UNIT ARC OF LEARNING™ (AoL)

Growing, Growing, Growing: Linear Versus Exponential Patterns of Change (AoL)					
■ Exponential Functions ■ Properties of Exponents	Introduction *Setting the Scene*	Exploration *Mucking About*	Analysis *Going Deeper*	Synthesis *Looking Across*	Abstraction *Going Beyond*
Investigation 1. Exponential Growth Patterns					
Problem 1.1 Making Ballots: Linear or Nonlinear Relationship?	1.1	1.1			
Problem 1.2 The King's Reward: Representing Exponential Functions		1.2			
	1.2				
Problem 1.3 The Killer Plant Strikes Lake Victoria: *y*-Intercepts Other Than 1		1.3	1.3		
	1.3	1.3			
Problem 1.4 Growing Mold: Interpreting Equations for Exponential Functions		1.4	1.4		
	1.4	1.4			
Mathematical Reflection		MR	MR		
	MR	MR			
Investigation 2. Growth Factors and Growth Rates					
Problem 2.1 Reproducing Rabbits: Fractional Growth Rates			2.1		
		2.1			
Problem 2.2 Investing in the Future: Growth Rates			2.2		
		2.2			
Problem 2.3 Making a Difference: Connecting Initial Values to Growth Factors			2.3		
		2.3			
Mathematical Reflection			MR		
		MR			
Investigation 3. Exponential Decay					
Problem 3.1 Making Smaller Ballots: Introducing Exponential Decay			3.1	3.1	
		3.1	3.1		
Problem 3.2 Fighting Fleas: Representing Exponential Decay			3.2	3.2	
		3.2	3.2		
Problem 3.3 Cooling Water Experiment: Modeling Exponential Decay			3.3	3.3	
		3.3			
Problem 3.4 Wrapping Up: Exponential Functions				3.4	
		3.4			
Mathematical Reflection				MR	
		MR			

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Investigation 4. Patterns with Exponents					
Problem 4.1 Looking for Patterns Among Exponents				4.1	
		4.1	4.1	4.1	
Problem 4.2 More Patterns: Properties of Exponents				4.2	
			4.2	4.2	
Problem 4.3 Water Usage: Operations with Scientific Notation				4.4	
			4.3	4.3	
Problem 4.4 Growing Amoebas: Extending the Properties of Exponents				4.3	
				4.3	
Mathematical Reflection				MR	
			MR	MR	

Exponential functions are used an example of nonlinear functions. The difference is that linear functions have additive patterns of change, while exponential functions have a multiplicative pattern of change. This difference continues the discussion of multiplicative and additive structure of number started in *Connected Mathematics*® 4 grade 6 units. Exponential function situations are generally easier for students to access and represent. Furthermore, exponential functions have many relevant applications. Students will continue to explore exponential functions in high school, including the use of complex numbers as exponents. In this unit, students use the table or graph to estimate information about a variable given the value of the other variable. For example, students may want to know the date that a population will reach a certain number. They can use the table or graph to estimate the exponent, which is the date. In high school, they will learn a symbolic method for finding the exponent, called logarithms. Properties of real numbers will also continue in high school as students use complex numbers as exponents. A detailed description of the Arc of Learning™ can be found in the *A Guide to Connected Mathematics*® 4 and the online portal.