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

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

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

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

The procedures followed during the development and implementation of this project will serve as a model for boards, schools, and teachers in designing assessment tasks within the context of regular classroom work, developing rubrics, assessing the achievement of their own students, and planning for the improvement of students’ learning.
The samples in this document will provide parents\(^1\) 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 4;
- 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 / Data Management and Probability
The Task
This task required students to:
• use price lists to determine the cost of pizzas from two different parlours, and then determine which parlour provides the best value;
• use collected and given data to make decisions about class pizza orders;
• solve problems related to fractional parts of pizzas;
• show possible combinations of pizza toppings.

Presented with flyers from two pizza parlours, students determined and recorded all the possible prices of large pizzas from the two parlours, and determined which of the two parlours had the cheaper pizza. Students then conducted a survey of the pizza needs of their class, collected and graphed the data, and used the information to decide what type of pizza should be bought for the class.

Next, students used given data from a tally sheet and a bar graph to decide how much pizza a class should order. They also solved problems about fractional parts of pizzas, and they showed the possible combinations of given pizza toppings.

Expectations
This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected expectations from two strands – Number Sense and Numeration, and Data Management and Probability. 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. represent, and explore the relationships between, decimals, mixed numbers, and fractions using concrete materials and drawings (4m1);
2. compare and order whole numbers and decimals using concrete materials and drawings (4m2);
3. understand and explain basic operations (addition and subtraction) of decimals by modelling and discussing a variety of problem situations (4m4);
4. solve problems involving whole numbers and decimals, and describe and explain the variety of strategies used (4m7);
5. compare and order whole numbers and decimals from 0.01 to 10 000 using concrete materials, drawings, and symbols (4m13);
6. represent and explain number concepts and procedures (4m15);
7. represent, compare, and order mixed numbers and proper and improper fractions with like denominators (e.g., \(1/5\) and \(3/5\) or \(1/8\) and \(3/8\)) using concrete materials and drawings (4m18);
8. select the appropriate operation and solve one-step problems involving whole numbers and decimals with and without a calculator (e.g., how much change will you receive when you purchase an $8.95 item with $10?) (4m30).

Data Management and Probability

Students will:
9. collect and organize data and identify their use (4m101);
10. interpret displays of data and present the information using mathematical terms (4m103);
11. conduct surveys and record data on tally charts (4m108);
12. explain how data were collected and describe the results of a survey (4m110);
13. use conventional symbols, titles, and labels when displaying data (4m111);
14. construct labelled graphs both by hand and by using computer applications, and create intervals suited to the range and distribution of the data gathered (4m114);
15. read and interpret data presented on tables, charts, and graphs, and discuss the important features (4m115).

Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills relating to the following:
- collecting, organizing, displaying, and interpreting data
- designing and conducting surveys
- representing common fractions and mixed numbers using concrete materials
- making a systematic list
- solving problems involving operations with whole numbers and decimals

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 58–64 of this document.
Task Rubric – Pizza for a Class Party

<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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2, 4</td>
<td>selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution</td>
<td>selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3, 5, 6, 7, 10, 15</td>
<td>demonstrates a limited understanding when interpreting data and making decisions based on available data</td>
<td>demonstrates a partial understanding when interpreting data and making decisions based on available data</td>
<td>demonstrates a general understanding when interpreting data and making decisions based on available data</td>
<td>demonstrates a thorough understanding when interpreting data and making decisions based on available data</td>
</tr>
<tr>
<td></td>
<td>demonstrates a limited understanding of fractions and decimal numbers</td>
<td>demonstrates some understanding of fractions and decimal numbers</td>
<td>demonstrates a general understanding of fractions and decimal numbers</td>
<td>demonstrates an in-depth understanding of fractions and decimal numbers</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8, 11, 13, 14</td>
<td>uses computations and mathematical procedures that include many errors and/or omissions when constructing displays of data and performing calculations</td>
<td>uses computations and mathematical procedures that include some errors and/or omissions when constructing displays of data and performing calculations</td>
<td>uses computations and mathematical procedures that include few errors and/or omissions when constructing displays of data and performing calculations</td>
<td>uses computations and mathematical procedures that include few, if any, minor errors or omissions when constructing displays of data and performing calculations</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3, 4, 9, 10, 12, 15</td>
<td>uses words, pictures, and/or diagrams to describe data and number concepts with limited clarity</td>
<td>uses words, pictures, and/or diagrams to describe data and number concepts with some clarity</td>
<td>uses words, pictures, and/or diagrams to describe data and number concepts clearly</td>
<td>uses words, pictures, and/or diagrams to describe data and number concepts clearly and precisely</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on pages 12–13.  
Note: This rubric does not include criteria for assessing student performance that falls below level 1.
Exemplar Task - Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**
- Large pizza with cheese - $12.99
- Each additional topping - $1.45
  (maximum 3 toppings)

**YUM YUM PIZZA**
- Large pizza with cheese - $14.00
- Each additional topping - $0.99
  (maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

If I buy one pizza with three toppings at Pizza Palace it will be $14.34 because $12.99 + 3($1.45) = $14.34.

If I buy one pizza with three toppings at Yum Yum Pizza it will be $16.97 because $14.00 + 3($0.99) = $16.97.

b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

I would get a better deal at Yum Yum Pizza because the topping is $0.99 and at Pizza Palace it is $1.45.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

They should buy it at Yum Yum Pizza because for two toppings on 3 pizzas will make $43.98 but on Pizza Palace it will be $25.98.
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

I will ask them what is your favourite like: pepperoni, cheese, pineapple, and other.

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

<table>
<thead>
<tr>
<th>pepperoni</th>
<th>cheese</th>
<th>pineapple</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>9</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

b) Display the data you collected in a graph.
c) How would you use the data to help you decide what to order?

I would use the data because it will help me a lot.

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td></td>
</tr>
<tr>
<td>One fourth</td>
<td></td>
</tr>
<tr>
<td>One half</td>
<td></td>
</tr>
</tbody>
</table>

Number of Students

- One eighth: 18
- One fourth: 7
- One half: 2
Use the data given to decide how much pizza the class should order.

The class should order 4 pizzas.

2. Many Grade 4 students can eat $\frac{1}{8}$ of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

We would need to order 3 pizzas and 1 quarter.
3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

mushrooms and olives or onions and mushrooms or onions and olives.

4. Suppose that ¾ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.

They all get half of 4/1.

Teacher’s Notes

Problem Solving
– The student selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution (e.g., in Part A, questions 1a and 1b, calculates one of the possible options, resulting in limited solutions).

Understanding of Concepts
– The student demonstrates a limited understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 3c, “I would use the data because it will help me alot.”).
– The student demonstrates a limited understanding of fractions and decimal numbers (e.g., in Part B, question 1, the diagram showing eighths, quarters, and halves has limited connection to the data presented; in Part A, question 1, performs correct and incorrect calculations using decimal numbers).

Application of Mathematical Procedures
– The student uses computations and mathematical procedures that include many errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 3a, shows more than 10 students surveyed in the tally/graph results; in Part A, question 3b, makes some graph/label errors; in Part A, question 1c, calculates incorrectly for Yum Yum Pizza, and uses the wrong number of toppings and pizzas for Pizza Palace, but calculates this amount correctly).

Communication of Required Knowledge
– The student uses words, pictures, and/or diagrams to describe data and number concepts with limited clarity (e.g., in Part B, uses few diagrams and the explanations for questions 1, 2, and 4 have limited clarity).

Comments/Next Steps
– The student needs to use fraction manipulatives to determine the relationship between whole numbers, fractions, and decimals.
– The student should use diagrams to communicate ideas.
– The student needs to read questions carefully to determine what is being asked.
– The student needs to draw and label graphs accurately.
Pizza for a Class Party

Exemplar Task - Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**
Large pizza with cheese - $12.99
Each additional topping - $1.45
(maximum 3 toppings)

**YUM YUM PIZZA**
Large pizza with cheese - $14.00
Each additional topping - $0.99
(maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

<table>
<thead>
<tr>
<th>Pizza Palace</th>
<th>Yum Yum Pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>$13.99</td>
<td>$14.00</td>
</tr>
<tr>
<td>+ $1.45</td>
<td>+ $0.99</td>
</tr>
<tr>
<td>$15.44</td>
<td>$14.99</td>
</tr>
</tbody>
</table>

1. b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

You can get a better deal at Pizza Palace, you can get a better deal because it is 99 cents less than Yum Yum Pizza.

1. c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

I think you could still get a better deal at Pizza Palace because Yum Yum Pizza is $15.44 and Pizza Palace is $14.00.

Pizza Palace is 10 more cents than Yum Yum Pizza.
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

I would get some paper, write down what kind of pizzas they have and ask the people in my class what kind of pizza they want, write their names down under the column.

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

What kind of pizza would you like:
- Peperoni and cheese
- Mushrooms and cheese
- Just cheese

b) Display the data you collected in a graph.

<table>
<thead>
<tr>
<th>Peperoni &amp; Cheese</th>
<th>Mushrooms and Cheese</th>
<th>Just Cheese</th>
<th>Everything</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
c) How would you use the data to help you decide what to order?

I could use the data to choose what I want by seeing what I like. I don't like everything. I don't like just cheese and I don't like mushrooms. I would get pepperoni and cheese.

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td>16</td>
</tr>
<tr>
<td>One fourth</td>
<td>12</td>
</tr>
<tr>
<td>One half</td>
<td>4</td>
</tr>
</tbody>
</table>

[Bar graph showing the number of students per pizza size]
Use the data given to decide how much pizza the class should order.

The class should buy 3 pizzas. They should buy 3 pizzas because 8 people want 1 pizza and the other 8 want 1 and the 2 wants an other.

2. Many Grade 4 students can eat $\frac{1}{8}$ of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

We would have to order 22 pizzas because $\frac{1}{8}$ is a whole pizza. There is 22 people in my class.

each get 1 pizza if the was true for my class.

3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

Mushroom and olives, Mushrooms and onions, Olives and onions

Here are all the possible combinations.

4. Suppose that $\frac{3}{4}$ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy that leads to an incomplete or inaccurate solution (e.g., in Part A, question 1a and 1b, uses limited data to find an incomplete solution, and, in 1a, adds many incorrect combinations).

Understanding of Concepts
- The student demonstrates a limited understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 3c, refers to own preferences rather than using collected data in order to determine what kind of pizza to order).
- The student demonstrates a limited understanding of fractions and decimal numbers (e.g., in Part B, question 2, “We would have to order 22 pizza’s because 1/8 is a whole pizza. There is 22 people in my class.”; in Part A, question 1c, adds the topping totals correctly, but calculates the difference incorrectly).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include many errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 1a, calculates correctly but adds the wrong numbers; in question 3b, presents a set of data that is different from the data presented in 3a, and presents it in a chart rather than a graph; calculates incorrectly in Part B, questions 1, 2, and 4).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe data and number concepts with limited clarity (e.g., in Part B, question 4, the diagram does not reflect 3/4 of a 12-slice pizza, and the explanation has limited clarity).

Comments/Next Steps
- The student needs to use fraction manipulatives to determine the relationship between whole numbers, fractions, and decimals.
- The student should use organizational tools to help in problem solving and communication of data (e.g., systematic lists, charts, and tree diagrams).
- The student needs to display data accurately in graphs and/or charts.
- The student should read all questions carefully, in order to accurately identify both the information presented and what is being asked or required.
- The student should refer to word charts or a personal dictionary to check spelling.
Pizza for a Class Party  Level 2, Sample 1

Exemplar Task- Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**
Large pizza with cheese - $12.99
Each additional topping - $1.45
(maximum 3 toppings)

**YUM YUM PIZZA**
Large pizza with cheese - $14.00
Each additional topping - $0.99
(maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

   **PIZZA PALACE**
   - Large pizza with 1 topping: $12.99 + $1.49 = $14.48
   - Large pizza with 2 toppings: $12.99 + $2.98 = $15.97
   - Large pizza with 3 toppings: $12.99 + $4.17 = $17.16

   **YUM YUM PIZZA**
   - Large pizza with 1 topping: $14.00 + $0.99 = $14.99
   - Large pizza with 2 toppings: $14.00 + $1.98 = $15.98
   - Large pizza with 3 toppings: $14.00 + $2.97 = $16.97

b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

   At yum yum pizza you can get a better deal because for a large pizza and 3 toppings it is $16.97. And at pizza palace you can get a large pizza and 3 toppings for $17.16. So I would go to yum yum pizza if you don't want to waste your money. Also you are getting the exact same thing for a better price.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

   The class should go to yum yum pizza because toppings are 99¢, so after you will have money for something else, or pizza place toppings are $1.45. So go to yum yum pizza.
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

What kind of pizza would you like? A. pepperoni  B. cheese  C. mushroom  D. green pepper or E. pepperoni, cheese, mushroom, green pepper. You can only pick one.

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

![Chart showing survey results]

b) Display the data you collected in a graph.
Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One fourth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One half</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Number of Students

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>One eighth</th>
<th>One fourth</th>
<th>One half</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Use the data given to decide how much pizza the class should order.

The class should order 3 pizzas because if you order 2 pizzas you would only have 16 pieces but if you order 3 you will have 24 pieces, I know because

\[
\begin{array}{cc}
1/8 & 1/8 \\
16 & 24
\end{array}
\]

2. Many Grade 4 students can eat 1/8 of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

My class would need 3 pizzas because there are 22 people in my class and if we order 2 pizzas only 16 students could have some of the pizza and then 6 people don't have pizza.

3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

1. mushrooms and olives
2. mushrooms and onions
3. olives and onions

4. Suppose that 3/4 of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution (e.g., in Part A, question 1, uses an organized chart leading to a solution with some accuracy; in 1b, provides a partially accurate written response).

**Understanding of Concepts**
- The student demonstrates a partial understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 1b, makes some use of the data and provides a partial [although inaccurate] explanation).
- The student demonstrates some understanding of fractions and decimal numbers (e.g., in Part B, question 4, provides some evidence that \( \frac{3}{4} \) of 12 is 9).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include some errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 3, provides a graph showing 11 responses from 10 classmates, with a labelling error in the “all 4” column; in Part B, question 1, performs correct calculations, but they do not apply to the data provided [25 students, not 24]).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe data and number concepts with some clarity (e.g., in Part A, question 3a, charts information clearly, but shows 11 responses instead of 10; in 3c, does not provide specific details).

**Comments/Next Steps**
- The student should use an organizational framework when exploring possible combinations.
- The student needs to develop strategies to determine whether the results are reasonable.
- The student needs to use concrete materials to determine the relationship between whole numbers and fractions.
- The student needs to read all questions carefully, in order to accurately identify what information is provided and what is being asked.
- The student should refer to word charts or a personal dictionary to check spelling.
Exemplar Task- Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**

- Large pizza with cheese - $12.99
- Each additional topping - $1.45 (maximum 3 toppings)

**YUM YUM PIZZA**

- Large pizza with cheese - $14.00
- Each additional topping - $0.99 (maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

   - Pizza Palace:
     - $12.99
     - $14.45
     - $15.89
     - $17.24

   - Yum Yum Pizza:
     - $14.00
     - $14.99
     - $15.98
     - $16.97

b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

   - Pizza Palace:
     - $12.99 + 1.45 + 1.45 + 1.45 + 1.45 = $17.57
     - $12.99 + 1.45 + 1.45 + 1.45 = $16.97

   - Yum Yum Pizza:
     - $14.00 + 0.99 + 0.99 + 0.99 + 0.99 = $17.91

   - Pizza Palace is cheaper by $0.24

   - Yum Yum Pizza:
     - $15.98 + 17.24 = $33.22

   - Pizza Palace is cheaper by $33.22

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

   - Pizza Palace:
     - $15.98 + $17.24 = $33.22

   - Pizza Palace is cheaper by $16.78
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

what do you like better
pepperoni and bacon, pineapple and bacon
or onion and mushroom?
what is your favourite topping?

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

b) Display the data you collected in a graph.
c) How would you use the data to help you decide what to order?

Legend:
- P: apple
- B: bacon
- M: much

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td>14</td>
</tr>
<tr>
<td>One fourth</td>
<td>12</td>
</tr>
<tr>
<td>One half</td>
<td>8</td>
</tr>
</tbody>
</table>

![Bar graph showing pizza choices]
Use the data given to decide how much pizza the class should order.

2. Many Grade 4 students can eat $\frac{1}{8}$ of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

4. Suppose that $\frac{3}{4}$ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy that leads to a partially complete and/or partially accurate solution (e.g., in Part A, question 1a, uses repeated addition to determine pizza prices [with one error]; in 1b and 1c, uses partial information to determine the best buy, resulting in an incomplete solution).

**Understanding of Concepts**
- The student demonstrates a partial understanding when interpreting data and making decisions based on available data (e.g., in Part B, question 1, “the class should by 12 fourths and 1 eight”, suggesting four pizzas in total).
- The student demonstrates some understanding of fractions and decimal numbers (e.g., in Part B, question 4, uses whole numbers and fractions to determine that each student should get 1½ slices, although the diagram does not support the solution).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include some errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 1, calculates pizza costs and differences with some errors; in Part A, question 3a and b, the data gathered and the graph are accurate, but unclear, and the left axis is incorrectly labelled.).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe data and number concepts with some clarity (e.g., in Part B, question 2, gives an explanation, “Are class should by 3 pizzas because the pizzas are in ¼ths and there will be two left over...”, without clearly identifying the number of students – the diagram and statement seem to suggest that there are 22 students).
Exemplar Task- Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**
Large pizza with cheese - $12.99
Each additional topping - $1.45
(maximum 3 toppings)

**YUM YUM PIZZA**
Large pizza with cheese - $14.00
Each additional topping - $0.99
(maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

   Pizza Palace
   1. Pizza and a topping: $12.99 + $1.45 = $14.44
   2. Pizza and 2 toppings: $12.99 + $2.90 = $15.89
   3. Pizza and 3 toppings: $12.99 + $3.45 = $16.44

   Yum Yum Pizza
   1. A Pizza: $14.00
   2. A Pizza and a topping: $14.00 + $0.99 = $14.99
   3. A Pizza and 2 toppings: $14.00 + $1.98 = $15.98
b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

You should go to Pizza Palace because it would cost you $14.44 for a pizza and a topping, and at Yum Yum Pizza, it would cost you $14.99. I would be $0.55 less at Pizza Palace. For a pizza with 3 toppings, go to Yum Yum because it is $16.97 and at Pizza Palace it is $17.34. It would be $0.37 less.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

The class should go to Pizza Palace because you would get $1.77 more change than in Yum Yum Pizza.

2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

- How many slices do you want?
- What toppings do you want?

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

What toppings would you like?
- Bacon
- Extra cheese
- Ham
- Mushroom
b) Display the data you collected in a graph.

Favourite Toppings

<table>
<thead>
<tr>
<th>Topping</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacon</td>
<td></td>
</tr>
<tr>
<td>Ham</td>
<td></td>
</tr>
<tr>
<td>Mushrooms</td>
<td></td>
</tr>
<tr>
<td>Extra Cheese</td>
<td></td>
</tr>
</tbody>
</table>


c) How would you use the data to help you decide what to order?

1. I learned that 3 more people want extra cheese more than mushrooms.
2. I learned that at least 1 person likes mushrooms on their pizza.
3. I learned that 2 more people like ham more than mushrooms.
4. I learned that at least 4 people like extra cheese on their pizza.
5. I learned that at least 2 people like bacon on their pizza.
6. I learned that at least 3 people like ham on their pizza.
7. I learned that not very many people like mushrooms on pizza.
8. I learned that people vote more for extra cheese than ham.
9. I learned that we should order extra cheese.
Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
</tr>
<tr>
<td>One fourth</td>
</tr>
<tr>
<td>One half</td>
</tr>
</tbody>
</table>

   Number of students
   - One eighth: 16
   - One fourth: 14
   - One half: 8

   There are 25 students in the class.

2. Many Grade 4 students can eat 1/8 of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

   - Use the data given to decide how much pizza the class should order.
   - \[ \frac{16}{8} = 2 \text{ pizzas} \]
   - \[ \frac{14}{8} = 1.75 \text{ pizzas} \]
   - \[ \text{They need to buy 5 pizzas.} \]

   I large pizza = 8 slices
   I will need 3 pizzas.
   I counted the slices of pizza that I drew to figure out how many pizzas I will need. I stopped counting when I got to 24.

   There are 24 students in my class.
3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

4. Suppose that ¾ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.

Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution (e.g., in Part A, question 1a, uses numbered lists and repeated addition to accurately find all possible pizza prices; in 1c, determines the best purchase and the change from $50).

Understanding of Concepts
- The student demonstrates a general understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 1b, presents data for one and three toppings and explains reasoning).
- The student demonstrates a general understanding of fractions and decimal numbers (e.g., in Part B, question 1, converts all fractions to a common denominator).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include few errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 1, accurately calculates various pizza prices; in Part A, question 3b, accurately transfers collected data to the graph).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe data and number concepts clearly (e.g., in Part A, questions 3a and 3b, labels charts and graphs accurately; throughout the task, provides concluding statements that support the mathematical findings).

Comments/Next Steps
- The student needs to focus interpretations of graphs on information relevant to the decision-making process.
- The student needs to use an organizational framework to ensure all possible combinations are found.
- The student should continue to use diagrams and mathematical language to present solutions.
Exemplar Task - Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

<table>
<thead>
<tr>
<th>PIZZA PALACE</th>
<th>YUM YUM PIZZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large pizza with cheese - $12.99</td>
<td></td>
</tr>
<tr>
<td>Each additional topping - $1.45 (maximum 3 toppings)</td>
<td>Large pizza with cheese - $14.00</td>
</tr>
<tr>
<td>Each additional topping - $0.99 (maximum 3 toppings)</td>
<td></td>
</tr>
</tbody>
</table>

1. a) Find all the possible prices of large pizzas from both pizza parlours.

<table>
<thead>
<tr>
<th>Pizza Palace</th>
<th>YumYum Pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>$12.99 large with cheese</td>
<td>$14.00 large with cheese</td>
</tr>
<tr>
<td>$12.99 + 1.45</td>
<td>$14.00 + 0.99</td>
</tr>
<tr>
<td>$14.44 large 1 topping</td>
<td>$14.99 large with 1 topping</td>
</tr>
<tr>
<td>$14.44 + 1.45</td>
<td>$15.98 large with 2 toppings</td>
</tr>
<tr>
<td>$15.89 large with 2 toppings</td>
<td></td>
</tr>
<tr>
<td>$15.98 + 1.45</td>
<td>$16.97 large with 3 toppings</td>
</tr>
<tr>
<td>$17.43</td>
<td></td>
</tr>
</tbody>
</table>
b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

If you were getting large pizza with cheese I would go to Pizza Palace. If you were getting large pizza with 1 topping I would go to Pizza Palace. If you were getting large pizza with 2 toppings I would go to Yum Yum Pizza.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

If the class has $50.00 to spend on two topping pizza I would go to Pizza Palace because it is least money for 2 toppings.
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

What is your favourite topping?
How many slices of pizza? (many)
Do you like pepperoni on your pizza?

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

<table>
<thead>
<tr>
<th>Number of Slices</th>
<th>Number of People</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 slice</td>
<td>0</td>
</tr>
<tr>
<td>2 slices</td>
<td>1</td>
</tr>
<tr>
<td>3 slices</td>
<td>1</td>
</tr>
<tr>
<td>4 slices</td>
<td>2</td>
</tr>
</tbody>
</table>

b) Display the data you collected in a graph.

Number of slices you can get
c) How would you use the data to help you decide what to order?

I would use the data to help me decide what to order by how many slices I would need.

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td>18</td>
</tr>
<tr>
<td>One fourth</td>
<td>16</td>
</tr>
<tr>
<td>One half</td>
<td>7</td>
</tr>
</tbody>
</table>

![Bar graph showing number of students for each pizza size]
Use the data given to decide how much pizza the class should order.

$$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{21}{8}$$

$$\frac{2}{8} = \frac{1}{4}$$

You will need 5 pizzas with 1 slice left over.

2. Many Grade 4 students can eat 1/8 of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

$$\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} = \frac{21}{8}$$

We would need to order 3 pizzas with 6 slices left over.

3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

- Mushrooms, mushrooms
- Olives, olives
- Onions, onions
- Mushrooms, olives
- Mushrooms, onions
- Olives, onions

4. Suppose that 3/4 of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.

Each student can have 1 slice and 1 half slice because a used a fraction circle to help me.
Teacher’s Notes

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy that leads to a generally complete and accurate solution (e.g., in Part A, question 1a, uses a chart to organize data by pizza parlour and number of toppings, and uses repeated addition based on subtotals to accurately find all possible pizza prices; in 1b, uses the data to accurately compare three possible options; in 1c, calculates using the wrong number of toppings for Pizza Palace).

**Understanding of Concepts**
- The student demonstrates a general understanding when interpreting data and making decisions based on available data (e.g., in Part B, questions 1 and 2, provides a clear and accurate explanation for the number of pizzas needed).
- The student demonstrates a general understanding of fractions and decimal numbers (e.g., accurately calculates the solution using a variety of fractions in Part B, question 1, and using a variety of decimals in Part A, question 1a).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include few errors and/or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 1a, calculates all combinations correctly; in Part A, question 3b, accurately displays the gathered data on a labelled graph).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe data and number concepts clearly (e.g., in Part B, question 4, provides appropriate pictures and explanation, but does not show the method used to arrive at the solution).

Comments/Next Steps
- The student should continue to use collected data to make precise decisions.
- The student could improve clarity by using appropriate notation and diagrams.
- The student should use an organizational framework when exploring possible combinations of items.
Pizza for a Class Party  Level 4, Sample 1

Exemplar Task- Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

<table>
<thead>
<tr>
<th>PIZZA PALACE</th>
<th>YUM YUM PIZZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large pizza with cheese - $12.99</td>
<td>Large pizza with cheese - $14.00</td>
</tr>
<tr>
<td>Each additional topping - $1.45</td>
<td>Each additional topping - $0.99</td>
</tr>
<tr>
<td>(maximum 3 toppings)</td>
<td>(maximum 3 toppings)</td>
</tr>
</tbody>
</table>

1. a) Find all the possible prices of large pizzas from both pizza parlours. 8 ways

<table>
<thead>
<tr>
<th>Pizza Palace</th>
<th>Yum Yum Pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>no toppings - $12.99</td>
<td>no toppings - $14.00</td>
</tr>
<tr>
<td>adding 1 topping - $1.45</td>
<td>adding 1 topping - $0.99</td>
</tr>
<tr>
<td>1 topping - $14.44</td>
<td>1 topping - $14.99</td>
</tr>
<tr>
<td>adding 1 topping - $1.45</td>
<td>adding 1 topping - $0.99</td>
</tr>
<tr>
<td>2 toppings - $15.89</td>
<td>2 toppings - $15.98</td>
</tr>
<tr>
<td>adding 1 topping - $1.45</td>
<td>adding 1 topping - $0.99</td>
</tr>
<tr>
<td>3 toppings - $17.34</td>
<td>3 toppings - $16.97</td>
</tr>
</tbody>
</table>

b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

If the class wanted a pizza just with cheese they would get a better deal at Pizza Palace because it cost less than a cheese pizza at Yum Yum Pizza. If the class wanted a topping on there pizza the best deal would come from the Pizza Palace because it cost less than a topping pizza from Yum Yum Pizza. If the class wanted a pizza with 3 toppings it would cost less at Pizza Palace.

<table>
<thead>
<tr>
<th>Pizza Palace</th>
<th>Yum Yum Pizza</th>
</tr>
</thead>
<tbody>
<tr>
<td>- $50.00</td>
<td>- $50.00</td>
</tr>
<tr>
<td>- $15.89</td>
<td>- $15.98</td>
</tr>
<tr>
<td>- $34.11</td>
<td>- $34.02</td>
</tr>
</tbody>
</table>

Note: The student’s answers to (b) and (c) continue on page C.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

If the class wanted a 3 topping pizza they should buy it from Pizza Palace because it cost less than a 3 topping pizza at Yum Yum Pizza. If you bought a pizza from Pizza Palace you would get $34.11 in change, if you bought the pizza from Yum Yum Pizza you would get $34.02 in change.
1b) Palace, but if the class wanted a 3 topping it would cost less at yum yum pizza.

1c) $34.00 in range. You would get many back if you got your pizza from Pizza Palace.

2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

If I was in charge of ordering the pizza I would ask the class how many toppings they want, how much does each child pay and how many pizza slices does each child get. I would do this in a bar graph like this:

How many toppings? How much does each child pay? How many slices do you get?

1 2 3 4 5 6

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

How many toppings?

1 topping: 

2 toppings: 

3 toppings: 

0 toppings: 

b) Display the data you collected in a graph.

Number of people wanting the number of toppings

<table>
<thead>
<tr>
<th>Number of toppings</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

I've learned that most people I talked to would want 3 toppings on their pizza, and nobody would like 1 topping on their pizza.
c) How would you use the data to help you decide what to order?
I would use the data to help me decide how many topping I should order on the pizza. Most people wanted 3 topping so I would order 3 toppings on the pizza.

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td>****</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One fourth</td>
<td>***</td>
<td>***</td>
<td></td>
</tr>
<tr>
<td>One half</td>
<td></td>
<td></td>
<td>***</td>
</tr>
</tbody>
</table>
Use the data given to decide how much pizza the class should order.

I would buy 1/8 for 16 kids, 1/4 for 7 kids, and 1/2 for 2 kids. I would need to buy 5 pizzas because the students would only get 1/8 of a pizza.

2. Many Grade 4 students can eat 1/8 of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

We have 27 students in our class so we need to buy 4 pizzas...

If we ordered 3 pizzas, 3 kids would not get any pizza.
3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

4. Suppose that $\frac{3}{4}$ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.

---

**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution (e.g., in Part A, question 1a, organizes data by charting pizza parlours and the number of toppings, and uses repeated addition based on subtotals to efficiently and accurately find all possible prices; in 1b, compares all of the possible topping prices accurately).

**Understanding of Concepts**
- The student demonstrates a thorough understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 1b, considers all possible options in order to make recommendations when buying pizza).
- The student demonstrates an in-depth understanding of fractions and decimal numbers (e.g., in Part B, question 1, uses data from the tally chart and bar graph to determine the number of pizza slices, by grouping equivalent fractions and rounding to the nearest whole pizza; in Part B, question 4, accurately finds $\frac{3}{4}$ of a 12-slice pizza and shares equally among six people).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include few, if any, minor errors or omissions when constructing displays of data and performing calculations (e.g., in Part A, question 1a, accurately uses repeated addition to determine the cost of the pizza with various numbers of toppings; in Part B, question 1, adds fractions accurately in determining the number of pizzas required, and identifies that there will be “$\frac{1}{4}$ – left over”).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe data and number concepts clearly and precisely (e.g., uses an organizational framework to structure data in several questions; in Part B, questions 1 and 2, uses diagrams and computations to support findings).
Comments/Next Steps
– The student should continue to give accurate and complete explanations to all questions.
– The student should consider more complex recommendations based on a broader range of found data.
– The student should continue to present a variety of survey questions to help determine which question is most appropriate.
Pizza for a Class Party  
Level 4, Sample 2

Exemplar Task- Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

**PIZZA PALACE**
Large pizza with cheese - $12.99
Each additional topping - $1.45
(maximum 3 toppings)

**YUM YUM PIZZA**
Large pizza with cheese - $14.00
Each additional topping - $0.99
(maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.

   | 12.99          | 14.00 |
   | 1.45           | 1.99  |
   | 13.44          | 13.99 |
   | 15.89          | 15.99 |
   | 17.34          | 16.99 |

b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

   I think you can get a better deal at other place because 1 pizza 1 topping is a better deal at Pizza Palace. Yum Yum Pizza also gives a better deal at pizza 2 toppings but your prices gives a better deal for 1 pizza 3 toppings.

c) The class has $50 to spend on two topping pizzas. Where should they buy and why?

   You should buy 1 pizza 2 toppings at Pizza Palace because there is $15.89 and at Yum Yum it's 15.99 so you save 9 cents at Pizza Palace.
2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

- How much pizza do you want? (3 at the most)
- What toppings do you want?

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.

<table>
<thead>
<tr>
<th>Pizza</th>
<th>Number of Slices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

b) Display the data you collected in a graph.
c) How would you use the data to help you decide what to order?

I can use that info by counting up how many slices each kid wants. Multiply the numbers by 1, 2, 3.

0, 3, 7
0 pizzas, 6 pizzas, 13 pizzas
1 pizza has 10 slices. 3 pizzas = 30 slices.

\[
\begin{align*}
\frac{21}{6} - \frac{27}{3} &< 3 \text{ leftover}
\end{align*}
\]

Part B

1. To help them decide their pizza order, students in a class gathered the following data:

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th>One eighth</th>
<th>One fourth</th>
<th>One half</th>
</tr>
</thead>
</table>
|                              | \[\begin{align*}
\text{One eighth} & \quad \text{16} \\
\text{One fourth} & \quad \text{7} \\
\text{One half} & \quad \text{2}
\end{align*}\] |

![Bar chart showing the number of students who prefer different pizza sizes.](chart.png)
Use the data given to decide how much pizza the class should order.

2. Many Grade 4 students can eat $\frac{1}{8}$ of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.

3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

4. Suppose that $\frac{3}{4}$ of a twelve-slice pizza is left over. Show how six students could share the left over pizza equally.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy that leads to a thorough and accurate solution (e.g., in Part A, question 1a, organizes data by pizza parlour and number of toppings, and uses repeated addition based on subtotals to efficiently and accurately find all possible prices; in 1b, finds the best prices for one-, two-, and three-topping pizzas).

**Understanding of Concepts**
- The student demonstrates a thorough understanding when interpreting data and making decisions based on available data (e.g., in Part A, question 1b, considers all possible options in order to make recommendations about where to buy pizza).
- The student demonstrates an in-depth understanding of fractions and decimal numbers (e.g., in Part B, question 1 and 2, demonstrates a thorough understanding of the grouping of equivalent fractions and rounding to the nearest whole pizza, and of fractional remainders; in Part A, question 1a and c, demonstrates a thorough understanding of decimal calculations).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include few, if any, minor errors or omissions when constructing displays of data and performing calculations (e.g., in Part B, questions 1 and 2, gathers and presents data accurately; throughout the task, uses correct calculations).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe data and number concepts clearly and precisely (e.g., throughout the task, uses diagrams and computations clearly and precisely to support findings; in Part B, question 1 and 2, provides a clear summary of findings).

**Comments/Next Steps**
- The student should continue to give accurate and complete explanations to all questions.
- The student needs to add more detail to graph titles and labels.
- The student should show all calculations to support diagrams (see Part B, question 4).
Title: Pizza for a Class Party

Time requirements: 130-150 minutes (total)
• Pre-task 1 – 20-30 minutes
• Pre-task 2 – 20-30 minutes
• Exemplar task – 45 minutes x 2
(Time requirements are suggestions, and may vary.)

Description of the Task
Students are given the task of ordering pizza for a class party. They will use price lists to find the cost of pizzas from two different pizza parlours and will compare the prices for the best value. Next, they will use collected and given data to make decisions about pizza that needs to be ordered. Students will solve problems related to fractional parts of pizzas, and will give all the possible combinations of toppings, from a selection of three available toppings, for a two-topping pizza.

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. represent, and explore the relationships between, decimals, mixed numbers, and fractions using concrete materials and drawings (4m1);
2. compare and order whole numbers and decimals using concrete materials and drawings (4m2);
3. understand and explain basic operations (addition and subtraction) of decimals by modelling and discussing a variety of problem situations (4m4);
4. solve problems involving whole numbers and decimals, and describe and explain the variety of strategies used (4m7);
5. compare and order whole numbers and decimals from 0.01 to 10 000 using concrete materials, drawings, and symbols (4m13);
6. represent and explain number concepts and procedures (4m15);
7. represent, compare, and order mixed numbers and proper and improper fractions with like denominators (e.g., ½ and ¾ or ¾ and ½) using concrete materials and drawings (4m18);
8. select the appropriate operation and solve one-step problems involving whole numbers and decimals with and without a calculator (e.g., how much change will you receive when you purchase an $8.95 item with $10?) (4m30).

Data Management and Probability
Students will:
9. collect and organize data and identify their use (4m101);
10. interpret displays of data and present the information using mathematical terms (4m103);
11. conduct surveys and record data on tally charts (4m108);
12. explain how data were collected and describe the results of a survey (4m110);
13. use conventional symbols, titles, and labels when displaying data (4m111);
14. construct labelled graphs both by hand and by using computer applications, and create intervals suited to the range and distribution of the data gathered (4m114);
15. read and interpret data presented on tables, charts, and graphs, and discuss the important features (4m115).

Teacher Instructions
Prior Knowledge and Skills Required
Before attempting the task, students should have had experience with the following:
• collecting, organizing, displaying, and interpreting data
• designing and conducting surveys
• representing common fractions and mixed numbers using concrete materials
• making a systematic list
• solving problems involving operations with whole numbers and decimals
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 tasks.

Materials and Resources Required

- Rubric – one copy for each student
- Overhead transparency of the rubric, for review with the students (optional – see General Instructions, point 2)
- Overhead projector (optional – see General Instructions, point 2)
- Student package (see Appendix 1)
- Sets of fraction pieces
- Calculators
- Computers with graphing software
- Paper and pencils

Classroom Set-up

Students will need to work at tables or desks. You may have students work in pairs or small groups for the pre-tasks. Students work individually and independently for the exemplar task.

General Instructions

1. The rubric for this task should be used to assess the students’ work.
2. Before administering these tasks, review the rubric with the class. Give each student a copy of the rubric, or create a transparency to use with the class.
3. The pre-tasks are intended to ensure that students have the knowledge required to complete the exemplar task.
4. Provide students with an adequate supply of fraction pieces.
5. Provide ample time for the students to become familiar with using the fraction pieces, if they have not used this manipulative before.
6. The time frames suggested for the pre-tasks and the exemplar task may vary.
7. All of the student’s work must be completed at school.
8. Encourage students to use calculators, manipulative materials (e.g., fraction pieces), and diagrams in these tasks. Remind the students to show their work.

For the exemplar task:

Part A, question 1 e) – Students should not be expected to divide $50.00 by the cost of each two-topping pizza. However, they can use strategies such as repeated addition (keep adding the cost of the pizza to get to the greatest total less than $50.00) or repeated subtraction (keep subtracting the cost of the pizza from $50.00), and count the number of times the operation is performed, and determine how much money is left over.

Part A, question 2 – Students might design a survey to find the number of slices students will eat, the topping(s) they would like on their pizza, the type of crust, and so forth.

Part A, question 3 a) – To construct an active survey might be disruptive within the task. An alternative suggestion would be for students to imagine collecting the data. Otherwise, the students could collect the data during recess.

Part A, question 3 b) – Students can construct a graph by hand or by using a computer application.

Part B, questions 1, 2, and 4 – Students should use manipulative materials and/or diagrams to solve the problem. They should not be required to use fraction operations.

Part B, question 3 – Students can use any method to organize and find all possible combinations. A double ingredient (e.g., double onion) can count as a combination.

Task Instructions

Introductory Activities

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

Pre-task 1 (20–30 minutes)

Pose the following problem:

- Imagine that our class is going to have a pizza party and we will order large pizzas that are cut into 8 slices. Everyone is going to have 2 slices of pizza. What fraction of a pizza will each student eat?

Have the students work in pairs or in small groups to solve the problem. Ask students to explain strategies they used.

Extend the problem:

- Everyone in the class is going to have 2 slices of pizza. If the pizzas were cut into eighths, how many pizzas would we need to order?

Again, have the students work collaboratively to solve the problem. Discuss solutions and strategies.

*The rubric is reproduced on page 14 of this document.*
Pre-task 2 (20–30 minutes)

Show students a price list similar to the following:

<table>
<thead>
<tr>
<th>The Pizza Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza by the slice – $2.25</td>
</tr>
<tr>
<td>Can of pop – $0.75</td>
</tr>
</tbody>
</table>

Ask the students to calculate the cost of (a) 1 slice of pizza and 2 cans of pop, (b) 2 slices of pizza and 1 can of pop, (c) 2 slices of pizza and 2 cans of pop, and so forth. Have students describe the strategies they used to calculate the costs.

Exemplar Task (45 minutes x 2)

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

Appendix 1

Exemplar Task – Part A

Your class has won a pizza party for contributing a lot of canned goods to the food bank.

Your class has flyers from two pizza parlours.

PIZZA PALACE

- Large pizza with cheese – $12.99
- Each additional topping – $1.45 (maximum 3 toppings)

YUM YUM PIZZA

- Large pizza with cheese – $14.00
- Each additional topping – $0.99 (maximum 3 toppings)

1. a) Find all the possible prices of large pizzas from both pizza parlours.
b) At which pizza parlour can the class get a better deal, Pizza Palace or Yum Yum Pizza? Explain your thinking.

c) The class has $50 to spend on two-topping pizzas. Where should they buy and why?

2. Your teacher puts you in charge of ordering the pizza for your class. What survey questions would you need to ask your classmates before you order the pizza?

3. a) Ask 10 classmates one of your survey questions. Collect your data in the space below.
b) Display the data you collected in a graph.

c) How would you use the data to help you decide what to order?
Part B

1. To help them decide their pizza order, students in a class gathered the following data:

How much pizza will you eat?

- One eighth
- One fourth
- One half

Use the data given to decide how much pizza the class should order.

<table>
<thead>
<tr>
<th>How much pizza will you eat?</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>One eighth</td>
<td>18</td>
</tr>
<tr>
<td>One fourth</td>
<td>10</td>
</tr>
<tr>
<td>One half</td>
<td>6</td>
</tr>
</tbody>
</table>

2. Many Grade 4 students can eat $\frac{1}{6}$ of a pizza. If this were true for your class, how many pizzas would you need to order? Explain your thinking.
3. Suppose you have the choice of 3 pizza toppings: mushrooms, olives, and onions. Show all the possible combinations for a two-topping pizza.

4. Suppose that $\frac{3}{4}$ of a twelve-slice pizza is left over. Show how six students could share the leftover pizza equally.
Designing Quilts

The Task
This task required students to:

• explore the relationship between linear dimensions and area and perimeter in non-congruent rectangles using colour tiles;
• build and draw as many different rectangles as possible from a given number of tiles;
• determine the perimeters of different rectangles;
• determine the areas of different rectangles;
• determine whether it is possible to build rectangular-shaped quilts from an odd number of tiles;
• investigate whether the following statement is true: the greater the perimeter, the greater the area.

Students built non-congruent rectangles from a given number of tiles, drew conclusions about the different rectangles, and decided which would be the best for a quilt shape and why. Then they investigated whether it is true that the greater the perimeter of a rectangle, the greater its area. Finally, they were challenged to use tiles to build rectangles whose perimeter is an odd number.

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

Students will:
1. solve problems related to their day-to-day environment using measurement and estimation (4m36);
2. estimate, measure, and record the perimeter and the area of two-dimensional shapes, and compare the perimeters and areas (4m37);
3. estimate the area of regular polygons and measure the area in square centimetres using grid paper (4m51);
4. understand that different two-dimensional shapes can have the same perimeter or the same area (4m52);
5. explain the meaning of linear dimension, perimeter, and area (4m53);
6. explain the difference between perimeter and area and indicate when each measure should be used (4m55).

Prior Knowledge and Skills
To complete this task, students were expected to have some knowledge or skills relating to the following:
• exploring the concepts of area and perimeter of polygons.

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 100–104 of this document.
### Task Rubric – Designing Quilts

<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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>selects and applies a problem-solving strategy to measure and compare perimeter and area, arriving at an incomplete or inaccurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a partially complete and/or partially accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a generally complete and accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a thorough and accurate solution</td>
</tr>
<tr>
<td><strong>Understanding of concepts</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, 4, 5, 6</td>
<td>demonstrates a limited understanding of area and perimeter</td>
<td>identifies and describes the relationship between linear dimensions and area and perimeter by providing limited explanations and diagrams</td>
<td>demonstrates some understanding of area and perimeter</td>
<td>identifies and describes the relationship between linear dimensions and area and perimeter by providing partially accurate and/or partially complete explanations and diagrams</td>
</tr>
<tr>
<td><strong>Application of mathematical procedures</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2, 3</td>
<td>uses computations and mathematical procedures that include many errors and/or omissions in determining the area and perimeter of rectangles</td>
<td>uses computations and mathematical procedures that include some errors and/or omissions in determining the area and perimeter of rectangles</td>
<td>uses computations and mathematical procedures that include few errors and/or omissions in determining the area and perimeter of rectangles</td>
<td>uses computations and mathematical procedures that include few, if any, minor errors or omissions in determining the area and perimeter of rectangles</td>
</tr>
<tr>
<td><strong>Communication of required knowledge</strong></td>
<td>The student:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>uses words, pictures, and/or diagrams in a way that shows the difference between area and perimeter with limited clarity</td>
<td>uses words, pictures, and/or diagrams in a way that shows the difference between area and perimeter with some clarity</td>
<td>uses words, pictures, and/or diagrams in a way that shows the difference between area and perimeter clearly</td>
<td>uses words, pictures, and/or diagrams in a way that shows the difference between area and perimeter clearly and precisely</td>
</tr>
</tbody>
</table>

*The expectations that correspond to the numbers given in this chart are listed on page 66.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.
1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

They are all different rectangular shapes, there different colours and different perimeter.

c) What arrangement would make the best quilt shape?

I think the 8 by 8 or the 3 by 6 would be the best quilt because it will cover your body.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

b) Explain why Katelin was correct or incorrect.

Katelin is right because my example has a bigger ribbon with a bigger quilt and a smaller ribbon with a smaller quilt. So the bigger ribbon can go on the bigger quilt.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

You can use tiles to make rectangles with 15, 24, 60 but not 17 because no numbers go into the # 17 not 2, 3, 4, 5, 6, 7, 8, 9 or 10.

24 yes

60 yes

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

Let's say we had the perimeter of 10. A rectangle or
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy to measure and compare perimeter and area, arriving at an incomplete or inaccurate solution (e.g., in question 3b, “Let’s say we had the perimeter of 10 P. a rectangle P = 10 A = 6 or P = 10 A = 6.”).

Understanding of Concepts
- The student demonstrates a limited understanding of area and perimeter (e.g., in question 3a, incorrectly focuses on area when determining the perimeter of Martin’s quilt).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing limited explanations and diagrams (e.g., his or her response to question 2b [“Katelin is right because my exaple has a bigger ribbon with a bigger quilt and a smaller ribbon with a smaller quilt. So the bigger ribbon can go on the bigger quilt.”] does not reflect findings in question 1 [“They are all different rectangular shapes … and different perimeter.”]).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include many errors and/or omissions in determining the area and perimeter of rectangles (e.g., in question 1a, makes some calculation errors [“P = 23 units” in the far-left rectangle, and “A = 18 units” in the far-right rectangle, which also contains the wrong number of squares]; in question 3b, shows one possible solution, duplicated).

Communication of Required Knowledge
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter with limited clarity (e.g., in question 1a, draws and labels some rectangles inappropriately; in question 1b, does not note that in the different shapes the perimeter changes but the area is the same).

Comments/Next Steps
- The student needs to further explore measurement using concrete materials to form the connections between linear measure and area and perimeter.
- The student should use diagrams and organizational tools to support findings.
Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

I noticed that almost all the quilts are different perimeter.

c) What arrangement would make the best quilt shape? Explain your choice.

A square because squares are best for quilts.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

b) Explain why Katelin was correct or incorrect.

Katelin is correct because the bigger piece of ribbon is more likely to fit around the bigger quilt because it is bigger than the smaller piece of ribbon.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units? Yes No No?

What do you think? Explain your thinking.

15 and 60 Yes because 15 you can make a rectangle 3 by 5 and 60 you can make a rectangle 10 by 6. 17 and 24 No because you can’t make a rectangle with an area of 17 or 24.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

I believe because one could be vertical or horizontal and it can be a different rectangle.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy to measure and compare perimeter and area, arriving at an incomplete or inaccurate solution (e.g., in question 1a, creates two different rectangles correctly, but misses the third possible rectangle; in question 1b, states that “I noticed that almost all the quilts are different perimeter”, but does not note that in the different quilts the perimeter is different but the area is the same).

Understanding of Concepts
- The student demonstrates a limited understanding of area and perimeter (e.g., based on labels in question 1a, seems to have some understanding of area and perimeter, but in question 3a, focuses on area when determining the perimeter of Martin’s quilt: “15 and 60 yes because 15 you can make a rectangle 3 by 5....”).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing limited explanations and diagrams (e.g., in question 2b, gives few, and unclear, examples to justify the statement about the relationship between area and perimeter [“...the bigger piece of ribbon is more likely to fit around the bigger quilt because it is bigger....”], and does not use his or her findings from question 1 [“I noticed that almost all the quilts are different perimeter.”]).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include many errors and/or omissions in determining the area and perimeter of rectangles (e.g., in question 1a, correctly calculates the area of the rectangles, but incorrectly calculates one perimeter and omits one possible rectangle).

Communication of Required Knowledge
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter with limited clarity (e.g., in question 3b, “I believe because one could be vertical or horizontal and it can be a different rectangle.”).

Comments/Next Steps
- The student needs to further explore area and perimeter using concrete materials.
- The student should begin to move from stating conclusions to explaining them, using labelled diagrams and organizational tools to support findings.
Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

I notice that the quilts are all different sizes, they all all have a different perimeter but they end up with the same A. The A will always be 18 cm².

c) What arrangement would make the best quilt shape?

I think quilt B is the best quilt shape because it has more room for one person to sleep with it as a bedspread.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

\[ P = \text{ribbon} \quad A = \text{inside the quilt} \]

b) Explain why Katelin was correct or incorrect.

Katelin is correct because it is true that the longer the ribbon, the more area you can trim and the shorter the ribbon, the less area you can trim.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

15 units - No, I don't think you can build a rectangular quilt with 15 units because the number is not an even number.

17 units - No, I don't think you can build a quilt with 17 units because it is not an even number. The sum of an even number + the same even number equals the perimeter. 17 units - 24 units - Yes, I think you can make a rectangular quilt with 24 units because the even number x together will equal 24 units. 60 units - Yes, I think you can make a rectangular quilt with 60 units because it is an even number.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

I believe that because certain perimeters have more room to fit more than one rectangular quilt.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a partially complete and/or partially accurate solution (e.g., in question 1a, builds two of Trevor’s quilt shapes; in question 2, uses only one example, leading to a partial solution).

Understanding of Concepts
- The student demonstrates some understanding of area and perimeter (e.g., in question 1a, illustrates two of three possible solutions).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing partially accurate and/or partially complete explanations and diagrams (e.g., in question 1b, displays an understanding of the connection between perimeter and area, but in question 2b, does not consider quilts of equal areas but different perimeters: “Katelin is correct because it is true that the longer the ribbon the more area you can trim....”).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include some errors and/or omissions in determining the area and perimeter of rectangles (e.g., in question 1a, makes an error in calculation; in question 3a, uses word sentences for computations: “…two even number x together will equal 24 units.”, without showing supporting calculations).

Communication of Required Knowledge
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter with some clarity (e.g., throughout the task, provides explanations with reasonable clarity, but includes illustrations or diagrams only in questions 1a, 2a, and 3b; the 2a diagram provides only one example).

Comments/Next Steps
- The student should continue to explore area and perimeter using concrete materials.
- The student needs to develop and use algorithms to support and extend thinking.
- The student needs to use labelled diagrams and examples to communicate more clearly.
Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

- They all are rectangles.
- They all have 18 area.
- Some are bigger.
- Some are longer.
- Some are smaller.
- Some are shorter.

c) What arrangement would make the best quilt shape? Explain your choice.

I would have 6cm wide, 3cm tall. Because it would cover my neck down and side to side.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

D

b) Explain why Katelin was correct or incorrect.

Katelin was correct because bigger the perimeter, the bigger the area.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

You cannot do 15 and 17 because they are not even numbers.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

Words: It is able because there are more than one combination of rectangle perimeter of 20 cm.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a partially complete and/or partially accurate solution (e.g., in question 1a, records the area but not the perimeter, and finds two of the three possible rectangles).

Understanding of Concepts
- The student demonstrates some understanding of area and perimeter (e.g., in question 1a, notes that “A = L x W” and calculates areas correctly, but omits the perimeter measurements).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing partially accurate and/or partially complete explanations and diagrams (e.g., in his or her response to question 2b [“Katelin was correct because Bigger the perimeter the bigger the area.”], does not use findings from question 1 [“They all have 18 area. Some are bigger … Some are smaller.”]).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include some errors and/or omissions in determining the area and perimeter of rectangles (e.g., in question 1a, calculates the areas correctly for two shapes, but omits the perimeter; in question 2b, omits calculations; in question 3a, provides an accurate example of a 24-unit perimeter; in question 3b, calculates one of the perimeters incorrectly).

Communication of Required Knowledge
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter with some clarity (e.g., in question 1b, “They all are rectangles. They all have 18 area. Some are bigger. Some are longer. Some are smaller. Some are shorter.”).

Comments/Next Steps
- The student requires further experiences in connecting area and perimeter to daily life.
- The student needs opportunities to improve explanations of findings and to extend thinking.
- The student needs opportunities for further experiences in measuring perimeters with larger dimensions.
Designing Quilts  Level 3, Sample 1

Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can't decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

- One thing I notice is that if you arrange the rectangles right then you could use the same shape just switch the length and the width around.
- Another thing I noticed is that on some of the rectangles the perimeter can change but the area stays the same.

c) What arrangement would make the best quilt shape? Explain your choice.

Think that the 3 by 6 would be the best quilt shape because it is not too long and it is not too wide and there would also fit the rectangle enough and not too wide.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

b) Explain why Katelin was correct or incorrect.

Katelin is incorrect because you can have quilts with the same area but different perimeters.

For example.

\[ A \quad P = 38 \text{ units} \quad A = 18 \text{ square units} \]

\[ B \quad P = 38 \text{ units} \quad A = 18 \text{ square units} \]

A and B need more than C.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units?
60 units?
What do you think? Explain your thinking.

\[ P = 24 \]
\[ 2 \times 12 \text{ units will work because } 24 \text{ is an even number.} \]

\[ P = 60 \text{ units} \]

I think you can make a rectangle with 60 and 24 because these two numbers are even, but 17 and 15 are odd. One reason is because there are 2 lengths and 2 widths and you can divide 2 into 24.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

Perimeters are even and you can add: \( 7 + 7 + 5 + 5 = 24 \) and \( 8 + 8 + 4 + 4 = 24 \)
You can use all of these to make more than 1 quilt.
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a generally complete and accurate solution (e.g., in question 1a, uses diagrams and algorithms to calculate and display accurate areas and perimeters for the three possible rectangles).

**Understanding of Concepts**
- The student demonstrates a general understanding of area and perimeter (e.g., in question 1a, accurately records area and perimeter, and in question 1b, notes differences).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing generally accurate and complete explanations and diagrams (e.g., in question 2b, uses accurate diagrams and specific examples to show that two rectangles with the same area can require different lengths of ribbon).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include few errors and/or omissions in determining the area and perimeter of rectangles (e.g., in question 3a, creates an accurately labelled diagram; in question 1a, calculates areas and perimeters accurately, but duplicates two of the rectangles).

**Communication of Required Knowledge**
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter clearly (e.g., in questions 1a, 2b, and 3a, uses diagrams, algorithms, and words to explain responses).

**Comments/Next Steps**
- The student needs opportunities to improve explanations of findings.
- The student should use grid paper to record accurate diagrams.
Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

   Use 18 square tiles. Build as many different rectangular arrangements as you can.

   Show each arrangement on the grid paper below.

   Record the perimeter and area next to each arrangement.

   \[
   A = 18 \text{ cm}^2, \quad P = 22 \text{ cm}
   \]

   \[
   A = 18 \text{ cm}^2, \quad P = 18 \text{ cm}
   \]

   \[
   A = 18 \text{ cm}^2, \quad P = 18 \text{ cm}
   \]

   \[
   A = 18 \text{ cm}^2, \quad P = 36 \text{ cm}
   \]

   \[
   A = 18 \text{ cm}^2, \quad P = 36 \text{ cm}
   \]

b) What are some of the things you notice about the different arrangements for the quilts?

   Some of the things are that some of the shapes you can turn one shape to get another. Also the perimeter is not the same in all of the shapes even if the area is the same.

c) What arrangement would make the best quilt shape? Explain your choice.

   The best quilt shape is the one with 18 unit perimeter and 18 cm$^2$ area because it is wide enough and long enough to be on a bed.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

b) Explain why Katelin was correct or incorrect.

She is wrong because my quilts show $A = 14$.

1. Quilt needs 30 units to trim it.
2. Quilt needs 18 units to trim it.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

It is possible only with 24 units and 60 units because they are even numbers. 15 and 17 are odd numbers.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

I think that we can build more than 1 quilt with certain perimeters because if you build a quilt, you can rearrange the units so the area is different.

Examples:

- A = 16, P = 20
  - 20 units
  - A = 25, P = 20
    - or
    - 5 units
Teacher’s Notes
Problem Solving
– The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a generally complete and accurate solution (e.g., in question 1, uses labelled diagrams to accurately compare area and perimeter for the three possible rectangles).

Understanding of Concepts
– The student demonstrates a general understanding of area and perimeter (e.g., in question 1a, accurately draws and labels the different rectangles for Trevor’s quilt arrangements, and in question 1b, notes the differences).
– The student identifies and describes the relationship between linear dimensions and area and perimeter by providing generally accurate and complete explanations and diagrams (e.g., in question 3a, accurately identifies the need for the perimeter to be an even number to build Martin’s quilts).

Application of Mathematical Procedures
– The student uses computations and mathematical procedures that include few errors and/or omissions in determining the area and perimeter of rectangles (e.g., in questions 1a, 2a, and 3a, calculates all areas and perimeters correctly, although algorithms are not shown; in question 1a, duplicates two of the rectangles).

Communication of Required Knowledge
– The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter clearly (e.g., in question 1, uses labelled diagrams and written explanations to compare area and perimeter).

Comments/Next Steps
– The student should show calculations to support conclusions.
– The student should reread his or her written answers to check for clarity.
1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts? I noticed that the area didn’t change but the perimeter did. When the sides get thinner, the perimeter gets longer. I also noticed you can’t make a square with a area of 18.

c) What arrangement would make the best quilt shape? Explain your choice.

I think 3x6 would be the best quilt shape because if you needed it for a bed it would be most likely to fit. Because it is wider, the other 6 are too thin.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

We can’t always correct

\[ A = 4 \text{ units}^2 \]
\[ P = 10 \text{ units} \]
\[ A = 6 \text{ units}^2 \]
\[ P = 14 \text{ units} \]

b) Explain why Katelin was correct or incorrect. She is wrong because sometimes the shape changes but the area stays the same but the perimeter is different.

\[ A = 4 \]
\[ P = 8 \]

She needs more string for H1 than H2 even though they have the same area.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

"You can't do a quilt with an odd perimeter, you can with even. You can do it with 24 units and 60 units."

\[
\begin{align*}
\text{P} &= 20 + 20 + 10 + 10 = 60 \\
\text{A} &= 20 \times 10 = 200
\end{align*}
\]

\[
\begin{align*}
\text{P} &= 4 + 8 + 4 + 8 = 24 \\
\text{A} &= 8 \times 4 = 32
\end{align*}
\]

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt? Yes, you can.

They both have the same perimeter.

1. \(3 \times 3 + 7 + 3 = 12 \text{ units}\)
2. \(5 + 5 + 1 + 1 = 12 \text{ units}\)
3. \(3 \times 1 = 5 \text{ units}\)
4. \(3 \times 3 = 9 \text{ units}\)

Here's another one.

\[2 + 4 + 4 + 4 = 12 \text{ units}\]

\[2 \times 4 = 8 \text{ units}\]
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a thorough and accurate solution (e.g., in question 1, accurately records all three possible rectangles, and compares them thoroughly; in question 2, provides two correct examples of rectangles with equal areas and different perimeters).

Understanding of Concepts
- The student demonstrates a thorough understanding of area and perimeter (e.g., in question 1b, “When the sides get thinner the perimeter gets longer. I also noticed you can’t make a square with a area of 18.”).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing accurate and thorough explanations and diagrams (e.g., in question 2b, uses diagrams to support the statement that Katelin “is wrong because sometimes the shape changes but the area stays the same but the perimeter is different”).

Application of Mathematical Procedures
- The student uses computations and mathematical procedures that include few, if any, minor errors or omissions in determining the area and perimeter of rectangles (e.g., in question 1, calculates and displays all areas and perimeters accurately, without duplication; in question 3b, uses accurate computations).

Communication of Required Knowledge
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter clearly and precisely (e.g., in questions 1a and 1b, uses labelled diagrams and a clear explanation to compare area and perimeter).

Comments/Next Steps
- The student should use conventional mathematical language and descriptive detail to communicate findings.
- The student should use diagrams, algorithms, and words to explain the findings in all responses.
- The student should continue to thoroughly respond to questions.
- The student should proofread carefully to eliminate spelling errors.
Designing Quilts          Level 4, Sample 2

Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

b) What are some of the things you notice about the different arrangements for the quilts?

I notice that the arrangements for the quilts are different because the area is the same but the perimeter is different. For example, pretend there was a rectangle with 12 square units, you could make different rectangles with 12 square units but the perimeter would probably be different, for example:

- A = 12 sq. units
  - P = 16 units

- A = 12 sq. units
  - P = 26 units

The areas are both the same but the perimeters are different.

c) What arrangement would make the best quilt shape? Explain your choice.

I think the one I did that was 18 square units and a perimeter with 18 units because it makes the quilt shape as the others. The other ones are too thin. This is what it looks like:

- A = 18 square units
  - P = 18 units
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

- Area: 12 sq. units
- Perimeter: 14 units

b) Explain why Katelin was correct or incorrect.
I think she's wrong because the one with the lowest perimeter looks bigger than the one that has the largest perimeter, but both areas are the same.

- Area A: 12 sq. units
- Perimeter A: 16 units

A needs a longer ribbon.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

\[ P = L + W + L + W \]
\[ = 60 \text{ cm} + 60 \text{ cm} + 60 \text{ cm} + 60 \text{ cm} \]
\[ = 240 \text{ cm} \]
\[ A = LW \]
\[ = 60 \text{ cm} \times 60 \text{ cm} \]
\[ = 3600 \text{ cm}^2 \]

[Diagram of a square with dimensions and calculations]

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?

You can because there is more ways to make one perimeter.

[Diagram showing different rectangles with varying perimeters and areas]

\[ P = L + L + L + W \]
\[ = 4 \text{ cm} + 4 \text{ cm} + 2 \text{ cm} + 2 \text{ cm} \]
\[ = 12 \text{ cm} \]
\[ A = 8 \text{ square units} \]

\[ P = L + L + L + W \]
\[ = 5 \text{ cm} + 5 \text{ cm} + 5 \text{ cm} + 5 \text{ cm} \]
\[ = 20 \text{ cm} \]
\[ A = 5 \text{ square units} \]
**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy to measure and compare perimeter and area, arriving at a thorough and accurate solution (e.g., in question 1, accurately records all three possible rectangles for Trevor’s quilts, and extends the solution: “…pretend there was a rectangle with 12 sq units, you could make different rectangles with 12 square units but the perimeter would probably be different”).

**Understanding of Concepts**
- The student demonstrates a thorough understanding of area and perimeter (e.g., in question 3b, determines that quilts with the same perimeter can have different dimensions).
- The student identifies and describes the relationship between linear dimensions and area and perimeter by providing accurate and thorough explanations and diagrams (e.g., in question 2b, “I think she’s wrong because the one with the lowest perimeter looks bigger than the one that has the largest perimeter. But both areas are the same.”).

**Application of Mathematical Procedures**
- The student uses computations and mathematical procedures that include few, if any, minor errors or omissions in determining the area and perimeter of rectangles (e.g., in question 1a, calculates and displays all areas and perimeters accurately, without duplicating any rectangles; in question 3b, uses an accurate tree diagram and other accurately labelled diagrams to show quilts of multiple dimensions; in question 3a, “\(20 \text{ cm} \times 10 \text{ cm} = 200 \text{ cm}^2\)”).

**Communication of Required Knowledge**
- The student uses words, pictures and/or diagrams in a way that shows the difference between area and perimeter clearly and precisely (e.g., in question 1b, communicates with clarity and precision using relevant examples, clearly labelled diagrams, and clear observations – “I notice that the arrangements for the quilts are different because the area is the same but the perimeter is different.”).

**Comments/Next Steps**
- The student should continue to use diagrams, algorithms, and detailed explanations in responses.
- The student should use detailed, precise mathematical language to describe solutions.
- The student should proofread to eliminate occasional spelling errors.
Title: Designing Quilts

Time requirements:
- Pre-task – 45 minutes
- Exemplar task – Day 1 – 45–60 minutes
- Day 2 – 45–60 minutes

(The pre-task and exemplar task may be completed on three separate days. Time requirements are suggestions, and may vary.)

Description of the Task

This task requires students to:
- explore the relationship between linear dimensions and area and perimeter in non-congruent rectangles using colour tiles;
- build and draw as many different rectangles as possible from a given number of tiles;
- determine the perimeters of different rectangles;
- determine the areas of different rectangles;
- determine whether it is possible to build rectangular-shaped quilts from an odd number of tiles;
- investigate whether the following statement is true: the greater the perimeter, the greater the area.

Students will build non-congruent rectangles from a given number of tiles, draw conclusions about the different rectangles, and decide which would be the best for a quilt shape and why. Then they will investigate whether it is true that the greater the perimeter of a rectangle, the greater its area. Finally, they are challenged to use tiles to build rectangles whose perimeter is an odd number.

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. solve problems related to their day-to-day environment using measurement and estimation (4m36);
2. estimate, measure, and record the perimeter and the area of two-dimensional shapes, and compare the perimeters and areas (4m37);
3. estimate the area of regular polygons and measure the area in square centimetres using grid paper (4m51);
4. understand that different two-dimensional shapes can have the same perimeter or the same area (4m52);
5. explain the meaning of linear dimension, perimeter, and area (4m53);
6. explain the difference between perimeter and area and indicate when each measure should be used (4m55).

Teacher Instructions

Prior Knowledge and Skills Required

Before attempting the task, students should have had experience with the following:
- exploring the concepts of area and perimeter of polygons.

The Rubric*

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

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

Accommodations

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

*The rubric is reproduced on page 67 of this document.
Materials and Resources Required
- Rubric – one copy for each student
- Overhead transparency of the rubric, for review with the students (optional – see General Instructions, point 2)
- Student package (see Appendix 1)
- Colour tiles (30 per student – the colour of the tiles does not matter)
- Overhead projector (for the pre-task)
- Overhead projector colour tiles (optional – regular colour tiles may be used)
- Pencils
- Pencil crayons, crayons, or markers (if desired)

Classroom Set-up
Students may work individually or in pairs for the pre-task. Students work individually and independently at their desks for the exemplar task.

General Instructions
1. The rubric for this task should be used to assess the students’ work.
2. Before administering these tasks, review the rubric with the class. Give each student a copy of the rubric, or create a transparency to use with the class.
3. The pre-task is intended to ensure that students have the knowledge required to complete the exemplar task.
4. Provide students with an adequate supply of colour tiles.
5. Provide ample time for the students to become familiar with using the colour tiles, if they have not used this manipulative before.
6. The time frames suggested for the pre-task and the exemplar task may vary.
7. All of the student’s work must be completed at school.

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

Pre-task: Constructing a Rectangle (45 minutes)
1. Use the overhead projector and colour tiles to construct a rectangle with the dimensions of your choice (e.g., 5 x 4, 6 x 3, 7 x 2).
2. Have students use colour tiles to reproduce the rectangle shown on the overhead.
3. Demonstrate how to find the area and the perimeter. Students may use the edge of a tile to find the perimeter.
4. Have students build a rectangle that has an area of twelve square units.
5. Have them record their rectangle on grid paper.
6. Challenge them with this question: “Is there another way to build a rectangle with an area of twelve square units?”
7. Have students find the perimeter for each of the shapes with an area of twelve square units.
8. Allow them to share their findings using the overhead projector.

Exemplar Task (45–60 minutes x 2)
1. Hand out the student package. (See Appendix 1 for the worksheets containing the task the students will work on independently.)
2. Explain to students the meaning of the word trim (see question 2a).
3. Remind students about the rubric, and make sure that each student has a copy of it.
4. Tell the students that they will be working independently on the assigned task.
5. Set the students to work on the task.
Appendix 1

Exemplar Task

1. a) Trevor needs your help. He has decided to make a quilt. He would like to sew together 18 square pieces of material but can’t decide upon the best rectangular arrangement of the squares.

Use 18 square tiles. Build as many different rectangular arrangements as you can.

Show each arrangement on the grid paper below.

Record the perimeter and area next to each arrangement.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
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<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
</tr>
</tbody>
</table>

b) What are some of the things you notice about the different arrangements for the quilts?

c) What arrangement would make the best quilt shape? Explain your choice.
2. a) Katelin believes that the longer the piece of ribbon she has, the greater the area of quilt she can trim. Use the grid paper below to find out if she is correct. (Keep in mind what you learned in question 1.)

b) Explain why Katelin was correct or incorrect.
3. a) Martin is not sure whether you can use tiles to build rectangular quilts with the following perimeters: 15 units? 17 units? 24 units? 60 units?

What do you think? Explain your thinking.

b) Why do you believe that for certain perimeters we can build more than one rectangular quilt?
Geometry and Spatial Sense
From Shapes to Shapes

The Task
This task required students to:
• build trapezoids of various sizes using pattern blocks;
• build triangles and hexagons using pattern blocks;
• determine the value of trapezoids that they build;
• use pattern blocks to form angles, then measure and name the angles.

Students discovered and used relationships among various geometric shapes to solve problems and develop their spatial visualization skills.

Students used anywhere from 1 to 10 pattern block pieces to build trapezoids, and recorded their arrangements. Students then determined whether trapezoids of specified perimeters could be built, and recorded their results. Next, students used pattern blocks to build triangles and hexagons; showed how many triangles would cover the shapes built; and showed why they agreed or disagreed with a statement about the relationship between pattern block triangles and trapezoids. Then students built trapezoids worth specified sums of money, given a value for one trapezoid. Finally, students placed pattern blocks side by side in a specified way to make angles; measured and named the angles made; and determined the kinds of angles that could not be made by so placing the pattern blocks.

The pattern blocks the students worked with included the following: yellow hexagon, blue rhombus, beige rhombus, red trapezoid, green triangle, and orange square.

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

Students will:
1. solve problems using geometric models (4m61);
2. investigate the attributes of three-dimensional figures and two-dimensional shapes using concrete materials and drawings (4m62);
3. use language effectively to describe geometric concepts, reasoning, and investigations, and coordinate systems (4m67);
4. identify and sort quadrilaterals (e.g., square, trapezoid) (4m71);
5. identify similar and congruent figures using a variety of media (4m73);
6. construct congruent figures in a variety of ways (4m74);
7. discover geometric patterns and solve geometric puzzles with and without the use of computer applications (4m75);
8. measure angles using a protractor (4m76);
9. use mathematical language to describe geometric ideas (e.g., line, angle) (4m77);
10. discuss ideas, make connections, and articulate hypotheses about geometric properties and relationships (4m80).
Prior Knowledge and Skills

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

- sorting and classifying two-dimensional shapes according to certain criteria (e.g., number of sides, number of pairs of parallel sides)
- the meaning of parallel and congruent
- using pattern blocks and recording on pattern block paper
- measuring and naming angles
- determining the perimeter of polygons

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 174-81 of this document.
## Task Rubric – From Shapes to Shapes

<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></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 7</td>
<td>selects and applies a problem-solving strategy to make a few of the trapezoids, arriving at an incomplete or inaccurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to make some of the trapezoids, arriving at a partially complete and/or partially accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to make most of the trapezoids, arriving at a generally complete and accurate solution</td>
<td>selects and applies an appropriate problem-solving strategy to make all of the trapezoids, arriving at a thorough and accurate solution</td>
</tr>
</tbody>
</table>

| **Understanding of concepts** | The student: | | | |
| 10 | demonstrates understanding of a few of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks | demonstrates understanding of some of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks | demonstrates understanding of most of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks | demonstrates understanding of all or almost all of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks |

| **Application of mathematical procedures** | The student: | | | |
| 2, 4, 8 | constructs the required figures and angles with many errors and/or omissions | constructs the required figures and angles with some errors and/or omissions | constructs the required figures and angles with few errors and/or omissions | constructs the required figures and angles with few, if any, minor errors and/or omissions |
| | accurately identifies a few of the required figures and angles | accurately identifies some of the required figures and angles | accurately identifies many of the required figures and angles | accurately identifies almost all of the required figures and angles |

| **Communication of required knowledge** | The student: | | | |
| 3, 9, 10 | uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with limited clarity | uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with some clarity | uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly | uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly and precisely |

*The expectations that correspond to the numbers given in this chart are listed on page 106. Note that although all of the expectations listed there were addressed through instruction relating to the task, student achievement of expectations 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.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with $1, 2, 3 \ldots 10$ pattern block pieces.

a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks $\ldots$ 10 blocks.

Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

Yes you can do it.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

   a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.
   You can use 26 Triangles to do it.

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

   Show why you agree or disagree with his statement.
   I would agree with him because 3 green triangles make 1 red trapezoid.
3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.

b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

   a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

   Draw your angles in the space below. Measure and name the angles.

   Measure the angles and record your angles on the paper.

b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.
Teacher’s Notes

Problem Solving
- The student selects and applies a problem-solving strategy to make a few of the trapezoids, arriving at an incomplete or inaccurate solution (e.g., in question 1a, finds and records six of the possible trapezoids, without labelling them; in question 1b, accurately records only the 5-unit and 7-unit perimeters, so the conclusion, “Yes you can do it”, lacks proof).

Understanding of Concepts
- The student demonstrates understanding of a few of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2a, creates three hexagons with pattern block outlines but does not identify the number of triangles needed to cover them, and creates one triangle without pattern block outlines).

Application of Mathematical Procedures
- The student constructs the required figures and angles with many errors and/or omissions (e.g., in question 1a, generates some possible trapezoids with pattern blocks; in question 4a, constructs two of the possible angles).
- The student accurately identifies a few of the required figures and angles (e.g., in question 4a, measures angles but does not name them).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with limited clarity (e.g., in question 3a, uses a single inaccurate illustration, and provides no supporting explanation).

Comments/Next Steps
- The student needs to extend patterns with concrete material.
- The student needs to practise building shapes using pattern blocks.
- The student should describe results and findings using mathematical terminology, to support and add clarity to answers.
From Shapes to Shapes  Level 1, Sample 2

Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3…10 pattern block pieces.

a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks … 10 blocks.

Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

7. 7 triangles could make a large trapezoid.

4. 4 trapezoids could make a large trapezoid.

5. 4 rhombuses would make a large trapezoid.

1. A trapezoid does make a trapezoid.

2. 2 triangles don’t make a trapezoid.

3. 3 triangles do make a trapezoid.

8. Susan is wrong because there are too many blocks so it would not be a trapezoid.

9. Susan is wrong because when we put 9 triangles together we had 1 left.

10. Susan is wrong because we put 10 trapezoids together we had one triangle left in the middle.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

You can't have all the numbers because none of the sides measure up to be as big as 1 unit. Even if they were, it would only be 4 trapezoids for 5 units.

2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.

1 = 9 triangles
2 = 6 triangles
3 = 6 triangles
4 = 6 triangles
c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

I agree because if you used a hexagon, triangles could cover it.

3. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.

You can't build 2.50$ out of trapezoids.
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.

The right angle can’t be made because none of the shapes are straight except for the square but the square goes out so far.

Teacher’s Notes

Problem Solving
– The student selects and applies a problem-solving strategy to make a few of the trapezoids, arriving at an incomplete or inaccurate solution (e.g., in question 1a, provides five correct written explanations, and illustrates one; in question 1b, uses four trapezoids to make one larger trapezoid).

Understanding of Concepts
– The student demonstrates understanding of a few of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, illustrates some triangles and hexagons, but examines only one size of each, and therefore limits the number of triangles needed to cover them).

Application of Mathematical Procedures
– The student constructs the required figures and angles with many errors and/or omissions (e.g., in question 4, constructs some of the possible angles).
– The student accurately identifies a few of the required figures and angles (e.g., in question 4, names all angles incorrectly, and measures one angle correctly).

Communication of Required Knowledge
– The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with limited clarity (e.g., throughout the task, provides written explanations that have limited connection to illustrations).

Comments/Next Steps
– The student needs to extend patterns using pattern blocks (and other concrete materials) and explore all possible patterns.
– The student should gather evidence from illustrations.
– The student should use mathematical language to communicate findings, and should add detail to clarify answers.
– The student should refer to word charts or a personal dictionary to check spelling.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3…10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks … 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

Note: The student’s attempt at a 10-block trapezoid appears at the top of page D.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units.
Record your answers on the pattern block paper.

I could do 5 units, 7 units, and 10 units. I couldn’t do 5.5 units and 12 units.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.

6 triangles

4 triangles

---

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

I agree with his statement because $3 \triangle = 1 \square$, so if you saw how many trapezoids it took and you did $\times 3$, that's how many triangles it took to cover that shape.
3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.

b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.

I think these angles cannot be made because the two squares make a straight line and a square has 4 angles and in this picture it still has 4 angles so nothing really changed.

**Teacher’s Notes**

**Problem Solving**
- The student selects and applies an appropriate problem-solving strategy to make some of the trapezoids, arriving at a partially complete and/or partially accurate solution (e.g., in question 1, accurately records some of the trapezoids).

**Understanding of Concepts**
- The student demonstrates understanding of some of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, illustrates hexagons that are all the same size; the second triangle is a different size, but is incorrect).

**Application of Mathematical Procedures**
- The student constructs the required figures and angles with some errors and/or omissions (e.g., in question 2, constructs some hexagons and one triangle correctly; in question 4, uses pattern blocks to create two of the possible angles).
- The student accurately identifies some of the required figures and angles (e.g., in question 4, measures some of the angles accurately, and names one).

**Communication of Required Knowledge**
- The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with some clarity (e.g., in question 2c, uses explanations and illustrations to describe the relationship between trapezoids and triangles with some clarity).

**Comments/Next Steps**
- The student should use math manipulatives to extend patterns.
- The student should continue to use illustrations.
- The student should communicate using mathematical terminology more often, to better describe the findings.
- The student needs to accurately record illustrations that will lead to complete solutions.
- The student should label and measure angles accurately.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3...10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks ... 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

<table>
<thead>
<tr>
<th>block</th>
<th>✓</th>
</tr>
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<tbody>
<tr>
<td>1 block</td>
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<td>2 blocks</td>
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<td>3 blocks</td>
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<td>9 blocks</td>
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<tr>
<td>10 blocks</td>
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</tbody>
</table>

You can make a trapezoid with the following number of blocks: 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

These shapes fit in the pattern block figure. The number of blocks 6, 7, 8, 9, and 10, could not fit into the trapezoid shape.

So Susan was not completely correct.

b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

   I am sure that you can make trapezoids with 5 units, 5.5 units, and 7 units. I knew that because I tried it. And 10, and 12 units did not work because it didn’t fit in its proper shape. The reason I think you can’t make it also is because there were too many blocks.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

   a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.

   **Triangles:** You can make many kinds of triangles. Ex: I made more triangles than hexagons.

   **Hexagons:** You can make some hexagons. Ex: I made less hexagons than triangles.
b. For each of the shapes you have built, show how many triangles would cover each of them.

a) 4
b) 4
c) 6
d) 6
e) 6

For most of my shapes 6 was the # of triangles that covered them.

Ex -
c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

I agree with Luciano.

It makes sense because it was to see how many triangles were on a hexagon he would multiply 2 by 3 and would get six (he would know he's right by $\frac{1}{2}$).

$$2 \times 3 = 6$$

$$\frac{6}{3} = 2$$

3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

- $1.00;
- $2.50;
- $4.00;
- $6.50

Record your answer on the paper provided.

- $2.50

I do think it is possible to make trapezoids worth $2.50 $2.50 \times 16 = 25.00$ I used the calculator to do the multiplying.

- $4.00

I do think it is possible to make trapezoids that are worth $4.00 because, when I multiplied $25.4 \times 16 = 406.00$ it equaled $4.00. $25.4 \times 16 = 4.00.$
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.

I noticed that most of the patterns are like this.
and that they go up by 25°. Ex: 25°, 50°, 75°, 100°, 125° and so on, and so on.

25° + 25° = 50°

or

25° + 25° = 50°

4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to make some of the trapezoids, arriving at a partially complete and/or partially accurate solution (e.g., in question 1, finds and records some of the possible trapezoids).

Understanding of Concepts
- The student demonstrates understanding of some of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, constructs hexagons that are all the same size; in question 2c, demonstrates understanding of the geometric relationship between the triangles and trapezoids).

Application of Mathematical Procedures
- The student constructs the required figures and angles with some errors and/or omissions (e.g., in question 2, constructs some hexagons and triangles that are all the same size; in question 4, creates some of the possible angles, using only three of the pattern blocks).
- The student accurately identifies some of the required figures and angles (e.g., in question 4, names and measures some of the angles, with some accuracy).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies with some clarity (e.g., in question 3, uses a clear, although inaccurate, definition and pattern to develop the amount of money a trapezoid structure could create).
Comments/Next Steps
- The student needs to practise building shapes using pattern blocks.
- The student should extend patterns with math manipulatives and through illustrations.
- The student needs to show supporting data, to add clarity to reasoning.
- The student should use a variety of pattern blocks to explore all of the possible angles that could be constructed.
- The student should refer to word charts or a personal dictionary to check spelling.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3...10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks ... 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

Note: The student’s 7-block trapezoid appears at the top of page E.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.

For my big triangle 25 triangles to cover it and 24 triangles to cover the big hexagon.
K

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

yes it would take 1 trapezoid to cover 1 trapezoid and it would take 3 triangles to cover 1 trapezoid

For example, I had 4 trapezoids how many triangles would cover it because $4 \times 3 = 12$

L

3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; 2.50; 4.00; 6.50$

Record your answer on the paper provided.

I cannot make a trapezoid with $2.50

I cannot make a trapezoid with $6.50

I can make it with the dollars but not with the $50$
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.

I didn't notice any patterns when I made the trapezoids but that some are small.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.

A Acute Angle can not be made because it is less then 90°

Teacher’s Notes

Problem Solving
- The student selects and applies an appropriate problem-solving strategy to make most of the trapezoids, arriving at a generally complete and accurate solution (e.g., in question 1a, records trapezoids using 10 combinations; in question 1b, accurately draws trapezoids with three of the required perimeters).

Understanding of Concepts
- The student demonstrates understanding of most of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 1b, finds and illustrates trapezoids with most of the required perimeters; in question 2a and 2b, accurately shows and explains the number of triangles needed to cover the same area as the large hexagon and triangle; in question 2c, explains the triangle/trapezoid relationship: “It would take 3 triangles to cover 1 trapezoid”).

Application of Mathematical Procedures
- The student constructs the required figures and angles with few errors and/or omissions (e.g., in question 2, accurately constructs two sizes of hexagons and triangles; in question 4a, accurately constructs several angles).
- The student accurately identifies many of the required figures and angles (e.g., in question 4a, measures the angles accurately, and names three of four correctly).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly (e.g., in question 4a, clearly illustrates, measures, and names angles created from pattern blocks; in question 2c, accurately explains and illustrates the relationship between the area of the triangle and the trapezoid).
Comments/Next Steps
- The student should explore and illustrate more options when addressing a problem.
- The student should communicate using mathematical terminology when describing results and findings.
- The student should continue to use labelled illustrations and use these findings to elaborate explanations.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3... 10 pattern block pieces.

a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks ... 10 blocks.

Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units.

Record your answers on the pattern block paper.

..It is possible to make a trapezoid out of 1, 2, 3...10.

Note: The student’s work on pattern block paper in response to questions 1a and 1b appears on pages C–F.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

   a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.

\[ \therefore \text{24 triangles took up the hexagon.} \]
\[ \therefore \text{6 triangles took the small hexagon.} \]
\[ \therefore \text{26 triangles took up the triangle.} \]

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

\[
\text{Yes I do agree because it depends on how many trapezoids I used in a shape, say I used 7 trapezoids 3 triangles take up a trapezoid so I use multiplication. Examples: } 7 \times 3 = 21 \\
\text{or say } 8 \times 3 = 24 \text{ or if I used } 12 \text{ trapezoids } 12 \times 3 = 36 \text{ so you just multiply by 3's to get your answer how many triangles in a shape of trapezoids.}
\]
3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.

$1.00 (easy), $2.50 (impossible), $4.00

Work $6.50 (impossible)
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>-</td>
</tr>
<tr>
<td>$2.00</td>
<td>-</td>
</tr>
<tr>
<td>$1.75</td>
<td>-</td>
</tr>
<tr>
<td>$3.00</td>
<td>X</td>
</tr>
<tr>
<td>$4.00</td>
<td>V</td>
</tr>
<tr>
<td>$6.50</td>
<td>X</td>
</tr>
</tbody>
</table>

Note: The student’s diagrams for this question appear on pages L and M.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.

160°, it is an obtuse angle

150°, obtuse angle

180°, a straight angle

b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.

When a square and a square is put together (no angle)

or 2 circle (no angle).
Teacher’s Notes

Problem Solving
– The student selects and applies an appropriate problem-solving strategy to make most of the trapezoids, arriving at a generally complete and accurate solution (e.g., in question 1a, finds and records all trapezoids required; in question 1b, accurately records trapezoids with some of the required perimeters).

Understanding of Concepts
– The student demonstrates understanding of most of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, clearly explains and illustrates the large triangle and hexagon and their components, and the number of triangles needed to cover them; in question 2c, explains the triangle/trapezoid relationship: “… you just multiply by 3’s to get your and how many triangles in a shape of trapezoids.”).

Application of Mathematical Procedures
– The student constructs the required figures and angles with few errors and/or omissions (e.g., in question 2, accurately constructs two sizes of hexagons and triangles; in question 4, constructs three of the required angles).
– The student accurately identifies many of the required figures and angles (e.g., in question 4, measures and names the constructed angles accurately).

Communication of Required Knowledge
– The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly (e.g., in question 2, uses diagrams, mathematical language, and labels to describe all dimensions of the large hexagon and triangle).

Comments/Next Steps
– The student should continue to use illustrations and appropriate language to add clarity to all responses.
– The student should continue to explore the construction of angles with pattern blocks.
Exemplar Task

1. Sasan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3…10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks … 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

   **Susan is not correct, it is possible to make trapezoidal shapes with 1, 2, 3…10 pattern block pieces**
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

You can build trapezoids out of those measurements.
2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

   a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover each of them.

A. 6 triangles.
B. 4 triangle.
C. 6 triangles.
D. 6 triangles.
E. 9 triangles.
F. 16 triangles.
G. 6 triangles.

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

I agree with Luciano because all you have to do is multiply 3 with the number of trapezoids for example mine $4 \times 3 = 12$
3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.

$2.00

$4.25

The new big shape is still a trapezoid.

4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.
You can make all the angles with pattern blocks.

Teacher’s Notes

Problem Solving

– The student selects and applies an appropriate problem-solving strategy to make all of the trapezoids, arriving at a thorough and accurate solution (e.g., in question 1, finds, illustrates, and labels all of the required trapezoids).

Understanding of Concepts

– The student demonstrates understanding of all or almost all of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, illustrates the shapes and their components clearly, correctly identifies the number of triangles needed to cover each shape, and explains clearly and concisely the area relationship between the triangles and trapezoids).

Application of Mathematical Procedures

– The student constructs the required figures and angles with few, if any, minor errors and/or omissions (e.g., in questions 1 and 2, accurately constructs trapezoids, hexagons, and triangles; in question 4, accurately constructs a variety of angles).
– The student accurately identifies almost all of the required figures and angles (e.g., in question 4, accurately measures and names all angles).

Communication of Required Knowledge

– The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly and precisely (e.g., clearly labels and details all illustrations, and writes clear and concise explanations).

Comments/Next Steps

– The student should continue to extend patterns and use the found data to further discuss ideas, make connections, and articulate geometric properties and relationships.
– The student needs to use mathematical language to elaborate on responses to all questions.
Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3…10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks … 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.

   Susan eventually is wrong. You can build a trapezoid with 1, 2, 3…10 pattern blocks.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

It is possible to build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units.
1. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.

2. You have just seen that you can use different numbers of pattern blocks to build triangles. Can you wonder whether it would be possible to build triangles and hexagons using pattern blocks to build irregular solids?
b. For each of the shapes you have built, show how many triangles would cover each of them.

a) 6 triangles
b) 6 triangles
c) 1 triangle
d) 9 triangles
e) 4 triangles
f) 6 triangles
g) 6 triangles
h) 4 triangles
i) 16 triangles
c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.

I agree with him because in a trapezoid there are 3 triangles. That way you know automatically.

3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

   $1.00; $2.50; $4.00; $6.50

   Record your answer on the paper provided.
b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.

$0.25

$1.25

$2.00

I notice on b) that the trapezoids are facing up then down.

4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a) How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.
b) Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.

Reflex angles cannot be made this way because the pattern blocks don't twist or expand.

Teacher's Notes
Problem Solving
- The student selects and applies an appropriate problem-solving strategy to make all of the trapezoids, arriving at a thorough and accurate solution (e.g., in question 1, finds and illustrates all required trapezoids and their perimeters, and labels all except one).

Understanding of Concepts
- The student demonstrates understanding of all or almost all of the required concepts about geometric properties and relationships discovered through the exploration with pattern blocks (e.g., in question 2, clearly illustrates a variety of triangles and hexagons and their components; in question 2c, explains the triangle/trapezoid relationship clearly: "I agree with him because in a trapizoid there are 3 triangles. That way you know automaticly.").

Application of Mathematical Procedures
- The student constructs the required figures and angles with few, if any, minor errors and/or omissions (e.g., in question 2, constructs a variety of hexagons and triangles accurately; in question 4, investigates thoroughly with pattern blocks to construct all possible angles).
- The student accurately identifies almost all of the required figures and angles (e.g., in question 4, names and measures 8 of 9 angles accurately).

Communication of Required Knowledge
- The student uses words, pictures, and/or diagrams to describe and explain geometric ideas, reasoning, and problem-solving strategies clearly and precisely (e.g., throughout the task, provides clear illustrations and labels together with precise language to articulate findings).

Comments/Next Steps
- The student needs to use mathematical language to elaborate on responses to all tasks.
- The student should continue to use labelled illustrations to support all responses.
- The student should refer to word charts or a personal dictionary to check spelling.
Teacher Package

Mathematics Exemplar Task
Grade 4 – Geometry and Spatial Sense
Teacher Package

Title: From Shapes to Shapes

Time requirements: 195 minutes (total)
- Pre-task 1 – 45 minutes × 1
- Pre-task 2 – 30 minutes × 1
- Pre-task 3 – 30 minutes × 1
- Exemplar task – 45 minutes × 2
(The pre-tasks and exemplar task may be completed on four separate days. Time requirements are suggestions, and may vary.)

Description of the Task

Students will discover and use relationships among various geometric shapes to solve problems and develop their spatial visualization skills.

Students will use anywhere from 1 to 10 pattern block pieces to build trapezoids, and record their arrangements. Students will then determine whether trapezoids of specified perimeters can be built, and record their results. Next, students will use pattern blocks to build triangles and hexagons; show how many triangles will cover the shapes built; and show why they agree or disagree with a statement about the relationship between pattern block triangles and trapezoids. Then students will build trapezoids worth specified sums of money, given a value for one trapezoid. Finally, students will place pattern blocks side by side in a specified way to make angles; measure and name the angles made; and determine the kinds of angles that cannot be made by so placing the pattern blocks.

Teachers should note that the concept of congruency is reviewed with students in the pre-tasks. The final task, however, does not include questions that address students’ understanding of the concept explicitly.

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. solve problems using geometric models (4m61);
2. investigate the attributes of three-dimensional figures and two-dimensional shapes using concrete materials and drawings (4m62);
3. use language effectively to describe geometric concepts, reasoning, and investigations, and coordinate systems (4m67);
4. identify and sort quadrilaterals (e.g., square, trapezoid) (4m71);
5. identify similar and congruent figures using a variety of media (4m73);
6. construct congruent figures in a variety of ways (4m74);
7. discover geometric patterns and solve geometric puzzles with and without the use of computer applications (4m75);
8. measure angles using a protractor (4m76);
9. use mathematical language to describe geometric ideas (e.g., line, angle) (4m77);
10. discuss ideas, make connections, and articulate hypotheses about geometric properties and relationships (4m80).

Teacher Instructions

Prior Knowledge and Skills Required
Before attempting the task, students should have had experience with the following:
- sorting and classifying two-dimensional shapes according to certain criteria (e.g., number of sides, number of pairs of parallel sides)
- the meaning of parallel and congruent
- using pattern blocks and recording on pattern block paper
- measuring and naming angles
- determining the perimeter of polygons
The Rubric*

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

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

Accommodations

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

Materials and Resources Required

- Rubric – one copy for each student
- Overhead transparency of the rubric, for review with the students (optional – see General Instructions, point 2)
- Student package (see Appendix 1)
- Overhead projector
- Pattern block triangle paper (see pages 15 and 16 in this Teacher Package).
- Paper and pencils
- Coloured pencils
- Protractors

Classroom Set-up

For the pre-tasks, students may be arranged in pairs or in small groups in such a way that everyone can see the overhead.

For the pre-tasks and the exemplar task, students need a large surface area on which to construct shapes with pattern blocks.

Students may need to work on the exemplar task at different times if a large supply of pattern blocks is not readily available.

Students work individually and independently for the exemplar task.

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General Instructions

1. The rubric for this task should be used to assess the students’ work.
2. Before administering these tasks, review the rubric with the class. Give each student a copy of the rubric, or create a transparency to use with the class.
3. The pre-tasks are intended to ensure that students have the knowledge required to complete the exemplar task.
4. Provide students with an ample supply of pattern blocks and access to coloured pencils for recording.
5. Provide ample time for the students to become familiar with using the pattern blocks, if they have not used these manipulatives before.
6. The times suggested for the pre-tasks and the exemplar task may vary.
7. All of the students’ work must be completed at school.

Task Instructions

Introductory Activities

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

**Pre-task 1: Building Hexagons (45 minutes × 1)**

1. Display the pattern blocks on the overhead projector. Ensure that students know the names of the six different pattern block pieces (hexagon, trapezoid, rhombus [beige and blue], square, triangle).
2. Place a hexagon on the overhead projector.
3. Ask the students: “How many blocks have I used?”
4. Continue to build hexagons using 2 blocks (i.e., with 2 trapezoids), 3 blocks (i.e., with 1 trapezoid, 1 blue rhombus, and 1 triangle), 4 blocks (two choices, i.e., with 2 blue rhombs and 2 triangles, or 1 trapezoid and 3 triangles). After building a hexagon using 4 blocks, ask the students: “Are there any other ways to build a hexagon using 4 blocks?”
5. Have the students continue exploring this task for 5 and 6 blocks. Ask them to trace around each block in their solutions.
6. Have the students share their findings on the overhead projector.
7. Discuss with the students the meaning of the word congruent.
8. Discuss how different pattern block arrangements can produce congruent hexagons.

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*The rubric is reproduced on page 108 of this document.*
Pre-task 2: Measuring Angles (30 minutes x 1)
Have the students determine the size and name of each interior angle of the pattern block pieces.

Pre-task 3: Investigating Trapezoids (30 minutes x 1)
1. Display on the overhead projector a trapezoid made with pattern blocks.
2. Count the number of blocks in the design.
3. Ask the students to display a pattern block piece (red trapezoid) that is similar to the shape shown on the overhead projector.
4. Identify both shapes as trapezoids.
5. Discuss the similarities and the differences between the two trapezoids.
6. Record the responses on a chart.
   • **Similarities:** four-sided, one set of parallel sides, no angles that are equal to a right angle
   • **Differences:** number of blocks used for construction, size
7. Make sure that students know what a trapezoid is: a four-sided figure with exactly one pair of parallel sides.

Exemplar Task (45 minutes x 2)
1. Hand out the student package. (See Appendix 1 for the worksheets containing the task the students will work on independently.)
2. Remind students about the rubric, and make sure that each student has a copy of it.
3. Tell the students that they will be working independently on the assigned tasks.
4. Encourage students to record their arrangements.
5. Set the students to work on the task.

Appendix 1

Exemplar Task

1. Susan was experimenting with pattern blocks to see what shapes could be made with the various pattern block pieces. After attempting to build trapezoids from the pattern block pieces, she said that she does not think it is possible to make trapezoidal shapes with 1, 2, 3, …, 10 pattern block pieces.

   a. Find out if she is correct. Use pattern blocks to build trapezoids that can be made with 1 block, 2 blocks, …, 10 blocks.

   Record all of the arrangements you have made on the pattern block paper. For pattern block paper, see the last two pages.
b. If the length of the longest side of a pattern block trapezoid represents 1 unit, show why you can or cannot build trapezoids with the following perimeters: 5 units, 5.5 units, 7 units, 10 units, 12 units. Record your answers on the pattern block paper.

2. You have just seen that you can use different numbers of pattern blocks to build trapezoids. Cynthia wondered whether it would be possible to build triangles and hexagons using pattern blocks.

a. Show how you can build triangles or hexagons using pattern blocks. Use the back of the page if needed.
b. For each of the shapes you have built, show how many triangles would cover it.

c. Luciano said that if he knew how many trapezoids it takes to cover a shape, he could tell you how many triangles it would take to cover the same shape.

Show why you agree or disagree with his statement.
3. a. If the trapezoid is worth $0.25, experiment to see if you can build trapezoids that are worth:

$1.00; $2.50; $4.00; $6.50

Record your answer on the paper provided.

b. Build some more trapezoids and state the cost of each. Describe any patterns you notice.
4. By placing pattern blocks side by side with sides touching sides of equal length, we can create different angles.

a. How many different angles can you form by placing a pattern block alongside other pattern blocks?

Draw your angles in the space below. Measure and name the angles.

Measure the angles and record your angles on the paper.

b. Which angles cannot be made this way? Suggest reasons why you think these angles cannot be made.
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The Ministry of Education wishes to acknowledge the contribution of the many individuals, groups, and organizations that participated in the development and refinement of this resource document.