

Hasenschule: A girl who invented a matrix.

Hitoshi Yamauchi

2013-3-3(Sun)

Abstract: I would like to talk about one of my students. Recently she is practicing addition and subtraction. One day, she invented a matrix.

1 A girl who invented a matrix.

I have a fun to teach C. Six months ago, she had a problem of one digit plus and minus. She often cried in my class. But now she can calculate three digits plus and minus.

One day, she was solving a question shown in Figure 1. I expected the answer as shown in Figure 2. If she could do it, I would be happy.

While I looked other students, she worked on the problem. I just walked next to her, and what I saw was, my god, a matrix! (Figure 3)

I asked her, “Wait a moment! Did you do this alone?” she answered me “Yes, I did. It is not correct?”

It doesn’t matter. The correctness of the calculation doesn’t matter. I was astonished that she organized the answer like this. I could see two vectors in the original ques-

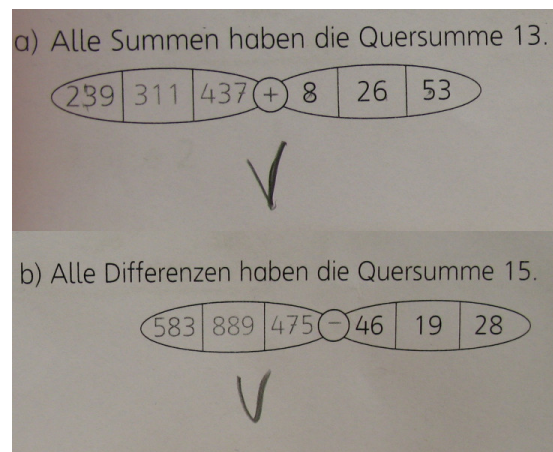


Figure 1: The question.

tion, but both numbers are written in the horizontal direction. She rearranged one of a set of horizontal numbers to the vertical direction and put the operator ‘+’ at the top left. Then she filled the matrix.

This is a reasonable notation. Figure 4 shows how many repetition are there in Figure 2. Each number is repeated three times, the ‘+’, ‘-’, and ‘=’ are repeated nine times.

The upper matrix in Figure 3, the operator ‘+’ is shown up only once, at the top left. Because all the operators are ‘+’. But

she has not removed since the bottom figure uses the different operator '-'. She didn't write '=' at all. This is great, if she removed the '+' or '-' operator, then we cannot see which operator is used. But '=' is always use, so removing that makes no misunderstanding. She wrote this in a minimal and sufficient way.

Moreover, there is no repeated number in Figure 3. Again she wrote minimal and sufficient information. People may make a mistake when they copied anything by hand. The mathematical notation has been developed for long time and I think the matrix form is one of the most compact and sophisticated form. If you use some spreadsheet software (e.g., Excel), you know a spreadsheet is a powerful notation. It is much easier than Figure 2 form.

She might see this form. But even so, she knows how to use it and when to use it. It seems it was so natural to her to organize this calculation in this way. I was moved. I usually don't give a gold point, but, this time, I felt the gold point is for this. I told her she did so great. She might not understand this since it is just natural to her. I hope one day she will understand more deeply what she did today.

One thing I am afraid is that someone think this is too advance to her and say that the answer should be like in Figure 2.

Today, I was surprised and moved. I was happy that I saw children do mathematics so freely.

$$\begin{array}{l}
 239 + 8 = 247 \\
 239 + 26 = 265 \\
 239 + 53 = 292 \\
 311 + 8 = 319 \\
 311 + 26 = 337 \\
 311 + 53 = 364 \\
 437 + 8 = 445 \\
 437 + 26 = 463 \\
 437 + 53 = 490
 \end{array}$$

Figure 2: Expected answer.

Figure 3: A matrix is invented.

$$\begin{array}{l}
 239 + 8 = 247 \\
 239 + 26 = 265 \\
 239 + 53 = 292 \\
 311 + 8 = 319 \\
 311 + 26 = 337 \\
 311 + 53 = 364 \\
 437 + 8 = 445 \\
 437 + 26 = 463 \\
 437 + 53 = 490
 \end{array}$$

Figure 4: Unnecessary duplication.