Palindrome divisible by 11

(Keywords: Placement value.)
(From: Thinking mathematically)

Question to explore: Are all 4-digit palindromes divisible by 11?

A number like 12321 is called palindrome because it reads the same backwards as forwards. A friend of mine claims that all palindromes with four digits are exactly divisible by 11. Are they?

1. Check the assertion on 4 different cases. Does it hold?

2. Let's try to look systematically:
   a. What is the smallest 4 digits palindrome? Is it divisible by 11?

   b. What is the next smallest? Is it divisible by 11?

   c. And the next? Write the first 5 four-digits palindromes in order. Check that each is divisible by 11.

   d. What is the difference between consecutive palindromes? Does it help you solve the original question?

3. Consider 1991 and 2002. Can you extend your previous results?

4. Alternatively (or in addition), can you prove the above using algebra?

5. Extensions: 5 digits and more?

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