SOROBAN

USEFUL ARITHMETICAL TOOL

• The League for Soroban Education of Japan, Inc.

PREFACE

Soroban, an uncommon word for you perhaps, is what you see in this picture.

In Japan this soroban has been used accurately and rapidly since 500 years ago.

There are many computers nowadays in this electronic age. However, we are still using soroban in banks, business offices and at home for all sorts of calculations.

Soroban is also used as an effective education tool, especially for lower-grade students to understand basic number systems as follows;

1. Soroban has the very simple structure displays the numbers the same way as the decimal system.

2. Easy to understand base-ten and place value for children.

3. You can determine the calculating process step by step.

4. Using a calculating device motivates children to have an active attitude toward study.

5. Practicing soroban develops the children's anzan ability.

We believe soroban is good for both business and educational fields as one of the products of Japanese culture and therefore we would like to introduce the use of soroban all over the world.

We also hope the introduction of soroban will contribute to mutual understanding and the happiness of human beings. We, therefore, wrote this booklet for the above purpose.

We are happy if you are interested in studying soroban.

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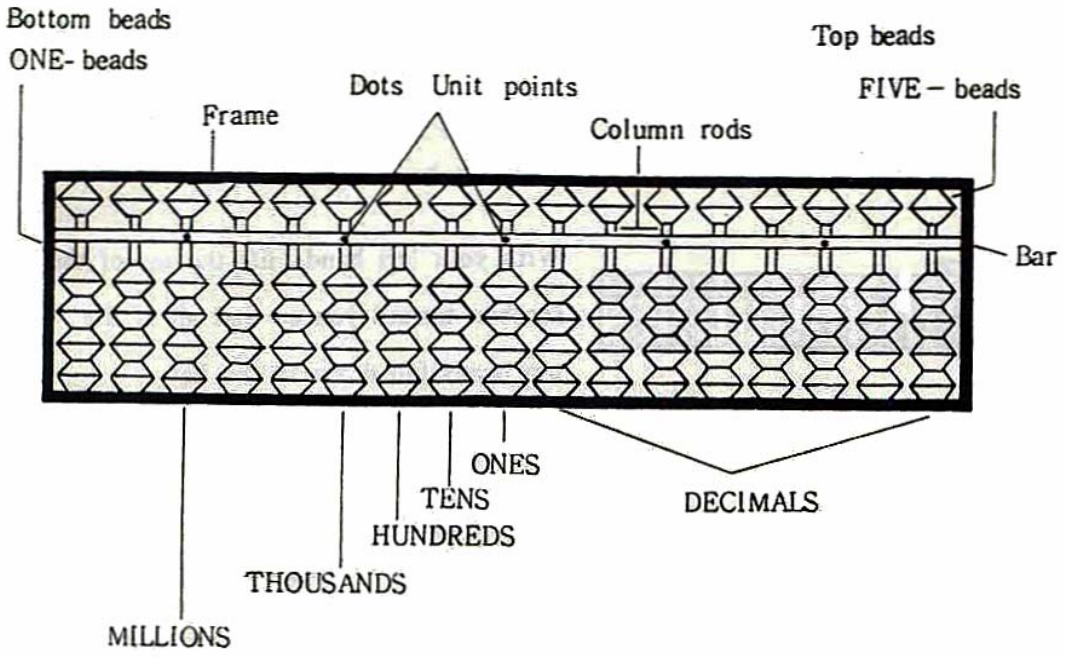
1. Part of Soroban



Structure of Soroban

As illustrated above, the Soroban is calculating instrument with a number of counting beads that slide back and forth along rods.

A cross bar (center bar) divides the Soroban into two parts. The upper part consists of row of the 5-value beads and the lower consisting four rows of the one-value beads. Every single bead above the bar has the value of “five” and the beads below the bar have a value of “one” respectively.

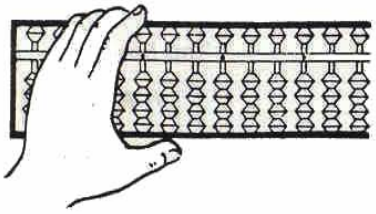
The columns, toward the left always have higher values than those toward the right.

Dots are to be used to indicate the unit point of numbers or a decimal point.

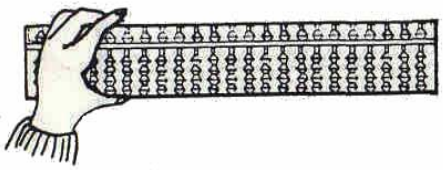
3. Display of Numbers on Soroban

(1) Initial Operation

Here is an easy way to clear the soroban and make it show zero:

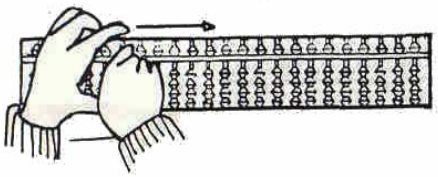


Sit at a desk when you use soroban. Lay the soroban flat on the desk in front of you, and hold the frame with your left hand as shown.



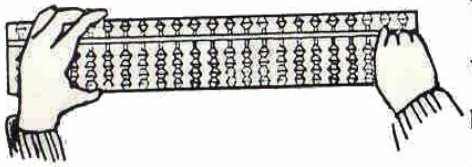
With your left hand, lift the top of the soroban toward you so that all of the top beads fall down to the bar.

Gently lay the soroban down flat.



Move your right forefinger from left to right along the upper edge of the bar.

This will push up all the top beads.



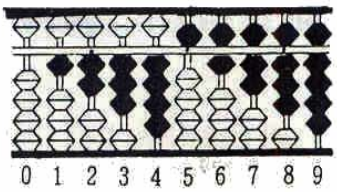
When all beads are pushed away from the bar (all top beads up and all bottom beads down),

the soroban shows ZERO.

(2) How to Display Numbers

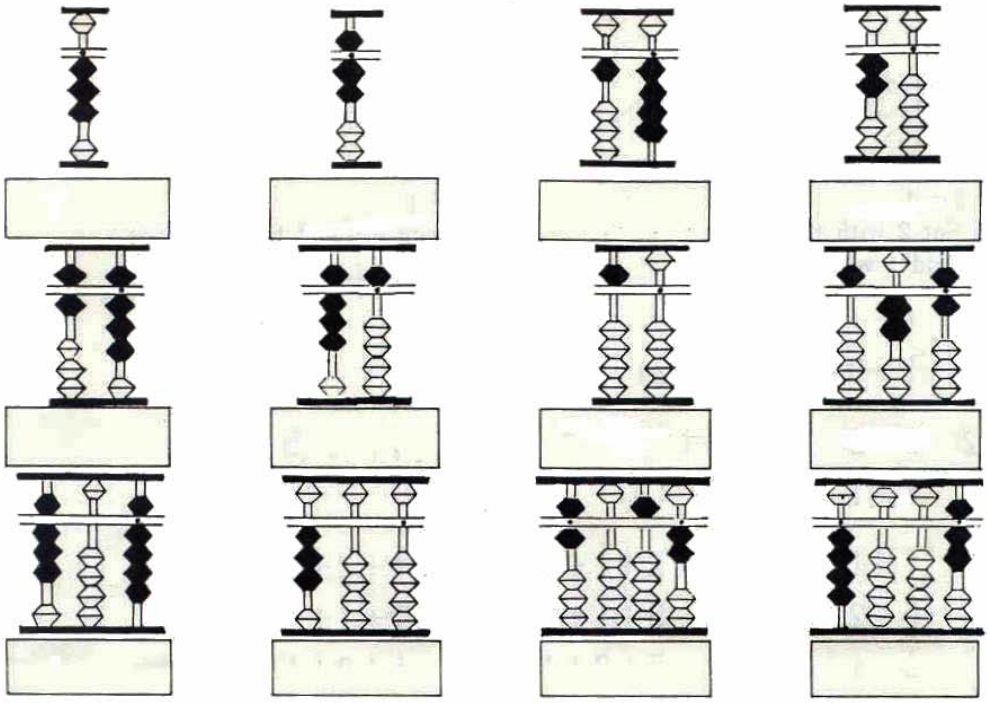
The values of counting beads are determined by their positions. They obtain values when they are pusged toward the center bar lose them when pushed away from the bar.

Numbers one to nine can be displayed on the Soroban as shown in the following chart.



4. Let's Read Soroban

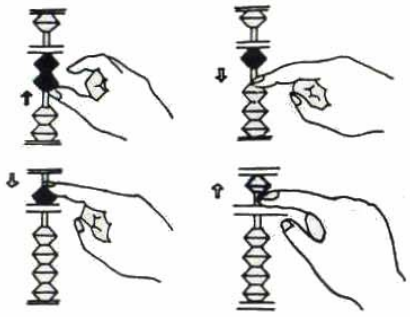
Write the correct number under each picture.



5. Fingering

The following symbols are used to indicate the movement of counting beads and the use of fingers.

- ◇ Bead left intact and/or returned home position
- ◆ Bead being moved for calculation
- ⇕ Slide up or down the bead with forefinger
- ↑ Slide up the bead with thumb



Always use the thumb to add bottom beads. This is the only time the thumb is used.

It never goes above the bar.

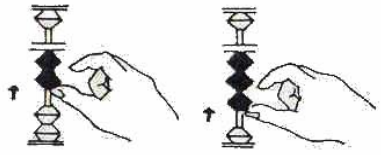
Always use the forefinger to subtract bottom beads.

Always use the forefinger to add top beads.

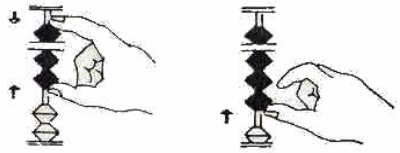
Always use the forefinger to subtract bottom beads.

B. CALCULATION BY SOROBAN

STEP 1



2 + 1
1) Set 2 with thumb
2) Add 1 with thumb

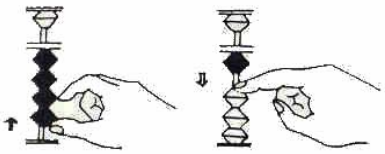


7 + 1
1) Pinch top and bottom beads
2) Add 1 with thumb

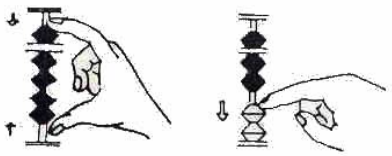
①	1+1	2+1	2+2	3+1
	1+3	11+21	22+12	24+20
②	5+3	7+1	6+3	5+2
	8+1	65+14	76+22	50+10

③	1+1+2	2+1+1	1+2+1
	5+2+1	5+1+2	7+1+1
	6+1+2	5+3+1	6+2+1

STEP 2



4 − 3
1) Set 4 with thumb
2) Subtract 3 with forefinger



9 − 2
1) Set 9, pinch top and bottom beads
2) To subtract, use forefinger.

①	2−1	4−1	4−3	4−2
	3−1	44−32	34−21	41−20
②	9−2	8−1	7−1	8−3
	6−1	97−32	89−34	90−10

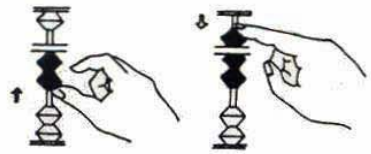
③	4−2+1	1+2−3	3−1−2
	5+4−3	8+1−4	7−2+3
	8−3+1	7+2−3	9−1−2

④

11	21	31	43	14	34
13	23	12	−12	20	−12
−24	−31	−30	13	−34	21

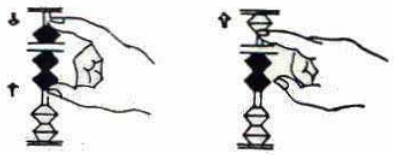
75	68	78	67	58	89
12	31	20	−12	41	−21
−31	−42	−41	23	−32	30

STEP 3



2 + 5

1) Set 2 with thumb
2) Add 5 with forefinger



7 − 5

1) Pinch together 7 (5 and 2)
2) Subtract 5 with forefinger

① 3+5　1+5　4+5　23+15

26+52　47+50　12+55　30+50

② 6−5　9−5　8−5　37−15

83−51　69−50　97−55　80−50

③ 1+5+3　2+2+5　4+5−5

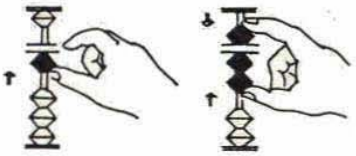
3+5−5　2+5−2　3−2+5

4−3+5　2+5−5　9−5−2

④

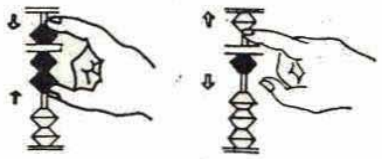
12	32	21	13	21	24
35	51	15	55	53	55
50	15	53	−50	−51	−15

STEP 4



1 + 6

1) Set 1 with thumb
2) Pinch together 6 (5 and 1)



7 − 6

1) Pinch together 7 (5 and 2)
2) Subtract 1 with forefinger
3) Subtract 5 with forefinger

① 2+7 3+6 1+8 2+6
1+7 82+16 11+78 20+70

② 8−7 9−8 8−6 9−7
9−6 37−16 89−68 80−70

③ 3+6−7 8−7+6 7−6+8
1+8−9 2+7−8 1+6−7
9−7+6 3+6−7 9−8−1

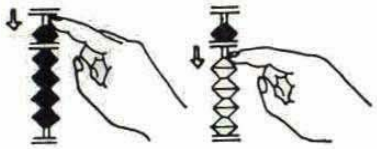
④

12	32	21	11	88	49
76	67	76	87	−63	50
−37	−98	−67	−68	60	−96

⑤

3	7	4	9	4
1	2	5	−2	−3
−2	−3	−6	1	8
19	1	6	83	12
−8	25	92	6	65
73	63	−57	−31	−6
38	71	56	21	25
−26	16	31	72	62
52	−72	−25	−41	−50

STEP 5



4 + 1 Set 4 with thumb

1) Add 5 with forefinger
2) Subtract 4 with forefinger

① 4+1 3+3 3+2 4+4

2+3 54+23 41+24 30+40

② 3+2+1 2+2+1 2+4−5

7−5+3 4+2+2 3+4−6

1+4+2 9−6+3 8−6+4

③

41	32	62	43	27	89
23	53	34	54	31	−58
−14	12	−25	−80	−56	37

④

2	3	2	9	4
1	−2	2	−5	4
3	4	3	1	−7

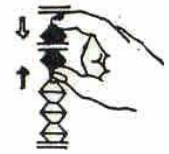
2	23	68	74	4
14	2	−5	−60	92
63	54	13	1	−85

⑤

42	87	31	95	49
31	−56	64	−50	−16
22	48	−70	42	23

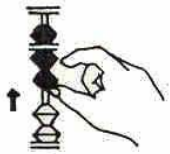
72	41	98	24	43
−50	37	−53	33	24
46	−25	14	40	31

STEP 6

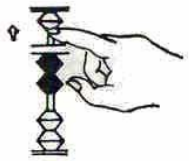


6 − 4

Pinch together 6



1) Add 1 with thumb



2) Subtract 5 with forefinger

① 5−1　　7−3　　5−3　　8−4

6−2　　85−34　　67−34　　50−20

② 5+2−3　　2+6−4　　4+1−3

2+3−1　　2+4−2　　6−3+4

6−4+3　　4+2−3　　9−2−4

③

95	75	14	31	87	32
−81	−43	43	24	−43	34
23	17	−20	−42	30	−43

④

3	5	1	1	7
2	−1	5	7	−3
4	5	−2	−4	−1

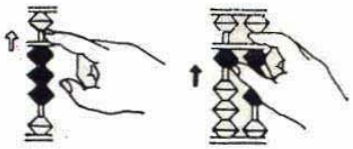
42	76	68	92	54
35	20	−47	5	2
1	−3	2	−84	−25

⑤

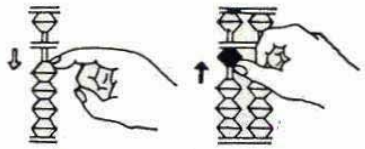
14	34	59	69	23
72	51	−16	−25	32
−65	−40	24	41	−43

75	48	69	37	42
−24	−13	−53	60	56
30	−22	−14	−73	−64

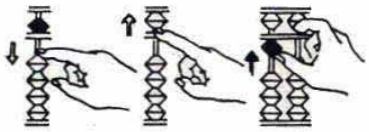
STEP 7



8 + 5 : Pinch together 8
1) Subtract 5 with forefinger
2) Add 10 with thumb



2 + 8 : Set 2 with thumb
1) Subtract 2 with forefinger
2) Add 10 with thumb



6 + 4 : Set 6 with forefinger
1) Subtract 1, 2) Subtract 5,
3) Add 10 with thumb

①	3+8	2+9	4+7	4+6
	1+9	23+19	42+88	30+70
	9+6	8+9	7+8	8+7
	37+9	29+58	68+98	90+90
②	8+5	6+5	7+5	29+5
	26+15	87+52	75+55	80+50
③	8+2	9+3	9+2	26+4
	28+53	82+46	79+34	90+10

④

5	6	1	5	8
−1	−4	1	4	−1
7	8	9	8	9

3	6	1	3	7
5	3	7	6	−1
8	5	5	2	4

⑤ 23+14+29　　84+13−64　　39+32+84

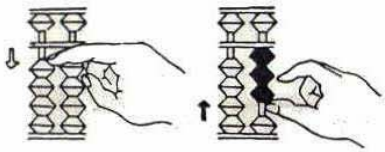
52+23+15　　49+48−83　　94+71−42

⑥

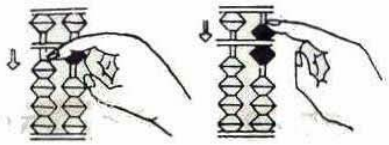
56	23	38	64	78
21	46	49	43	54
43	42	35	24	93

46	97	24	83	61
93	−34	47	34	29
21	52	−41	−13	80

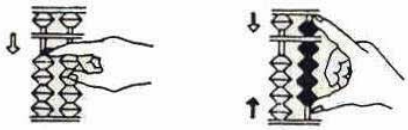
STEP 8



10−7 : Set 10 with thumb
1) Subtract 10 with forefinger
2) Add 3 with thumb



11−5 : Set 11 with thumb
1) Subtract 10 with thumb
2) Add 5 with forefinger



10−1 : Set 10 with thumb
1) Subtract 10 with forefinger
2) Add 9 (pinch together)

①	10−6	12−8	10−7	11−8
	12−9	61−59	101−97	100−80
	15−8	17−9	15−7	15−6
	36−8	86−29	157−98	180−90

②

4	7	18	14	6
6	8	−9	−5	5
−7	−6	7	6	−8
4	8	1	13	7
9	5	9	−5	4
−5	−4	−3	3	−2

③

95	91	82	46	114
−7	−5	−4	−17	−55
79	53	45	35	50
120	176	136	122	89
−89	−98	−57	−43	25
34	17	15	31	−32

④ 62+54−92　　136−93+78　　82+43−51

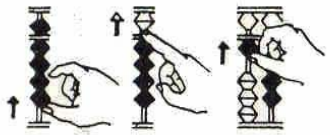
43+65−13　　84+32−23　　156−89+94

⑤

57	85	98	45	95
−29	53	−19	−27	45
52	−47	83	58	−56
92	95	71	82	121
68	−36	−54	77	−89
−53	−41	19	−95	34

add→ / add↓				total
	44	49	42	
	43	45	47	
	48	41	46	
total				

STEP 9



8 + 6 : Set 8
1) Add 1 with thumb
2) Subtract 5, 3) Add 10

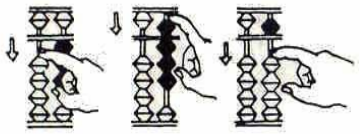
① 5+6 5+9 6+8 25+7
67+27 53+83 67+66 80+60

② 25+57−21 43+35+61 86−40+78
12+43+85 28+46+72 110−45+79

③

3	2	51	46	83
2	4	26	28	64
9	6	67	73	−53
65	38	42	91	76
28	−13	36	−24	46
70	46	64	73	−59

STEP 10



13−8 : Set 13
1) Subtract 10, 2) Add 5
3) Subtract 3

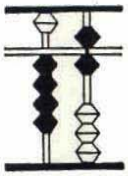
① 12−6 14−9 13−8 42−7
84−28 136−64 141−76 140−60

② 38+45−26 72+21−37 95+41−82
65+61−72 131−76+87 55+67−46

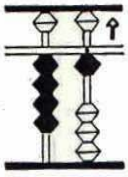
③

6	26	13	134	102
8	7	−6	−76	−37
−9	−8	−4	−24	−41
56	95	143	68	83
78	38	−78	76	36
−69	−47	66	−87	−63

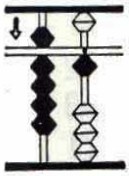
STEP 11



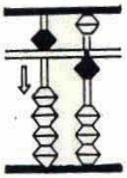
46+5
Set 46



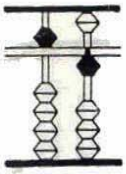
1) Subtract 5 with forefinger



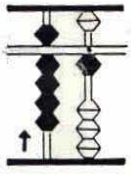
2) Add 50



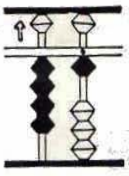
3) Subtract 40 with forefinger



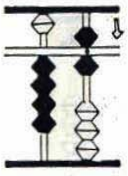
51−5
Set 51



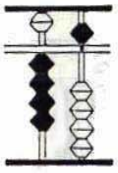
1) Add 40



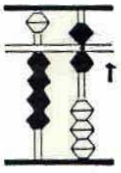
2) Subtract 50



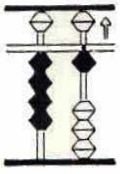
3) Add 5



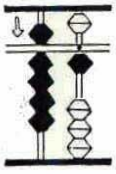
45+6
Set 45



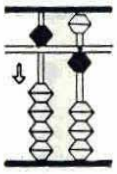
1) Add 1



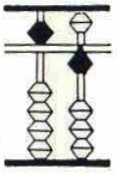
2) Subtract 5



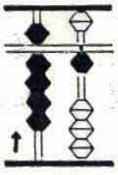
3) Add 50



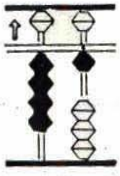
4) Subtract 40



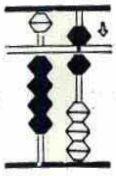
51−6
Set 51



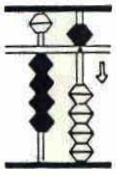
1) Add 40



2) Subtract 50



3) Add 5



4) Subtract 1

① 43+8　　48+7　　48+5　　46+7

18+34　　28+26　　35+18　　19+31

② 52−9　　57−8　　50−5　　52−4

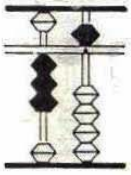
74−26　　72−23　　63−17　　90−41

③

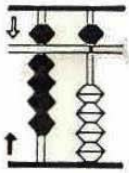
36	98	84	63	16
−23	−71	−46	−57	37
39	29	12	46	−48

61	82	96	74	21
−18	−33	−49	−28	61
31	21	52	15	−36

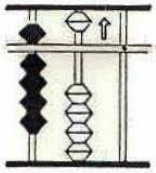
STEP 12



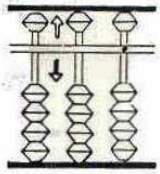
35+65
Set 35



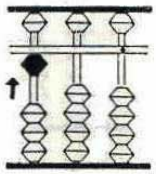
1) Add 60



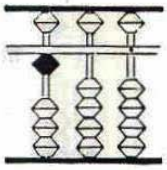
2) Subtract 5



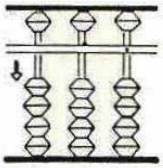
3) Subtract 90



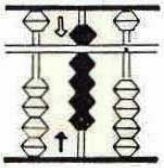
4) Add 100



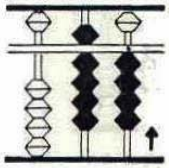
100−6
Set 100



1) Subtract 100



2) Add 90



3) Add 4

① 99+8　　98+3　　96+7　　41+59

35+65　　67+34　　68+36　　47+57

② 107−8　　103−4　　104−6　　130−38

170−74　　124−28　　126−29　　144−48

③

92	73	84	35	21
−38	−25	−75	68	15
49	58	93	43	66

161	75	81	192	86
−67	56	96	−97	27
18	−32	−78	81	−16

④

36+12+65−19　　105−83+79−46

27+26+98−53　　71−24+97−48

101−25+58−37　　91−45+86−34

⑤

48	32	92	59	106
−12	96	−25	89	−12
69	−79	37	31	−48
97	54	48	73	56

⑥

276	58	34	427	62
79	94	42	24	67
48	73	437	94	374
92	46	23	56	98
6	367	68	183	259

378	49	498	786	999
53	87	59	−43	−86
−64	95	−34	−35	−14
86	−36	−28	66	−57
−157	−72	−67	−279	−46

C. ANZAN (MENTAL CALCULATION)

If you close your eyes and concentrate your mind, you can see your parent's face or beautiful views, etc.

In the same way by concentrating to practice, the soroban will develop your imaginative ability in picturizing soroban beads in you head and you can work just as using a real soroban. This is called "reflective image ability", which everybody has.

By using imaginative soroban beads in your head you can calculate addition, subtraction, multiplication, division, which we call "anzan using and imaginative soroban".

By this way, you can calculate without using pencils or papers. It's fantastic isn't it?

Pages from 17 to 20 are specially made for anzan practice. Anzan is one of the final goals in practicing soroban in Japan. The best ways to practice anzan:

1. Asking your instructor or your friends to dictate numbers, moving invisible beads and then put your answers on the soroban.

2. Practice yourself, using soroban and soon after try again on the same problem in anzan.

3. Seeing the numbers, do anzan just as if you were using soroban.

STEP 1

1	2	3	4	5	6	7	8	9	10
1	4	2	3	4	5	3	2	3	4
5	5	5	5	5	5	7	8	7	6
-6	- 9	-7	-8	-9	9	-9	6	-8	9
7	6	9	7	3	-5	5	-5	5	-5
-5	- 5	-5	-5	5	6	-6	9	-7	6

STEP 2

1	2	3	4	5	6	7	8	9	10
4	6	9	3	8	6	7	8	9	6
6	-5	-5	7	-5	4	3	2	1	4
-9	9	6	-6	-3	-1	-2	-9	-8	-7
5	-7	-8	5	9	-5	-5	5	5	5
-6	5	5	-9	-5	6	7	4	3	-8

STEP 3

1	2	3	4	5	6	7	8	9	10
9	1	2	7	5	3	2	4	4	2
−5	9	5	−5	5	1	−1	−3	−2	2
6	7	3	8	−6	6	9	5	8	6
−4	3	−8	−2	5	−4	−6	4	5	−9
−5	−1	5	−5	1	−5	5	−1	5	3

STEP 4

1	2	3	4	5	6	7	8	9	10
9	5	6	9	7	8	6	9	2	3
−5	1	−1	−4	−2	−3	−1	−5	8	−2
6	−5	5	5	3	2	−5	−1	−4	9
−8	9	−2	−9	−5	−5	4	7	−5	−6
1	3	−3	5	7	−1	−2	−9	2	5

STEP 5

1	2	3	4	5	6	7	8	9	10
6	7	8	1	1	1	5	5	4	2
4	3	2	1	2	1	2	4	1	3
5	4	9	5	5	8	3	1	5	5
5	5	1	3	2	7	1	3	1	4
1	1	4	9	3	3	2	1	5	2

STEP 6

1	2	3	4	5	6	7	8	9	10
5	5	5	3	5	7	2	9	1	8
−4	−1	−3	2	−4	−5	−1	−4	4	2
9	6	5	4	2	8	2	−3	−1	−4
−6	−3	3	−5	2	−6	7	2	−3	−1
−3	−2	−1	−2	3	−1	−8	7	9	−2

STEP 7

1	2	3	4	5	6	7	8	9	10
1	1	2	3	5	3	2	4	1	2
6	8	6	7	3	2	1	6	4	8
3	1	2	4	2	2	5	8	5	4
1	5	3	6	6	3	2	2	2	5
5	2	1	8	4	9	8	3	1	1

STEP 8

1	2	3	4	5	6	7	8	9	10
6	9	8	7	7	9	7	9	7	6
5	5	5	5	5	6	8	6	3	1
9	1	2	1	8	5	2	1	8	5
2	5	1	5	9	3	3	5	7	2
5	3	4	2	5	5	1	7	1	6

STEP 9

1	2	3	4	5	6	7	8	9	10
7	3	5	8	6	6	8	7	4	4
2	7	5	5	9	−3	−4	−3	8	1
−4	−5	−9	−9	−1	5	−2	5	−9	−3
−1	−2	2	1	−5	2	8	−8	4	8
5	6	8	−2	−8	−7	−3	4	−3	−9

STEP 10

1	2	3	4	5	6	7	8	9	10
5	5	7	6	8	2	6	6	7	8
6	9	7	8	6	8	−4	3	7	6
3	5	3	2	1	−7	9	5	−8	−9
7	1	8	6	9	9	−6	−9	6	8
1	4	2	3	4	−7	8	1	3	−7

STEP 11

1	2	3	4	5	6	7	8	9	10
33	66	44	87	55	21	55	24	13	86
55	−55	55	−55	24	34	−11	31	42	−31
11	44	−33	23	−13	−53	44	−23	−11	−21
−44	33	−66	44	−55	31	−22	14	22	34
−55	−53	22	−77	68	22	−33	−32	−43	−53

STEP 12

1	2	3	4	5	6	7	8	9	10
21	79	82	42	34	52	75	19	33	70
57	50	70	38	18	35	83	68	29	15
50	21	23	53	49	73	45	95	38	25
32	45	25	70	68	54	12	59	77	66
40	60	44	67	36	97	62	64	45	34

STEP 13

1	2	3	4	5	6	7	8	9	10
70	84	72	36	42	84	25	68	72	89
−26	32	84	25	35	92	89	45	−58	−61
52	−59	−65	91	93	−67	74	32	46	73
34	45	30	−87	−56	31	−63	−70	93	46
−98	−60	99	53	−74	−66	−71	−58	−85	−58

STEP 14

1	2	3	4	5	6	7	8	9	10
46	83	51	94	80	24	38	79	17	72
89	18	60	29	−34	58	90	34	23	89
−70	99	−16	−27	76	71	−29	51	80	−66
55	−66	48	88	79	−56	77	−65	−22	58
−27	−35	−76	−95	−63	24	66	32	36	−97

D. EXAMINATION PROBLEMS

1. 9-Kyu (Nineth Grade)

Addition and Subtraction

(Time limit : 10minutes) (70%accuracy required)

1	2	3	4	5
53	9	6	61	4
94	8	17	3	10
5	60	8	40	78
17	−3	49	−8	1
9	26	3	2	53
36	−14	50	−79	9
8	7	7	24	5
20	8	15	−6	36
7	−52	2	80	9
1	40	39	5	27

6	7	8	9	10
12	8	70	97	5
4	56	4	1	60
8	37	3	30	9
70	−2	91	9	2
4	95	68	−74	84
63	4	2	3	41
85	−10	6	51	6
2	9	50	−5	20
90	71	2	−68	3
6	−3	84	2	78

2. 8-Kyu (Eighth Grade)

Addition and Subtraction

(Time limit : 10minutes) (70%accuracy required)

1	2	3	4	5
26	48	71	34	50
58	30	59	81	97
70	19	48	90	16
32	−64	20	53	81
41	97	36	−72	34
79	70	45	−89	62
25	−35	87	25	40
80	18	14	36	93
69	−21	60	−10	76
43	56	29	67	82

6	7	8	9	10
62	95	39	87	13
53	40	14	16	80
18	28	67	−90	49
37	−67	20	25	37
40	91	75	74	92
85	38	42	−13	60
29	10	36	68	45
54	−53	50	51	28
70	26	79	−42	96
91	−84	18	30	75

3. 7-Kyu (Seventh Grade)

Addition and Subtraction

(Time limit : 10minutes) (70%accuracy required)

1	2	3	4	5
24	731	69	307	825
61	20	854	714	49
307	96	687	−28	306
59	−504	42	650	61
82	658	970	86	293
930	−19	16	39	87
576	471	53	−163	970
648	35	91	921	15
29	140	504	−75	628
804	−86	732	−490	36
72	−327	48	38	401
315	98	120	52	74

6	7	8	9	10
12	580	98	416	93
450	92	406	38	824
79	38	817	45	570
634	601	53	−360	61
506	−13	320	56	936
28	−854	72	701	89
95	478	65	187	45
147	35	937	−72	602
81	921	14	−948	58
370	−62	59	23	730
52	−709	740	−15	419
893	46	621	209	27

4. 6-Kyu (Sixth Grade)

Addition and Subtraction

(Time limit : 10minutes) (70%accuracy required)

1	2	3	4	5
281	19	465	87	603
764	461	209	306	18
79	970	87	572	769
402	48	612	−51	825
690	−132	850	739	57
28	506	96	614	930
943	−94	473	−280	541
87	463	941	892	26
135	−57	324	31	802
291	789	67	905	794
56	−201	35	−763	13
304	315	840	18	630
523	850	972	−49	471
870	−683	51	−654	986
65	72	108	320	24

6	7	8	9	10
74	58	972	36	160
580	801	765	541	387
251	423	17	725	92
48	630	403	−307	548
795	−17	96	79	203
306	546	140	480	76
53	−908	681	−91	694
429	682	28	612	189
170	15	572	−158	21
97	−734	34	73	460
312	491	907	806	975
408	−52	360	594	83
65	−869	95	−62	507
189	320	851	−240	342
236	97	423	831	59

ANSWERS

P. 4

3	6,052
7	4,007
14	
20	
68	
85	
50	
526	
809	
300	

P. 5

STEP 1

2	8	4	
3	8	4	
4	9	4	
4	7	8	
4	9	8	
32	79	9	
34	98	9	
44	60	9	
		9	

STEP 2

1	7	3
3	7	0
1	6	0
2	5	6
2	5	5
12	65	8
13	55	6
21	80	6

P. 6

STEP 3

0	67	8	1
13	98	6	4
13		9	3
44		38	22
0		78	32
43		97	19
56		67	42
57		80	30
57			
78			

9	97	
9	98	
4	89	
3	18	
5	23	
6	64	
6		
2		
2		

P. 7

STEP 4

9	1	2	51
9	1	7	1
9	2	9	30
8	2	0	30
8	3	1	85
98	21	0	3
89	21	8	
90	10	2	
		0	

P. 7

STEP 4

2	64
6	15
3	62
8	52
9	37
84	
89	
41	
58	
71	

P. 8

STEP 5

5		50	6	95
6		97	5	79
5	1	71	7	25
8	5	17	5	87
5	8	2	1	56
77	1	68	79	68
65	7		79	53
70	6		76	59
	6		15	97
			11	98

P. 9

STEP 6

4	4	37	9	21
4	4	49	9	45
2	2	37	4	67
4	4	13	4	85
4	4	74	3	12
51	7	23	78	81
33	5		93	13
30	3		23	2
	3		13	24
			31	34

P. 10

STEP 7

11	15	13	10	11
11	15	11	12	10
11	46	12	11	11
10	87	34	30	17
10	156	41	81	16
42	180	139	128	16
130		130	113	14
100		130	100	13
15				11
17				10

P. 11

STEP 7

66	120
33	111
155	122
90	131
14	225
123	160
	115
	30
	104
	170

P. 12

STEP 8

4	8	3	167	24	80	⇩	⇨
4	9	9	139	121	91		
3	28	16	123	74	162		
3	57	15	64	95	76		
3	59	3	109	93	84	135	135
2	90	8	65	161	107	135	135
4		9	95		18	135	135
20		7	94		36		
7		11	110		64		
8		9	82		66		

P. 13

STEP 9

11	61	14	
14	139	12	
14	124	144	
32	140	147	
94	146	94	
136	144	163	
133		71	
140		142	
		140	
		63	

STEP 10

6	57
5	56
5	54
35	54
56	142
72	76
65	
80	

P. 14

5
25
3
34
24
65
86
131
57
56

P. 15

STEP 11

51	43	52	
55	49	56	
53	45	50	
53	48	52	
52	48	5	
54	49	74	
53	46	70	
50	49	99	
		61	
		46	

P. 16

STEP 12

107	99	103	94	202	501
101	99	106	55	103	638
103	98	102	98	152	604
100	92	146	96	252	784
100	96	102	97	102	860
101	96	112	98		296
104	97	99			123
104	96	99			428
		176			495
		97			796

ANZAN (mental calculation)

P. 17

1	2
2	0
1	8
4	7
2	0
8	4
20	10
0	10
20	10
0	10
20	0

P. 18

3	4
1	3
19	13
7	5
3	6
10	10
1	1
9	2
9	1
20	3
4	9

P. 18

5	6
21	1
20	5
24	9
19	2
13	8
20	3
13	2
14	11
16	10
16	3

P. 19

7	8	9	0
16	27	9	22
17	23	9	24
14	20	11	27
28	20	3	25
20	34	1	28
19	28	3	5
18	21	7	13
23	28	5	6
13	26	4	15
20	20	1	6

P. 20

11	12	13	14
0	200	32	93
35	255	42	99
22	244	220	67
22	290	118	89
79	205	40	138
55	311	74	121
33	277	54	242
14	305	17	131
23	222	68	134
15	210	89	56

P. 21

9-kyu
250
89
196
122
232
344
265
380
46
308

P. 22

8-kyu
523
218
469
215
631
539
124
440
206
575

P. 23

7-kyu
3,907
1,313
4,186
2,051
3,745
3,347
1,153
4,202
280
4,454

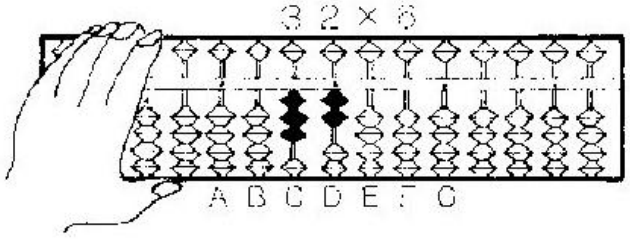
P. 24

6-kyu
5,518
3,326
6,130
2,687
7,489
4,013
1,483
6,344
3,919
4,796

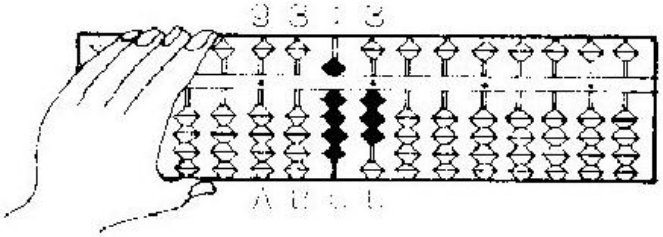
MULTIPLICATION & DIVISION

A. FOREWARD

1. Before studying multiplication and division in the use of soroban, it is better to have a good skill of addition and subtraction to some extent.
2. If you are not confidence in your memory of the multiplication table, it is recommendable for you to use the table in studying multiplication and division.
3. There are several methods of multiplication and division on the soroban. The one introduced in this textbook is a recent method generally accepted in Japan.
4. In the recent method, multiplicand or dividend only is set on the soroban as illustrated below. The answer is produced by observing multiplier or divisor instead of setting them on the soroban.
   (a) Place the top edge of the soroban immediately under the multiplicand or dividend.
   (b) Set multiplicand or dividend on a unit rod at the central part of the soroban.



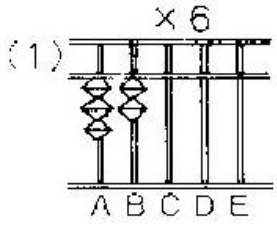
5. The one's place of the product is as follows:
   (a) In multiplication, the one's place of the product becomes the column rod counted off one more than the number of columns equal to the number of digits in the multiplier towards the right from the unit place of the multiplicand.
   As illustrated above 4, the column rod F becomes the one's place of the product according to the numbers of column in the multiplier (one digit plus one equals to two digits).
   (b) In division, the last column shifted to the left from the dividend's unit place one more column than the digits in the divisor becomes the one's place of the product.
   In the following illustration, the column rod B is the one's place of product because of two digits (one digit divisor plus one digit).



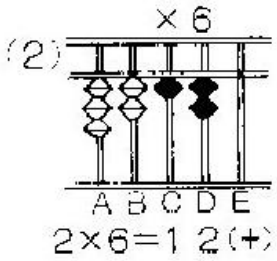
6. The symbol ● used in the illustrations in the following pages indicates products. Also, the symbol ○ indicates multiplicand or dividend.
In order to avoid complication, no numerical value beads are taken away in the illustrations.

B. MULTIPLICATION

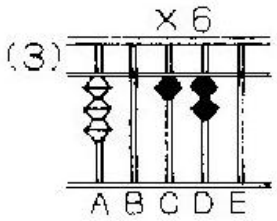
STEP 1 Calculation of problems like 32×6



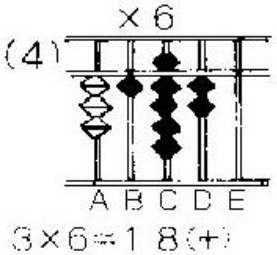
(1) Set the multiplicand 32 on the column rods AB as in the illustration (1).



(2) Multiply 2 in the multiplicand 32 by the multiplier 6, so set $12(2 \times 6)$ on rod C the tens place, and rod D the ones.



(3) Take away 2 multiplyed in the multiplicand 32.



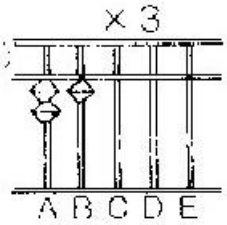
(4) Multiply 30 in the multiplicand 32 by the multiplier 6, so set 180 (30×6) on rod B the hundreds place, and rod C tens.
Take off 30 multiplyed in the multiplicand.

The product is 192.

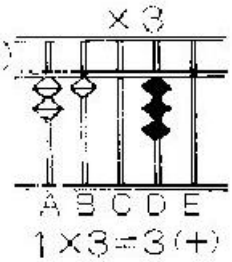
Exercises

① 23×8	⑥ 33×6
② 64×6	⑦ 96×3
③ 42×9	⑧ 73×5
④ 74×8	⑨ 87×2
⑤ 52×7	⑩ 36×4

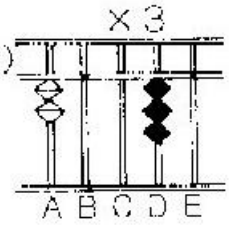
STEP 2 Calculation of problems like 21×3

(1) 

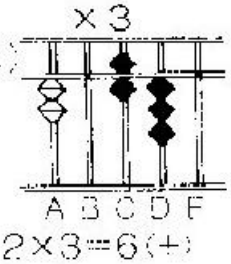
(1) Set the multiplicand 21 on the rods AB as illustrated.

(2) 

(2) Multiply 1 in the multiplicand 21 by the multiplier 3, so set 3 (1×3) on rod D the ones place.

(3) 

(3) Take away 1 multiplyed in the multiplicand 21.

(4) 

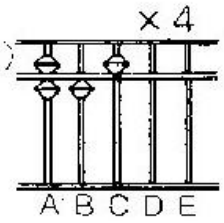
(4) Multiply 20 in the multiplicand by the multiplier 3, so set 60 (20×3) on rod C tens place.
Take off 20 multiplyed in the multiplicand.

The product is 63.

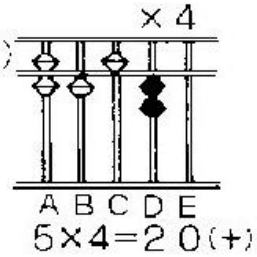
Exercises

① 22×4	⑥ 11×4
② 42×2	⑦ 21×2
③ 23×3	⑧ 13×3
④ 12×2	⑨ 24×2
⑤ 32×3	⑩ 12×4

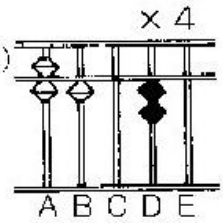
STPE 3 Calculation of problems like 615×4

(1) 

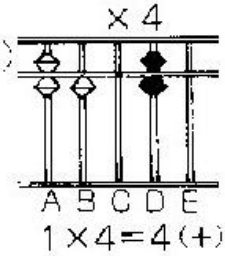
(1) Set the multiplicand 615 on the rods ABC as illustrated.

(2) 

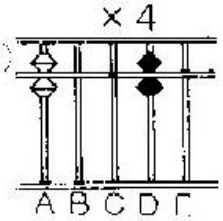
(2) Multiply 5 in the multiplicand 615 by the multiplier 4, so set 20 (5×4) on rod D tens place.

(3) 

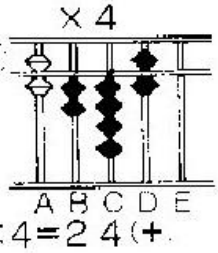
(3) Take away 5 multiplyed in the multiplicand 615.

(4) 

(4) Multiply the multiplicand 10 by the multiplier 4, so set 40 (10×4) on rod D tens place.

(5) 

(5) Take off 10 multiplyed.

(6) 

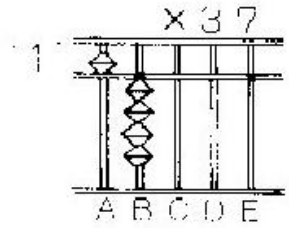
(6) Multiply the multiplicand 600 by the multiplier 4, so set 2,400 (600×4) on rod B the thousands place.
Take away 600 multiplyed.

The product is 2,460.

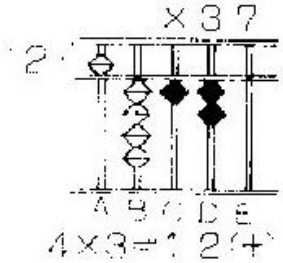
Exercises

① 973 × 5	⑥ 124 × 2	⑪ 652 × 5
② 412 × 8	⑦ 321 × 3	⑫ 875 × 4
③ 357 × 6	⑧ 212 × 4	⑬ 495 × 2
④ 628 × 4	⑨ 537 × 6	⑭ 988 × 5
⑤ 813 × 7	⑩ 718 × 9	⑮ 515 × 2

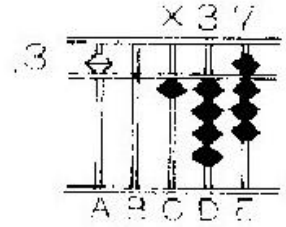
STEP 4 Calculation of problems like 54×37



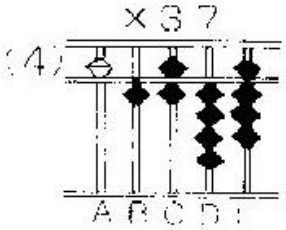
(1) Set the multiplicand 54 on the rod AB as illustrated.



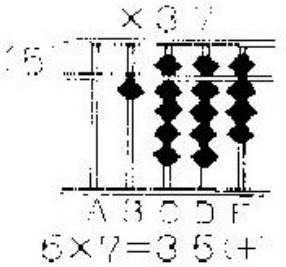
(2) Multiply 4 in the multiplicand 54 by 30 in the multiplier 37, so set 120 (4×30) on rod C the hundreds place and rod D the tens.



(3) Multiply 4 in the multiplicand 54 by 7 in the multiplier 37, so set 28 (4×7) on rod D the tens place and rod E the ones.
Take away 4 multiplyed.



(4) Multiply the multiplicand 50 by 30 in the multiplier 37, so set 1,500 (50×30) on rod B the thousands place.



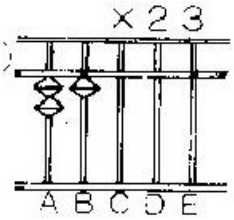
(5) Multiply the multiplicand 50 by 7 in the multipiler 37, so set 350 (50×7) on rod C the hundreds place and rod D the tens.
Take off 50 multiplyed.

The product is 1,998.

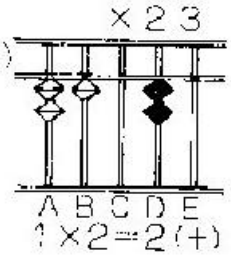
Exercises

① 43 × 44
② 33 × 54
③ 45 × 33
④ 53 × 75
⑤ 74 × 33
⑥ 23 × 76
⑦ 68 × 38
⑧ 37 × 87
⑨ 98 × 26
⑩ 34 × 47

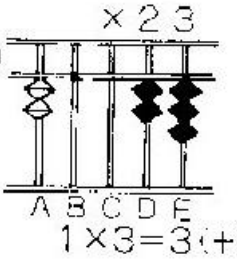
STEP 5 Calculation of problems like 21×23

(1) 

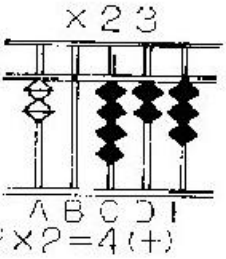
(1) Set the multiplicand 21 on the rod AB as illustrated.

(2) 

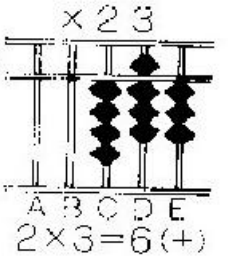
(2) Multiply 1 in the multiplicand 21 by 20 in the multiplier 23, so set 20 (1×20) on rod D the tens place.

(3) 

(3) Multiply 1 in the multiplicand 21 by 3 in the multiplier 23, so set 3 (1×3) on rod E the ones place.
Take away 1 multiplyed.

(4) 

(4) Multiply the multiplicand 20 by 20 in the multiplier 23, so set 400 (20×20) on rod C the hundreds place.

(5) 

(5) Multiply the multiplicand 20 by 3 in the multiplier 23, so set 60 (20×3) on rod D the tens place.
Take away 20 multiplyed.

The product is 483.

Exercises

① 23×13

② 12×33

③ 11×54

④ 32×12

⑤ 14×21

⑥ 31×22

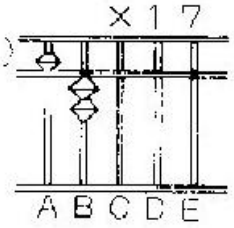
⑦ 13×23

⑧ 32×31

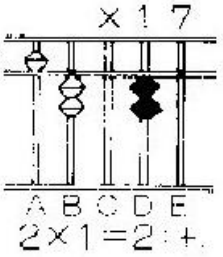
⑨ 64×11

⑩ 12×42

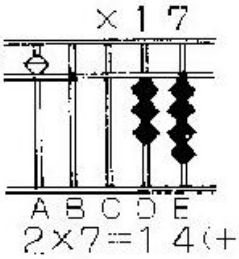
STEP 6 Calculation of problems like 52×17

(1) 

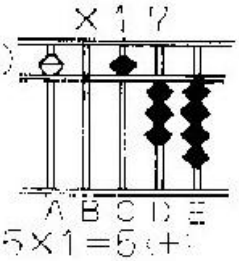
(1) Set the multiplicand 52 on the rods AB as illustrated.

(2) 

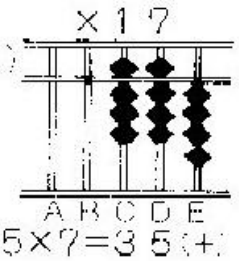
(2) Multiply 2 in the multiplicand 52 by 10 in the multiplier 17, so set 20 (2×10) on rod D the tens place.

(3) 

(3) Multiply 2 in the multiplicand 52 by 7 in the multiplier 17, so set 14 (2×7) on rod D the tens place and rod E the ones.
Take away 2 multiplyed.

(4) 

(4) Multiply the multiplicand 50 by 10 in the multiplier 17, so set 500 (50×10) on rod C the hundreds place.

(5) 

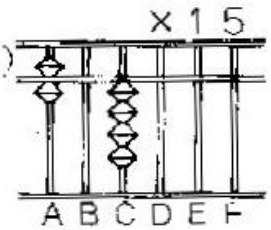
(5) Multiply the multiplicand 50 by 7 in the multiplier 17, so set 350 (50×7) on rod C the hundreds place and rod D the tens.
Take away 50 multiplyed.

The product is 884.

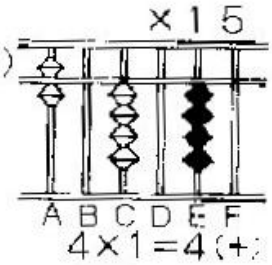
Exercises

① 62 × 16
② 53 × 15
③ 96 × 18
④ 53 × 71
⑤ 32 × 62
⑥ 56 × 91
⑦ 47 × 80
⑧ 12 × 50
⑨ 30 × 79
⑩ 40 × 25

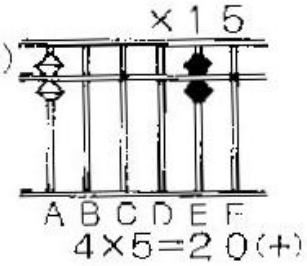
STEP 7 Calculation of problems like 604×15

(1) 

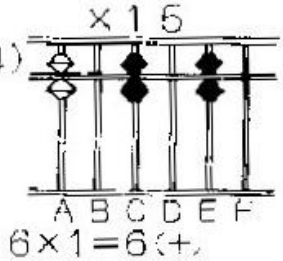
(1) Set the multiplicand 604 on the rods ABC as illustrated.

(2) 

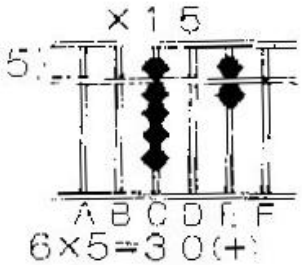
(2) Multiply 4 in the multiplicand 604 by 10 in the multiplier 15, so set 40 (4×10) on rod E.

(3) 

(3) Multiply 4 in the multiplicand 604 by 5 in the multiplier 15, so set 20 (4×5) on rod E. Take away 4 multiplyed.

(4) 

(4) Multiply the multiplicand 600 by 10 in the multiplier 15, so set 6,000 (600×10) on rod C.

(5) 

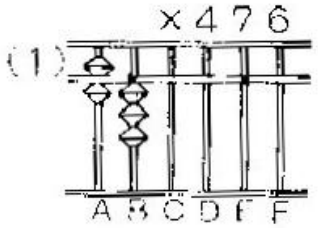
(5) Multiply the multiplicand 600 by 5 in the multiplier 15, so set 3,000 (600×5) on rod C. Take away 600 multiplyed.

The product is 9,060.

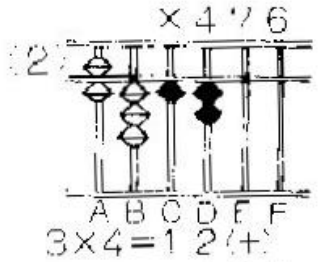
Exercises

① 802 × 25	⑥ 543 × 27
② 504 × 13	⑦ 819 × 45
③ 744 × 63	⑧ 435 × 72
④ 638 × 87	⑨ 380 × 51
⑤ 288 × 25	⑩ 630 × 32

STEP 8 Calculation of problems like 63×476

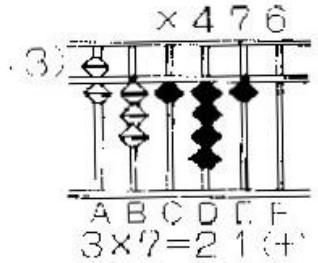


(1) Set the multiplicand 63 on the rods AB as illustrated.

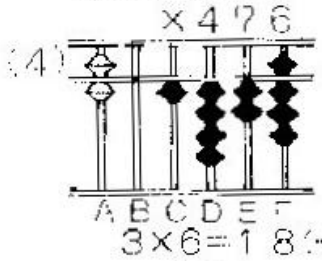


(2) Multiply 3 in the multiplicand 63 by 400 in the multiplier 476, so set 1,200 (3×400) on the rods CD.

(3) Multiply 3 in the multiplicand 63 by 70 in the multiplier 476, so set 210 (3×70) on the rods DE.

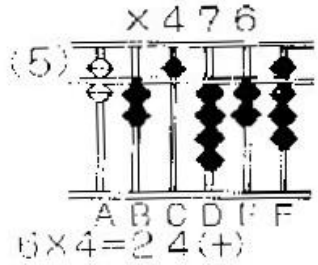


(4) Multiply 3 in the multiplicand 63 by 6 in the multiplier 476, so set 18 (3×6) on the rods EF. Take away 3 multiplyed.



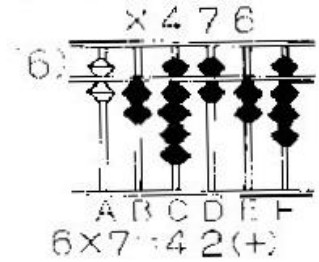
(5) Multiply the multiplicand 60 by 400 in the multiplier 476, so set 24,000 (60×400) on the rods BC.

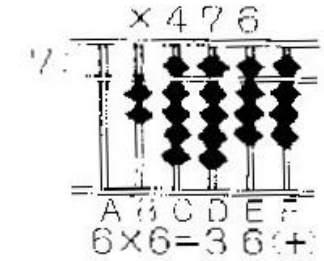
(6) Multiply the multiplicand 60 by 70 in the multiplier 476, so set 4,200 (60×70) on the rods CD.



(7) Multiply the multiplicand 60 by 6 in the multiplier 476, so set 360 (60×6) on the rods DE. Take away 60 multiplyed.

The product is 29,988.

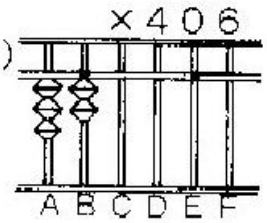




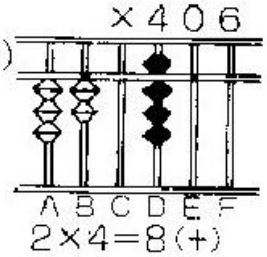
Exercises

①	84 × 367	⑥	27 × 572
②	67 × 234	⑦	24 × 763
③	43 × 629	⑧	56 × 125
④	64 × 256	⑨	18 × 457
⑤	25 × 485	⑩	29 × 913

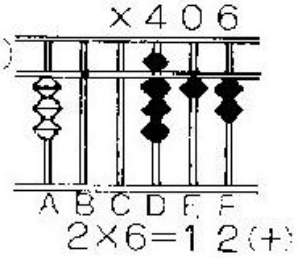
STEP 9 Calculation of problems like 32×406

(1) 

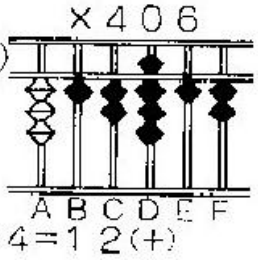
(1) Set the multiplicand 32 on the rods AB as illustrated.

(2) 

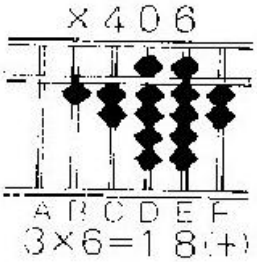
(2) Multiply 2 in the multiplicand 32 by 400 in the multiplier 406, so set 800 (2×400) on the rod D.

(3) 

(3) Multiply the multiplicand 2 by 6 in the multiplier 406, so set 12 (2×6) on the rods EF.
Take away 2 multiplyed.

(4) 

(4) Multiply the multiplicand 30 by 400 in the multiplier 406, so set 12,000 (30×400) on the rods BC.

(5) 

(5) Multiply the multiplicand 30 by 6 in the multiplier 406, so set 180 (30×6) on the rods DE.
Take away 30 multiplyed.

The product is 12,992.

Exercises

① 75 × 403	⑥ 28 × 504
② 94 × 701	⑦ 43 × 802
③ 53 × 604	⑧ 25 × 604
④ 21 × 407	⑨ 28 × 309
⑤ 62 × 205	⑩ 76 × 108

ANSWERS

×

STEP 1 (P3)

184	198
384	288
378	365
592	174
364	144

STEP 2 (P4)

88	44
84	42
69	39
24	48
96	48

STEP 3 (P5)

4,865	248	3,260
3,296	963	3,500
2,142	848	990
2,512	3,222	4,940
5,691	6,462	1,030

STEP 4 (P6)

1,892	1,748
1,782	2,584
1,485	3,219
3,975	2,548
2,442	1,598

STEP 5 (P7)

299	682
396	299
594	992
384	704
294	504

STEP 6 (P8)

992	5,096
795	3,760
1,928	600
3,763	2,370
1,984	1,000

STEP 7 (P9)

20,050	14,661
6,552	36,855
46,872	31,320
55,506	19,380
7,200	20,160

STEP 8 (P10)

30,828	15,444
15,678	18,312
27,047	7,000
16,384	8,226
12,125	26,477

STEP 9 (P11)

30,225	14,112
65,894	34,486
32,012	15,100
8,547	8,652
12,710	8,208

÷

STEP 1 (P12)

12	13
23	33
41	22
32	11
21	11

STEP 2 (P13)

32	79
45	46
94	67
98	59
62	63

STEP 3 (P14)

13	52
31	29
27	51
64	18
12	72

STEP 4 (P15)

243	293
124	428
357	811
471	251
129	915

STEP 5 (P16)

101	3,030
103	4,006
104	4,003
205	4,005
110	7,050
420	3,750
3,001	1,200
5,009	7,000

STEP 6 (P17)

4	2	3
3	2	3

STEP 7 (P18)

6	4	4
7	7	6

STEP 8 (P19)

21	72
23	12
31	42
34	21
12	23

STEP 9 (P20)

46	34
95	55
23	42
23	35
54	24

STEP 8~9 (P20)

15	42
27	41
51	26
64	24
14	15

STEP 11 (P22)

7	6
4	5
7	7
8	6
70	40

STEP 12 (P24)

57	67
78	29
43	36
58	58
37	68

STEP 13 (P25)

87	97
84	46
86	79
59	28
27	38

STEP 14 (P27)

6	914
7	308
45	703
21	346
94	602

STEP 15 (P28)

47	701
14	108
91	832
53	203
35	407

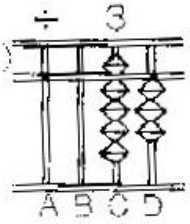
STEP 16 (P31)

69	39
89	83
59	59
49	78
88	57

C. DIVISION

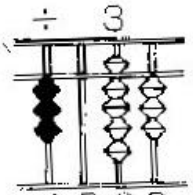
STEP 1 Calculation of problems like $93 \div 3$

(1) ÷ 3



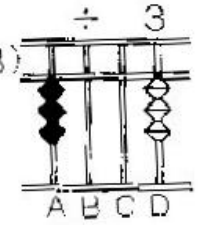
(1) Set the dividend 93 on the rods CD as illustrated. Compare the divisor 3 with 9 in the dividend 93, and find the quotient 3 by $9 \div 3$.
The quotient 3 as given by the tens' dividend, $90 \div 3$ shows 30.

(2) ÷ 3



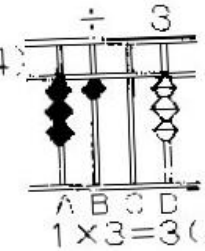
(2) Set the quotient 30 on the rod A, the second rod (skip one rod) to the left of 9 in the dividend 93. Then multiply the divisor 3, and subtract the product 90 (30×3) from the dividend 90 on the rod C.

(3) ÷ 3



(3) Compare the divisor 3 with the remaining dividend 3, and find the quotient 1 by $3 \div 3$.

(4) ÷ 3



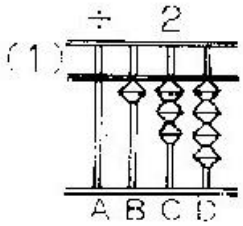
(4) Set the quotient 1 on the rod B, the second rod (skip one rod) to the left of the dividend 3. Then multiply the divisor 3, and subtract the product 3 (1×3) from the dividend 3 on the rod D.

The quotient is 31.

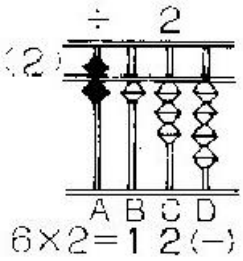
Exercises

① $48 \div 4$
② $69 \div 3$
③ $82 \div 2$
④ $64 \div 2$
⑤ $84 \div 4$
⑥ $39 \div 3$
⑦ $66 \div 2$
⑧ $88 \div 4$
⑨ $55 \div 5$
⑩ $77 \div 7$

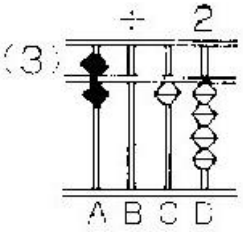
STEP 2 Calculation of problems like 134÷2



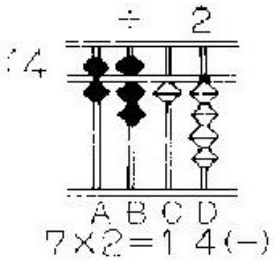
(1) Set the dividend 134 on the rods BCD as illustrated.
Compare the divisor 2 with 1 in the dividend 134. But, it can't be divided in integral number.
Then, compare 2 with 13 in 134, and find the quotient 6 by 13÷2.
The quotient 6 as given by the tens' dividend, 130÷2 shows 60 (the remainder 10).



(2) Set the quotient 60 on the rod A, to the left of 13 in the dividend 134.
Then multiply the divisor 2, and subtract the product 120 (60×2) from the dividend 130 on the rods BC.



(3) Compare the divisor 2 with the remaining dividend 14, and find the quotient 7 by 14÷2.



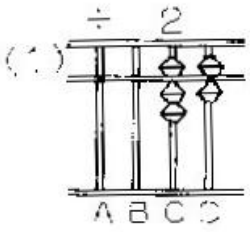
(4) Set the quotient 7 on the rod B, to the left of the dividend 14, and subtract the product 14 (7×2) from the 14 on rods CD.

The quotient is 67.

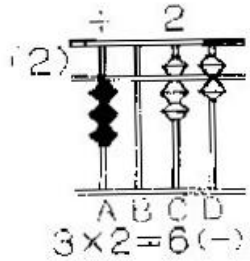
Exercises

① 192 ÷ 6	⑥ 158 ÷ 2
② 225 ÷ 5	⑦ 368 ÷ 8
③ 376 ÷ 4	⑧ 201 ÷ 3
④ 882 ÷ 9	⑨ 531 ÷ 9
⑤ 434 ÷ 7	⑩ 504 ÷ 8

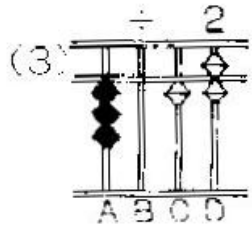
STEP 3 Calculation of problems like $76 \div 2$

(1) 

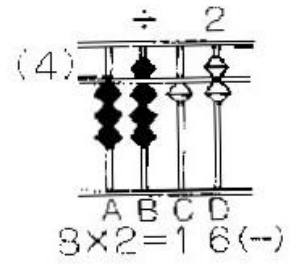
(1) Set the dividend 76 on the rods CD as illustrated. Compare the divisor 2 with 7 in the dividend 76, and find the quotient 3 by $7 \div 2$.
This quotient 3 as given by the tens' dividend, $70 \div 2$ shows 30 (the remainder 10).

(2) 

(2) Set the quotient 30 on the rod A, the second rod (skip one rod) to the left of 7 in the dividend 76.
Then multiply the divisor 2, and subtract 60 (30×2) from the 70 on rod C.

(3) 

(3) Compare the divisor 2 with the remaining dividend 16, and find the quotient 8 by $16 \div 2$.

(4) 

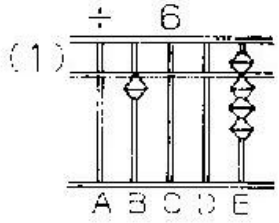
(4) Set the quotient 8 on the rod B, to the left of the dividend 16, and subtract the product 16 (8×2) from the 16 on rods CD.

The quotient is 38.

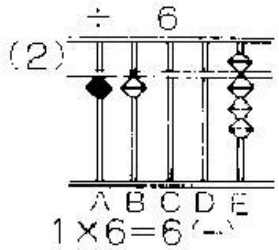
Exercises

①	$65 \div 5$	⑥	$208 \div 4$
②	$279 \div 9$	⑦	$58 \div 2$
③	$81 \div 3$	⑧	$357 \div 7$
④	$128 \div 2$	⑨	$72 \div 4$
⑤	$96 \div 8$	⑩	$216 \div 3$

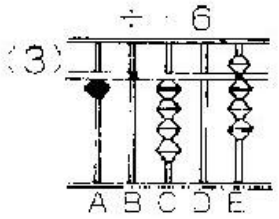
STEP 4 Calculation of problems like 1,008÷6



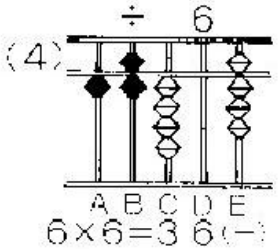
(1) Set the dividend 1,008 on the rods BCDE as illustrated.
Compare the divisor 6 with 1 in the dividend 1,008. But, it can't be divided in integral number. Then, compare 6 with 10 in 1,008, and find the quotient 1 by 10÷6.
This quotient 1 as given by the hundreds' dividend, 10 hundreds ÷6 shows 1 hundred (the remainder 4 hundreds).



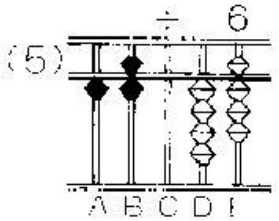
(2) Set the quotient 1 hundred on the rod A, to the left of 10 in the dividend 1,008. Then, multiply the divisor 6, and subtract the product 600 (100 ×6) from the dividend 10 hundreds on the rods BC.



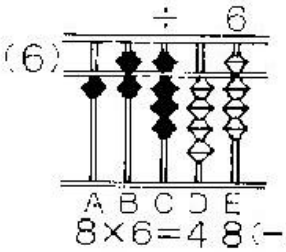
(3) Compare the divisor 6 with 40 in the remaining dividend 408, and find quotient 6 (60) by 40÷6.



(4) Set the quotient 6 (60) on the rod B, to the left of 40 in the dividend 408. Then, multiply the divisor 6, and subtract the product 360 (60×6) from the dividend 400 on the rods CD.



(5) Compare the divisor 6 with the remaining dividend 48, and find the quotient 8 by 48÷6.



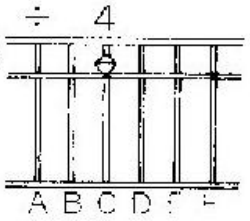
(6) Set the quotient 8 on the rod C, to the left of the dividend 48, and subtract the product 48(8× 6) from the 48 on rods DE.

The quotient is 168.

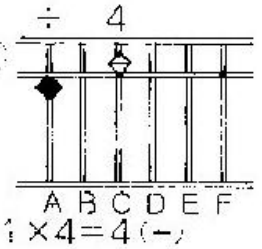
Exercises

① 729÷3	⑤ 903÷7	⑨ 1,004÷4
② 496÷4	⑥ 586÷2	⑩ 8,235÷9
③ 1,785÷5	⑦ 2,568÷6	
④ 3,768÷8	⑧ 6,488÷8	

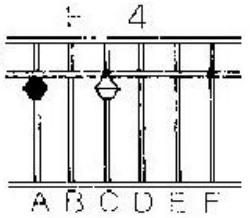
STEP 5 Calculation of problems like 5,000÷4

(1) 

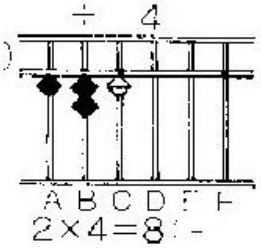
(1) Set the dividend 5,000 on the rods CDEF as illustrated.
Compare the divisor 4 with 5 in the dividend 5,000, and fnid the quotient 1 by 5÷4. This quotient 1 as given by thousands' dividend shows 1 thousand (the remainder 1 thousand).

(2) 

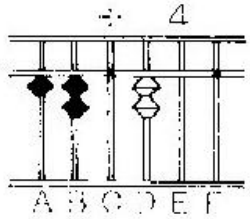
(2) Set the quotient 1 (thousand) on the rod A, the second rod (skip one rod) to the left of the 5 (thousand).
Then, multiply the divisor 4, and subtract 4 thousand (1,000×4) from 5 thousand on rod C.

(3) 

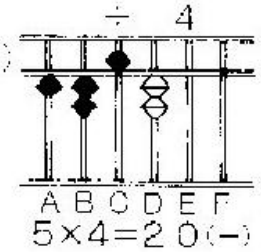
(3) Compare the divisor 4 with 10 in the dividend 1,000, and find the quotient 2 (hundreds) by 10÷4.

(4) 

(4) Set the quotient 2 (hundreds) on the rod B, to the left of the dividend 10 (hundreds).
Then, multiply the divisor 4, and subtract 800 (200×4) from the dividend 1,000 on rods CD.

(5) 

(5) Compare the divisor 4 with 20 in the remaining dividend 200, and find the quotient 5 (50) by 20÷4.

(6) 

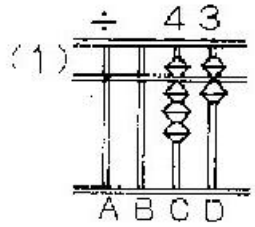
(6) Set the quotient 5 (50) on the rod C, to the left of the dividend 20, and subtract the product 200 (50×4) from the 200 on rods DEF.

The quotient is 1,250.

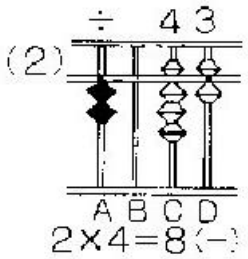
Exercises

① 606÷6	⑤ 770÷7	⑨ 18,180÷6	⑬ 49,350÷7
② 309÷3	⑥ 840÷2	⑩ 20,030÷5	⑭ 30,000÷8
③ 936÷9	⑦ 9,003÷3	⑪ 12,009÷3	⑮ 6,000÷5
④ 820÷4	⑧ 45,081÷9	⑫ 32,040÷8	⑯ 14,000÷2

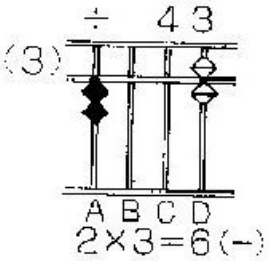
STEP 6 Calculation of problems like 86÷43



(1) Set the dividend 86 on the rods CD as illustrated. Compare the divisor 43 with the dividend 86, and find the quotient 2.
(Easy to compare 4 in the 43 with 8 in the 86 and find the quotient 2)



(2) Set the quotient 2 on the rod A, the second rod (skip one rod) to the left of the dividend. Then, multiply 40 in the divisor 43, and subtract the product 80 (2×40) from the dividend on rod C.



(3) Next multiply 3 in the dividend 43, and subtract the product 6 (2×3) from the 6 on rod D.

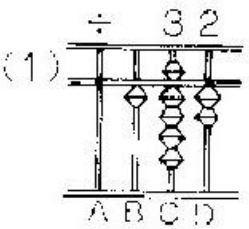
The quotient is 2.

Exercises

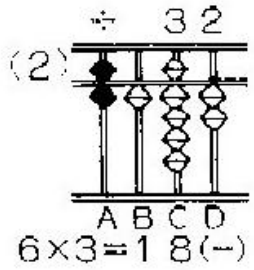
① 84 ÷ 21　　③ 48 ÷ 24　　⑤ 99 ÷ 33

② 96 ÷ 32　　④ 88 ÷ 44　　⑥ 69 ÷ 23

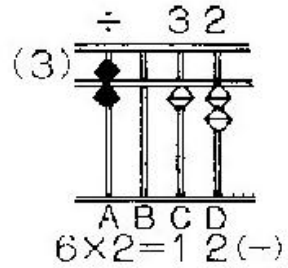
STEP 7 Calculation of problems like 192÷32



(1) Set the dividend 192 on the rods BCD as illustrated.
Compare the divisor 32 with 19 in the dividend 192. But, it can't be divided in integral number. Then, 192÷32 equals 6.
(Easy to compare 3 in the 32 with 19 in the 192 and find the quotient 6)



(2) Set the quotient on the rod A, to the left of 19 in the dividend. Then, multiply 30 in the divisor 32, and subtract the product 180 (6×30) from the 190 on rods BC.



(3) Next multiply 2 in the divisor 32, subtract the product 12 (6×2) from the dividend on rods CD.

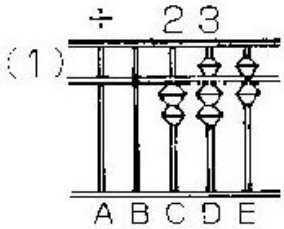
The quotient is 6.

Exercises

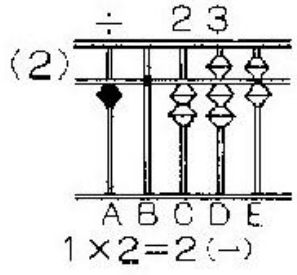
① 270÷45 ③ 304÷76 ⑤ 388÷97

② 441÷63 ④ 574÷82 ⑥ 204÷34

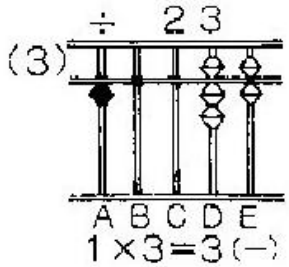
STEP 8 Calculation of problems like 276÷23



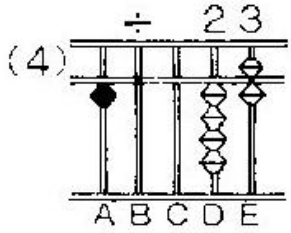
(1) Set the dividend 276 on the rods CDE as illustrated.
Compare the divisor 23 with 27 in the dividend, and find the quotient 1 by 27÷23. This quotient as given by the tens' dividend shows 270÷23 equals 10 (the remainder 40).



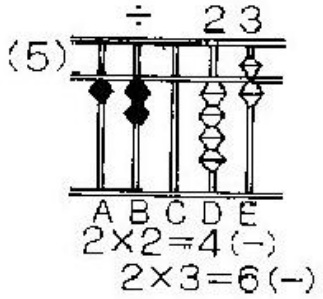
(2) Set the quotient 1 (10) on the rod A, the second rod to the left of the first digit of the dividend. Then, multiply 20 in the divisor 23 and subtract the product 200 (10×20) from the dividend on rod C.



(3) Next multiply 3 in the divisor 23 and subtract the product 30 (10×3) from the dividend on rod D.



(4) Compare the divisor 23 with the remaining dividend 46 and find the quotient 2 by 46÷23.



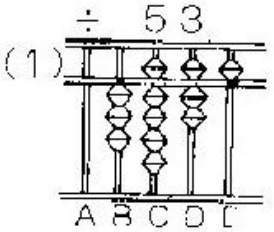
(5) Set the quotient 2 on the rod B, the second rod (skip one rod) to the left of the dividend.
Then, multiply the divisor 23 and subtract the product 46 (2×23) from the dividend on rods DE.

The quotient is 12.

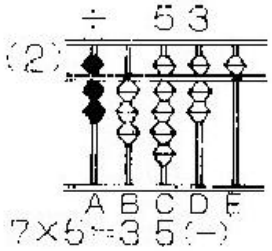
Exercises

① 861 ÷ 41	⑥ 792 ÷ 11
② 299 ÷ 13	⑦ 408 ÷ 34
③ 992 ÷ 32	⑧ 882 ÷ 21
④ 748 ÷ 22	⑨ 294 ÷ 14
⑤ 516 ÷ 43	⑩ 713 ÷ 31

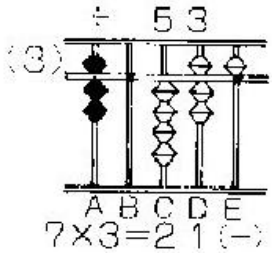
STEP 9 Calculation of problems like 3,975÷53



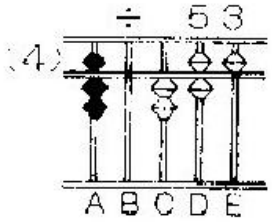
(1) Set the dividend 3,975 as illustrated.
Compare the divisor 53 with 39 in the dividend 3,975. But, it can't be divided in integral number due to 39<53.
Then, compare the 53 with 397 in the 3,975 and find the quotient 7.
This quotient as given by the tens' dividend shows 70.
(Easy to compare 5 in the 53 with 39 in the 3,975 and find the quotient)



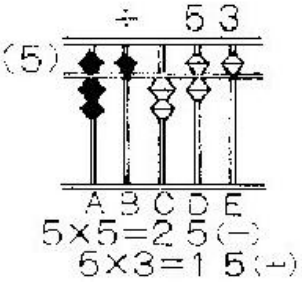
(2) Set the quotient 7 (70) on the rod A, the first rod to the left of the first digit of the dividend. Then, multiply 50 in the divisor 53 and subtract the product 3,500 (70×50) from the dividend on rods BC.



(3) Next multiply 3 in the divisor 53 by the quotient 70 and subtract the product 210 (70×3) from the dividend on rods CD.



(4) Compare the divisor 53 with 26 in the remaining dividend 265. But, it can't be divided in integral number due to 26<53. Then, compare the 53 with the 265 and find the quotient 5.



(5) Set the quotient 5 on the rod B, the next rod to the left of the dividend and subtract the product 265 (5×53) from the dividend on rods CDE.

The quotient is 75.

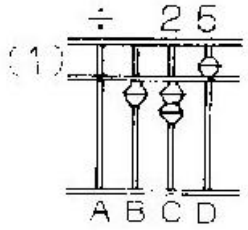
Exercises

① 1,978 ÷ 43	⑥ 2,516 ÷ 74
② 4,940 ÷ 52	⑦ 3,960 ÷ 72
③ 1,748 ÷ 76	⑧ 2,772 ÷ 66
④ 2,254 ÷ 98	⑨ 1,995 ÷ 57
⑤ 3,402 ÷ 63	⑩ 1,560 ÷ 65

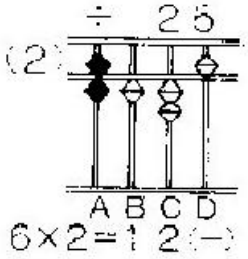
Exercises

① 690 ÷ 46	⑥ 1,806 ÷ 43
② 864 ÷ 32	⑦ 2,419 ÷ 59
③ 3,315 ÷ 65	⑧ 598 ÷ 23
④ 1,344 ÷ 21	⑨ 864 ÷ 36
⑤ 882 ÷ 63	⑩ 675 ÷ 45

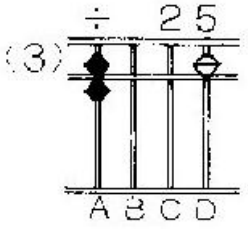
STEP 10 Calculation of problems like 125÷25



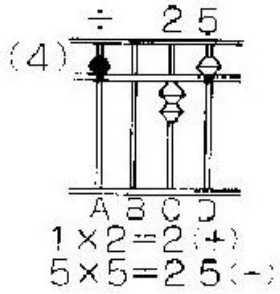
(1) Set the dividend as illustrated. 125÷25 equals 5. This, however, bears difficulties generally for beginners in division. So you may locate and set a temporary quotient 6 by 12÷2.



(2) Set the temporary quotient 6 on the rod A. Then, multiply 20 in the divisor 25 and subtract the product 120 (6×20) from the dividend on rods BC.



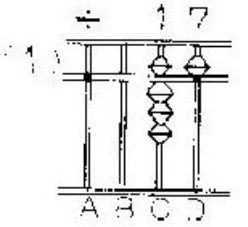
(3) Next multiply 5 in the 25 by 6 and try to subtract the product 30 (6×5) from the dividend 5 remaining on rod D.
But it can't be subtractive because the quotient 6 is too large. Thus, it must be revised to smaller.



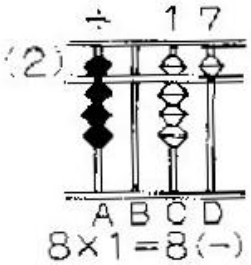
(4) Deduct 1 from the quotient 6 and multiply 20 in the divisor 25 by 1 reduced, and add the product 20 (1×20) on rod C.
Then multiply 5 in the divisor 25 by the revised quotient 5 and subtract the product 25 (5×5) from the dividend on rods CD.

The quotient is 5.

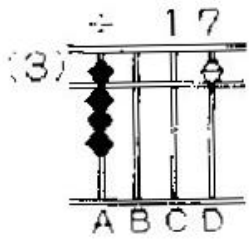
STEP 11 Calculation of problems like 85÷17



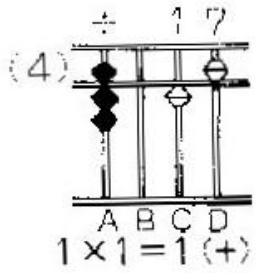
(1) Set the dividend as illustrated.
85÷17 equals 5. But it is not easy to locate the quotient 5 immediately.
So, compare 1 in the 17 with 8 in the 85 and find the temporary quotient 8 by 8÷1 (80÷10).



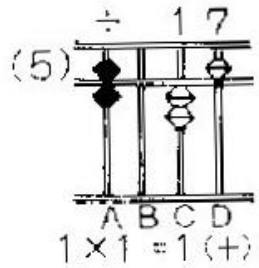
(2) Set the quotient 8 on the rod A, and multiply 1 in the divisor 17 by the 8, and subtract the product 80 (8×10) from the dividend on rod C.



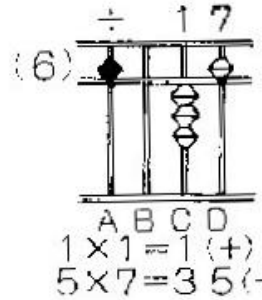
(3) Next multiply 7 in the divisor 17 by the 8 and try to subtract the product 56 (8×7) from the dividend 5 remaining on rod D. But it can't be subtractive because the quotient 8 is too large. Thus, it must be revised to smaller one.



(4) Deduct 1 from the quotient 8 and multiply 10 in the divisor 17 by 1 reduced, and add the product 10 (1×10) on rod C. However, the revised quotient 7 by 7 in the devisor 17 equals 49 which can't be subtractive yet from the remaining devidend.
The quotient must be again revised.



(5) Deduct 1 the quotient 7 and add 10 on rod C. The revised quotient 6 and its product by 7 in the divisor 17 (6×7) are still too large, so the quotient must be further revised.



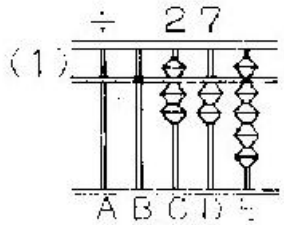
(6) Deduct 1 from the quotient 6 and add 10 to rod C. Then multiply 7 in the divisor 17 by the revised quotient 5 and subtract the product 35 (5×7) from the remaining dividend.

The quotient is 5.

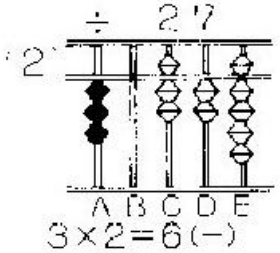
Exercises

①	168 ÷ 24	⑥	234 ÷ 39
②	64 ÷ 16	⑦	90 ÷ 18
③	189 ÷ 27	⑧	182 ÷ 26
④	456 ÷ 57	⑨	174 ÷ 29
⑤	2,450 ÷ 35	⑩	760 ÷ 19

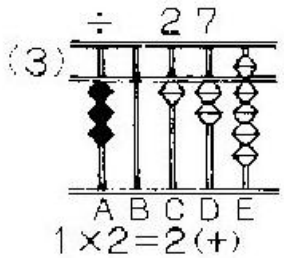
STEP 12 Calculation of problems like 729÷27



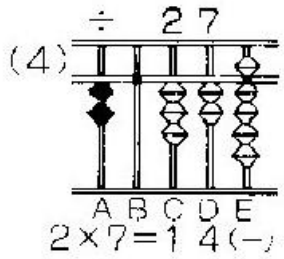
(1) Set the dividend as illustrated.
Compare 2 in the 27 with 7 in the 72 and find the quotient 3.
This quotient 3 as given by 700÷20 shows 30.



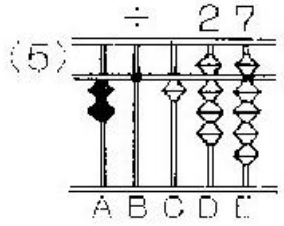
(2) Set the quotient 3 (30) on the rod A. Multiply 2 in the divisor 27 and subtract the product 600 (30×20) from the dividend on rod C.



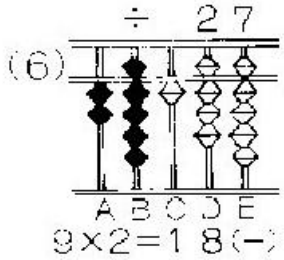
(3) Next multiply 7 in the divisor 27 and try to subtract the product 210 (30×7) from the dividend on rods CD. But it can't be subtractive because the quotient 3 is too large.
Thus, it must be revised to smaller one.
Deduct 1 from the quotient 3 and add 2 (10×20=200) to rod C.



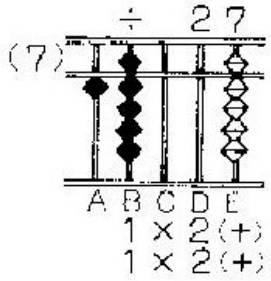
(4) Multiply 7 in the divisor 27 by the revised quotient 2 (20) and subtract the product 140 (20×7) from the rods CD. Hereby the quotient of tens place was decided.



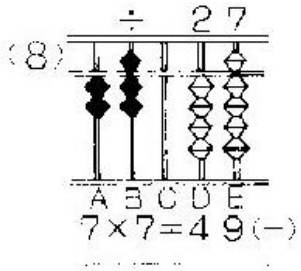
(5) Last, as the quotient of ones place will be found by 189÷27, it can be simply located by 18÷2. 18÷2=9.



(6) Set the quotient 9 on the rod B. Mlutiply 2 in the divisor 27 and subtract the product 180 (9×20) from the rods CD.



(7) As the product of quotient 9 by 7 in the divisor 27, 63 (9×7) can't be subtractive from the rods DE, the quotient must be revised to smaller one. Deduct 1 from the quotient 9 and add 20 (1×20) to the rod D.
Since the product of the revised quotient 8 by the 7, 56 (8×7) can't be subtractive yet, it must be again revised. Deduct 1 from the quotient 8 and add 20 (1×20) to the rod D.



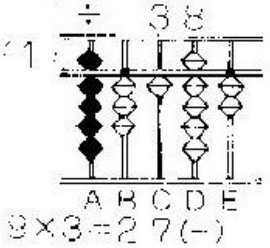
(8) Then, subtract the product 49 (7×7) of the revised quotient 7 by the divisor 7 from the rods DE.

The quotient is 27.

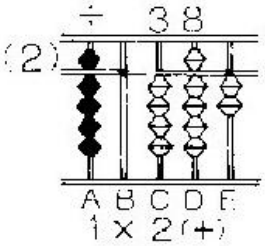
Exercises

① 3,648 ÷ 64	⑥ 3,216 ÷ 48
② 1,872 ÷ 24	⑦ 2,842 ÷ 98
③ 688 ÷ 16	⑧ 900 ÷ 25
④ 3,074 ÷ 53	⑨ 2,146 ÷ 37
⑤ 962 ÷ 26	⑩ 5,372 ÷ 79

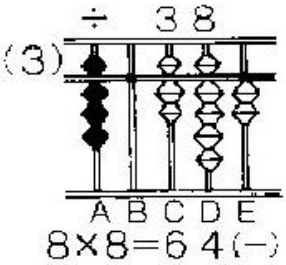
STEP 13 Calculation of problems like 3,192÷38



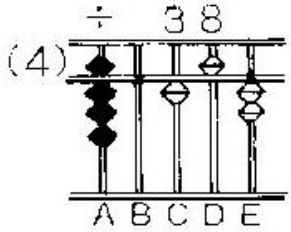
(1) Set the dividend.
It cant' be divided in integral number by 31. The ten's place in the quotient can be found by 319÷38 which equals 8(80) with the remainder 15(150). However, as descrived earlier, if the quotient would be located by 31÷3, it would be 10 (100) with the remainder 1 (100).
This quotient resulting from 31÷3 is contradictory to the premise that the dividend 31 (3,100) is smaller than the divisor 38 (3,800).
In case of this problem, immediately try 9 (90) as the quotient figure and set it on rod A. Multiply 3 in the divisor 38 and subtract the product 2,700 (90×30) from rods BC.



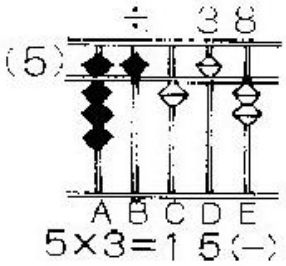
(2) The product of the quotient 9 by 8 in the divisor 38, 720 (90×8) can't be subtractive from rods CD. Deduct 1 from the quotient 9 and add 3 (10×30) to rod C.



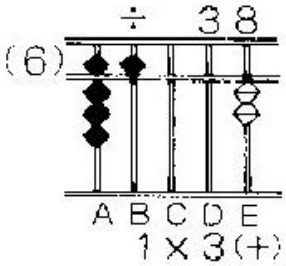
(3) Multiply the divisor 8 by the revised quotient 8 and subtract the product 640 (80×8) from rods CD.



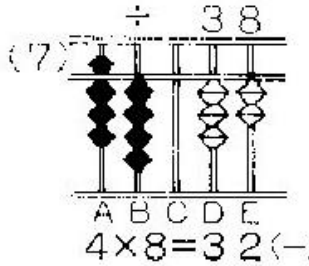
(4) Compare 3 in the 38 with 15 in the 152 and find the quotient 5 (150÷30), and set on rod B.



(5) Then multiply the 5 by 3 in the divisor 38 and subtract the product 150 (5×30) from CD.



(6) The product of the quotient 5 by 8 in the divisor 38, 40 (5×8) can't be subtracitve. The quotient must be revised.



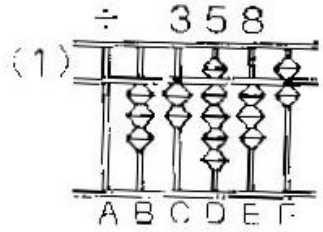
(7) Subtract the product of the revised quotient 4 by the 8, 32 (4×8) from rods DE.

The quotient is 84.

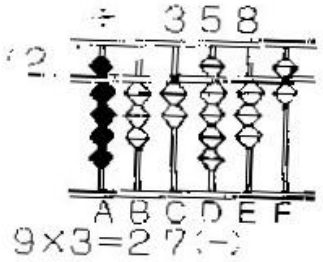
Exercises

① 1,131 ÷ 13	⑥ 5,626 ÷ 58
② 2,184 ÷ 26	⑦ 782 ÷ 17
③ 4,042 ÷ 47	⑧ 3,081 ÷ 39
④ 2,124 ÷ 36	⑨ 392 ÷ 14
⑤ 783 ÷ 29	⑩ 1,026 ÷ 27

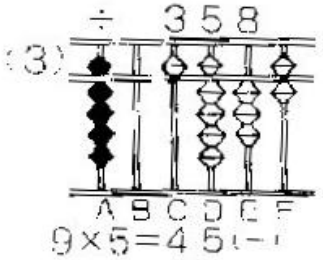
STEP 14 Calculation of problems like 32,936÷358



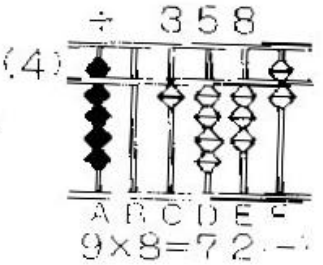
(1) Set the dividend.
Compare the divisor 358 with 329 in the dividend 32,936. It can't be divided in integral number becase of 329<358. So compare the 358 with 3,293 in the 32,936 and find the quotient 9, on the rod A. This quotient 9 as given by the tens dividend shows 90.



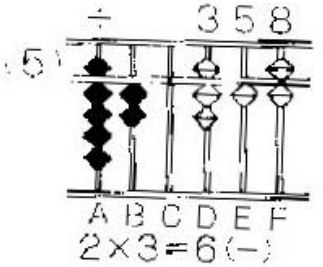
(2) Multiply 300 in the divisor 358 by the quotient 90 and subtract the product 27,000 (90×300) from rods BC.



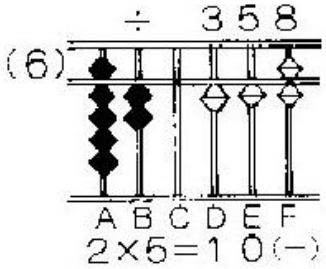
(3) Next multiply 50 in the divisor 358 and subtract the product 4,500 (90×50) from rods CD.



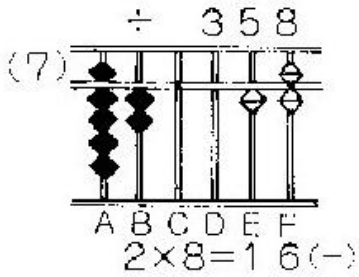
(4) Further, multiply 8 in the divisor 358 and subtract the product 720 (90×8) from rods DE. The remaining dividend is 716.
Compare the divisor 358 with the remaining dividend 716 and find the quotient 2 by 716÷358, on rod B.



(5) Multiply 300 in the divisor 358 by the quotient 2 and subtract the product 600 (2×300) from rod D.



(6) Next, multiply 50 in the divisor 358 and subtract the product 100 (2×50) from rods DE.



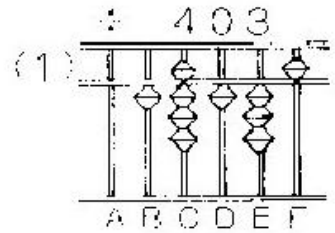
(7) Last, multiply 8 in the divisor 358 and subtract the product 16 (2×8) from rods EF.

The quotient is 92.

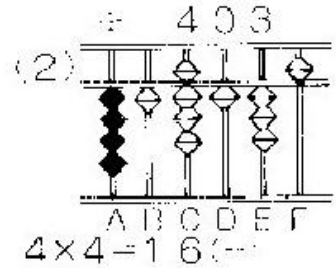
Exercises

①	4,692÷782	⑥	582,218÷637
②	1,792÷256	⑦	148,764÷483
③	15,705÷349	⑧	95,608÷136
④	5,733÷273	⑨	337,004÷974
⑤	40,514÷431	⑩	225,750÷375

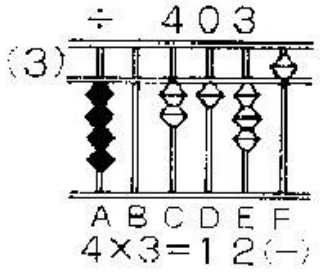
STEP 15 Calculation of problems like 18,135÷403



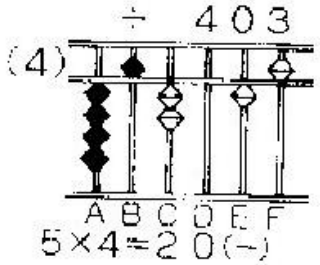
(1) Set the dividend.
Compare the divisor 403 with 181 in the dividend 18,135. It can't be divided in integral number because of 181<403. So compare the 403 with 1,813 in the dividend 18,135 and find the quotient 4, on rod A. This quotient 4 as given by the tens dividend shows 40.



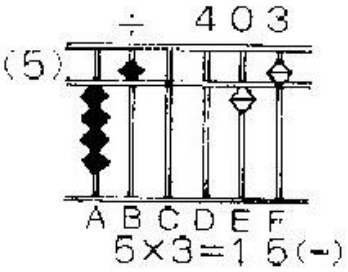
(2) Multiply the quotient 40 by 400 in the divisor 403 and subtract the product 16,000 (40×400) from rods BC.



(3) Next, multiply 3 in the divisor 403 and subtract the product 120 (40×3) from rods DE. The remaining dividend comes 2,015.
Then, compare the 403 with 201 in the 2,015. Because of 201<403, find the quotient 5 by 2,015÷403 and set on rod B.



(4) Multiply 400 in the 403 by the quotient 5 and subtract the product 2,000 (5×400) from rods CD.



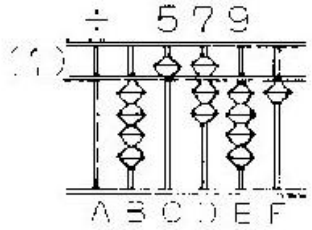
(5) Last, Multiply 3 in the 403 and subtract the product 15 (5×3) from rods EF.

The quotient is 45.

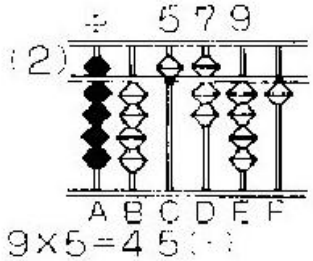
Exercises

① 14,382÷306
② 2,926÷209
③ 45,591÷501
④ 5,512÷104
⑤ 28,175÷805
⑥ 282,503÷403
⑦ 75,816÷702
⑧ 753,792÷906
⑨ 61,915÷305
⑩ 244,607÷601

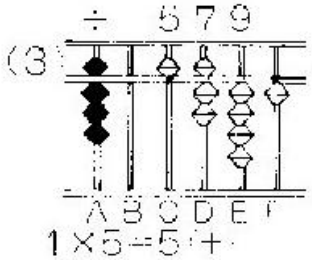
STEP 16 Calculation of problems like 45,741÷579



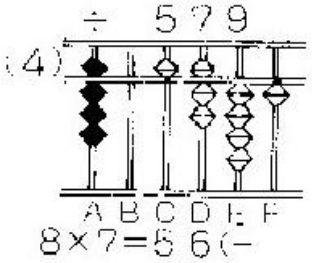
(1) Set the dividend.
Compare the divisor 579 with 457 in the dividend 45,741. It can't be divided in the integral number because of 457<579. Then, compare the 579 with 4,574 in the 45,741 and find the quotient 70 with the remainder 5,210 by 45,740÷579.
For beginner, it can be located tentatively 9 by 45÷5 and set on rod A. This tentative quotient obviously shows 90.



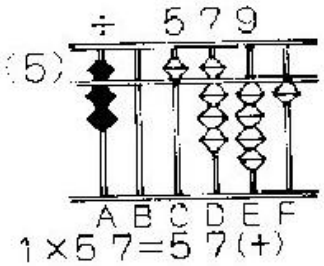
(2) Multiply 500 in the divisor 579 by the quotient 90 and subtract the product 45,000 (90×500) from rods BC.



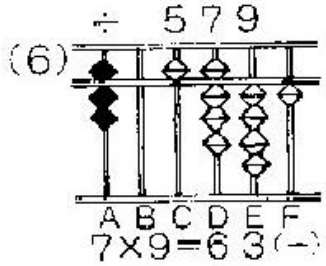
(3) Next, multiply 70 in the 579 and subtract the product 6,300 from rods CD. Because it can't be subtractive, the tentative quotient 90 must be reduced to 80. Then, multiply the divisor 500 by the 10 reduced and add the product 5,000 (10×500) to rod C.



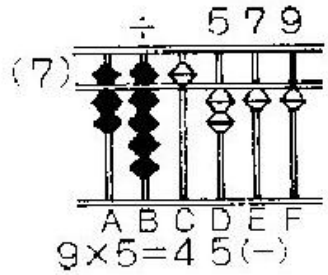
(4) So, multiply 70 in the 579 by the revised quotient 80 and subtract the product 5,600 (80×70) from rods CD.



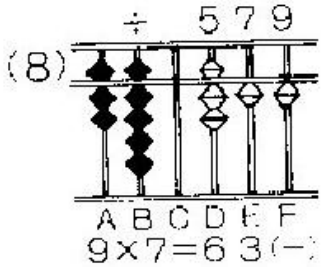
(5) Further, multiply 9 in the divisor 579 by the quotient 80 and try to subtract the product 720 (80×9) from rods DE. But, it can't be subtractive. So the tentative quotient 80 must be again reduced to 70. Then, multiply the divisor 570 by 10 reduced, and add the product 5,700 (10×570) to rods CD.



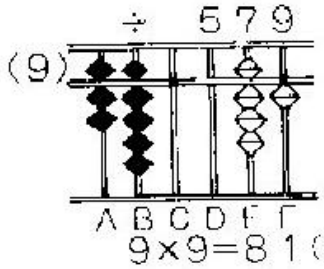
(6) Then multiply 9 in the divisor 579 by the revised quotient 70 and subtract the product 630 (70×9) from rods DE. Hereby the quotient of tens place was decided.
Next, compare the divisor 579 with 521 in the remaining dividend 5,211. It can't be divided in the integral number because of 521<579. So, compare the 579 with the 5,211 and find the quotient 9, on rod B.



(7) Multiply 500 in the divisor 579 and subtract the product 4,500 (9×500) from rods CD.



(8) Next, multiply 70 in the 579 and subtract the product 630 (9×70) from rods DE.



(9) Last, multiply 9 in the 579 and subtract the product 81 (9×9) from rods EF.

The quotient is 79.

Exercises

① 31,671÷459

② 55,981÷629

③ 15,812÷268

④ 19,502÷398

⑤ 35,112÷399

⑥ 4,953÷127

⑦ 9,047÷109

⑧ 12,803÷217

⑨ 28,002÷359

⑩ 8,493÷149

ANSWERS

×

STEP 1 (P3)

184	198
384	288
378	365
592	174
364	144

STEP 2 (P4)

88	44
84	42
69	39
24	48
96	48

STEP 3 (P5)

4,865	248	3,260
3,296	963	3,500
2,142	848	990
2,512	3,222	4,940
5,691	6,462	1,030

STEP 4 (P6)

1,892	1,748
1,782	2,584
1,485	3,219
3,975	2,548
2,442	1,598

STEP 5 (P7)

299	682
396	299
594	992
384	704
294	504

STEP 6 (P8)

992	5,096
795	3,760
1,928	600
3,763	2,370
1,984	1,000

STEP 7 (P9)

20,050	14,661
6,552	36,855
46,872	31,320
55,506	19,380
7,200	20,160

STEP 8 (P10)

30,828	15,444
15,678	18,312
27,047	7,000
16,384	8,226
12,125	26,477

STEP 9 (P11)

30,225	14,112
65,894	34,486
32,012	15,100
8,547	8,652
12,710	8,208

÷

STEP 1 (P12)

12	13
23	33
41	22
32	11
21	11

STEP 2 (P13)

32	79
45	46
94	67
98	59
62	63

STEP 3 (P14)

13	52
31	29
27	51
64	18
12	72

STEP 4 (P15)

243	293
124	428
357	811
471	251
129	915

STEP 5 (P16)

101	3,030
103	4,006
104	4,003
205	4,005
110	7,050
420	3,750
3,001	1,200
5,009	7,000

STEP 6 (P17)

4	2	3
3	2	3

STEP 7 (P18)

6	4	4
7	7	6

STEP 8 (P19)

21	72
23	12
31	42
34	21
12	23

STEP 9 (P20)

46	34
95	55
23	42
23	35
54	24

STEP 8~9 (P20)

15	42
27	41
51	26
64	24
14	15

STEP 11 (P22)

7	6
4	5
7	7
8	6
70	40

STEP 12 (P24)

57	67
78	29
43	36
58	58
37	68

STEP 13 (P25)

87	97
84	46
86	79
59	28
27	38

STEP 14 (P27)

6	914
7	308
45	703
21	346
94	602

STEP 15 (P28)

47	701
14	108
91	832
53	203
35	407

STEP 16 (P31)

69	39
89	83
59	59
49	78
88	57