Just In Time Quick Check
Standard of Learning (SOL) 7.1a

Strand: Number and Number Sense
Standard of Learning (SOL) 7.1a *The student will investigate and describe the concept of negative exponents for powers of ten.*
Grade Level Skills: ● Recognize powers of 10 with negative exponents by examining patterns. ● Represent a power of 10 with negative exponents in fraction and decimal form.
Just in Time Quick Check
Just in Time Quick Check Teacher Notes

Supporting Resources:
● VDOE Mathematics Instructional Plans (MIPS)
    o 7.1a – Powers of Ten (Word) / PDF Version
● VDOE Algebra Readiness Formative Assessments
    o SOL 7.1a (Word) / PDF Version
● VDOE Algebra Readiness Remediation Plans
    o Scientific Notation (Word) / PDF Version
● VDOE Word Wall Cards: Grade 7 (Word)
	(PDF)
	    o Powers of Ten
	● Desmos Activity
	    o 7.1 Powers of Ten

Supporting and Prerequisite SOL: 6.2a, 6.4, 5.2a

SOL 7.1a - Just in Time Quick Check

1) a. Complete the chart.

Exponential Form	Expanded Form	Fraction Form
10^{-3}		
	$\dfrac{1}{10} \bullet \dfrac{1}{10} \bullet \dfrac{1}{10} \bullet \dfrac{1}{10}$	
		$\dfrac{1}{100,000}$

b. Show what each entry would be in the row showing an exponential form of 10^{-7}.
Describe the pattern that supports your answer.

2) Determine if the following statements are true or false. Justify your reasoning for each statement.

Statement	True or False	Justify Reasoning
$10^0 = 1$		
$10^{-3} = 0.003$		
$10^{-4} = 0.0001$		

3) Consider the chart below.

Power of 10	Value
10^2	100
10^1	10
10^0	1
10^{-1}	0.1
10^{-2}	0.01

a. What is the value of 10^6? _____

b. What is the value of 10^{-6}? _____

c. Represent 10^{-5} as a fraction and as a decimal: Fraction _____   Decimal _____

SOL 7.1a - Just in Time Quick Check Teacher Notes
Common Errors/Misconceptions and their Possible Indications

1) a. Complete the chart.

Exponential Form	Expanded Form	Fraction Form
10^{-3}		
	$\dfrac{1}{10} \bullet \dfrac{1}{10} \bullet \dfrac{1}{10} \bullet \dfrac{1}{10}$	
		$\dfrac{1}{100,000}$

   b. Show what each entry would be in the row showing an exponential form of 10^{-7}.
       Describe the pattern that supports your answer.

A common misconception (error) a student may make is comprehending the associated vocabulary (exponential form and expanded form). This may indicate a need to emphasize mathematical vocabulary. For example, students may provide answers for expanded form such as: 10 ● -3 (multiplying the base and the exponent); -10 ● -10 ● -10 (delineating the base as a negative 10 three times); or, vice versa -3 ● -3 ● -3 ● -3 ● -3 ● -3 ● -3 ● -3 ● -3 ● -3 (delineating the exponent of -3 ten times). This misconception underscores students' not understanding that negative exponents for powers of 10 are used to represent numbers between 0 and 1. The same reasoning may affect the responses given for portion b of this problem as students may not recognize the pattern of negative powers of 10.

When encountering negative powers of ten, it might be helpful for the student to write the reciprocal of 10 the same number of times as the power (expanded form).

2) Determine if the following statements are true or false. Justify your reasoning for each statement.

Statement	True or False	Justify Reasoning
$10^0 = 1$		
$10^{-3} = 0.003$		
$10^{-4} = 0.0001$		

*Statement $10^0 = 1$: A misconception for this statement is for students to multiply the base and the exponent, thus resulting in a value of 0 and a student responding that the statement is **false**. Students must understand that any number raised to the power of 0 is one.*

*Statement $10^{-3} = 0.003$: A misconception for this statement is for students to have the appropriate number of digits behind the decimal point, but to use the given exponent in the thousandths place; thus, resulting in a value of 0.003 and a student responding with **true**. For negative powers of 10, students should move the decimal to the left and place a 1 in the appropriate place value.*

*Statement $10^{-4} = 0.0001$: This misconception is tied to proceeding statement. Students may err by denoting this statement as **false**. For negative powers of 10, students should move the decimal to the left and place a 1 in the appropriate place value.*

3) Consider the chart below.

Power of 10	Value
10^2	100
10^1	10
10^0	1
10^{-1}	0.1
10^{-2}	0.01

a. What is the value of 10^6? _____

b. What is the value of 10^{-6}? _____

c. Represent 10^{-5} as a fraction and as a decimal: Fraction _____ Decimal _____

For parts a and b of this problem, students may not understand powers of 10 and negative powers of 10 by recognizing patterns. Some students may respond to similarly to question 1 and provide such answers as 60 (multiplying the base by the exponent) or 60,466,176 (multiplying the exponent of 6 ten times). For the fraction representation, a student may respond by writing $\frac{1}{10^{-5}}$ .This indicates that a student may not have a clear understanding of using reciprocals of bases when associated with a negative power. For the decimal representation, common errors that students may make is to write either 0.000001 or 0.00005. Responses other than 0.00001 represent misconceptions of the meaning of a negative power of 10.

Students will benefit from examining patterns of powers of 10 using an expanded chart or table. An example with all forms can be found in the Grade 7 Mathematics Curriculum Framework [Standard 7.1a].