Problem

	1000	100	10	1
1 × 99				
2 × 99				
3 × 99				
4 × 99				
5 × 99				

Calculate and write the first five multiples of 99 in the chart given. What pattern do you notice in each column? Use this pattern to predict the next five multiples of 99. Add then to the chart. Check your predictions with a calculator.

Extensions:

1. Add to your chart the multiples of 99 from 11×99 to 15×99. Use any new patterns you can see to predict and write the next five multiples of 99 (to 20×99). Check with a calculator.

2. Predict and write the multiples of 99 from 21×99 to 25×99. Check with a calculator.

3. WITHOUT USING YOUR CALCULATOR, using the pattern you discovered in 1, predict the value of 89×99.

4. Write the sum of the digits in each product. Describe the results.

Hints

Hint 1 - Would a place value chart be helpful?

Extension:
How would you adapt your place value chart?

Multiple	100's digit	10's digit	1's digit
99	0	9	9

Solution

The first five multiples of 99 are 99, 198, 297, 396, 495. Thus the place value patterns are:

- the ones digit decreases by 1 with each multiple;

- the tens digit remains 9 in each multiple;

- the hundreds digit increases by 1 with each multiple.

Hence the next four multiples are 594, 693, 792, and 891.

Extensions:

1. The next multiples are 990, 1089, 1188, 1287, 1386, 1485, 1584, 1683, 1782, 1881, 1980, 2079, 2178, 2277, 2376, 2475. So, for the multiples from 11×99 to 20×99, the patterns are:

   - the ones digit decreases by 1 with each multiple, going from 9 to 0;
   - the tens digit remains 8;
   - the hundreds digit increases by 1, going from 0 to 9;
   - the thousands digit remains 1 in each multiple.

2. From 21×99 to 25×99, the patterns for the ones and hundreds digit are the same as for 11×99 to 15×99, the tens digit decreases to 7, and the thousands digit changes to 2.

3. We can conclude from our observations in 1. that with each ten multiples of 99 (i.e., each decade of multiples), the patterns for the ones and hundreds digits are the same within each decade. But the tens digit decreases by 1 for each decade (i.e., the tens digit is 9 for 1×99 to 10×99, 8 for 11×99 to 20×99, 7 for 21×99 to 30×99, etc), while the thousands digit is 0 for 1×99, to 10×99, 1 for 11×99 to 20×99, 2 for 21×99 to 30×99, etc). Hence 89×99 would be 8811.

4. The sum of the digits in each product is 18, due to the fact that the sum of the thousands digit and the tens digit is always 9, and the sum of the hundreds digit and the ones digit is always 9.