Chapter **7**

Tools and Strategies for Solving Exponential and Logarithmic Equations

Curriculum Expectations

Exponential and Logarithmic Functions

Evaluating Logarithmic Expressions

A1.4 make connections between the laws of exponents and the laws of logarithms [e.g., use the statement $10^{a+b} = 10^a 10^b$ to deduce that $\log_{10} x + \log_{10} y = \log_{10}(xy)$], verify the laws of logarithms with or without technology (e.g., use patterning to verify the quotient law for logarithms by evaluating expressions such as $\log_{10} 1000 - \log_{10} 100$ and then rewriting the answer as a logarithmic term to the same base), and use the laws of logarithms to simplify and evaluate numerical expressions

Technology Notes

The technology used in this chapter includes graphing calculators, specifically the TI-83 Plus/TI-84 Plus series, a computer algebra system (CAS), specifically the TI-89/89T series, *The Geometer's Sketchpad®*, and *Fathom™*.

Connecting Graphs and Equations of Logarithmic Functions

A2.4 pose problems based on real-world applications of exponential and logarithmic functions (e.g., exponential growth and decay, the Richter scale, the pH scale, the decibel scale), and solve these and other such problems by using a given graph or a graph generated with technology from a table of values or from its equation

Solving Exponential and Logarithmic Equations

A3.1 recognize equivalent algebraic expressions involving logarithms and exponents, and simplify expressions of these types

A3.2 solve exponential equations in one variable by determining a common base (e.g., solve $4^x = 8^{x+3}$ by expressing each side as a power of 2) and by using logarithms (e.g., solve $4^x = 8^{x+3}$ by taking the logarithm base 2 of both sides), recognizing that logarithms base 10 are commonly used (e.g., solving $3^x = 7$ by taking the logarithm base 10 of both sides)

A3.3 solve simple logarithmic equations in one variable algebraically [e.g., $\log(5x + 6) = 2$, $\log_{10}(x + 1) = 1$]

A3.4 solve problems involving exponential and logarithmic equations algebraically, including problems arising from real-world applications

Characteristics of Functions

Using Function Models to Solve Problems

D3.3 solve problems, using a variety of tools and strategies, including problems arising from real-world applications, by reasoning with functions and by applying concepts and procedures involving functions (e.g., by constructing a function model from data, using the model to determine mathematical results, and interpreting and communicating the results within the context of the problem)

Chapter 7 Planning Chart

Section Suggested Timing	Student Text Page(s)	Teacher's Resource Blackline Masters	Assessment	Tools
Chapter 7 Opener • 10 min	361			
Prerequisite Skills • 75 min	362–363	• BLM 7–1 Prerequisite Skills		
7.1 Equivalent Forms of Exponential Equations • 75 min	364–369	• T–2 *The Geometer's Sketchpad®* 4 • BLM 7–2 Section 7.1 Practice		• linking cubes • graphing calculator • computer • *The Geometer's Sketchpad®*
7.2 Techniques for Solving Exponential Equations • 75 min	370–377	• BLM 7–3 Section 7.2 Practice		• graphing calculator
7.3 Product and Quotient Laws of Logarithms • 75–150 min	378–386	• T–2 The Geometer's Sketchpad® 4 • T–4 The Computer Algebra System (CAS) on the TI-89 Calculator • BLM 7–4 Investigate A: Graphs of Common Logarithms of Products • BLM 7–5 Section 7.3 Practice		• computer • *The Geometer's Sketchpad®* • graphing calculator • computer algebra system
7.4 Techniques for Solving Logarithmic Equations • 75 min	387–392	• G–1 Grid Paper • BLM 7–6 Section 7.4 Practice		• grid paper • graphing calculator
7.5 Making Connections: Mathematical Modelling With Exponential and Logarithmic Equations • 75 min	393–407	• T–1 Microsoft® Excel • T–2 *The Geometer's Sketchpad®* 4 • T–3 *Fathom™* • BLM 7–7 Investigate the Population Growth of Decimal Point • BLM 7–8 Section 7.5 Practice	• BLM 7–9 Section 7.5 Achievement Check Rubric	• graphing calculator • computer • Fathom™ • *The Geometer's Sketchpad®*
Chapter 7 Review • 60–75 min	408–409	• BLM 7–10 Chapter 7 Review		• graphing calculator
Chapter 7 Problem Wrap-Up • 40–75 min	409		• BLM 7–11 Chapter 7 Problem Wrap-Up Rubric	• graphing calculator
Chapter 7 Practice Test • 60–75 min	410–411		• BLM 7–12 Chapter 7 Test	• graphing calculator
Chapter 7 Task: Make Your Own Slide Rule • 60–75 min	412	• BLM 7–14 BLM Answers	• BLM 7–13 Task: Make Your Own Slide Rule Rubric	• two strips of cardstock, 3 cm by 30 cm • ruler • computer • Internet

Chapter 7 Blackline Masters Checklist

	BLM	Title	Purpose
Prerequisite Skills			
	BLM 7–1	Prerequisite Skills	Practice
7.1 Equivalent Forms of Exponential Equations			
	T–2	*The Geometer's Sketchpad®* 4	Technology
	BLM 7–2	Section 7.1 Practice	Practice

	BLM	Title	Purpose
7.2 Techniques for Solving Exponential Equations			
	BLM 7–3	Section 7.2 Practice	Practice
7.3 Product and Quotient Laws of Logarithms			
	T–2	*The Geometer's Sketchpad*® 4	Technology
	T–4	The Computer Algebra System (CAS) on the TI-89 Calculator	Technology
	BLM 7–5	Investigate A: Graphs of Common Logarithms of Products	Student Support
	BLM 7–5	Section 7.3 Practice	Practice
7.4 Techniques for Solving Logarithmic Equations			
	G–1	Grid Paper	Student Support
	BLM 7–6	Section 7.4 Practice	Practice
7.5 Making Connections: Mathematical Modelling With Exponential and Logarithmic Equations			
	T–1	*Microsoft*® Excel	Technology
	T–2	*The Geometer's Sketchpad*® 4	Technology
	T–3	*Fathom*™	Technology
	BLM 7–7	Investigate the Population Growth of Decimal Point	Student Support
	BLM 7–8	Section 7.5 Practice	Practice
	BLM 7–9	Section 7.5 Achievement Check Rubric	Assessment
Chapter 7 Review			
	BLM 7–9	Chapter 7 Review	Practice
Chapter 7 Problem Wrap-Up			
	BLM 7–10	Chapter 7 Problem Wrap-Up Rubric	Assessment
Chapter 7 Practice Test			
	BLM 7–11	Chapter 7 Test	Summative Assessment
Chapter 7 Task: Not Fatal			
	BLM 7–12	Task: Make Your Own Slide Rule Rubric	Assessment
	BLM 7–13	BLM Answers	Answers

Prerequisite Skills

Student Text Pages
362 to 363

Suggested Timing
75 min

Related Resources
- BLM 7–1 Prerequisite Skills

Assessment
You may wish to use **BLM 7–1 Prerequisite Skills** as a diagnostic assessment. Refer students to the Skills Appendix for examples and further practice of topics.

Chapter Problem

- The Chapter Problem is introduced on page 363. This collection of problems, related to the sounds produced by electric guitars, should appeal particularly to students who enjoy modern music. Explain that as they work through the Chapter Problem, in Section 7.2 (question 16), Section 7.3 (question 11), Section 7.4 (question 8), and Section 7.5 (question 10), students will solve a variety of problems related to the amplification and equalization of electric music. Explain that they will learn more about electric guitars and how they work if they decide to pursue a career in the music performing or recording industry.