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# JAPANESE



# FOR ABACISTS

暑  
き  
日  
や  
ひ  
や  
と  
算  
盤  
枕  
哉

Issa, 1818

# Japanese for Abacists

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# Chapter 1

## In the beginning ...

Since the most modern and advanced abaci are found in Japan, it is a good idea for abacists to have some knowledge of the Japanese language and especially the writing system. Many webpages in Japan deal with the Japanese abacus, the soroban, but are in Japanese only. Part of the vocabulary we use when talking about techniques is Japanese.

This little document wants to explain Japanese characters and words in order to help understand abacus-related texts. It is no complete reference to the Japanese language or writing system and I left out some of the finer details, but I hope it can be an aid to understand Japanese terminology and writing. If you find errors or think I should explain some points better than I did here, please let me know and I will update this document.

## Chapter 2

# The Japanese writing system

Japanese uses three different writing systems: Kanji, hiragana, and katakana. The systems are normally used mixed in the very same sentence. Here is an example of a complete Japanese sentence using hiragana and katakana:

ようこそそろばんワールドへ

It means *Welcome to Abacus world*. It is read (in Japanese): youkoso soroban warudohe. The first part (ようこそ) is in hiragana, reads youkoso and means welcome. The second part (そろばん) is also in hiragana and is read soroban. The last part is in katakana (ワールドへ). Have a close look at the reading warudohe. If you speak it quickly and sloppy you may be able to recognize the English word *world* here. ワールドへ is borrowed from English and the pronunciation was just adopted to the Japanese katakana syllabary!

## Kanji

Kanji are Japanese characters that stand for a word like *book* or *sun*. They are used for writing nouns, adjectives, adverbs and verbs. A kanji can often be regarded as a simplified picture of the object it describes (pictographs), but it can also be an abstract representation of some idea (symbolic). Literally, kanji means 'Chinese character', because they are of Chinese origin. They were adopted by Japan beginning in the 5th century A.D. (via Korea) including their original meaning and pronunciation. Here are some examples of kanji characters: 算盤発生.

There are several thousands of kanji and it takes years for Japanese children to learn them. There is a set of 1945 kanji, the so-called Jouyou kanji, which have been declared for usage in public documents. These should be sufficient to read a newspaper. If you want to read more sophisticated texts or especially old texts, you need to learn more.

漢  
字

## Composite kanji

Kanji characters can stand alone, like in the words *tree* (木) or *waterfall* (瀑), but often a word is composed of more than one kanji. For example, the Japanese word for *Japan* (日本) is composed of the kanji for *sun* (日) and *source/origin* (本). Therefore Japan is also called the land of the rising sun (origin/rise of the sun).

Here is another example loosely related to monetary soroban calculation – the origin of the Yen. Until about 1800 B.C. the Chinese used bivalve shells for money. The kanji for *shellfish* is 貝. A shellfish (in terms of money) combined with a mouth (口), in terms of a human being speaking with an open mouth, represents a new kanji 員 with the meaning ‘person, talking about money’ or employee/member. An employee combined with a coin means Yen. The coin is drawn as a rectangle around the employee: 圓. This is the traditional kanji for the Japanese currency. It is printed on cheques, documents, or receipts of banks, when tradition, accuracy and beauty play an important role. There is another kanji for the Yen used in modern business: 円. It can also mean circle or round.

From this example you can see that kanji characters are normally composed of different building blocks and can have a lot of different meanings. These building blocks are called radicals and there is traditionally a set of 214. From these you can build most kanji.

## Kanji readings

A large number of words and concepts (including the abacus) entered Japan from China without having a native equivalent. Many kanji words entered Japanese directly, with a pronunciation resembling the original Chinese. This Chinese-derived reading is called on-yomi (音読み). At the same time, native Japanese already had words corresponding to many borrowed kanji, they just did not have the writing system to write them down. Kanji were then used to represent these words but with the original Japanese pronunciation. This Japanese-derived reading is known as kun-yomi (訓読み). A single kanji may have both multiple on-yomi and kun-yomi.

One example may illustrate this. The kanji 計 means plot, plan, scheme, or measure. It is a composition of the kanji for the words *say* (言) and the number 10 (十). When the kanji 計 stands alone, the kun-yomi is used and the word is read hakaru. When the kanji is used in combination with other kanji, the on-yomi is used and it is pronounced kei. Some examples are *calculation/reckoning* = 計算 (keisan), *total* = 総計 (soukei), *sum* = 通計 (tsuukei), or *wristwatch* = 露出計 (roshiyutsukei). In books for kanji learners (and in other places) you can often find kanji with small hiragana syllables written immediately above or beside them. These are called furigana (sometimes also ruby), and they tell you the pronunciation of the kanji. Since many kanji have more than one reading, the furigana is there to help learners find the correct pronunciation.

貝  
口  
員  
↓  
圓

はかる  
計  
けい さん  
計算

## Kana

Kana is a collective term for two sets of characters representing sounds, specifically syllables: hiragana and katakana. These were developed in Japan in the 9th century. There are basically 46 characters in each syllabary, each of them representing a syllable that can be transcribed using latin characters (mostly starting with a consonant, like: so, ka, ni). You can write all Japanese words in Kana (also words that are written in kanji normally) and this is how schoolchildren begin to learn Japanese, before they learn kanji.

The kana characters are in fact simplified forms of certain kanji characters and have evolved over time to the present form. Both syllabaries contain the same syllables so there are two possibilities to write a syllable like *so* in *soroban*: in hiragana it is そ and in katakana it is ソ. But how do you know which one to use? Quite easy. Hiragana is used for grammatical endings of verbs, nouns, and adjectives, as well as for particles, and several other original Japanese words not written in kanji. Hiragana is also used for human echoisms like yawning in comic strips (mangas).

Katakana is mostly used for loan words from foreign languages and for non-japanese person names and geographical names that can not be written in kanji. Katakana is also used in company names. Comic strips use katakana for echoisms of animals (like barking), things (explosion), and human actions (like knocking).

Hiragana is also used to show the pronunciation of kanji. To do this, they are written as small characters above or at the side of the kanji (and then called furigana).

Please note that kana has fewer syllables than possible with the latin alphabet. For example, there is no l and no q in Japanese. This becomes important when building loan words.

## Hiragana

Here is the table with the hiragana characters and the corresponding syllables. They are arranged in the traditional order with the vowels in the order a-i-u-e-o. The only syllable missing is the character *n*, which is not a syllable in its strict sense, but only a consonant. It is written ん (much resembling the latin written n) and only used at the end of words. The following tables display the syllables giving the pronunciation and then the hiragana in two different fonts. I have included the tables in two versions with different fonts because there are sometimes subtle differences in the appearance and depending on the font a text is written in, it can be difficult to see what hiragana is printed. For example, the website of the Japanese League for soroban education at <http://www.soroban.or.jp> uses the latter font in the parts where the text is represented by graphics.

か  
な

ひ  
ら  
が  
な

Hiragana syllables in a 'roman' font

a あ	wa わ	ra ら	ya や	ma ま	ha は	na な	ta た	sa さ	ka か
i い		ri り		mi み	hi ひ	ni に	chi ち	shi し	ki き
u う		ru る	yu ゆ	mu む	fu ふ	nu ぬ	tsu つ	su す	ku く
e え		re れ		me め	he へ	ne ね	te て	se せ	ke け
o お	o を	ro ろ	yo よ	mo も	ho ほ	no の	to と	so そ	ko こ

Hiragana syllables in a 'typewriter' font

a あ	wa わ	ra ら	ya や	ma ま	ha は	na な	ta た	sa さ	ka か
i い		ri り		mi み	hi ひ	ni に	chi ち	shi し	ki き
u う		ru る	yu ゆ	mu む	fu ふ	nu ぬ	tsu つ	su す	ku く
e え		re れ		me め	he へ	ne ね	te て	se せ	ke け
o お	o を	ro ろ	yo よ	mo も	ho ほ	no の	to と	so そ	ko こ

You will note that not all fields in the above tables are filled. These sounds are no longer used in Japanese. Note also, there are two characters for the sound o: お and を. The latter was pronounced wo originally, but in modern Japanese it is just o. The difference between お and を is the usage. を is used as a grammatical particle only, while お is used like a normal vowel.

Now try to write the word *soroban*: You can easily find so そ, ro ろ, and the n ん, but there is no ba! This is because we missed some sounds in the above tables. There are two diacritic symbols used to form some further sounds. They change the way certain syllables are pronounced. The sign ̂ (called dakuten or nigori) is normally used to make sounds voiced and the sign ̃ (called handakuten or maru) is used to change h to p. Here are your choices (again in two different fonts):

ga が	gi ぎ	gu ぐ	ge げ	go ご	ga が	gi ぎ	gu ぐ	ge げ	go ご
za ざ	ji じ	zu ず	ze ぜ	zo ぞ	za ざ	ji じ	zu ず	ze ぜ	zo ぞ
da だ	ji ぢ	zu づ	de で	do ど	da だ	ji ぢ	zu づ	de で	do ど
ba ば	bi び	bu ぶ	be べ	bo ぼ	ba ば	bi び	bu ぶ	be べ	bo ぼ
pa ぱ	pi ぴ	pu ぷ	pe ぺ	po ぽ	pa ぱ	pi ぴ	pu ぷ	pe ぺ	po ぽ

And there is the *ba* we needed. So *soroban* is written as そろばん. There are some more syllables (*kyu*, *kya*, *gya*, ...) but I think the ones above are sufficient for now. Let us examine a final example. A complete Japanese sentence in hiragana is: これはそろばんです. The transliteration is: *kore wa soroban desu* (は in this context is pronounced *wa* and not *ha*). What does it mean? *Kore* means *this* and *desu* means *are/is*. The small word *wa* is a particle having grammatical meaning. So the whole sentence can be translated as: *This is a soroban*. You can easily turn this sentence into a question. Just append the particle *ka* to the end of the sentence: これはそろばんですか = Is this a soroban?

# カタカナ

## Katakana

The katakana system contains the same syllables as hiragana, it just uses other characters. Therefore, I will only display the tables with the characters here without explaining again, how they are used. The consonant *n* is written *ン*.

Katakana syllables in a 'roman' font

a ア	wa ワ	ra ラ	ya ヤ	ma マ	ha ハ	na ナ	ta タ	sa サ	ka カ
i イ		ri リ		mi ミ	hi ヒ	ni ニ	chi チ	shi シ	ki キ
u ウ		ru ル	yu ユ	mu ム	fu フ	nu ヌ	tsu ツ	su ス	ku ク
e エ		re レ		me メ	he ヘ	ne ネ	te テ	se セ	ke ケ
o オ	wo ヲ	ro ロ	yo ヨ	mo モ	ho ホ	no ノ	to ト	so ソ	ko コ

Katakana syllables in a 'typewriter' font

a ア	wa ワ	ra ラ	ya ヤ	ma マ	ha ハ	na ナ	ta タ	sa サ	ka カ
i イ		ri リ		mi ミ	hi ヒ	ni ニ	chi チ	shi シ	ki キ
u ウ		ru ル	yu ユ	mu ム	fu フ	nu ヌ	tsu ツ	su ス	ku ク
e エ		re レ		me メ	he ヘ	ne ネ	te テ	se セ	ke ケ
o オ	wo ヲ	ro ロ	yo ヨ	mo モ	ho ホ	no ノ	to ト	so ソ	ko コ

ga ガ	gi ギ	gu グ	ge ゲ	go ゴ
za ザ	ji ジ	zu ズ	ze ゼ	zo ゾ
da ダ	ji チ	du ツ	de デ	do ド
ba バ	bi ビ	bu ブ	be ベ	bo ボ
pa パ	pi ピ	pu プ	pe ペ	po ポ

ga ガ	gi ギ	gu グ	ge ゲ	go ゴ
za ザ	ji ジ	zu ズ	ze ゼ	zo ゾ
da ダ	ji チ	du ツ	de デ	do ド
ba バ	bi ビ	bu ブ	be ベ	bo ボ
pa パ	pi ピ	pu プ	pe ペ	po ポ

We are now able to write the name of Tomoe, the soroban manufacturer, in katakana: トモエ. You will find this name on the boxes in which Tomoe ships their products.

Here is an example using mixed hiragana and katakana. The text is from the top of Tomoe's Japanese online shop: そろばんカタログ. The first word is in hiragana and you already know it. It's *soroban*. The second is in katakana and reads katarogu. It is a loan word from English and means *catalogue*. You can easily recognize the English pronunciation that has been adapted to the katakana syllabary. Since Japanese has no l, the r is used instead. Now, we can see what the text means: soroban catalogue.

## Transliteration and romaji

The term romaji (へボン) is used to describe Japanese text represented using latin characters. So *soroban* is romaji for a Japanese word built from the four kana characters *so*, *ro*, *ba*, and *n*. Sometimes you will find words in Japanese that are transcribed differently. This is because different systems for transcribing the Japanese sounds have evolved over time. Three main systems exist:



- The Nihon system (日本式). This is the system being closest to the original kana pronunciation. It was developed by the physicist Aikitsu Tanakadate in 1885.
- The Kunrei (= Monbusho) system (訓令式). It was developed in 1937 and is based on the older Nihon system, adapted for modern Japanese. The Kunrei system is approved by the ISO (ISO-3602) and also recommended by ANSI. It is the official system used in Japanese schools today.
- The Hepburn system (ヘボン式). It was developed by James Curtis Hepburn, an American missionary, in 1896. It is widely used and is close to English pronunciation.

Here are some of the differences in these three systems:

Kana	Nihon	Kunrei	Hepburn
し	si	si	shi
じ	zi	zi	ji
ち	ti	ti	chi
ぢ	di	zi	ji
つ	tu	tu	tsu
づ	du	zu	zu
ふ	hu	hu	fu
を	wo	o	o

In this document, I tried to follow the Kunrei system. I may not always have succeeded ...

## Chapter 3

# Japanese mathematics

破算

### The Japanese number system

The decimal system known from the Western world is also used in Japan. The numbers from 1 to 9 are quite simple kanji and the lower numbers resemble their meaning by symbolizing a bunch of baboo sticks:

0	零
1	一
2	二
3	三
4	四
5	五
6	六
7	七
8	八
9	九
10	十
100	百
1,000	千
10,000	万
$10^8$	億 = 100,000,000
$10^{12}$	兆 = 1,000,000,000,000
$10^{16}$	京
$10^{20}$	垓
$10^{32}$	溝
$10^{36}$	澗
$10^{40}$	正

Using these kanji, you can write all Japanese numbers up to  $10^{44} - 1$ , which should be enough for a start. Numbers are written with kanji from the largest

element to the smallest element, zeros are implied but not written (as opposed to Chinese). So 11 becomes 十一 (10+1), 12 is 十二 (10+2) and so on until 19 (十九).

But what about 20? This is composed as 2 times 10, becoming 二十. From here it is easy again: 21 = 二十一 ( $2 \times 10 + 1$ ), 22 = 二十二 ( $2 \times 10 + 2$ ), 23 = 二十三, 24 = 二十四, and so on. At some point we reach 99 (九十九) and finally 100 (百). This is the basic schema by which numbers are built in Japanese. You will immediately have noted, that this is very convenient for soroban operation. You can read the number from left to right and instantly transfer it to the soroban.

Let's try with higher numbers. What is 175? That's  $1 \times 100 + 7 \times 10 + 5$ , so the number is spelled 百七十五. In the same manner 386 becomes 三百八十六. Numbers in the thousands are still easy because 1000 has its own kanji: 9274 is 九千二百七十四. Another example, now with zeros in between: 2037 is 二千三十七.

We now reach 10,000, written as 万. From here on, the Japanese number system takes four magnitudes instead of three like in the Western system in order to reach the next steps, 億 and 兆. Some examples:

- 43,076 = 四万三千七十六
- 9,836,703 = 983,6703 = 九百八十三万六千七百三
- 123,456,789 = 1,2345,6789 = 億二千三百四十五万六千七百八十九
- 2,036,521,801 = 20,3652,1801 = 二十億三千六百五十二万八千八百一
- 500,000,000,020,001 = 500,0000,0002,0001 = 五百兆二万一

Now you can see when Japanese numbers become impractical (and we have not tried pronouncing them yet!).

## Decimals and negative numbers

(still to be written)

## Date and time

Now that we know the numbers, it is just a small step to understand dates and times. You just need to know the kanji for the words day, month, and year which are 日, 月, and 年 respectively. (You will have noted that the kanji for *day* is the same as for *sun*.) On countless webpages dates are written like this:

- 2004年 = the year 2004
- 2003年8月13日 = '2003 year 8 month 13 day' = 13 August 2003

Abacus day in Japan is 8月8日. Sometimes you will also see the name of a weekday. These are:

月曜日 Monday (day of the moon)  
火曜日 Tuesday (day of fire)  
水曜日 Wednesday (day of water)  
木曜日 Thursday (day of the tree)  
金曜日 Friday (day of metal)  
土曜日 Saturday (day of the earth)  
日曜日 Sunday (day of the sun)

They are called after phenomena in nature. 13 August 2003 might be written as 2003年8月13日 (水) omitting the 曜日 part which just means 'weekday' and is superfluous here.

## The Japanese abacus

The Japanese abacus is called soroban. It is normally written in hiragana: そろばん. You can also find the word written in kanji as 珠算. This is also pronounced soroban, but this is an irregular spelling. The regular pronunciation is しゅざん (syuzan/shuzan) and this means *calculation with abacus*. The word soroban comes from China originally where the abacus today is called suanpan.

English	romaji	Japanese	comment
frame	waku	枠	
rod	keta	桁	
bead	dama	玉	
unit point	teiten	定位点	built from: determine + rank + spot

(to be continued)

## Chapter 4

# Vocabulary for calculation

There are four basic arithmetic operations: addition, subtraction, multiplication, and division. Here are the Japanese words:

English	romaji	Japanese	comment
number	kazu	数	
calculation with abacus	shuzan	珠算	
addition	kazan	加算	
subtraction	hikizan	引算	
addition/subtraction	mitorizan	見取算	
multiplication	jouzan	乗算	
division	jozan	除算	
number dictation	yomiagezan	読上算	built from: raed + up + number
?? computer	densan	電算	
japanese mathematiacs	wazan	破算	
mental arithmetic	anzan	暗算	

As you can see, one of the kanji (算) is always the same. Standing alone, it can mean a lot of things: calculate, divining, number, abacus, probability. This kanji is composed of the radical of bamboo (竹) and ... (to be continued)

Anzan is another nice word. The first kanji of anzan is 暗, which means *darkness/disappear/be blinded*. You could translate anzan as *arithmetics without sight*, meaning without using your eyes to look on a soroban.