Ongoing Assessment

• Upon completing the Chapter Review, students can also answer questions such as the following:

- *Did you work by yourself or with others?*

- *What questions did you find easy? Difficult? Why?*

- *How often did you have to check the related Example in the text to help you with the questions? For which questions?*

Using the Chapter Review

Each question in **BLM 5.CR.1 Chapter 5 Review** reviews different skills and concepts. Have students work independently to complete the Chapter Review, then with a partner to compare solutions. Alternatively, the Chapter Review could be assigned for reinforcing skills and concepts in preparation for the Practice Test. You may wish use **BLM G10 Grid Paper**. Provide an opportunity for the students to discuss any questions containing strategies or questions with features they find difficult. Having students present their solutions to the entire class is an excellent opportunity for students to practise their communication skills and to discuss alternative ways of presenting their answers, especially with multiple representations being one of the key concepts in this unit. You may wish to use **BLM A4 Presentation Checklist** to assist you in assessing students' presentation skills.

After they complete the Chapter Review, encourage students to make a list of questions that caused them difficulty, and include the related sections and teaching examples. They can use this to focus their studying for a final test on the chapter's content.

Study Guide

Use the following study guide to direct students who have difficulty with specific questions to appropriate examples to review.

Question	Section(s)	Refer to
1	5.2	Example 1 (page 248)
2	5.1	Example 1 (page 239)
3	5.3	Example 1 (page 255)
4	5.6	Investigate (page 279)
5	5.6	Example 1, 2 (pages 280, 281)
6	5.1	Example 1, 2 (pages 239, 240)
7	5.5	Investigate (page 272)
8	5.2	Example 2 (page 249)
9	5.4	Example 2 (page 266)

Using the Practice Test

This Practice Test can be assigned as an in-class or take-home assignment. If it is used as an assessment, use the following guidelines to help you evaluate the students.
Can students do each of the following?
• Discern between direct and partial variation
• Calculate the constant of variation
• Calculate slope
• Relate slope and rate of change
• Find first differences
• Interpret first differences to determine if a relation is linear or non-linear
• Represent relations verbally, numerically, graphically, and algebraically
• Write a linear relation in the form $y = mx + b$, given an initial value or
    y-intercept, and the slope or constant rate of change
• Communicate their understanding of the concepts
• Solve problems involving these concepts
• Choose the appropriate tools and calculations when solving problems
• Reflect on their findings and adjust their solutions appropriately

Summative Assessment

• Use **BLM 5.CP.1 Chapter 5
  Problem Wrap-Up Rubric** to
  assess student achievement.

Using the Chapter Problem

If the Chapter Problem questions have been taken up in class, plan on 40 min of class time. Otherwise, plan on 30 min to discuss the Chapter Problem questions and 40 min for the Chapter Problem Wrap-Up.

When discussing the toothpick patterns throughout this chapter, have students visualize the patterns by seeing how and by how much they grow on each step. Have them organize their thoughts by placing the data into a chart. They should use the tools of this chapter to calculate the slope, analyse the rate of change, and investigate first differences. You may also wish students to extend their learning by investigating other toothpick patterns or designing their own to determine what makes a pattern linear versus non-linear.

The Chapter Problem Wrap-Up question appears to be straightforward. However, the second part of the question is quite challenging and requires some creativity on the part of students. The first part of the problem can be completed in 15 min, but the second half may require an extended period of time. The second half might even be assigned as a take-home problem. Conduct a short review of the Chapter Problem questions from the sections, reviewing the equation creation skills that were used.

Many students will benefit from having a supply of toothpicks or similar manipulatives available for this problem. Grid paper and graphing calculators should also be available for students to use. You may wish to use **BLM G10 Grid Paper** to support this activity.

Level 3 Sample Response

I made a chart for the first pattern after drawing a few more diagrams in the pattern:

Number of Regions (R)	Number of Toothpicks (T)
1	4
2	7
3	10
4	13
5	16
6	19

I think this pattern is linear because the first differences are always 3.
To make an equation, I chose the variables R and T. The common first difference should be the slope of the equation.
The equation is of the form $T = 3R + b$
To find b, substitute values for R and T. $b = 1$
Therefore, the linear equation is $T = 3R + 1$

I made a similar chart for the second pattern after drawing three more patterns.

Number of Regions (R)	Number of Toothpicks (T)
1	3
4	9
9	18
16	30
25	45
36	63

I don't think this is linear. However, I can't do a first differences test because the R variable does not increase in constant manner. I tried doing a scatter plot in my calculator, and it seemed almost linear but not quite. See my screen below.
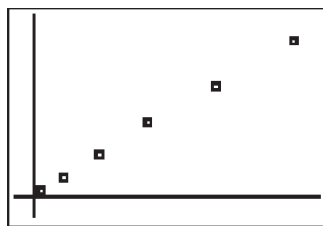
I could try this another way. Let's try calculating slope.
The slope from (1, 3) to (4, 9) is 2. The slope from (4, 9) to (9, 18) is 1.8. Clearly, this is not linear.
I don't know how to change the diagrams to make the pattern linear.

Level 4 Sample Response

For a linear pattern, you have to add the same number of toothpicks each time and create an additional shape. One way to do this is as follows:

The chart for this pattern is:

Number of Regions (R)	Number of Toothpicks (T)
1	3
2	5
3	7
4	9
5	11

The related equation for this pattern is of the form $T = 2R + b$.
Substituting the pair (1, 3), we find that $b = 1$
Therefore, the equation is $T = 3R + 1$

Level 3 Notes
Look for the following:
• Complete error-free charts for each pattern based on the given diagrams
• Correct use of slope or first differences calculations in both patterns
• An equation is developed for the first pattern
• The second pattern may not be modified or have an equation provided
• Justifications for each response

What Distinguishes Level 2
At this level, look for the following:
• Partial charts for each pattern with possible errors; not all diagrams may be used
• Chart headings for the second pattern may reflect pattern number rather than number of closed regions
• Some errors in slope or first differences calculations in both patterns
• An incomplete equation provided for the first pattern, for example, students may only write $y = mx + b$
• There may be little or no attempt at a solution for the second pattern
• Limited justification for responses

What Distinguishes Level 4
At this level, look for the following:
• Additional diagram will be drawn to extend the patterns
• Complete error-free charts of each pattern that include data from additional diagrams in the patterns
• Correct use of slope or first differences calculations in both patterns with recognition that first differences cannot be used in the second pattern
• One or more suggested modifications for the second pattern with appropriate equations
• Possible references to the fact that these patterns are examples of partial variation relationships
• Use of diagrams, graphs, or technology to support that the second pattern is not linear
• Clear and detailed justification for responses