1a and 2a and uses pictures to show the patterns; omits one term of the pattern in the picture in question 2a).

Understanding of Concepts
- The student shows a limited understanding of the relationship between growing patterns and addition (e.g., the response in question 1d does not show how numbers are added together to move from one term to the next).

Application of Mathematical Procedures
- The student creates and extends patterns, making many errors and/or omissions (e.g., in question 1a, the pattern has only four terms, and the layout is not linear).
- The student identifies simple relationships between and among patterns (e.g., in question 2c, notes that both patterns have a term with three cubes and that the partner’s pattern has bigger numbers).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams with limited clarity and/or accuracy to describe and explain the growing-pattern rule (e.g., in question 1b, states, “I added by 1’s”; in question 1c, gives an incomplete description of the pattern).

Comments/Next Steps
- The student needs to explore how growing patterns and addition are alike.
- The student needs to make comparisons.
Growing Patterns

1. a) Use interlocking cubes to make a pattern that grows.
   
   Your growing pattern should grow at least 4 times.
   
   Draw your growing pattern below.

b) My patterning rule is:

   My patterning grows by twos by the top and bottom.
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

First I made a line with two cubes. Then I put two more cubes. Then I put two more cubes. Then I put two more cubes. Then I was finish.

d) Look at the numbers in your pattern. How are they like adding?

You add two to each wan.

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is:

It gets bigger with two cubes by the top and right side.
Teacher’s Notes

Problem Solving
- The student uses a problem-solving strategy to identify, extend, and create growing patterns, arriving at a partially complete and/or partially accurate solution (e.g., uses cubes to create the growing patterns for questions 1a and 2a, and uses pictures to show the patterns; in question 1a, omits one term of the pattern).

Understanding of Concepts
- The student shows a partial understanding of the relationship between growing patterns and addition (e.g., in question 1c, explains, “then I put two more cubes then I put two more cubes then I put two more cubes ...”; in question 1d, states, “you add two to each wan”).

Application of Mathematical Procedures
- The student creates and extends patterns, making some errors and/or omissions (e.g., in question 1a, creates and extends a simple pattern to four terms).
- The student identifies some of the relationships between and among patterns (e.g., in question 2c, compares the numbers by which the patterns increase and the numbers of cubes that the patterns use in the first term).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams with some clarity and/or accuracy to describe and explain the growing-pattern rule (e.g., in question 1b, is partially correct in stating, “My patterning grows by twos by the top and bottom”; in question 2b, describes the partner’s pattern correctly and with some clarity, saying, “It gets bigger with two cubes by the top and right side”).

Comments/Next Steps
- The student needs to create and analyse a variety of patterns.
- The student needs to talk about patterns before writing about them in order to clarify his or her thinking.
- The student needs to use numbers and/or charts to strengthen written explanations.
- The student needs to use more mathematical language (e.g., term, increases) in written responses.
**Growing Patterns**  
**Level 2, Sample 2**

1. a) Use interlocking cubes to make a pattern that grows.
   
   Your growing pattern should grow at least 4 times.
   
   Draw your growing pattern below.

   ![Growing pattern drawings]

b) My patterning rule is: Adding 3 to each box with $3\text{cm}^2$ as many times as you want to add $3\text{cm}^2$. 
c) Describe your pattern in enough detail so that someone else can make it grow one more time. What you have to do is put 3 in 1 box, add 3 in the second box, and keep adding 3.

d) Look at the numbers in your pattern. How are they like adding? Each time I would add 3.

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is: Keep adding 1 to each box.
Problem Solving

- The student uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a partially complete and/or partially accurate solution (e.g., uses concrete materials to create the growing patterns for question 1a, but omits one term of the pattern).

Understanding of Concepts

- The student shows a partial understanding of the relationship between growing patterns and addition (e.g., in question 1c, states, “What you have to do is put 3 in 1 box add 3 in the second box and keep adding 3”; in question 1d, states, “Each time I would add 3”).

Application of Mathematical Procedures

- The student creates and extends patterns, making some errors and/or omissions (e.g., in question 1a, extends the pattern to four terms).
- The student identifies some of the relationships between and among patterns (e.g., in question 2c, compares the materials that are used to make the patterns and compares the numbers by which the patterns increase).

Communication of Required Knowledge

- The student uses words, pictures, and/or diagrams with some clarity and/or accuracy to describe and explain the growing-pattern rule (e.g., in question 1b, describes the pattern rule as “Adding 3 to each ...”).

Comments/Next Steps

- The student needs to explore growing and shrinking patterns and to talk about the patterns and pattern rules that have been discovered.
- The student needs to see models that use examples (e.g., pictures, numbers, and/or charts) to complement pattern explanations.
Growing Patterns

1. a) Use interlocking cubes to make a pattern that grows.
   
   Your growing pattern should grow at least 4 times.
   
   Draw your growing pattern below.

b) My patterning rule is:

   My pattern rule is counting by 3's. I began with 3 cubes and kept on adding 3 more cubes.
   
   3, 6, 9, 12, 15
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

Begin with 3 cubes
keep adding more cubes to each new term
I have four terms.
I am counting by 3s.

d) Look at the numbers in your pattern.

How are they like adding?

\[
\begin{align*}
3 + 3 &= 6 \\
12 + 3 &= 15 \\
6 + 3 &= 9 \\
9 + 3 &= 12
\end{align*}
\]

I am adding 3 each time.
I need to add 3 cubes to get to each new term.

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is:

Begin with 2 cubes.
keep adding 2 cubes to get to each new term.
My partner is counting by 2s.
c) Compare your pattern with your classmate’s pattern.
   How are they alike?
   How are they different?

   They are both a growing pattern, and they are both in a line. Here’s how:
   Counting by 2s and mine is counting by 3s.

Teacher’s Notes

Problem Solving
- The student uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a generally complete and accurate solution (e.g., uses tiles to create the growing patterns in questions 1a and 2a, and uses pictures to represent the patterns, which are complete and accurate).

Understanding of Concepts
- The student shows a clear understanding of the relationship between growing patterns and addition (e.g., question 1d, uses addition sentences in demonstrating how numbers are added to show growth from one term to the next; supports the work by using a clear written statement: “I need to add 3 cubes to get to each new term”).

Application of Mathematical Procedures
- The student creates and extends patterns, making few errors and/or omissions (e.g., the patterns in questions 1a and 2a are correct).
- The student identifies many of the relationships between and among patterns (e.g., in question 2c, compares the patterns according to their type, their orientation on the page, and the way in which they increase).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams clearly and accurately to describe and explain the growing-pattern rule (e.g., in questions 1a to 1d, 2a, and 2b, effectively describes the patterns by using a combination of drawings, numbers, number sentences, and words).

Comments/Next Steps
- The student needs to investigate growing and shrinking patterns with a variety of materials and to analyse the underlying number patterns and relationships.
- The student should explore more complex arrangements of the materials as well as the patterns that result from the arrangements.
Growing Patterns

1. a) Use interlocking cubes to make a pattern that grows.
   Your growing pattern should grow at least 4 times.
   Draw your growing pattern below.

b) My patterning rule is:
   The pattern is you add one on the top
   one on the right hand side of the pattern and one on the left hand side.
   The numbers go 1, 4, 7, 10, 13.
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

There are 13 blocks so you have to put one more on the top and both sides.

d) Look at the numbers in your pattern. How are they like adding?

They are like adding because it goes 1, 4, 10, and you have to keep adding 3 to get the next term:

\[\begin{align*}
1 + 3 &= 4 \\
4 + 3 &= 7 \\
7 + 3 &= 10 \\
10 + 3 &= 13
\end{align*}\]

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is:

You have a higher number to add counting by because the numbers go 1, 3, 6, 10, 15, 21.
c) Compare your pattern with your classmate’s pattern.

How are they alike?

How are they different?

Teacher’s Notes

Problem Solving
– The student uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a generally complete and accurate solution (e.g., in questions 1a and 2a, uses pictures to record accurate growing patterns).

Understanding of Concepts
– The student shows a clear understanding of the relationship between growing patterns and addition (e.g., in question 1d, states that “you have to keep adding 3 to get the next term” and further illustrates the relationship by using addition sentences).

Application of Mathematical Procedures
– The student creates and extends patterns, making few errors and/or omissions (e.g., the patterns in questions 1a and 2a are complete and accurate).
– The student identifies many of the relationships between and among patterns (e.g., in question 2c, compares the two patterns in terms of their starting points, their visual appearances, and the numbers by which they grow).

Communication of Required Knowledge
– The student uses words, pictures, and/or diagrams clearly and accurately to describe and explain the growing-pattern rule (e.g., in questions 1 and 2, uses a variety of drawings, numbers, and words to describe and explain the patterns).

Comments/Next Steps
– The student demonstrates the application of previously learned knowledge in question 2c by using a Venn diagram as a tool for comparing the two patterns.
– The student needs to create and analyse complex growing and shrinking patterns.
Growing Patterns

Level 4, Sample 1

1. a) Use interlocking cubes to make a pattern that grows.

   Your growing pattern should grow at least 4 times.

   Draw your growing pattern below.

   ![Growing Pattern Diagram]

   **Term no.** | **no. of blocks**
   --- | ---
   1 | 4
   2 | 8
   3 | 12
   4 | 16
   5 | 20
   6 | 24
   7 | 28
   8 | 32
   9 | 36
   10 | 40

   b) My patterning rule is: Begin with four blocks and add 4 blocks to each new term. 4, 8, 12, 16, 20, 24, ...

   If I make my tenth term it will have 40 blocks.
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

I did my pattern by adding 4's
4 + 4 = 8  \quad 8 + 4 = 12  \quad 12 + 4 = 16
16 + 4 = 20  \quad 20 + 4 = 24
I was adding 4 every time.

d) Look at the numbers in your pattern.

How are they like adding?

The numbers are like adding because I added 4 blocks each time to get each new term.

4, 8, 12, 16, 20, 24, 28

2. a) Look at a classmate's pattern.

Draw your classmate's pattern in your own booklet.

Make it grow one more time.

b) My classmate's patterning rule is: Begin with 1 cube and add 1 to each new term. He was counting by 15.

<table>
<thead>
<tr>
<th>Term No.</th>
<th>No. of blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Teacher’s Notes

Problem Solving
- The student uses an appropriate problem-solving strategy to identify, extend, and create growing patterns, arriving at a thorough and accurate solution (e.g., in question 1b, draws a diagram and uses a table to organize the pattern information).

Understanding of Concepts
- The student demonstrates an in-depth understanding of the relationship between growing patterns and addition (e.g., in questions 1c and 1d, uses addition effectively to describe the pattern and to illustrate how the terms in the pattern are obtained).

Application of Mathematical Procedures
- The student creates and extends patterns, making few, if any, minor errors or omissions (e.g., in question 1a, the pattern grows by 4 five times; in question 1b, the pattern is extended to the tenth term).
- The student identifies almost all the relationships between and among patterns (e.g., in question 2c, makes a detailed and accurate comparison of the two patterns).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams clearly, accurately, and precisely to describe and explain the growing-pattern rule (e.g., in question 1b, uses words, numbers in a table, and drawings to give a full explanation of the pattern rule).

Comments/Next Steps
- The student should continue to explore how patterning is related to other mathematics topics.
- The student should investigate more complex patterns by arranging tiles or pattern blocks in a variety of ways and should analyse the resulting patterns.
- The student should explore patterns that grow by a different number each term (e.g., 1, 4, 8, 13, 19, ...) and continue to use tables and diagrams to analyse the patterns and to predict successive terms in the patterns.

c) Compare your pattern with your classmate’s pattern.

How are they alike?

They are alike because they’re both growing.

How are they different?

They have to add a certain number of cubes to get to each new term.

They are different because:

- I am adding 4 every time, and he is adding 1 every time.
- His first term has 1 cube, my first term has 4 cubes.
- His tenth term will have 10 cubes but my tenth term will have 40 cubes.
- My pattern is growing much faster than my pattern.

mine is 4, 8, 12, 16, 20, 24
his is 1, 2, 3, 4, 5.

You have to add his term 4 times to make one of mine.
Growing Patterns

A

1. a) Use interlocking cubes to make a pattern that grows.
   
   Your growing pattern should grow at least 4 times.
   
   Draw your growing pattern below.

B

b) My patterning rule is:

- that I am counting by twos and
- I went to twelve
- and I used 42 cubes altogether. I started
- off with 2 cubes.

So start off with 2 cubes

   Add a cube to get to each new term.
c) Describe your pattern in enough detail so that someone else can make it grow one more time.

Start with two cubes.
Add two cubes to get to each new term.
Count by twos.

The last term is twelve.
There are six terms in my growing pattern.
Use 42 cubes altogether.

<table>
<thead>
<tr>
<th>Term</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Term</td>
<td>2</td>
</tr>
<tr>
<td>Second Term</td>
<td>4</td>
</tr>
<tr>
<td>Third Term</td>
<td>6</td>
</tr>
<tr>
<td>Fourth Term</td>
<td>8</td>
</tr>
<tr>
<td>Fifth Term</td>
<td>10</td>
</tr>
<tr>
<td>Sixth Term</td>
<td>12</td>
</tr>
</tbody>
</table>

Total 42

d) Look at the numbers in your pattern.

How are they like adding?
They are like adding because I am counting by twos. I need to add two cubes to get to each new term.

\[
\begin{align*}
2 + 2 &= 4 \\
4 + 2 &= 6 \\
6 + 2 &= 8 \\
8 + 2 &= 10 \\
10 + 2 &= 12
\end{align*}
\]

2. a) Look at a classmate’s pattern.

Draw your classmate’s pattern in your own booklet.

Make it grow one more time.

b) My classmate’s patterning rule is:

C’s pattern rule is begin with one.
Add two cubes to get to each new term.
He went up to seven cubes in the fourth term.
Then I went to nine cubes in the fifth.

My classmate’s pattern: 1, 3, 5, 7, 9
The student needs to create more complex patterns by varying the arrangement of the materials or by using different materials to create patterns.

The student should explore patterns that grow in more complex ways and should continue to use words, numbers, and/or diagrams to analyze the patterns and communicate the findings.
Mathematics Exemplar Task
Grade 2 – Patterning and Algebra

Teacher Package

Title: Growing Patterns

Time Requirements: 50–65 minutes (total)
• 20 minutes to complete the pre-task
• 30–45 minutes to complete the exemplar task

These tasks will take place over several mathematics classes and may be done over several days in order for the students to build on the concepts being explored. Large blocks of time are recommended to allow students to complete their investigations. The time that it takes each student to complete the exemplar task is not being assessed. Some students may take longer than others to complete the tasks.

Description of the Task

This task will require students to:
• make a growing pattern by using interlocking cubes;
• describe the pattern they made;
• investigate a classmate’s growing pattern;
• extend a classmate’s pattern.

For the first part of the task, students will each make a pattern, draw it, write the pattern rule, and then describe the pattern in such a way that someone else can determine the next term. They will then look at the numbers in their pattern to see what addition pattern is evident in it. For the second part of the task, students will each draw a classmate’s pattern and the next term, write the pattern rule, and compare their own pattern with the classmate’s.

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. identify, extend, and create number, geometric, and measurement patterns, and patterns in their environment (2m82);
2. explore patterns and pattern rules (2m83);
3. identify relationships between and among patterns (2m84);
4. recognize that patterning results from repeating an operation (e.g., addition), using a transformation (slide, flip, turn), or making some other change to an attribute (e.g., position, colour) (2m85);
5. describe and make models of patterns encountered in any context (e.g., wallpaper borders, calendars), and read charts that display the patterns (2m86);
6. identify patterns (e.g., in shapes, sounds) (2m87);
7. relate growing and shrinking patterns to addition and subtraction (2m92);
8. explain a pattern rule (2m93);
9. given a rule expressed in informal language, extend a pattern (2m94).

Note that, although all of the expectations listed will be addressed through instruction relating to the task, student achievement of expectations 2, 5, and 6 will not be assessed in the final product.

Teacher Instructions

Prior Knowledge and Skills Required
To complete this task, students should have some knowledge or skills related to the following:
• creating growing and shrinking patterns from a variety of materials
• discussing and explaining pattern rules
• exploring addition and subtraction in patterns
• extending existing patterns

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.

*The rubric is reproduced on page 68 of this document.
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 in the administration of the exemplar task.

Classroom Set-up
For the investigation of the assigned tasks, the following classroom organization is recommended:
- Pre-task – a large-group work area on the floor, with the students sitting in a circle
- Exemplar task – individual workspaces at desks or tables

Materials and Resources Required
Before students attempt a particular task, provide them with the appropriate materials from among the following:
- copies of the student package for each student
- writing instruments (pencils, erasers)
- manipulatives (e.g., pattern blocks, coloured tiles, toothpicks, interlocking cubes)
- pieces of paper or place mats to go under each term of the pattern
- interlocking cubes
- rulers

General Instructions
Setting the Stage
All the student work is to be completed in its entirety at school.

The pre-task activities are to be completed with the whole group. Students are to work individually and independently to complete the exemplar task.

When students are completing the introductory activities, provide prompts to get them started or to extend their investigations. Recording the prompts serves as a reminder of the conversation that occurred between you and the student. These notes provide valuable information that will allow you to plan the next steps for both individual and group instruction.

Observe the Process
As students are working on the tasks, have them explain what they are doing. Having students explain their work orally reveals deep mathematical thinking that cannot always be seen in the written work of primary students. Where students do provide written work and it cannot be easily read, transcribe that work at the side of the page. In this space also, record any observations or comments the student makes that will be helpful in assessing the level of the student work.

Posting a Word List
It would be useful to post a chart listing mathematical language that is currently being developed or used during the task. Such a chart will provide the students with a resource to use when communicating their mathematical learning. Words that you may include for this task are: *growing pattern, increase, bigger, adding, counting by*.

The Pre-tasks
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.

Task Instructions
Introductory Activities
Pre-task: Investigating Growing Patterns (20 minutes)
1. Invite the students to sit on the carpet or floor in a circle. In the centre of the circle, place a growing pattern. This can be made from a variety of materials (e.g., coloured tiles, pattern blocks, toothpicks, interlocking cubes).
2. Have students discuss the growing pattern. You may use the following prompts:
   - “What do you notice about this series of ________ (pattern blocks, cubes)?”
   - “If I were to continue it, what do you think would happen? Why?”
3. Build patterns modelled on the samples from Appendices 2 and 3 to show that patterns can grow in a manner that is not simply linear.
4. Ask students to describe the patterns. Have them use mathematical language (e.g., “The unit of the pattern is ________.” “The pattern grows three more times.” “Each term is bigger than the one before.” “Each time, the pattern increases by ________.”).
5. Have students use the various pieces to build their own growing patterns.
6. Ask the students to state the pattern rule. They can tell how many pieces are added each time.
7. Invite the students to extend the pattern by showing what the next two entries would look like.
Exemplar Task (30–45 minutes)
1. Distribute a copy of the student package to each student.
2. Make sure that there is an adequate supply of interlocking cubes for the students.
3. Tell the students that they will be working independently to make, describe, and classify growing patterns. They will be given opportunities to write about the patterns they have created. The problem that the students will solve independently is provided in the worksheets in Appendix 1.

Appendix 1: Student Worksheets

Growing Patterns
1. a) Use interlocking cubes to make a pattern that grows.

Your growing pattern should grow at least 4 times.

Draw your growing pattern below.
b) My patterning rule is:

c) Describe your pattern in enough detail so that someone else can make it grow one more time.

d) Look at the numbers in your pattern.
   How are they like adding?
2. a) Look at a classmate’s pattern.
   Draw your classmate’s pattern in your own booklet.
   Make it grow one more time.

b) My classmate’s patterning rule is:

c) Compare your pattern with your classmate’s pattern.
   How are they alike?
   How are they different?
Appendix 2: Growing Patterns

Continue the pattern.

Appendix 3: Growing Patterns

Continue the pattern.
Data Management and Probability
Spinners!

The Task
This task required students to:
• use a given spinner and then create a different spinner in experiments to determine the fairness of spinners;
• create a spinner based on the data from two trials;
• choose one of two spinners based on the criterion of winning a game.

Students explained whether a given spinner was fair, and recorded their predictions about what was likely to occur if they spun the spinner twelve times. They then spun the spinner; recorded the results; used the data to extrapolate; and created a new spinner in which outcomes were equally likely. Next, students were given the results of spinning a spinner twenty times. They had to design the spinner used to produce the data, and test their design. Finally, they chose from two spinners the one likelier to produce a winning game, and tested to confirm their choice. For the task, students had to form a hypothesis, test it, and account for any difference between their hypothesis and what occurred.

Expectations
This task gave students the opportunity to demonstrate 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. collect and organize data (2m97);
2. create and interpret displays of data, and present and discuss the information (2m98);
3. demonstrate an understanding of probability and demonstrate the ability to apply probability in familiar day-to-day situations (2m99);
4. organize data using graphic organizers (e.g., diagrams, charts, graphs, webs) and various recording methods (e.g., placing stickers, drawing graphs) (2m107);
5. interpret displays of numerical information and express understanding in a variety of ways (e.g., draw a picture and use informal language to discuss) (2m109);
6. explore through simple games and experiments the likelihood that an event may occur (2m110);
7. investigate simple probability situations (e.g., flipping a coin, tossing dice) (2m111);
8. use mathematical language (e.g., likely, unlikely, probably) in informal discussion to describe probability (2m112).
Prior Knowledge and Skills

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

• using spinners and discussing the possible outcomes (in both experiments and games)
• comparing predictions and results
• using mathematical language (e.g., likely, unlikely, probably) in informal discussions

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 143–150 of this document.
## Task Rubric – Spinners!

<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>The student:</td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
</tr>
<tr>
<td>6</td>
<td>– selects and applies a problem-solving strategy to investigate probability situations, arriving at an incomplete or inaccurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a partially complete and/or partially accurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a generally complete and accurate solution</td>
<td>– selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
</tr>
<tr>
<td>5</td>
<td>– makes predictions about the probability that the spinner will land on each colour or number, but supports the predictions with little or no evidence</td>
<td>– makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with some evidence</td>
<td>– makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with a variety of evidence</td>
<td>– makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with thorough evidence</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
</tr>
<tr>
<td>1, 2, 3</td>
<td>– creates a spinner that meets a few of the criteria and applies procedures for determining probability outcomes (including organizing and interpreting data), making many errors and/or omissions</td>
<td>– creates a spinner that meets some of the criteria and applies procedures for determining probability outcomes (including organizing and interpreting data), making some errors and/or omissions</td>
<td>– creates a spinner that meets most of the criteria and applies procedures for determining probability outcomes (including organizing and interpreting data), making few errors or omissions</td>
<td>– creates a spinner that meets almost all of the criteria and applies procedures for determining probability outcomes (including organizing and interpreting data), making few, if any, minor errors or omissions</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
<td>The student:</td>
</tr>
<tr>
<td>8</td>
<td>– uses mathematical language with limited clarity to explain answers to probability tasks</td>
<td>– uses mathematical language with some clarity to explain answers to probability tasks</td>
<td>– uses mathematical language with clarity to explain answers to probability tasks</td>
<td>– uses mathematical language with clarity and precision to explain answers to probability tasks</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on page 100. Note that, although all of the expectations listed there were addressed through instruction relating to the task, student achievement of expectations 4 and 7 was not assessed in the final product.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.
Spinners!  
Level 1, Sample 1

1. You have made a spinner for a game.

a) This spinner will be used for a game. 
   Is it a fair spinner? Yes _____ No ✓

   Explain your thinking.

   I think this spinner is not fair because red got more room.

b) What do you think will happen when you spin this spinner 12 times?
   I think red is going to win because it has more room.

c) Spin the spinner 12 times. Record your results.
   Red ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
   yellow ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
   blue ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓
C

d) If you were to spin the spinner 20 times, what do you think would happen?

I think next time blue will win.

D

e) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
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<tbody>
<tr>
<td>First 20 Spins</td>
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</tr>
<tr>
<td>Second 20 Spins</td>
<td>###</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

![Red Yellow Green Circle]

b) Explain why you think this is what it looked like.

It looks like an eye because it is a circle.

c) Spin the spinner you just made 20 times. What happened? Record your results.

What do your results show?

Blue has more than red and yellow.
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? **spinner A**

b) Spin each spinner twelve times. What do you notice?

**spinner A**

**spinner B**

Explain your thinking.

I would pick spinner A because beside together.
Teacher’s Notes

Problem Solving
– The student selects and applies a problem-solving strategy to investigate probability, arriving at an incomplete or inaccurate solution (e.g., in question 1c, inaccurately uses check marks to record the spinner results; in question 2a, tries to create a spinner like the one from question 1, but does not use the data from the tally chart when dividing the spinner into sections).

Understanding of Concepts
– The student makes predictions about the probability that the spinner will land on each colour or number, but supports the predictions with little or no evidence (e.g., in question 3a, chooses spinner A because the 2’s are “beside together”, not recognizing that the larger area occupied by the 2’s in spinner B will increase the chance of winning; makes a prediction in question 1d that is not based on the data gathered in question 1c).

Application of Mathematical Procedures
– The student creates a spinner that meets a few of the criteria (e.g., in question 1e, draws a spinner that is divided inaccurately).
– The student applies procedures for determining probability outcomes (including organizing and interpreting data), making many errors and/or omissions (e.g., in question 2b, makes an irrelevant reference to the spinner’s appearance and overlooks the data that are provided).

Communication of Required Knowledge
– The student uses mathematical language with limited clarity to explain answers to probability tasks (e.g., in question 1b, does not use appropriate mathematical language in stating, “I think red is going to win because it has more room”, although the intent is understood).

Comments/Next Steps
– The student needs to explore the concept of probability through problems and games.
– The student needs to apply a greater variety of problem-solving strategies (e.g., make a chart, make a diagram).
– The student should first discuss answers orally, to clarify his or her thinking before being asked to write.
– The student needs to look at and interpret data carefully in order to answer questions correctly and appropriately.
Spinners!  Level 1, Sample 2

1. You have made a spinner for a game.

   ![Spinner Diagram]

   a) This spinner will be used for a game. Is it a fair spinner? Yes [ ] No [ ]

   Explain your thinking.

   I think it is yes because there is 3 spots.

b) What do you think will happen when you spin this spinner 12 times?

   I think the spinner would go on red the most!

c) Spin the spinner 12 times. Record your results.

<table>
<thead>
<tr>
<th>RED</th>
<th>BLUE</th>
<th>YELLOW</th>
</tr>
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<tbody>
<tr>
<td>V</td>
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<td>V</td>
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</tbody>
</table>
d) If you were to spin the spinner 20 times, what do you think would happen?

It would go on red the most because it is bigger.

I think

e) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
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<tbody>
<tr>
<td>First 20 Spins</td>
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<tr>
<td>Second 20 Spins</td>
<td>###</td>
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<td>###</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

[Diagram of a spinner divided into red, yellow, and green sections]

b) Explain why you think this is what it looked like.

Because on the tallie there is red, yellow, green.

c) Spin the spinner you just made 20 times. What happened? Record your results.

[Hand-drawn chart with tally marks for red, green, and yellow]

What do your results show?

Well I made a chart to tallie and red has the
3. In this spinner game you must get a 2 to win.

Spinner A

3 3 5 5
4 2 2

Spinner B

2 4 3 2

a) Which spinner would you rather use? A

b) Spin each spinner twelve times. What do you notice?

B is the best because it doesn't have that much.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies a problem-solving strategy to investigate probability situations, arriving at an incomplete or inaccurate solution (e.g., in questions 1c and 2c, uses a chart to record the results of spinning the spinner; in question 2a, makes a spinner with three sections but ignores the data when dividing the sections).

**Understanding of Concepts**
- The student makes predictions about the probability that the spinner will land on each colour or number, but supports the predictions with little or no evidence (e.g., in question 1b, predicts that the spinner will land on red the most but offers no reason for the prediction; in question 3a, selects spinner A “because it had the most numbers”, not recognizing that the larger area occupied by the 2’s in spinner B will increase the chance of winning).

**Application of Mathematical Procedures**
- The student creates a spinner that meets a few of the criteria (e.g., in question 1e, constructs a spinner that has red, blue, and yellow sections, but the colours do not have an equal chance of winning).
- The student applies procedures for determining probability outcomes (including organizing and interpreting data), making many errors and/or omissions (e.g., in question 2b, the phrase “Because on the tally there is Red, Yellow, Green” does not explain the division of the spinner in relation to the data shown in the tally).

**Communication of Required Knowledge**
- The student uses mathematical language with limited clarity to explain answers to probability tasks (e.g., in question 3a, gives as a reason for selecting spinner A that “it had the most numbers”).

**Comments/Next Steps**
- The student should practise reading and interpreting data from tally charts and graphs (e.g., in question 2b, the only information used from the chart is the spinner colours).
- The student needs to develop the language of data management and probability (e.g., fair spinner, equal chance) through simple games and activities.
- The student should refer to word charts or a personal dictionary for correct spellings.
Spinners!

1. You have made a spinner for a game.

a) This spinner will be used for a game. Is it a fair spinner? Yes ___ No ___

Explain your thinking.

I think that the spinner is not fair because it had more red than blue and yellow.

b) What do you think will happen when you spin this spinner 12 times?

You will get lots of red 6 blue 4 yellow 2

c) Spin the spinner 12 times. Record your results.

<table>
<thead>
<tr>
<th>Blue</th>
<th>Red</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>11</td>
<td>1</td>
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</tbody>
</table>
d) If you were to spin the spinner 20 times, what do you think would happen?

I will get Red.
3 Blues 8 yellow.

ej) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
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<th>Yellow</th>
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<tbody>
<tr>
<td>First 20 Spins</td>
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<tr>
<td>Second 20 Spins</td>
<td>###</td>
<td>###</td>
<td>###</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario's spinner looked like.

b) Explain why you think this is what it looked like.

because yellow has the most and green the least.

c) Spin the spinner you just made 20 times. What happened? Record your results.

What do your results show? I got it rat.
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? **Spinner B**

b) Spin each spinner twelve times. What do you notice?

I was rat
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a partially complete and/or partially accurate solution (e.g., in question 1b, uses words and numbers in order to record the prediction but does not explain why he or she selects those numbers; in question 1c, creates a chart and attempts to use tally marks to record the actual results of spinning the spinner).

Understanding of Concepts
– The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with some evidence (e.g., in question 1a, correctly gives evidence based on area, although in question 3a, provides evidence that does not relate to area).

Application of Mathematical Procedures
– The student creates a spinner that meets some of the criteria (e.g., in question 1e, creates a spinner with a red, a blue, and a yellow section).
– The student applies procedures for determining probability outcomes (including organizing and interpreting data), making some errors and/or omissions (e.g., in questions 1c and 2c, uses tallies to organize data but does not arrive at an appropriate outcome).

Communication of Required Knowledge
– The student uses mathematical language with some clarity to explain answers to probability tasks (e.g., in question 1a, explains, “I think that the spinner is not fair because it had more red than blue and yellow”).

Comments/Next Steps
– The student needs to use the proper format for tally marks.
– The student should explore probability activities to strengthen his or her understanding of chance and to develop the language of data management and probability (e.g., tally chart, graph, likely).
– The student needs to talk about how to organize written tasks before beginning to write.
– The student needs to include more detail in written responses (e.g., when asked to explain the results in question 2c, simply states, “I got it rat”). Talking about the answer before writing may be beneficial for this student.
– The student should refer to word charts or a personal dictionary for correct spellings.
Spinners! Level 2, Sample 2

Spinners!

1. You have made a spinner for a game.

a) This spinner will be used for a game. Is it a fair spinner? Yes _____ No __

b) What do you think will happen when you spin this spinner 12 times?

I think that red will get more spins.
red 8 blue 2 yellow 2

c) Spin the spinner 12 times. Record your results.

Red | Blue | Yellow
---|---|---
1 | 1 | 1
d) If you were to spin the spinner 20 times, what do you think would happen?

I think Red will get 10 and Blue will get 5 and yellow will get 5

e) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
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<tr>
<td>First 20 Spins</td>
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<tr>
<td>Second 20 Spins</td>
<td>####</td>
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<td>^</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

b) Explain why you think this is what it looked like.

I think that it was that way because yellow had the most spins.

c) Spin the spinner you just made 20 times. What happened? Record your results.

What do your results show?

that was the rite spinner
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? B

b) Spin each spinner twelve times. What do you notice?

I used B because there is more two than 3s and 4s

I used B because there is more two than 3s and 4s.

Two has more spins than bath charts it doesn't matter what spinner you use.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a partially complete and/or partially accurate solution (e.g., in question 2c, makes a tally chart and provides a brief but unclear written explanation).

Understanding of Concepts
- The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with some evidence (e.g., in question 1a, indicates that the spinner would land on red a greater number of times because red “hase a bigger spas”; in question 1d, supports the prediction with a numerical breakdown of how many times the spinner would land on each colour, although that numerical breakdown does not match the tally totals in question 1c).

Application of Mathematical Procedures
- The student creates a spinner that meets some of the criteria (e.g., in question 1e, creates a spinner that has red, yellow, and blue sections with equal areas).
- The student applies procedures for determining probability outcomes (including organizing and interpreting data), making some errors and/or omissions (e.g., in question 3b, describes an aspect of the data accurately but does not arrive at the appropriate conclusion).

Communication of Required Knowledge
- The student uses mathematical language with some clarity to explain answers to probability tasks (e.g., in question 1b, uses words and numbers to explain the prediction).

Comments/Next Steps
- The student should share work orally before completing written tasks, to improve the clarity of his or her written responses.
- The student should explore probability activities to strengthen his or her understanding of chance and to develop the language of data management and probability (e.g., tally, chart, graph, likely).
- The student should refer to word charts or a personal dictionary for correct spellings.
A

Spinners!

1. You have made a spinner for a game.

   Red
   Yellow
   Blue

a) This spinner will be used for a game.
   Is it a fair spinner? Yes _____ No  
   
   Explain your thinking.
   
   because the red more room than yellow and blue.

B

b) What do you think will happen when you spin this spinner 12 times?
   I think red will get 10 and yellow and blue are going to get 1 and 1.

c) Spin the spinner 12 times. Record your results.

   Y Y Y Y Y Y Y Y
   R R R R R R
   B B
d) If you were to spin the spinner 20 times, what do you think would happen?

I think red will get 10 and blue and yellow will both get 5.

e) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
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<tr>
<td>Second 20 Spins</td>
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<td>$$$ $$$</td>
<td>$$$</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

![Pie chart]

b) Explain why you think this is what it looked like. I think it’s like that because yellow has more than green and red.

c) Spin the spinner you just made 20 times. What happened? Record your results.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<td>R</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
</tr>
</tbody>
</table>

What do your results show? It shows that green and yellow tie.
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? **Spinner B**

H

Explain your thinking.

**Because 2 has a better chance to be landed**

b) Spin each spinner twelve times. What do you notice?

I notice that 2 got more than 4 and 3.
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a generally complete and accurate solution (e.g., in question 2c, uses a table and a graph to obtain a complete solution).

Understanding of Concepts
– The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with a variety of evidence (e.g., in question 3a, states that spinner B has “a Beter chans to be landed on”, and then draws a picture showing two 2’s, one 3, and one 4 to illustrate the point).

Application of Mathematical Procedures
– The student creates a spinner that meets most of the criteria (e.g., in question 1e, creates a spinner in which red, blue, and yellow all have an equal chance of winning).
– The student applies procedures for determining probability outcomes (including organizing and interpreting data), making few errors or omissions (e.g., in questions 1c, 2c, and 3b, uses charts and tallies to organize data and generally makes reasonable, supported predictions).

Communication of Required Knowledge
– The student uses mathematical language with clarity to explain answers to probability tasks (e.g., in question 2b, uses the term “more then”, and in question 3a, states that “2 has a Beter chans ... ”).

Comments/Next Steps
– The student needs to develop and use more precise mathematical language in oral and written responses. Creating a math dictionary would help this student to develop and use a greater variety of mathematics terms.
– The student needs to expand his or her answers (e.g., in question 1d, gives a numerical answer but does not explain why he or she chose the particular numbers).
– The student should refer to word charts or a personal dictionary to check spelling.
Spinners! Level 3, Sample 2

1. You have made a spinner for a game.

   ![Spinner Diagram]

   a) This spinner will be used for a game. Is it a fair spinner? Yes _____ No __________

   Explain your thinking.

   This spinner is not fair because red gets its own side and blue and yellow have to share the same side so is you spin the spinner it would maybe lend on red the most.

b) What do you think will happen when you spin this spinner 12 times?

   The spinner will probably land on red the most because red has to quarters all to its self and yellow and blue have to share two quarters.

   ![Results Table]

   c) Spin the spinner 12 times. Record your results.
d) If you were to spin the spinner 20 times, what do you think would happen?

It would land on red about 12 times  
20 - 12 = 8
so 8 will be for yellow and blue. So 4 for yellow and 4 for blue.

R | ******* | 8
Y | ******  | 4
B | ******  | 4

I think it would land on red the most because it has a bigger space than all the others.

e) Create a spinner in which red, blue and yellow all have the same chance of winning.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 20 Spins</td>
<td>###</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second 20 Spins</td>
<td>###</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

b) Explain why you think this is what it looked like.

I think Mario’s spinner looks like this because yellow has the most of red and green. Red and green have the least. So yellow would have more room then red and green.

c) Spin the spinner you just made 20 times. What happened? Record your results.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What do your results show?

My results show that yellow got the most out of all of them and green got the second most. Red got the least. Yellow got the exact same as Mario did. Red and green didn’t get the same as Mario did.
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? **spinner B**

b) Spin each spinner twelve times. What do you notice?

<table>
<thead>
<tr>
<th>Spinner B</th>
<th>31</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

I noticed that number two on A side and number two on B side got tide.
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a generally complete and accurate solution (e.g., draws diagrams, reasons logically, and constructs charts throughout the task).

Understanding of Concepts
– The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with a variety of evidence (e.g., in question 1d, reasons logically about how many times the spinner would land on each colour).

Application of Mathematical Procedures
– The student creates a spinner that meets most of the criteria (e.g., in question 1e, creates a spinner in which red, blue, and yellow all have the same chance of winning).
– The student applies procedures for determining probability outcomes (including organizing and interpreting data), making few errors and/or omissions (e.g., in questions 1d and 2, effectively uses tally charts to organize data and justify predictions and results).

Communication of Required Knowledge
– The student uses mathematical language with clarity to explain answers to probability tasks (e.g., uses mathematical terms such as fair, probably, quarters, and bigger appropriately).

Comments/Next Steps
– The student gives a sophisticated answer in question 2c by comparing the results obtained on his or her own spinner with the results that Mario obtained.
– The student needs to use titles and labels for graphs and charts.
– The student should include column and/or row totals when constructing tables and charts.
– The student should continue to use words, pictures, and/or diagrams when communicating about mathematical investigations.
Spinners!

1. You have made a spinner for a game.

   Red
   Yellow
   Blue

   a) This spinner will be used for a game. Is it a fair spinner? Yes _____ No _____

   Explain your thinking.

   Because red has a bigger space than yellow and blue on the spinner. So most of the spins will go to red.

   b) What do you think will happen when you spin this spinner 12 times?

   Probably 6 of the spins will go to red and 3 will go to blue and yellow because red has half the side of the spinner. Red will win 6 yellow and blue will get 3 because there is left for each of them.

   c) Spin the spinner 12 times. Record your results.

<table>
<thead>
<tr>
<th>Color</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>5</td>
</tr>
<tr>
<td>yellow</td>
<td>1</td>
</tr>
<tr>
<td>blue</td>
<td>6</td>
</tr>
</tbody>
</table>
d) If you were to spin the spinner 20 times, what do you think would happen?

Red would get it 10 times, yellow and blue would get 5 times each. Since there are 10 left to share for yellow and blue, since yellow and blue are the same size, they should get the same amount. So yellow will get 5 and blue will get 5 too.

I think 10 is half of 20, 5 is half of 10.

e) Create a spinner in which red, blue and yellow all have the same chance of winning.

Because the sections are the same size on the spinner, so it will go to them all the same amount of time.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 20 Spins</td>
<td>###</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Second 20 Spins</td>
<td>###</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

b) Explain why you think this is what it looked like.

Because there is about 21 yellow and 11 red, so red should be a little bigger. 8 green than green and 21 is almost 1/2 of 40. That is

---

c) Spin the spinner you just made 20 times. What happened? Record your results.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>yellow</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

What do your results show?

That yellow has the most, green has second red has last.
3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? **Spinner B**

b) Spin each spinner twelve times. What do you notice?

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>111</td>
<td>11</td>
<td>111</td>
<td>11</td>
</tr>
<tr>
<td>B</td>
<td>111</td>
<td>11</td>
<td>111</td>
<td>11</td>
</tr>
</tbody>
</table>

Explain your thinking.

because their is less numbers their so it will be easier to land on it and their is 2 2's.

That spinner B's 2 got more then spinner A, did.

In spinner B all the numbers got something

was right when choosing B, didn't it didn't and I
Teacher’s Notes

Problem Solving
− The student selects an appropriate problem-solving strategy to investigate probability situations, arriving at a thorough and accurate solution (e.g., in question 1e, creates a spinner that would give each colour an equal chance of winning and then explains why each colour has an equal chance of winning).

Understanding of Concepts
− The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with thorough evidence (e.g., in questions 1b and 1d, suggests why the spinner is likely to land most often on the colour red and provides numbers and words to support the prediction).

Application of Mathematical Procedures
− The student creates a spinner that meets almost all of the criteria (e.g., in question 1e, creates a spinner in which the three colours have an equal chance of winning, and explains why).
− The student applies procedures for determining probability outcomes (including organizing and interpreting data), making few, if any, minor errors or omissions (e.g., in questions 1, 2, and 3, makes reasonable and detailed predictions and uses tally charts to justify them).

Communication of Required Knowledge
− The student uses mathematical language with clarity and precision to explain answers to probability tasks (e.g., in question 1b, states, “probably 6 of the spins will go to red and 3 will go to blue and yellow because red has half the side of the spiner”).

Comments/Next Steps
− The student should be encouraged to label pictures and to put titles on graphs.
− The student could read written responses to a partner after completing his or her work, to ensure that explanations are clear.
− The student should refer to word charts or a personal dictionary for correct spellings.
Spinners!

1. You have made a spinner for a game.

a) This spinner will be used for a game. Is it a fair spinner? Yes _____ No __

Explain your thinking.

I chose no because 1 half (1) of the spinner is red but blue and yellow have to share the other half of the spinner. Blue and yellow are 1 quartr (1/4) each.

b) What do you think will happen when you spin this spinner 12 times?

I think that red will get more points because it is the bigger part of the spinner (1/3) and blue and yellow will get the same points because they are 1/4 each.

c) Spin the spinner 12 times. Record your results.

<table>
<thead>
<tr>
<th></th>
<th>TALLY</th>
<th>NUMBER OF SPINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>hhh</td>
<td>6</td>
</tr>
<tr>
<td>blue</td>
<td>lll</td>
<td>3</td>
</tr>
<tr>
<td>yellow</td>
<td>lll</td>
<td>3</td>
</tr>
<tr>
<td>total</td>
<td>hhh</td>
<td>12</td>
</tr>
</tbody>
</table>
d) If you were to spin the spinner 20 times, what do you think would happen?

I think red would get half the points and blue and yellow would get about 10 is half of 20.

<table>
<thead>
<tr>
<th></th>
<th>10</th>
<th>5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>yellow</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>20</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

I think red = 10

Yellow 5

Red 5

Blue 5

e) Create a spinner in which red, blue and yellow all have the same chance of winning.

I think that all of the colors will be even because they have the same amount of spaces for each color.
2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 20 Spins</td>
<td>11</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Second 20 Spins</td>
<td>4</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario’s spinner looked like.

![Pie chart](chart.png)

b) Explain why you think this is what it looked like.

*I think yellow will get the most space because it is the biggest part of the spinner. Red will get a bit more than green.*

c) Spin the spinner you just made 20 times. What happened? Record your results.

<table>
<thead>
<tr>
<th></th>
<th>red</th>
<th>yellow</th>
<th>green</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

What do your results show?

*It showed how yellow was the biggest part and got the most spins. Red and green got about the same amount of spins. As expected, yellow got just over half the spins. But I didn’t think green will get more than red.*
3. In this spinner game you must get a 2 to win.

**Spinner A**

3 5
4 2

**Spinner B**

3 2
5 4

a) Which spinner would you rather use? **Spinner B**

b) Spin each spinner twelve times. What do you notice?

<table>
<thead>
<tr>
<th></th>
<th>Spinner A</th>
<th>Spinner B</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>3</td>
<td>✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>4</td>
<td>✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>5</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
<td>✔ ✔ ✔ ✔ ✔ ✔</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

The spinner shows me that Spinner B gave me most (ie 2's). Spinner A gave me only three 2's. I made a good choice.

I picked Spinner B because the 2's take up \( \frac{2}{4} \) or \( \frac{1}{2} \) of B. But the 2's take up only \( \frac{3}{8} \) of Spinner A. \( \frac{3}{8} \) is bigger than \( \frac{1}{2} \).
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to investigate probability situations, arriving at a thorough and accurate solution (e.g., in question 2c, uses a tally chart with totals and gives a full explanation of the results).

Understanding of Concepts
– The student makes predictions about the probability that the spinner will land on each colour or number, and supports the predictions with thorough evidence (e.g., in question 1d, shows in many ways why the spinner would land on red the greatest number of times).

Application of Mathematical Procedures
– The student creates a spinner that meets almost all of the criteria (e.g., in question 1e, creates a spinner in which the three colours have an equal chance of winning, uses fractions to label each section of the spinner, and explains why each colour has an equal chance of winning).
– The student applies procedures for determining probability outcomes (including organizing and interpreting data), making few, if any, minor errors or omissions (e.g., in questions 1, 2, and 3, organizes data in tally charts, with totals, and uses diagrams to effectively support and justify detailed and thorough predictions).

Communication of Required Knowledge
– The student uses mathematical language with clarity and precision to explain answers to probability tasks (e.g., in question 3a, uses fractions in providing an explanation of his or her choice of spinners).

Comments/Next Steps
– The student should provide titles for diagrams.
– The student could investigate probability problems involving other spinners or number cubes.
Mathematics Exemplar Task  
Grade 2 – Data Management and Probability  
Teacher Package

Title: Spinners!

Time Requirements: 100 minutes (total)
- 20 minutes to complete the pre-tasks
- two periods of 40 minutes each to complete the exemplar task

The tasks are to be completed on three separate days.

Description of the Task

This task will require students to:
• use a given spinner and then create a different spinner in experiments to determine the fairness of spinners;
• create a spinner based on the data from two trials;
• choose one of two spinners based on the criterion of winning a game.

Students will explain whether a given spinner is fair, and will record their predictions about what is likely to occur if they spin the spinner twelve times. They will then spin the spinner; record the results; use the data to extrapolate; and create a new spinner in which outcomes are equally likely. Next, students will be given the results of spinning a spinner twenty times. They must design the spinner used to produce the data, and test their design. Finally, they will choose from two spinners the one likelier to produce a winning game, and test to confirm their choice. For the tasks, students must form a hypothesis, test it, and account for any difference between their hypothesis and what occurs.

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. collect and organize data (2m97);
2. create and interpret displays of data, and present and discuss the information (2m98);
3. demonstrate an understanding of probability and demonstrate the ability to apply probability in familiar day-to-day situations (2m99);
4. organize data using graphic organizers (e.g., diagrams, charts, graphs, webs) and various recording methods (e.g., placing stickers, drawing graphs) (2m107);
5. interpret displays of numerical information and express understanding in a variety of ways (e.g., draw a picture and use informal language to discuss) (2m109);
6. explore through simple games and experiments the likelihood that an event may occur (2m110);
7. investigate simple probability situations (e.g., flipping a coin, tossing dice) (2m111);
8. use mathematical language (e.g., likely, unlikely, probably) in informal discussion to describe probability (2m112).

Note that although all of the expectations listed will be addressed through instruction relating to the task, student achievement of expectations 4 and 7 will not be assessed in the final product.

Teacher Instructions

Prior Knowledge and Skills Required
To complete this task, students should have some knowledge or skills related to the following:
• using spinners and discussing the possible outcomes (in both experiments and games)
• comparing predictions with results
• using mathematical language (e.g., likely, unlikely, probably) in informal discussions

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.

*The rubric is reproduced on page 102 of this document.
Accommodations
Accommodations that are normally provided in the regular classroom for students with special
needs should be provided in the administration of the exemplar task.

Classroom Set-up
For the investigation of the assigned tasks, the following classroom organization is recommended:
• Pre-task 1 – a large-group meeting area to allow for the whole class to sit in a circle on the floor
• Pre-task 2 and exemplar task – individual workspaces at desks or tables

Materials and Resources Required
Before students attempt a particular task, provide them with the appropriate materials from
among the following:
– copies of the student package for each student
– large pattern block spinner (template provided in Appendix 2)
– pattern blocks
– chart paper or chalkboard
– writing instruments (pencils, erasers)
– paper clips
– spinners (template provided in Appendix 3)
– glue
– scissors
– crayons, pencil crayons, or markers

General Instructions
Setting the Stage
All the student work is to be completed in its entirety at school.

The pre-tasks are to be completed with the whole group. Students are to work individually and
independently to complete the exemplar task.

When students are completing the introductory activities, provide prompts to get them started or
to extend their investigations. Recording the prompts serves as a reminder of the conversation
that occurred between you and the student. These notes provide valuable information that will
allow you to plan the next steps for both individual and group instruction.

Observing the Process
As students are working on the tasks, have them explain what they are doing. Having students
explain their work orally reveals deep mathematical thinking that cannot always be seen in the
written work of primary students. Where students do provide written work and it cannot be easily
read, transcribe that work at the side of the student’s page. In this space also, record any
observations or comments the student makes that will be helpful in assessing the level of the
student work.

Posting a Word List
It would be useful to post a chart listing mathematical language that is currently being developed
or used during the task. Such a chart will provide the students with a resource to use when
communicating their mathematical learning. Words that you may include for this task are: fair,
chance, probability, data, spinner, and likely.

The Pre-tasks
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.

Task Instructions
Introductory Activities
Pre-task 1: Making Predictions (15 minutes)
1. Invite the students to sit on the carpet or floor in a circle. In the centre of the circle, place the
pattern block spinner (see Appendix 2) and a tub of pattern blocks.
2. Discuss the spinner (e.g., ask, “What do you notice about the spinner?”).
3. Explain that the group will spin the spinner 10 times. Ask the students for predictions about
what will happen (e.g., “What do you think is going to happen?” “Why?”).
4. Have the students spin the spinner 10 times and collect the corresponding pattern blocks.
5. Discuss how the group can determine the result (e.g., make a checklist, put the pattern blocks
into piles).
6. Have students compare the results with their prediction (e.g., ask, “Was this what we expected?”
“Did we make a good prediction?” “Why?”).
7. Discuss what would happen if the activity was repeated.
8. Repeat the activity, spinning 20 times.
9. Record and discuss what happened.

Pre-task 2: Making a Spinner (5 minutes)
Give each student a copy of the spinner in Appendix 3. Ask the student to colour the sections
appropriately. Tell the students that the spinner will be used in the exemplar task. Show the
students how they can operate the spinner by using a pencil and a paper clip (see Appendix 4).
Exemplar Task (two periods of 40 minutes each)

1. Distribute a copy of the student package to each student.
2. Tell the students that they will be working independently on the task that follows. The problem that the students will solve independently is provided in the worksheets in Appendix 1.

Appendix 1: Student Worksheets

Spinners!

1. You have made a spinner for a game.

a) This spinner will be used for a game. Is it a fair spinner? Yes _______ No _______

Explain your thinking.
b) What do you think will happen when you spin this spinner 12 times?

c) Spin the spinner 12 times. Record your results.

d) If you were to spin the spinner 20 times, what do you think would happen?

I think
e) Create a spinner in which red, blue, and yellow all have the same chance of winning.

2. Mario has experimented with a spinner. He recorded the data after two experiments. Each time he spun the spinner 20 times. Here is his data.

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 20 Spins</td>
<td>###</td>
<td>###</td>
<td>###</td>
</tr>
<tr>
<td>Second 20 Spins</td>
<td>###</td>
<td>###</td>
<td>###</td>
</tr>
</tbody>
</table>

a) Use this circle to show what you think Mario's spinner looked like.

b) Explain why you think this is what it looked like.
c) Spin the spinner you just made 20 times. What happened? Record your results.

What do your results show?

3. In this spinner game you must get a 2 to win.

a) Which spinner would you rather use? 

b) What do your results show?
b) Spin each spinner twelve times. What do you notice?
Appendix 3: Spinners for the Exemplar Task (one per student)

Appendix 4: How to Make a Spinner

Use a paper clip and a pencil for a spinner.
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