

Grade 3 Clarifying Lessons: Palindrome Patterns

OLD Resources. These resources have NOT yet been updated to align with the revised elementary mathematics TEKS. These revised TEKS were adopted by the Texas State Board of Education in 2005, with full implementation scheduled for 2006–07. These resources align with the original TEKS that were adopted in 1998 and should be used as a starting point only.

What is a Clarifying Lesson?

A model lesson teachers can implement in their classroom. Clarifying Lessons combine multiple TEKS statements and may use several Clarifying Activities in one lesson. Clarifying Lessons help to answer the question "What does a complete lesson look like that addresses a set of related TEKS statements, and how can these TEKS statements be connected to other parts of the TEKS?"

TEKS Addressed in This Lesson

Number, operation, and quantitative reasoning: 3.1A; 3.3B

Patterns, relationships, and algebraic thinking: 3.6A

Underlying processes and mathematical tools: 3.15C; 3.17A

Materials

- markers
- chart paper
- hundred charts

Lesson Resources

*Collection of Math Lessons from Grades 3-6:
Operations and Computation* by Marilyn Burns

Lesson Overview

Students use addition to create numbers that are palindromes and organize their results to look for patterns.

Mathematics Overview

Students make generalizations from patterns and practice reading large numbers and addition with regrouping.

Set-up (to set the stage and motivate the students to participate)

- Review the concept of a palindrome. A palindrome is a number that reads the same forward and backward, such as 44 or 252 or 8008. (3.1A) A number that is not a palindrome, such as 13, can be changed into a palindrome by adding in a certain way: Reverse the digits to make a new number and add it to the original number. Record how to do this on the board. Since it took one addition, 13 is a one-step palindrome. Some numbers take more than one addition. Demonstrate with 68 (a 3-step palindrome). (3.3B)

$$\begin{array}{r} 13 \\ +31 \\ \hline 44 \end{array} \quad \begin{array}{r} 68 \\ +86 \\ \hline 154 \end{array} \quad \text{and} \quad \begin{array}{r} 154 \\ +451 \\ \hline 605 \end{array} \quad \text{and} \quad \begin{array}{r} 605 \\ +506 \\ \hline 1111 \end{array} \text{ (a palindrome)}$$

- Present the problem to be solved: Each group is to investigate in this way all the numbers from 0 to 99 and look for patterns in how numbers become palindromes. (3.6A, 3.17A)
- Students should decide how to divide up the work within their group and how to keep records of their information. (3.15C) Examples of record-keeping devices include:

listing the numbers 0-99 in a chart showing the number of steps and the palindrome reached;

grouping the numbers 0-99 according to the palindrome they generate;

grouping the numbers 0-99 according to how many steps it takes to make a palindrome. (Tell them to beware of 98 and 89. These numbers each take 24 steps. The palindrome reached is 8,813,200,023,188).

recording the groups of numbers on a hundreds chart by coloring one-step palindromes

red, two-step palindromes green, etc.

Teacher Notes (to personalize the lesson for your classroom)

Guiding Questions (to engage students in mathematical thinking during the lesson)

- How did your group decide to record and organize your information? Why? (3.15C)
- What new things do you see if you reorganize it this way? (3.15C)
- What things have you found to be important in finding the palindromes? (3.3B)

- Are you beginning to notice any patterns? (3.6A)
- What shortcuts, if any, have you developed in finding the information? (3.6A, 3.17A)
- Are one-digit numbers palindromes? Why or why not? (3.17A)

Teacher Notes (to personalize the lesson for your classroom)

Summary Questions (to direct students' attention to the key mathematics in the lesson)

To determine to what extent students' have recognized patterns and made generalizations from them, ask questions such as:

- What are some patterns that emerged on the charts? (Have students record summary statements. Some groups notice, for example, that when the sum of the digits of a number is less than 10, the number is always a one-step palindrome. Others notice that all resulting palindromes are multiples of 11. Have students look for other patterns such as these.) (3.6A, 3.17A)
- How did you categorize the one-digit numbers--as one-step, already palindromes, or not palindromes at all? (There is no right answer for this, but groups should be able to explain their decision based on the patterns they have observed.) (3.17A)

Teacher Notes (to personalize the lesson for your classroom)

Assessment Task(s) (to identify the mathematics students have learned in the lesson)

- Have students write in their mathematics journal a summary paragraph of what they learned about palindromes.
- Give students a number from 0-99 and have them use the chart or table that their group created to describe its behavior when making a palindrome.

Teacher Notes (to personalize the lesson for your classroom)

Extension(s) (to lead students to connect the mathematics learned to other situations, both within and outside the classroom)

- Students can look for words that would be considered palindromes, such as mom, dad, Hannah.
- Students can try to write a sentence that is a palindrome or do research to find some that have been written, e.g. Able was I ere I saw Elba.

Teacher Notes (to personalize the lesson for your classroom)