8 Logarithmic Functions

General Outcome

Develop algebraic and graphical reasoning through the study of relations.

Specific Outcomes

RF7 Demonstrate an understanding of logarithms.

RF8 Demonstrate an understanding of the product, quotient and power laws of logarithms.

RF9 Graph and analyze exponential and logarithmic functions.

RF10 Solve problems that involve exponential and logarithmic equations.

By the end of this chapter, students will be able to:

Section	Understanding Concepts, Skills, and Processes
8.1	✓ demonstrate that a logarithmic function is the inverse of an exponential function
	✓ sketch the graph of $y = \log_c x$, $c > 0$, $c \neq 1$
	✓ determine the characteristics of the graph of $y = \log_c x$, $c > 0$, $c \neq 1$
	✓ explain the relationship between logarithms and exponents
	✓ express a logarithmic function as an exponential function and vice versa
	✓ evaluate logarithms using a variety of methods
8.2	✓ explain the effects of the parameters a, b, h, and k in $y = a \log_c (b(x - h)) + k$ on the graph of $y = \log_c x$, where $c > 1$
	✓ sketch the graph of a logarithmic function by applying a set of transformations to the graph of $y = \log_c x$, where $c > 1$, and state the characteristics of the graph
8.3	✓ develop the laws of logarithms
	✓ determine an equivalent form of a logarithmic expression using the laws of logarithms
	✓ apply the laws of logarithms to logarithmic scales
8.4	✓ solve a logarithmic equation and verify the solution
	✓ explain why a value obtained in solving a logarithmic equation may be extraneous
	✓ solve an exponential equation in which the bases are not powers of one another
	✓ solve a problem that involves exponential growth or decay
	✓ solve a problem that involves the application of exponential equations to loans, mortgages, and investments
	✓ solve a problem by modelling a situation with an exponential or logarithmic equation

Assessment	Supporting Learning
Assessment *for* Learning	
Method 1: Use the introduction on page 370 in *Pre-Calculus 12* to activate students' prior knowledge about the skills and processes that will be covered in this chapter. **Method 2:** Have students develop a journal entry to explain what they personally know about logarithms, how logarithms are represented, and how they can be used to model situations and solve problems.	• Have students update their list of what they need to work on and keep track of the skills and processes that need attention. • Students who require activation of prerequisite skills may wish to complete **BLM 8–1 Chapter 8 Prerequisite Skills**. This material is on the Teacher CD of this Teacher's Resource and mounted on the www.mcgrawhill.ca/school/learningcentres book site.
Assessment *as* Learning	
As students work on each section in Chapter 8, have them keep track of any problems they are having.	• As students complete each section, have them review the list of items they need to work on and check off any that have been handled. • Encourage students to write definitions for the Key Terms in their own words, including reminder tips that may be helpful for review throughout the chapter. • Encourage students to write examples of their own in their notebook or math portfolio. Students should have an example for each method that is covered in the chapter.
Assessment *for* Learning	
BLM 8–1 Chapter 8 Prerequisite Skills This master provides a review of prerequisite skills needed for the chapter	• Use the Prerequisite Skills blackline master to provide additional opportunities for students to demonstrate their readiness for the chapter material.

Chapter 8 Planning Chart

Section/ Suggested Timing	Prerequisite Skills	Materials/Technology	Teacher's Resource Blackline Masters	Exercise Guide	Assessment *as* Learning	Assessment *for* Learning	Assessment *of* Learning	Web Link www.mcgrawhill.ca/school/learningcentres
Chapter Opener • 45–60 min (TR page 199)			BLM 8–1 Chapter 8 Prerequisite Skills BLM U3–1 Unit 3 Project Checklist					• information on careers and educational programs in radiology
8.1 Understanding Logarithms • 60–90 min (TR page 200)	Students should be familiar with • graphing with a graphing calculator • sketching graphs of functions with or without technology • determining the domain and range of a function • identifying the characteristics of the graphs of functions	• graphing technology • grid paper	BLM 8–2 Section 8.1 Extra Practice TM 8–1 How to Do Page 377 Example 4 Using TI-Nspire™ With Touchpad	**Essential:** #1–10, 12, 13, 17 **Typical:** #1–9, 11–16, one of 18–20, C1–C2 **Extension/Enrichment:** #14–16, 18, 20–24, C1–C2	TR pages 201, 204	TR pages 203, 204		• information on the Geological Survey of Canada
8.2 Transformations of Logarithmic Functions • 60–90 min (TR page 205)	Students should be familiar with • transformations of the graphs of functions and their related equations • effects of the parameters *a*, *b*, *h*, and *k* • order in which transformations are applied	• graphing technology	BLM 8–3 Section 8.2 Extra Practice	**Essential:** #1, 2, 4, 5, 6a), b), 7, 8, 10, 12 **Typical:** #1, 3–5, 6c), d), 7, 9–11, 13 or 14, C1, C2, C4 **Extension/Enrichment:** #11, 14–17, C1, C2, C4	TR pages 206, 208	TR pages 207, 208		• information on Canadian geography and butterfly distribution
8.3 Laws of Logarithms • 60–90 min (TR page 209)	Students should be familiar with • the laws of powers	• graphing technology	BLM 8–4 Section 8.3 Extra Practice	**Essential:** #1, 2, 4–8, 10, 11, 12a), b), 13, 14 **Typical:** #1, 3, 4–7, 9–11, 12c), d), 14, one of 15–17, C1–C4 **Extension/Enrichment:** one of 15–17, 18–20, C1–C4	TR pages 210, 213	TR pages 212, 213		• information on the Canadian Centre for Occupational Health and Safety
8.4 Logarithmic and Exponential Equations • 90–120 min (TR page 214)	Students should be familiar with • solving systems of equations graphically • solving systems of equations algebraically • determining restrictions on a variable in an expression or equation	• graphing technology	BLM 8–5 Section 8.4 Extra Practice	**Essential:** #1–8, 10–12, 17 **Typical:** #1–9, two of 11–14, 15, 18, 19, one of 20–22, C1–C5 **Extension/Enrichment:** #9, 13, 14, 16, 20–22, C2–C5	TR pages 215, 218	TR pages 217, 218		• information on the Head-Smashed-In Buffalo Jump
Chapter 8 Review and Practice Test • 60–90 min (TR page 219)		• graphing technology	BLM 8–2 Section 8.1 Extra Practice BLM 8–3 Section 8.2 Extra Practice BLM 8–4 Section 8.3 Extra Practice BLM 8–5 Section 8.4 Extra Practice BLM 8–6 Chapter 8 Study Guide BLM 8–7 Chapter 8 Test	Have students do at least one question related to any concept, skill, or process that has been giving them trouble. **Chapter 8 Review minimum:** # 1–14, one of 15–17, 18–20 Provide students with the number of questions they can comfortably do in one class. Choose at least one question for each concept, skill, or process. **Chapter 8 Practice Test minimum:** #1–12		TR page 220	TR page 220 BLM 8–7 Chapter 8 Test	
Unit 3 Project Wrap-Up • 60–90 min (TR page 221)			Master 1 Holistic Project Rubric Master 2 Ana-Holistic Project Rubric BLM U3–1 Unit 3 Project Checklist				TR page 222 Master 1 Holistic Project Rubric Master 2 Ana-Holistic Project Rubric	• sample Unit 3 Project Holistic Rubric • sample Unit 3 Project Ana-Holistic Rubric
Unit 3 Cumulative Review and Test • 60–90 min (TR page 223)		• graphing technology	BLM U3–2 Unit 3 Test BLM 8–8 Chapter 8 BLM Answers	Have students do at least one question related to any concept, skill, or process that has been giving them trouble.		TR page 223	TR page 223	