

# Palindromes

Junior high school

## Objective

- Understand and use the concept of place value in whole numbers.
- Explore a variety of situations that lead to the expression of relationships.
- Construct and interpret formulas and expressions.
- Manipulate algebraic expressions.

## Explanation of the activity

A word that reads the same forwards and backwards, such as “mom” and “level”, is called a palindrome. A palindromic number is exactly the same; the number has the same value whichever way you write the digits. For Example, 212, 34543 and 10001.

## Using the calculator

Calculator functions used: Division

Press the following buttons and then start operation.

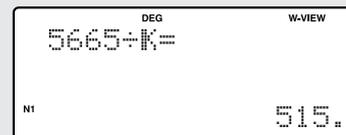
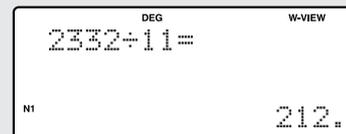


Write down some 4-digit palindromes and use the calculator to divide each of them by 11.

### Example:



5665 [=] etc.



If you type [ON/C] followed by the 4-digit palindrome 2332, the [÷] key, 11, and finally the [=] key, the calculator itself will remember the pattern. So if you want to repeat the division operation with a different 4-digit palindrome (5665), all you need to input is the palindrome followed by the [=] key.

Do you notice a pattern?

The use of the playback function will speed up the calculations and enable students to compare results to look for a pattern.

Make up some more 4-digit palindromes and divide each of them by 11. Have students compare their results until they notice a pattern.

•••••••••• **Using the activity in the classroom** ••••••••••

This is an activity that can first be given to students to work on and the results later discussed as a group. The object is to discover a pattern in the results—the pattern being that the answer will always be a whole number.

•••••••••• **Points for students to discuss** ••••••••••

The pattern may be too obvious for the students to mention, so it may be necessary to give them the following hint:

Try writing the number in its long form; for example,

$$2332 = 2 \times 1000 + 3 \times 100 + 3 \times 10 + 2$$

**Further Ideas**

- Try to explain the problem using algebra. You could start off by giving the class just the first line of the calculation below and let them work on the rest individually or in groups.

$$\begin{aligned} a b b a &= a \times 1000 + b \times 100 + b \times 10 + a \\ &= a \times 1000 + a + b \times 100 + b \times 10 \\ &= a (1000 + 1) + b (100 + 10) \\ &= a \times 1001 + b \times 110 \\ &= a 91 \times 11 + b \times 10 \times 11 \\ &= 11 (91a + 10b) \end{aligned}$$

- Try the activity using 6-digit palindromes.  
Have the class prove that not all 5-digit palindromes are exactly divisible by 11.