

Introduction to GER Replacement Units for Mathematics for Elementary School

Why we created replacement units

Tokyo Shoseki’s Mathematics for Elementary School (grades 1-6) is a translation of the original textbook used in Japan. We decided not to change the textbook in any way so that educators could see just how Japanese students learn mathematics. Although most of the chapters in the textbooks are easily transferable to a U.S. classrooms setting, there are some things that may be difficult to understand, namely the Japanese number system. Therefore, we created replacement units that can be used by teachers and students for the 3A chapter on Large Numbers and the 4A chapters on Large Numbers and Approximate Numbers.

The Japanese Number System

The Japanese number system was imported from China. This Chinese number system is also used many other East Asian countries. Like the U.S. system, the Japanese number system is also a base ten system. There are two main differences, however, in the way numbers are written and read. First of all, large numbers are written without commas. The number thirty-four thousand, for example, is written as 34000. Secondly, place value periods contain 4 places while in the U.S. system they contain 3 places.

English		1	4	5,	2	0	0,	3	0	7,	9	1	6,	2	0	0
		Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
Period		Trillions			Billions			Millions			Thousands			Units		

Japanese		1	4	5	2	0	0	3	0	7	9	1	6	2	0	0
	Thousands	Hundreds	Tens	Ones	Thousands	Hundreds	Tens	Ones	Thousands	Hundreds	Tens	Ones	Thousands	Hundreds	Tens	Ones
Period		Cho (Trillions)			Oku (100 millions)			Man (10 thousands)			Units					

In the U.S. number system, the number above is read as “145 trillion, 200 billion, 307 million, 916 thousand, 200 and written with commas as 145,200,307,916,200.

In the Japanese number system, the number above is read as “145 cho, 2003 oku, 791 man, 6200 and written without commas as 145200307916200. Since large numbers are difficult to read without the commas, Japanese students are told to “mark off every 4 places from the right” (see 4A p. 7) to make it easier.

Differences between the textbook and the replacement units

In the replacement units, we not only changed the number system, we also changed the size of the numbers. In Japan it is much more common to use very large numbers due to the nature of the Japanese currency (\$1 is about 115 yen). In the U.S., however, we rarely

use numbers this large. For the changes in the size of the numbers taught, please refer to the table below.

Unit	Textbook	Replacement Unit
3A Large Numbers	To 10 millions	To millions
4A Large Numbers	To quadrillions	To hundred billions
4A Approximate Numbers	To 10 million	No change

Using the textbook and replacement units

Tokyo Shoseki's Mathematics for Elementary School generally uses small numbers, even in higher grade levels, in order to help students focus on the concept without being distracted by calculation difficulty. Therefore, most of the chapters in the textbook are easily transferable to U.S. students. In cases where large numbers are used, the teacher should direct students to place commas every 3 digits from the right, which is a good exercise to help students understand the U.S. number system and why we use commas when we write numbers.

For the 3A chapter on "Large Numbers" and the 4A chapters on "Large Numbers" and "Approximate Numbers" we recommend using the replacement units. The pages on the replacement units correspond to those in the textbook. Names of places were changed, as well as some of the numbers, to reflect the U.S. context. We were careful to make sure, however, that these changes did not diminish the mathematical intent of the original. As an extension activity, after students have finished the replacement unit, it may be interesting to use the textbook to explore the Japanese number system.