

<p><b>Title:</b></p> <p>Going to St. Ives: Math and Poetry</p> <p>*Lesson based on the poem <i>St. Ives</i></p>	<p><b>Grade: 6</b></p>	<p><b>BIG Idea:</b></p> <p>An introduction to exponents</p>
<p><b>CCGPS Standards Addressed:</b></p> <p><b>MMCC6.EE.1</b> Write and evaluate numerical expressions involving whole-number exponents.</p> <p><b>Mathematical Practices Emphasized:</b></p> <ol style="list-style-type: none"> <li>1. Make sense of problems and persevere in solving them.</li> <li>2. Reason abstractly and quantitatively.</li> <li>3. Construct viable arguments and critique the reasoning of others.</li> <li>4. Model with mathematics</li> <li>6. Attend to precision</li> <li>8. Look for and express regularity in repeated reasoning.</li> </ol>	<p><b>Learning Goals:</b></p> <ol style="list-style-type: none"> <li>1. Students will model the problem situation numerically using repeated addition and/or multiplication.</li> <li>2. Students will use exponents to model the problem situation in order to represent the mathematics more efficiently.</li> </ol>	
<p><b>Materials:</b></p> <p><b>Teacher:</b></p> <p>PowerPoint presentation</p> <p><b>Per Student Group:</b></p> <p>Large sheet of poster paper                      Markers (couple per group)</p> <p>Note: Laminating large sheets of poster paper allows for re-use.</p>		

## Teacher Notes:

Introduce the following poem:

**As I was going to St. Ives  
I met a man with seven wives.  
Each of his wives had seven sacks,  
Each of the sacks held seven cats,  
Each of the cats had seven kits.  
Kits, cats, sacks, and wives.  
How many were going to St. Ives?**

\*Multiple illustrations of “Going to St. Ives” can be found in [Google Images](#) and can help students visualize the narrative of the poem.

Ask students how they think this poem relates to math. Eventually, ask students how they could determine how many went to St. Ives. Notice the reference to “how many,” not “how many people.” The question includes people and animals. It is imperative that students **NOT** count the narrator in the total – doing this will complicate the mathematics.

Allow students to work in small groups to determine the answer to the question. Students will likely use repeated addition and/or multiplication. Press them to show their work and their thinking on the large sheets of paper. If students are unable to start, suggest that they use a drawing and/or a numerical representation. Walk from group to group asking questions and making observations in order to enrich the large group conversation that will result from the work of the small groups.

In the large group conversation, ask student groups to present their work. A focus of the dialogue should be the large number of times that one must add seven (7). Multiplying is certainly a more efficient way of solving the problem than repeated addition. Below is just *one* way to conceive of the mathematics –

Man	+	Wives	+	Sacks	+	Cats	+	Kits (or, kittens)	
1	+	7	+	$7 \times 7$	+	$(7 \times 7) \times 7$	+	$(7 \times 7 \times 7) \times 7$	Line 1
1	+	7	+	$7(7)$	+	$49(7)$	+	$343(7)$	Line 2
1	+	7	+	49	+	343	+	2401	Line 3
$7^0$	+	$7^1$	+	$7^2$	+	$7^3$	+	$7^4$	Line 4

The total that went to St. Ives, then, is **2801**. Some students may argue that the “man” is not included in the collective, “Kits, cats, sacks, and wives. How many were going to St. Ives?” **2800**. Both answers can be justified.

**Line 1** above uses repeated multiplication to represent the problem. **Line 2** utilizes the interpretation of multiplication as \_\_\_\_\_ groups of \_\_\_\_\_. This interpretation helps students link the problem to content they learned in elementary school. **Line 3** is the

simplifying of Line 2.

Remind students that, though inefficient, the problem can be solved with repeated addition. Ask them what operation makes repeated addition more efficient – multiplication. Now shift the focus to *repeated* multiplication. The number “7” is multiplied repeatedly. Ask students if they know of a more efficient way to write repeated multiplication? Introduce the concept of *exponents*.

In **Line 1** above, the repeated multiplying of “7” is shown. Tell students that “7” is identified as the *base*. The number of times the *base* is used as a *factor* gives us the *exponent*. Begin with the wives, or  $7^1$ , and build the exponential notation from there. Ask students if they see a pattern forming – the exponents are increasing by 1 from 7 to 2401, or  $7^1$  to  $7^4$ , respectively.

To include the man as part of the exponential notation, ask students to look at the pattern as decreasing by 1, from 2401 to 1, or  $7^4$  to  $7^1$  respectively. Ask students, “If the pattern continued, how could we express the man in exponent notation? Can you see a pattern in what is happening to the exponents?” Subtracting 1 each time would result in  $7^0$  to represent the man.

Tell students that writing  $7 \times 7 \times 7 \times 7$  (the number of kits) does not take too long, as they may not see the need for added efficiency with exponents given this small number of factors. However, pose the following scenario: Using the website <http://www.usdebtclock.org/> round the national debt to the nearest billion.

As of this writing, that value would be 20,000,000,000,000. For the applicability to sixth-grade exponent standards, re-write this number as  $2 \times 10,000,000,000,000$ . The focus is not on scientific notation, but, rather, the efficiency of writing ten trillion in exponent form. Ask students how many times 10 must be multiplied to get a product of ten trillion. 10 must be used as a factor 13 times. Ask students to write 10 as a factor 13 times in order for them to see how time consuming this is. Write the following on the board:

$10 \times 10 \times 10$

Ask students what exponent could be used so that we wouldn't have to write this long multiplication sentence. Rewrite this as simply  $10^{13}$ . Remind students that the more math they know the more efficient they can be!