# Instruction Booklet for Using an Abacus for the Blind: Book 1

## Basics of Addition and Subtraction

Reference:
Ministry of Education, Culture, Sports, Science and Technology
Reference Materials for Braille Textbook: Abacus 1

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Preface

In Japanese schools for the blind and special needs education schools for the visually impaired, abacus is used instead of paper and pencil for doing arithmetic.

The history of such a use of abacus can be dated back to 1878, when education for students with visual impairment began. However, an ordinary, widely used abacus is difficult for students with visual impairment to use because the beads move so easily that even a slight unintentional touch by a finger may disrupt the entire computation. A special abacus for the blind was developed, in which beads move up and down not sliding along rods but flipping back and forth.

The special abacus was developed for students with low vision by TAKEDA Koichiro, who worked for the then School for the Blind of Tokyo University of Education (current Special Needs Education School for the Visually Impaired, University of Tsukuba), in around 1953. Later in 1963, Tokyo Horie Shoji started its mass production and has spread it widely.

Takeda learned how to teach abacus by watching how totally blind students used their fingers and developed the “6-finger technique”, which uses the thumbs and the index and middle fingers of both hands to move the beads. His abacus instruction methods for the blind was published in 1960, describing efficient methods of using the fingers and moving the beads for students with visual impairment.

Takeda’s work was later published in an American journal on mathematics, under the title of “The blind and abacus”.[t1] The Japanese methods of teaching abacus to students with visual impairment have spread also outside Japan.

Today, two types of special abacus for the visually impaired are commercially available as Horie abacus. With the initials of the names of those engaged in the development and manufacture of the abacus, the one with smooth bead movements is called Takeda type; and the other, called TH type, is equipped with springs to prevent unintentional bead movements.

Objectives of learning abacus may include increasing the efficiency of computation and entering competitions for demonstrating calculation speed and skills. In education for children with visual impairment, abacus is used as an essential tool for teaching the concepts of numbers and methods of doing arithmetic operations. Abacus is not only a good tool for doing arithmetic but is very effective for teaching the systems of numbers

when it is combined with counting tiles and numerals.

This Booklet was prepared for teachers based on the Reference Materials for Braille Textbook: Abacus 1 by the Ministry of Education, Culture, Sports, Science and Technology and explains the basic methods of doing addition and subtraction using the abacus. Many photos are used to exemplify finger movements to help teachers from all parts of the world to understand them.

References:

WATANABE Sumi, ed., *Booklet for Using Abacus in a Blind School* (in Japanese), School for the Blind, Tokyo University of Education, 1978.

Horie Abacus
Available from the online shop of Japan Braille Library

January 2024

Study Group on Education for Children with Total and Partial Blindness[t2], Elementary Department, Special Needs Education School for the Visually Impaired, University of Tsukuba

I. Special abacus for the blind

1. Types of special abacus for the blind

Special abacus for the blind is commercially available from the online shop of Japan Braille Library under the trade name of “Horie Abacus”.

There are two types. Takeda type focuses on smooth bead movements, and TH type is equipped with springs to prevent unintentional bead movements.

Compared to an ordinary abacus, the beads are larger and flatter and flip back and forth. The abacus is made of plastic and has 23 digits and projecting marks at every three digits to facilitate users recognize the places of a number.

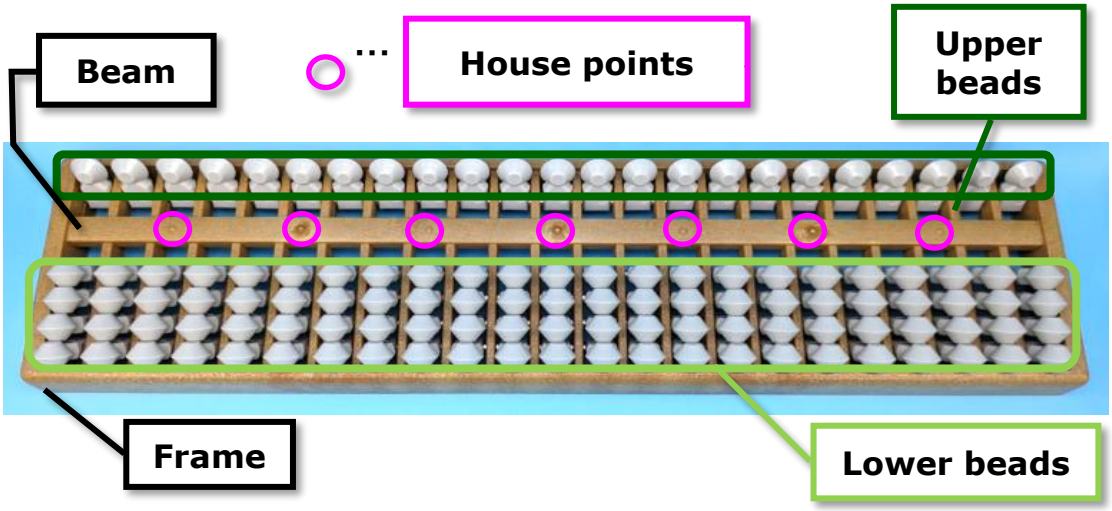
Specifications:
Dimensions: 330mm (width) × 80mm (length) × 25mm (height)
Weight:
Takeda type: 240g, TH type: 285g

Available from:
Online shop of Japan Braille Library

Contact address:
Takadanobaba 1-23-4, Shinjuku, Tokyo 169-8586
Telephone: 03-3209-0751
Facsimile: 03-3200-4133
E-mail: yougu@nittento.or.jp

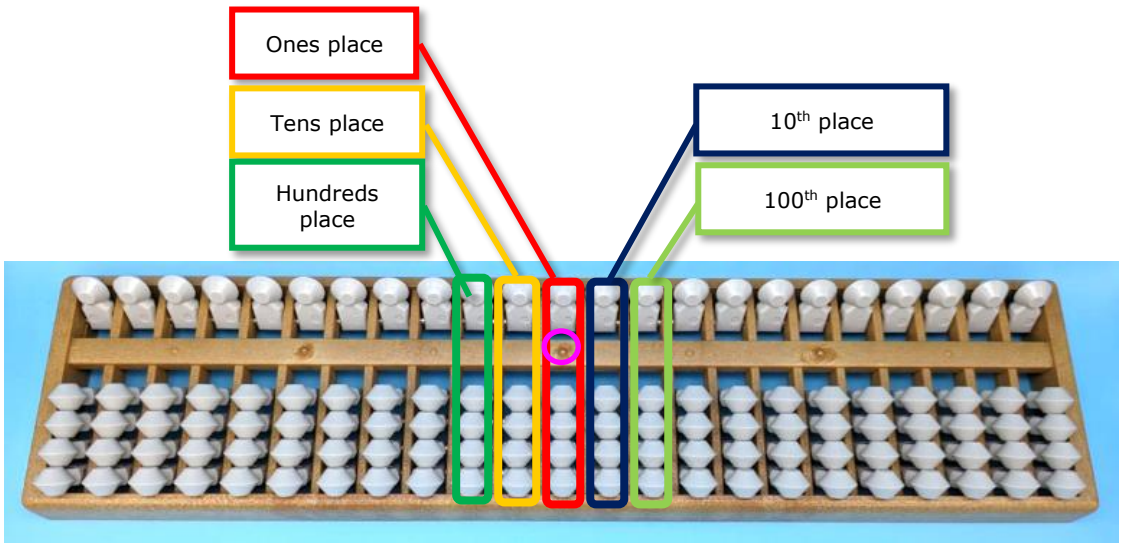
2. How abacus works

An abacus consists of the **frame**, **beam**, **upper beads**, **lower beads** and **house points**.




Each column, which consists of an upper bead and four lower beads, represents a digit of a number. House points are marked every third column, and one of them can be used as the unit column to represent the ones place of a number. The next column to the left represents the tens place of the number, and the second next to the left represents the hundreds place.

The columns to the right from the unit column represent the $10^{th}$, $100^{th}$ and so on places of the number.



3. How to enter a number on an abacus and move the beads

A number can be shown on an abacus by **enter**ing the number by pushing the beads that represent the number toward the beam. The number of beads entered on an abacus can be increased by **push**ing a bead(s) **toward** the beam and decreased by **push**ing a bead(s) **away** from the beam. Use your thumbs and index and middle fingers of both hands to push beads toward and away from the beam. Always be sure to keep touching the beads you have last pushed.

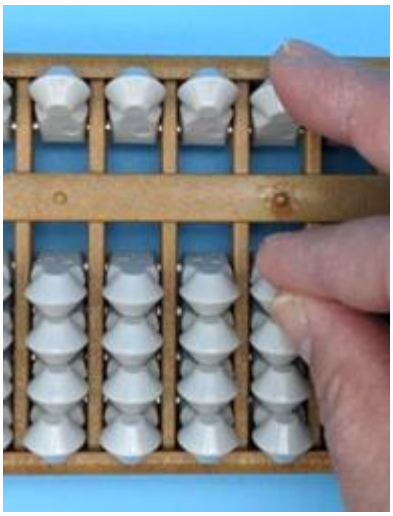
(1) To push a lower bead(s) toward the beam, use the ball of the thumb. To push a lower bead(s) away from the beam, use the ball of the index or middle finger or the nail of the thumb.

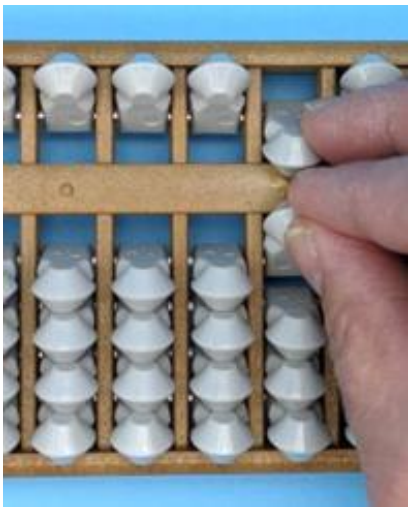
Hold 4 lower beads with a thumb and finger index, and push them toward the beam.

(2) To push an upper bead toward the beam, use the ball of the index or middle finger. To push an upper bead away from the beam, use the nail of the index or middle finger.

Push an upper bead (representing 5) toward and away from the beam using the middle finger.

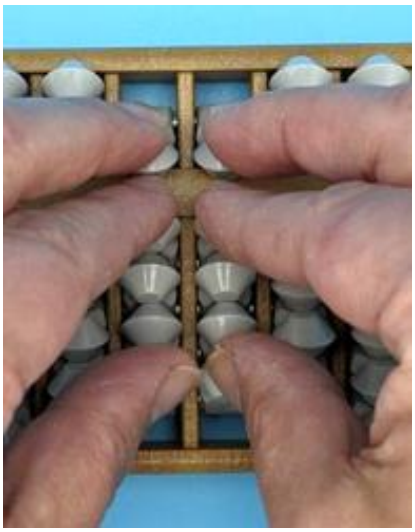
(3) To enter “6”, hold the upper bead and a lower bead with the index or middle finger and the thumb, respectively, and push them toward the beam.





Enter “6” by holding the beads with the thumb and middle finger and pushing them toward the beam.

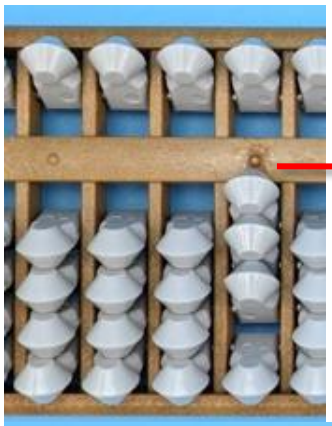
(4) To push beads representing a number larger than 10 toward or away from the beam, it is faster if you use both hands.
For example, to enter “99”, use your left hand to push the beads in the tens place toward the beam and your right hand to push the beads in the ones place toward the beam. Similarly, use both hands to push the beads away from the beam.



Use both hands to push beads toward the beam.

4. How to read abacus

By assuming that the right house point in the photos is for the ones place, the numerals shown by the photos are read as follows.



The number in the ones place is 3.

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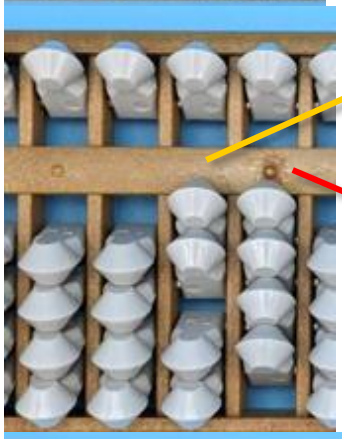

The number in the tens place is 2.

The number in the ones place is 4.

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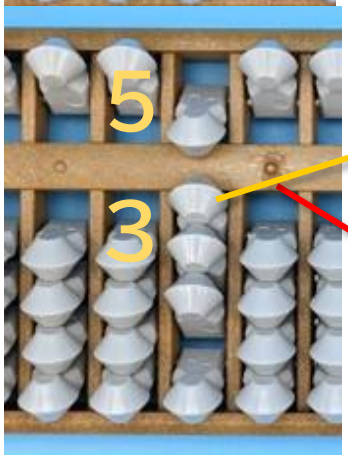


The number in the tens place is 5 plus 3, which is 8.

The number in the ones place is 0.

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II. Basics of addition and subtraction

1. Addition

(1) Computing 1 + 3

① Enter 1 at a house point by pushing one lower bead toward the beam.

② Push 3 lower beads in the same column toward the beam.

③ The answer is 4.

(2) Computing 2 + 5

① Enter 2 by pushing 2 lower beads toward the beam.

② Push the upper bead, which represents 5, toward the beam.

③ The answer is 7.

(3) Computing 3 + 6

① Enter 3 by pushing 3 lower beads toward the beam.

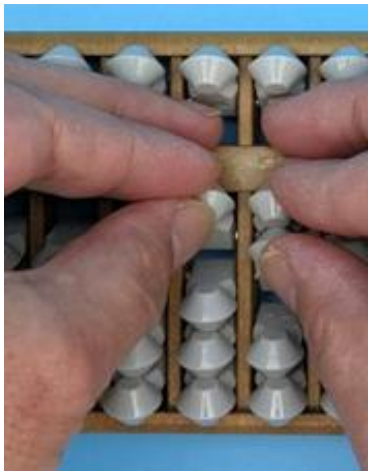
② Push beads that represent 6 (the upper bead plus 1 lower bead) toward the beam.

③ The answer is 9.

(4) Computing 10 + 2

① Enter 1 in the tens place by pushing a lower bead in the tens place toward the beam.

② Enter 2 in the ones place by pushing 2 lower beads in the one place toward the beam.



③ The answer is 12.

2. Subtraction

(1) Computing 4 - 2

① Enter 4 in the ones place by pushing 4 lower beads toward the beam.

② Push 2 beads in the same column away from the beam.

③ The answer is 2.

(2) Computing 8 - 5

① Enter 8 by pushing the upper bead and 3 lower beads toward the beam.

② Push the upper bead (representing 5) away from the beam.

③ The answer is 3.

(3) Computing 9 - 8

① Enter 9 by pushing the upper bead and 4 lower beads toward the beam.

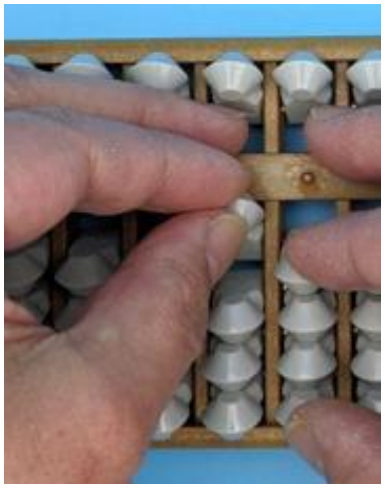
② Push beads that represent 8 away from the beam.
(Push 3 lower beads away from the beam, and then push the upper bead away from the beam. When you have grown accustomed, push the lower and upper beads away from the beam at once.)

③ The answer is 1.

(4) Computing 14 - 4

① Enter 14.
(Enter 10 with you left hand, and enter 4 with your right hand, i.e. push 1 lower bead in the tens place and 4 lower beads in the onces place toward the beam using your left and right hands, respectively.)

② Push 4 away from the beam.



③ The answer is 10.

III. Stock phrases for moving the upper bead

(1) Stock phrases for doing addition by moving the upper bead

When doing addition that involves moving the upper bead, the “stock phrases for doing addition by moving the upper bead” are used.

Adding 4: “Adding 4 is pushing 5 toward and 1 away from the beam.”
Adding 3: “Adding 3 is pushing 5 toward and 2 away from the beam.”
Adding 2: “Adding 2 is pushing 5 toward and 3 away from the beam.”
Adding 1: “Adding 1 is pushing 5 toward and 4 away from the beam.”

Example: Computing 2 + 3

Enter 2 by pushing 2 lower beads toward the beam.
There are only 2 lower beads left. So, the upper bead needs to be used.
Push the upper bead (representing 5) toward the beam.
Because 5 is larger than 3, which is to be added, by 2, push 2 lower beads away from the beam.

Compute by saying, “Adding 3 is pushing 5 toward and 2 away from the beam.”



(2) Stock phrases for doing subtraction by moving the upper bead

When doing subtration that involves moving the upper bead, the “stock phrases for doing subtractopm by moving the upper bead” are used.

Subtracting 4: “Subtracting 4 is pushing 1 toward and 5 away from the beam.”
Subtracting 3: “Subtracting 3 is pushing 2 toward and 5 away from the beam.”
Subtracting 2: “Subtracting 2 is pushing 3 toward and 5 away from the beam.”
Subtracting 1: “Subtracting 1 is pushing 4 toward and 5 away from the beam.”

Example: Computing 5 - 2

Enter 5 by pushing the upper bead toward the beam.
There are no lower beads that can be pushed away from the beam.
So, 2 needs to be subtracted from 5.
Because subtracting 2 from 5 is 3, push 3 lower beads toward the beam.
Push the upper bead away from the beam.

Compute by saying, “Subtracting 2 is pushing 3 toward and 5 away from the beam.”



IV. Stock phrases for addition and subtraction

When doing addition that involves carryover, the “stock phrases for addition” are used. When doing subtraction that involves borrowing, the “stock phrases for subtraction” are used.

(1) Stock phrases for addition

Adding 1: “Adding 1 is pushing 9 away from and 10 toward the beam.”
Adding 2: “Adding 2 is pushing 8 away from and 10 toward the beam.”
Adding 3: “Adding 3 is pushing 7 away from and 10 toward the beam.”
Adding 4: “Adding 4 is pushing 6 away from and 10 toward the beam.”
Adding 5: “Adding 5 is pushing 5 away from and 10 toward the beam.”
Adding 6: “Adding 6 is pushing 4 away from and 10 toward the beam.”
Adding 7: “Adding 7 is pushing 3 away from and 10 toward the beam.”
Adding 8: “Adding 8 is pushing 2 away from and 10 toward the beam.”
Adding 9: “Adding 9 is pushing 1 away from and 10 toward the beam.”

Example: Computing 3 + 8

Enter 3. (This involves pushing 3 lower beads in the ones place toward the beam.)
Because the beads in the ones places that can be pushed toward the beam are not enough to represent 8, think that 8 becomes 10 when 2 is added.
Push 2 away from the beam, and push 10 (one bead in the tens place) toward the beam.

Compute by saying, “Adding 8 is pushing 2 away from and 10 toward the beam.”



(2) Stock phrases for subtraction

Subtracting 1: “Subtracting 1 is pushing 10 away from and 9 toward the beam.”
Subtracting 2: “Subtracting 2 is pushing 10 away from and 8 toward the beam.”
Subtracting 3: “Subtracting 3 is pushing 10 away from and 7 toward the beam.”
Subtracting 4: “Subtracting 4 is pushing 10 away from and 6 toward the beam.”
Subtracting 5: “Subtracting 5 is pushing 10 away from and 5 toward the beam.”
Subtracting 6: “Subtracting 6 is pushing 10 away from and 4 toward the beam.”
Subtracting 7: “Subtracting 7 is pushing 10 away from and 3 toward the beam.”
Subtracting 8: “Subtracting 8 is pushing 10 away from and 2 toward the beam.”
Subtracting 9: “Subtracting 1 is pushing 10 away from and 1 toward the beam.”

Example: Computing 10 – 8

Enter 10. (This involves pushing 1 lower bead in the tens place toward the beam.)
Because 8 cannot be subtracted in the ones place,
think subtracting 8 from 10.
Push 10 (one lower bead in the tens place) away from the beam.
Because subtracting 8 from 10 gives 2, push 2 in the ones place toward the beam.

Compute by saying,
“Subtracting 8 is pushing 10 away from and 2 toward the beam.”