desmos

Unit 8.7, Unit Facilitation Guide

Overview

Prior Learning	Math 8, Unit 7	Future Learning
Math 6 • Operations with whole number exponents (e.g., using $V = s^3$)	• Exponent properties • Scientific notation	Math 8, Unit 8 • Square and cube roots High School • Exponential and polynomial functions • Rational exponents

Big Ideas

Exponent Properties (Lessons 1–6)

- Identify and create equivalent expressions involving positive, negative, and zero exponents.

Scientific Notation (Lessons 7–14)

- Express and perform operations with very large or very small quantities using powers of 10 and scientific notation.

Key Math Practice Standards

- **MP2:** Use properties of exponents to determine if exponential expressions are equivalent. Perform operations on numbers in scientific notation.
- **MP6:** Locate numbers on a number line using powers of 10.
- **MP7:** Rewrite expressions with exponents using a single power, and large or small numbers using scientific notation.

Unit Cool-Downs

Unit 8.7 Cool-Downs

Lessons by Standard

Standard	8.EE.A.1	8.EE.A.3	8.EE.A.4
Lessons	1, 2, 3, 4, 5, 6	2, 7, 8, 9, 10, 11, 13	3, 7, 8, 9, 10, 11, 12, 13

Section 1: Exponent Properties (Lessons 1–6)

Students identify and create equivalent expressions involving positive, negative, and zero exponents. This builds on students' work with expressions involving positive whole number exponents in Math 6. In high school, students will investigate properties of non-integer exponents.

Lesson	Title	Purpose	Vocabulary	Notes
1	Circles	Students review the concepts of whole number exponents that they worked on in Math 6.	exponent	
2	Combining Exponents	Students discover ways to write equivalent exponential expressions involving the product of powers and powers of powers.	base power of 10	
3	Power Pairs	Students look for and make use of structure to identify equivalent exponent expressions that use powers of powers and products of powers.		
4	Rewriting Powers	Students rewrite products of powers, quotients of powers, and powers of powers as single powers.		
5	Zero and Negative Exponents	Students develop an understanding of the meaning of zero and negative exponents.		
6	Write a Rule	Students write rules for simplifying exponential expressions.		This paper lesson includes an activity where students create visual displays.
	Practice Day 1			

Section 2: Scientific Notation (Lessons 7–13)

Students express and perform operations with very large or very small quantities using powers of 10 and scientific notation.

Lesson	Title	Purpose	Vocabulary	Notes
7	Scales and Weights	Students represent large and small numbers using multiples of powers of 10.		
8	Point Zapper	Students use number lines to represent large and small numbers as multiples of powers of 10.		
9	Use Your Powers	Students apply powers of 10 and exponent rules to solve problems in context.		This digital lesson includes an activity where students create a visual display.
10	Solar System	Students use scientific notation to express very large numbers and very small numbers.	scientific notation	
11	Balance the Scale	Students multiply and divide numbers expressed in scientific notation, and express how many times as much one quantity is as the other.		
12	City Lights	Students add and subtract numbers expressed in scientific notation and express the resulting sums and differences in scientific notation.		
13	Star Power	Students use scientific notation as a tool for comparing, combining, and operating on the net worth of different celebrities.		This lesson includes a digital supplement.
	Practice Day 2			

Suggestions for Consolidation or Omission

- **Lesson 1:** The purpose of this lesson is for students to recall using whole number exponents to represent repeated multiplication in preparation for upcoming lessons. If students show a strong understanding of using exponents in Problems 3 and 6 of the Readiness Check, this lesson may be omitted.
- **Lesson 3:** This lesson supports students in developing fluency with identifying equivalent expressions using positive exponents. If students show a strong understanding identifying equivalent expressions with exponents in earlier lessons, this lesson may be omitted. If omitted, be sure to support students in justifying how they know expressions are equivalent elsewhere in the unit.
- **Lesson 9:** This lesson gives students an opportunity to apply the concepts they learned about exponents to analyze a context in the world. If students show a strong understanding of working with powers of 10 in earlier lessons, this lesson may be omitted. If omitted, be sure to discuss how representing and working with numbers written in powers of 10 can empower us to better understand our world throughout the unit.
- **Lesson 13:** This lesson gives students an opportunity to apply what they've learned about exponents and scientific notation to analyze and compare the net worth of different celebrities. There is no new content introduced in this lesson.

Connections to Prior Learning

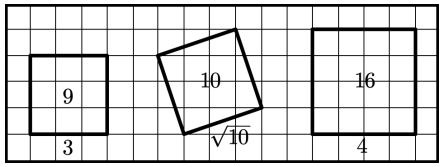
The following concepts from previous grades or units may support students in meeting grade-level standards in this unit:

- Writing and evaluating numerical expressions involving whole-number exponents. **(6.EE.A.1)**
- Multiplying and dividing multi-digit whole numbers and decimals. **(6.NS.B.2, 6.NS.B.3)**
- Reading, writing, and comparing decimals. **(5.NBT.A.3)**

Connections to Future Learning

The content in this unit supports the following concepts in later units and courses:

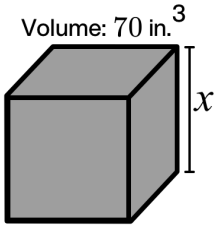
Square and Cube Roots (8.EE.A.2)



In this unit, students learn about exponents and their properties. In Math 8, Unit 8, they will explore square and cube roots, which are the inverses of squares and cubes.

If the area of a square is a square units, we call the length of its sides $\sqrt{a}$ ("the square root of a").

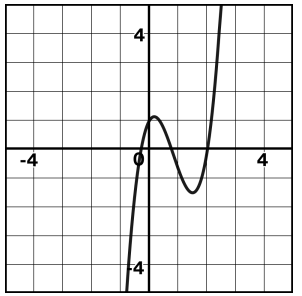
The top picture shows why $\sqrt{9} = 3$ and $\sqrt{16} = 4$. $\sqrt{10}$ is between 3 and 4 because 10 is between 9 and 16.



If the volume of a cube is a cubic units, we call the length of its edges $\sqrt[3]{a}$ ("the cube root of a").

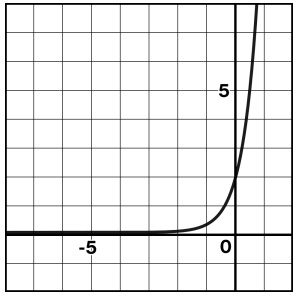
In the bottom picture, $x = \sqrt[3]{70}$, which is between 4 and 5 because $4^3 = 64$ and $5^3 = 125$.

Exponential and Polynomial Functions (HSF.IF.C.7.C, HSF.IF.C.7.E)



In this unit, students study exponents applied to numbers. In high school, they will study polynomial and exponential functions, where exponents are either applied to variables or the variable is an exponent.

$f(x) = 2x^3 - 5x^2 + 1.2x + 1$ is an example of a polynomial function because all of the terms of its equation look like ax^k, where a is a constant and k is a non-negative integer. Its graph is shown in the top image.



An exponential function is a function where the variable is the exponent, such as $g(x) = 2 \cdot (5)^x$. Its graph is shown in the bottom image.

Rational Exponents (HSN.RN.A.1)

In this unit, students make sense of exponents that are integers. In high school, they will use the properties of exponents and their understanding of square and cube roots from Math 8, Unit 8 to make sense of rational exponents.

For example, we can use the rules of exponents to explain why $5^{\frac{1}{3}} = \sqrt[3]{5}$. Using rules of exponents, we can show that $\left(5^{\frac{1}{3}}\right)^3 = 5^{\left(\frac{1}{3}\cdot 3\right)} = 5^1$. We also know that $\left(\sqrt[3]{5}\right)^3 = 5$, so it follows that $5^{\frac{1}{3}} = \sqrt[3]{5}$.