Achievement Chart Category Questions

- Specific questions within each **Practise, Apply, Solve** section are linked to the Achievement Chart categories and highlighted with blue headings: **Knowledge/Understanding; Communication; Application;** and **Thinking/Inquiry/Problem Solving**. These are single examples of questions that focus student abilities in these areas, and provide a good opportunity to assess these areas of the Achievement Chart. Full solutions are provided in the Solutions Manual, while assessment guidelines with links to the Achievement Chart, along with management and usage suggestions are provided in the Teacher's Resource.

- Single examples of Achievement Chart category questions are also identified in Chapter Review Tests in the Student Text and in the Sample Chapter Tests provided in the Teacher's Resource.

Knowledge and Understanding Question

Communication Question

Application Question

Thinking, Inquiry, Problem-Solving Question

10. Determine the number of terms in each geometric sequence.
(a) 2, 6, 18, … , 39 366 (b) 5, 10, 20, … , 10 240
(c) $-2, -10, -50, \ldots, -6250$ (d) $16, 8, 4, \ldots, \frac{1}{64}$
(e) 3, 6, 12, … , 384 (f) 4, 24, 144, … , 186 624

11. Determine the approximate solutions using graphing technology. Round to two decimal places.
(a) $3^x = 30$ (b) $5^x = 10$ (c) $5.6^y = 60$ (d) $(1.04)^x = 2$
(e) $25^{-x} = 10$ (f) $12^{2x} = 500$ (g) $4.1^{3x} = 40$ (h) $5^{2x-1} = 45$

12. A bacteria culture doubles in size every 15 min. How long will it take for a culture of 20 bacteria to grow to a population of 163 840?

13. **Knowledge and Understanding:** Determine the exact solution of $9^{2x+1} = 81(27^x)$.

14. The use of wind turbines to generate electrical energy in Europe has increased exponentially. The energy produced by wind turbines between 1980 and 1995 can be modelled by the equation $y = 6.489(1.580)^x$, where x is the number of years since 1980 and y is the number of gigawatt-hours of energy produced.
(a) Determine the amount of energy produced in 1980.
(b) Determine the amount of energy produced in 1992.
(c) In what year was 398.191 107 2 GW-h produced?
(d) Determine when 500 GW-h of energy were produced.

15. If $500 is deposited in an account paying 8%/a, compounded semiannually, how long will it take for the deposit to increase to $900?

16. **Communication:** You can solve an exponential equation algebraically or by using a graph. Explain how you would decide which method to use. Include examples.

17. Thorium-227 has a half-life of 18.4 days. How much time will a 50-mg sample take to decompose to 10 mg?

18. **Thinking, Inquiry, Problem Solving:** When a plant or an animal dies, it stops absorbing carbon-14 from the atmosphere. Carbon-14 is an unstable radioactive isotope and decays over time. By measuring the amount of carbon-14 remaining in a sample from a plant or animal fossil, scientists can accurately predict the age of the specimen.
(a) Research to find the half-life of carbon-14.
(b) Estimate the age of the fossil of a leaf that contains 0.10% of the original amount of carbon-14.

19. If a sum of money is invested at 9%/a, compounded monthly, how much time will the investment take to double?

20. **Application:** Erica has a new job with a starting salary of $32 000. She has been guaranteed an annual raise of 6% each year over the next ten years. When will her annual salary be more than $50 000?

21. When a driver leaves the lights of a parked car turned on, the battery begins to discharge. A 12-V car battery loses about 8% of its charge each hour. The car must have at least 9 V of power to turn the starter's motor. How much time does the driver have to turn off the lights and still be able to start the car?

22. **Check Your Understanding:** Solve $31\,250 = 2(5)^{3x-12}$ algebraically. Verify your answer by finding the zero of the corresponding relationship using graphing technology.

C

23. Solve.
(a) $2^{2x} - 33(2^x) + 32 = 0$ (b) $25^x - 30(5^x) + 125 = 0$

24. Solve. Round to two decimal places.
(a) $9^{x^2-3x} = \frac{1}{27}$ (b) $(5^{x^2})(625) = \left(\frac{1}{125}\right)^{2x}$

25. Samantha invests $1000 at 6%/a, compounded quarterly. Mark invests $1500 at 5%/a, compounded quarterly. When will the balances in their accounts be equal?

The Chapter Problem—Controlling Non-Native Plant Populations

In this lesson, you have studied exponential equations. Use what you have learned to answer these questions about the Chapter Problem on page 2.

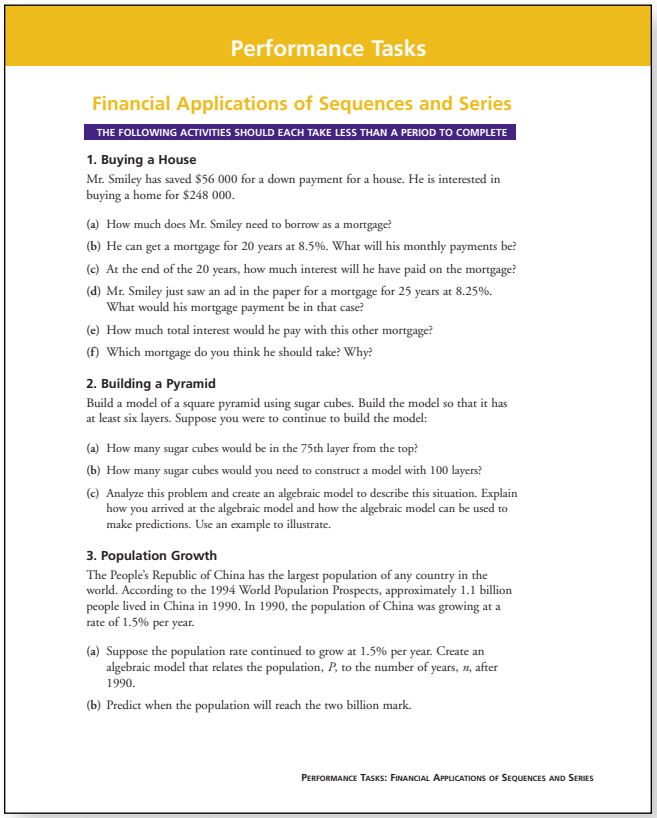
CP19. Use your model to predict the number of plants and seeds that exist after ten years.
CP20. How do the values in question CP19 compare with those in the table? Explain the similarities or differences.
CP21. Use your model, along with graphing technology, to determine when the number of plants exceeds 500 trillion.
CP22. If the site will support 105 mature knapweed plants per square metre, how many hectares would be affected after ten years? (1 ha = 10 000 m²)

Check Your Understanding, highlighted with green headings, encourage students to self-assess their understanding of main ideas. Answers are provided in the text. Teachers may also use these questions to monitor student understanding.

Performance Tasks

Each of the strands in *Nelson Mathematics 11* is supported by Performance Tasks. **Performance Tasks** may be used for either formative or summative assessment. These activities vary in length, and may be used to determine students' level of performance relative to the categories of the Achievement Chart.

- Performance Tasks appear at the end of each strand in the Student Text.
- Additional Performance Tasks are provided in the Teacher's Resource.
- Full support is provided in the Teacher Resource for all Performance Tasks, including timing, solutions, suggested use, suggested assessment tools, and rubrics.
- Performance Tasks may be used in conjunction with tests and quizzes.



Performance Tasks

Financial Applications of Sequences and Series

THE FOLLOWING ACTIVITIES SHOULD EACH TAKE LESS THAN A PERIOD TO COMPLETE

1. Buying a House

Mr. Smiley has saved $56 000 for a down payment for a house. He is interested in buying a home for $248 000.

(a) How much does Mr. Smiley need to borrow as a mortgage?

(b) He can get a mortgage for 20 years at 8.5%. What will his monthly payments be?

(c) At the end of the 20 years, how much interest will he have paid on the mortgage?

(d) Mr. Smiley just saw an ad in the paper for a mortgage for 25 years at 8.25%. What would his mortgage payment be in that case?

(e) How much total interest would he pay with this other mortgage?

(f) Which mortgage do you think he should take? Why?

2. Building a Pyramid

Build a model of a square pyramid using sugar cubes. Build the model so that it has at least six layers. Suppose you were to continue to build the model:

(a) How many sugar cubes would be in the 75th layer from the top?

(b) How many sugar cubes would you need to construct a model with 100 layers?

(c) Analyze this problem and create an algebraic model to describe this situation. Explain how you arrived at the algebraic model and how the algebraic model can be used to make predictions. Use an example to illustrate.

3. Population Growth

The People's Republic of China has the largest population of any country in the world. According to the 1994 World Population Prospects, approximately 1.1 billion people lived in China in 1990. In 1990, the population of China was growing at a rate of 1.5% per year.

(a) Suppose the population rate continued to grow at 1.5% per year. Create an algebraic model that relates the population, P, to the number of years, n, after 1990.

(b) Predict when the population will reach the two billion mark.

PERFORMANCE TASKS: FINANCIAL APPLICATIONS OF SEQUENCES AND SERIES

The Chapter Problem and Challenges

Each chapter presents **The Chapter Problem** and **Challenges** in the **Connections** section.

- The **Chapter Problem** illustrates how math is used in a variety of careers and is revisited throughout the chapter. Provides opportunity to assess students in the areas of application and communication.
- **Challenges** present challenging problems designed to provide opportunities for students to demonstrate performance at or above provincial standards. The tasks require students to apply their problem-solving skills to problems encompassing the "big ideas" of the chapter.
- **Web Challenge**–each set of Challenges includes an online problem that integrates the use of the Internet and the mathematics of the chapter.
- Support for both The Chapter Problem and the Challenges is provided in the Teacher's Resource.

knapweed

purple loosestrife

Connections

The Chapter Problem

Controlling Non-Native Plant Populations

The first Canadian settlers brought with them plants from their native lands, for example, the lilac. When other non-native plants, seeds, animals, and birds are introduced to our natural environment, the results can be unpredictable.

Invasive or noxious non-native plants can destroy and disrupt wildlife habitat, threaten the existence of endangered species, and disrupt migratory bird flight patterns.

In Ontario, purple loosestrife, which was brought to North America in the ballasts of sailing ships in the nineteenth century, is overtaking much of the wetlands. Knapweed, another non-native plant, is spreading at an alarming rate through cultivated fields, pastures, and roadsides. Biologists look for ways to naturally control the rapid growth of these weeds without using harmful chemicals and pesticides.

Knapweed Facts

- Ontario is home to three varieties of knapweed: spotted knapweed, brown knapweed, and Russian knapweed.
- It takes one year for knapweed to germinate, or sprout, and produce seed.
- Four percent of the seeds in the seedbank, or cache of seeds, germinate each year. The remaining 96% of the seeds produced by each plant are added to the seedbank.
- About 25% of the seedlings grow to maturity in one year.
- One knapweed plant produces 1000 seeds per plant.
- Knapweed seeds remain viable in soil for eight years.
- Knapweed plants live for five years.

Source: Ontario Ministry of Agriculture and Food

Non-Native Plant Problem

Suppose 100 knapweed seeds are accidentally carried into a field on hikers' clothing or shoes. If there are no other factors that will affect their growth, then how many knapweed plants and seeds will be produced in the field over ten years? When will the number of plants exceed five hundred trillion?

For help with this problem, see pages 16, 26, 42, 76, and 91.

Challenge 1

Chess is a fascinating game, with a long history. There are many stories about the origin of chess. One ancient story suggests that chess was invented for a wealthy ruler in India. The ruler was so pleased with the game that he offered the inventor whatever he wanted as a reward. The inventor thought for awhile and then asked for grains of wheat, to be given to him as follows:

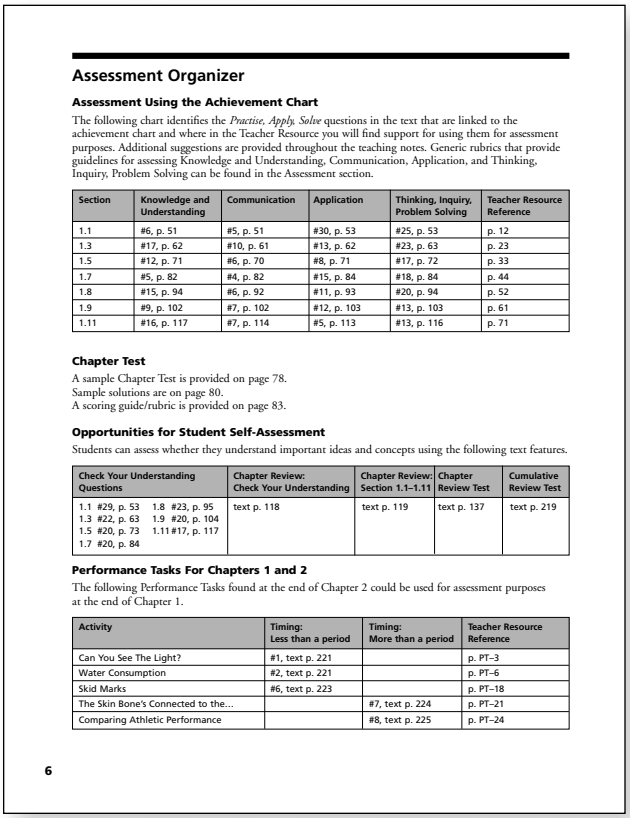
- one grain on the first square of the chessboard
- two grains on the second square
- four grains on the third square, and so on, until there were grains of wheat on each of the 64 squares of the chessboard

For each successive square, the number of grains of wheat is double.

1. The mass of a typical wheat grain is 0.0648 g. Calculate the total mass of wheat for the first ten squares.
2. One tonne (t) is 1 000 000 g. In 1996, the total world wheat production was 582 500 000 t. At this rate, how many years would it take to fill the chessboard completely?
3. Research to determine the selling price of 1 t of wheat in today's market. Use this information to determine the cash value of the inventor's reward.

Challenge 2

Jane draws a square and shades four corners. One side of each new square is one-quarter the length of the original square. Using the corners of the shaded squares Jane draws another square, and then shades its four corners in the same manner. If she carries this out over and over again, what portion of the original square will be shaded?



Assessment Organizer

Assessment Using the Achievement Chart

The following chart identifies the *Practise, Apply, Solve* questions in the text that are linked to the achievement chart and where in the Teacher Resource you will find support for using them for assessment purposes. Additional suggestions are provided throughout the teaching notes. Generic rubrics that provide guidelines for assessing Knowledge and Understanding, Communication, Application, and Thinking, Inquiry, Problem Solving can be found in the Assessment section.

Section	Knowledge and Understanding	Communication	Application	Thinking, Inquiry, Problem Solving	Teacher Resource Reference
1.1	#6, p. 51	#5, p. 51	#30, p. 53	#25, p. 53	p. 12
1.3	#17, p. 62	#10, p. 61	#13, p. 62	#23, p. 63	p. 23
1.5	#12, p. 71	#6, p. 70	#8, p. 71	#17, p. 72	p. 33
1.7	#5, p. 82	#4, p. 82	#15, p. 84	#18, p. 84	p. 44
1.8	#15, p. 94	#6, p. 92	#11, p. 93	#20, p. 94	p. 52
1.9	#9, p. 102	#7, p. 102	#12, p. 103	#13, p. 103	p. 61
1.11	#16, p. 117	#7, p. 114	#5, p. 113	#13, p. 116	p. 71

Chapter Test

A sample Chapter Test is provided on page 78.
Sample solutions are on page 80.
A scoring guide/rubric is provided on page 83.

Opportunities for Student Self-Assessment

Students can assess whether they understand important ideas and concepts using the following text features.

Check Your Understanding Questions	Chapter Review: Check Your Understanding	Chapter Review: Section 1.1–1.11	Chapter Review Test	Cumulative Review Test
1.1 #29, p. 53 1.8 #23, p. 95 1.3 #22, p. 63 1.9 #20, p. 104 1.5 #20, p. 73 1.11 #17, p. 117 1.7 #20, p. 84	text p. 118	text p. 119	text p. 137	text p. 219

Performance Tasks For Chapters 1 and 2

The following Performance Tasks found at the end of Chapter 2 could be used for assessment purposes at the end of Chapter 1.

Activity	Timing: Less than a period	Timing: More than a period	Teacher Resource Reference
Can You See The Light?	#1, text p. 221		p. PT–3
Water Consumption	#2, text p. 221		p. PT–6
Skid Marks	#6, text p. 223		p. PT–18
The Skin Bone's Connected to the...		#7, text p. 224	p. PT–21
Comparing Athletic Performance		#8, text p. 225	p. PT–24

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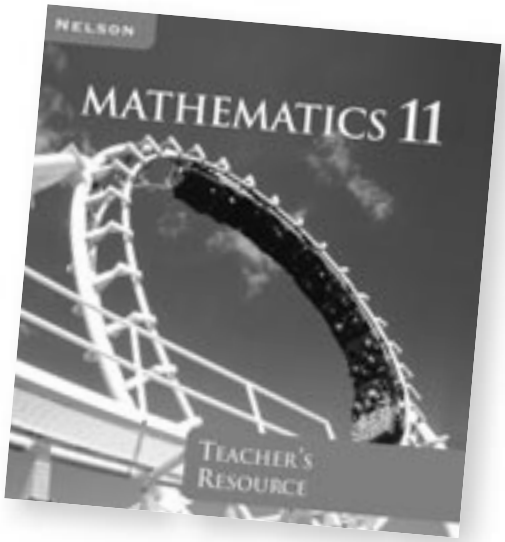

Assessment Organizer
Provided near the beginning of each chapter in the Teacher's Resource, the **Assessment Organizer** quickly identifies the assessment opportunities within the chapter.
(Example shown is taken from the *Nelson Mathematics 10* Teacher's Resource)

Teacher's Resource Assessment Section

In addition to the assessment support imbedded in the chapter lesson plans, the *Nelson Mathematics 11* Teacher's Resource offers a separate section on assessment.

Assessment, Evaluation and Grading

- The Purpose of Assessment
- Expanding the Vision of Assessment in Mathematics
- Assessment Terminology
- Assessment Strategies and Tools

Assessment Issues in Ontario Grade 11 Mathematics

- Assessing Expectations
  - How *Nelson Mathematics 11* Helps
- Connecting to the Achievement Chart
  - How *Nelson Mathematics 11* Helps with the Assessment of Achievement of Curriculum Expectations
- Assessing Learning Skills
  - How *Nelson Mathematics 11* Helps with the Assessment of Learning Skills
- The Provincial Report Card

Assessment Features in Nelson Mathematics 11

- Assessment Features in Each Chapter
- Performance Tasks in *Nelson Mathematics 11*
  - How to Use the Performance Tasks
  - Support for the Performance Tasks
  - Suggestions for Carrying Out the Performance Tasks
    - ◊ Individual Work
    - ◊ Cooperative Group Work
    - ◊ Group Work for the Purpose of Collecting and Sharing Data
    - ◊ Breaking a Performance Task into Stages
  - How to Assess the Performance Tasks

Assessment References and Resources

Assessment Blackline Masters

- Generic Rubrics for the Categories of the Achievement Chart
  - Knowledge and Understanding
  - Application
  - Thinking, Inquiry, and Problem Solving
  - Communication
- Generic Rubric for Chapter Problems
- Problem-Solving Checklist — Self-Assessment
- Review Problems Evaluation Sheet
- Assessment of Learning Skills
  - Generic Rubrics for Learning Skills
  - Group Participation: Peer-Assessment Rating Scale
  - Learning Skills Tracking Sheet
  - Work Habits Self-Reflection Sheet
  - Teamwork Self-Reflection Sheet
  - Initiative Self-Reflection Sheet
  - Independence Self-Reflection Sheet
  - Learning Skills Self-Reflection Checklists