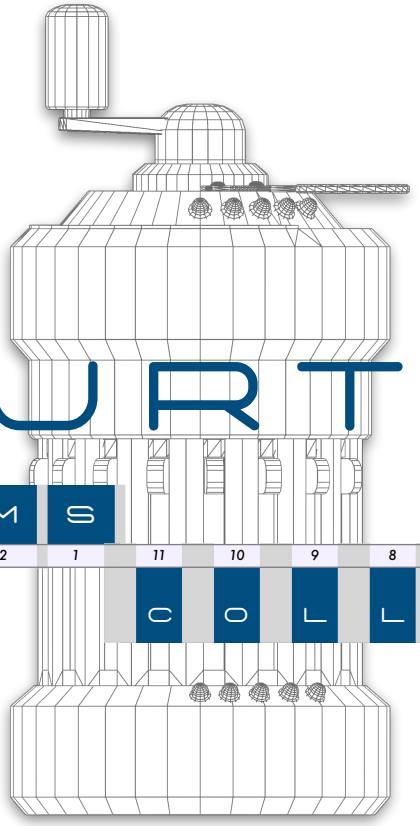
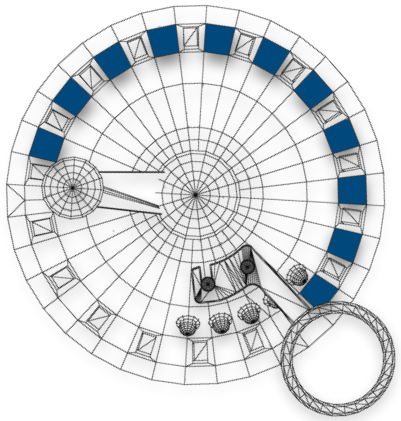
CURTA

ALGORITHMS

COLLECTION





A collection
of remastered algorithms
for the Curta calculating machine

A tribute to Curt Herzstark

Bernard Stabile - 2023

CURTA ALGORITHMS

1A Addition / Subtraction

a	**Addition** of whole numbers
b	**Addition** of numbers with decimal places
c	**Addition** of whole numbers when the number to be set exceeds the capacity of SR.
d	**Subtraction** with positive remainder with counting the numder of terms subtracted
e	**Subtraction** with negative remainder - 1
f	**Subtraction** with negative remainder - 2

1B Multiplication

a	Basic **multiplication**
b	**Multiplication** with constant factor
c	Shortened method of **multiplication - 1**
d	Shortened method of **multiplication - 1**
e	Shortened method of **multiplication - 1**
f	**Multiplication** with multiplicand already in CR

1C Division

a	**Division -** additive method - 1
b	**Division -** additive method - 1a
c	**Division -** additive method - 2
d	**Division -** Subtractive method. (Useful when a result already exists in RR)
e	**Successive division.** (To get a result in RR)

1D Rule of three

a	**Rule of three** - 1st method
b	**Rule of three** - 2nd method
c	**Rule of three** - 3rd method - Simultaneous calculation
d	**Rule of three** with complementary division - Type II
e	Extended **rule of three**

2 Roots

3 Serial calculations

4 Geometry

a **Calculation of area** from co-ordinates (shoelace method)

b **Sides of a triangle -** Pythagoras theorem

c **Distance between two points -** Pythagoras theorem

d **Calculation of co-ordinates**

e **Determination of a side** of an obtuse - angled triangle

5 Statistics

a Calculation of a **sum and a sum of squares** - Type II

b Calculation with the **'9' bridge** - Type II

c **Serial Percentages** with simultaneous control - Type II

d **Computation of arithmetic mean and standart deviation**

6 Number games

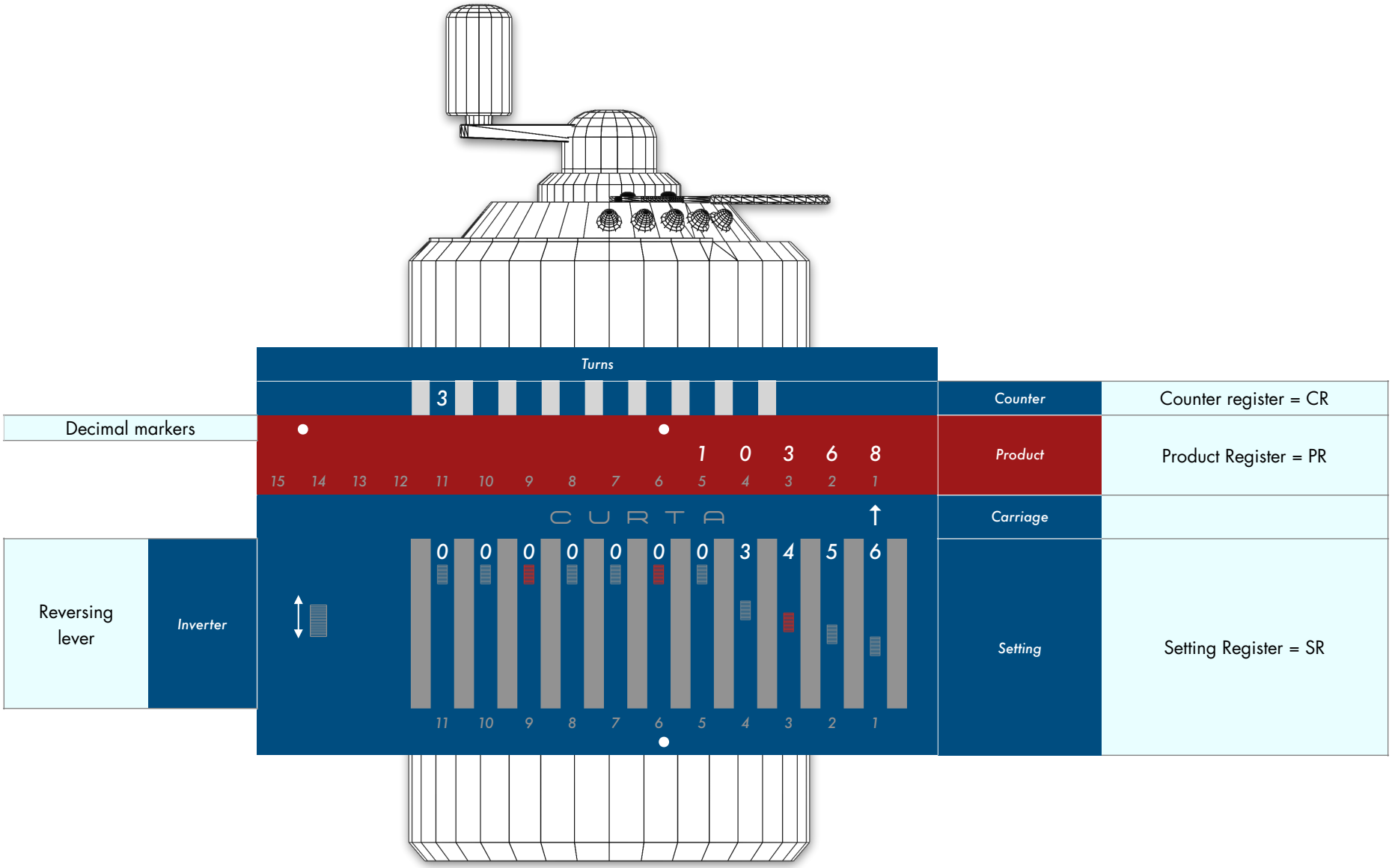
a **Collatz conjecture (Syracuse problem) (3x+1 algorithm)**

b **The golden ratio** with Fibonacci sequence

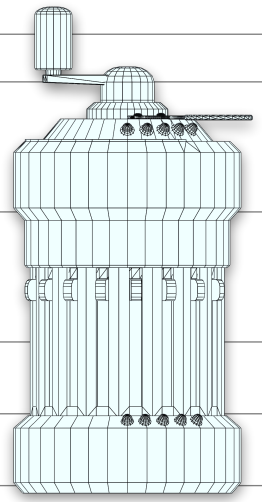
c **Multiplication** by the Vedic method

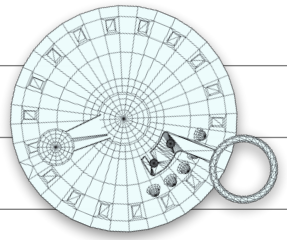
d **Converting a decimal number to binary**

e **Converting a binary number to decimal**


Turns
3
Decimal markers
1 0 3 6 8
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
CURTA
0 0 0 0 0 0 0 3 4 5 6
11 10 9 8 7 6 5 4 3 2 1
Reversing lever
Inverter
Counter
Counter register = CR
Product
Product Register = PR
Carriage
Setting
Setting Register = SR

Some hints... For the direct use of algorithms, it is assumed that the use of the Curta is known

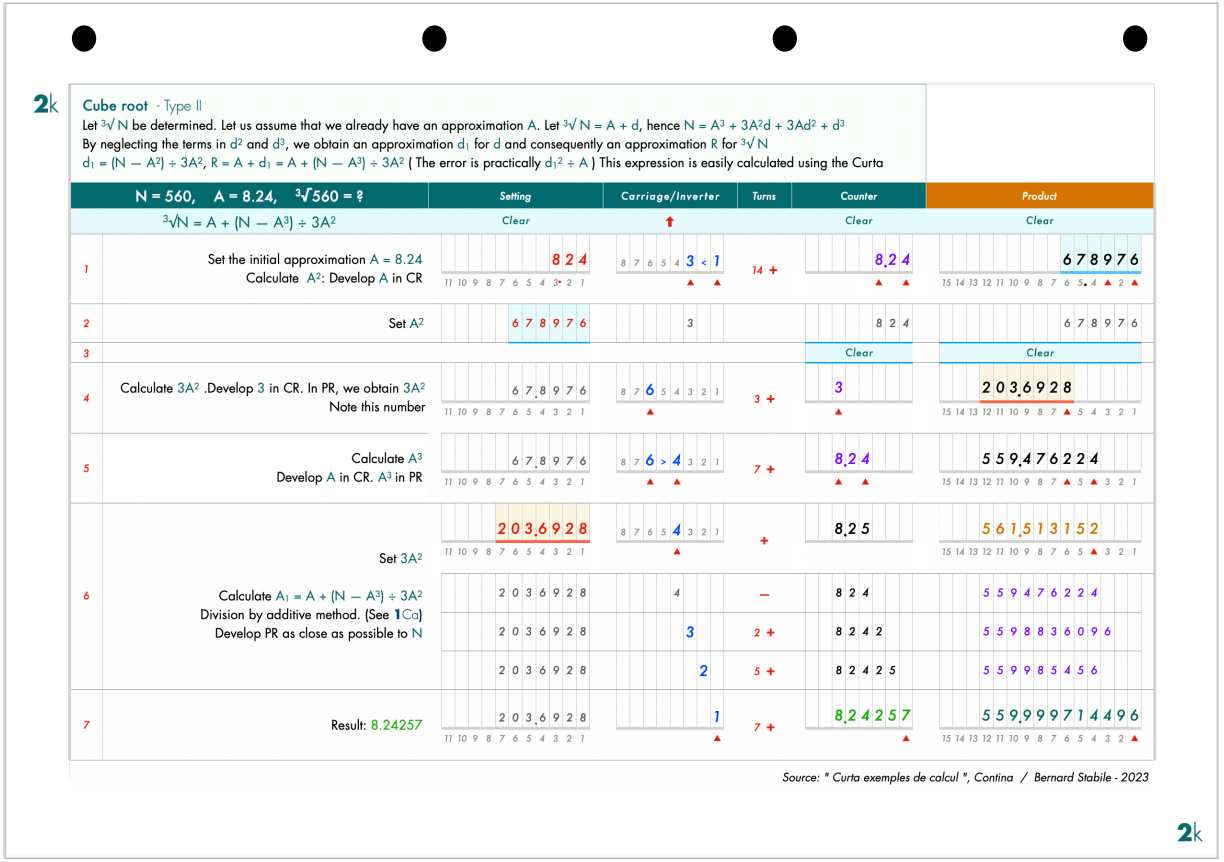




Number and direction of handle turns	6 + / 1 −
Position of reversing lever	⬆ / ⬇
Clearing lever	Clear
Carriage position	8 **7** > > **4** 3 2
Setting knobs	**3 0 1 7**
Intermediate calculation	1 7 4 4 0 3 6 8
Overflow / underflow result	9 9 9 9 9 **9 2 1 5 5 3**
Developing number (with carriage arrow)	**3 4 6 9 4 3 4 3**
Note the highlighted number	**2 7 2 4**
Unchanged position/result/setting	- - - - - - 3 4 6 9 4 3
Expected number (end of division/multiplication	**3 6 8 7 3**
Result (with decimal marker and carriage arrow)	**2 5 9 8 9 5 6 8**

Thanks to Sean Johnston for the Curta font
and to the curta.li site for its hospitality

The cards are designed to be perforated in the upper part (length) and placed in a binder



2k

Cube root - Type II

Let $\sqrt[3]{N}$ be determined. Let us assume that we already have an approximation A. Let $\sqrt[3]{N} = A + d$, hence $N = A^3 + 3A^2d + 3Ad^2 + d^3$
By neglecting the terms in d^2 and d^3, we obtain an approximation d_1 for d and consequently an approximation R for $\sqrt[3]{N}$
$d_1 = (N - A^2) \div 3A^2$, $R = A + d_1 = A + (N - A^3) \div 3A^2$ (The error is practically $d_1^2 \div A$) This expression is easily calculated using the Curta

N = 560, A = 8.24, $\sqrt[3]{560}$ = ?	Setting	Carriage/Inverter	Turns	Counter	Product
$\sqrt[3]{N} = A + (N - A^3) \div 3A^2$	Clear	↑		Clear	Clear
1 Set the initial approximation A = 8.24 Calculate A^2: Develop A in CR	824	3 < 1	14 +	8.24	678976
2 Set A^2	678976	3		824	678976
3				Clear	Clear
4 Calculate $3A^2$ .Develop 3 in CR. In PR, we obtain $3A^2$ Note this number	678976	6	3 +	3	2036928
5 Calculate A^3 Develop A in CR. A^3 in PR	678976	6 > 4	7 +	8.24	559.476224
6 Set $3A^2$	2036928	4	+	8.25	561.513152
Calculate $A_1 = A + (N - A^3) \div 3A^2$ Division by additive method. (See 1Ca) Develop PR as close as possible to N	2036928	4	–	824	559476224
	2036928	3	2 +	8242	559883609 6
	2036928	2	5 +	82425	559985456
7 Result: 8.24257	2036928	1	7 +	8.24257	559.999714496

Source: " Curta exemples de calcul ", Contina / Bernard Stabile - 2023

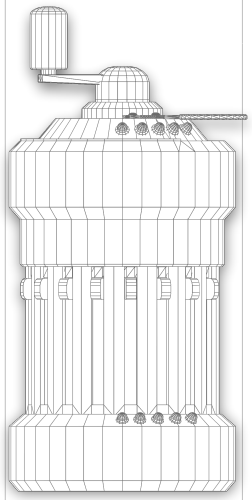
2k

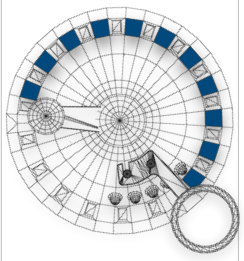
CURTA

ALGORITHMS

1A

ADDITION SUBTRACTION





a	**Addition** of whole numbers
b	**Addition** of numbers with decimal places
c	**Addition** of whole numbers when the number to be set exceeds the capacity of SR.
d	**Subtraction** with positive remainder with counting the numder of terms subtracted
e	**Subtraction** with negative remainder - 1
f	**Subtraction** with negative remainder - 2

1A

Addition of whole numbers

3,017 + 289 + 49,722,800 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a + b + c		Clear	⬆		Clear	Clear
1	Set a Bring it to PR	3017 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	3017 11 10 9 8 7 6 5 4 3 2 ▲
2	Set b Positive turn	289 8 7 6 5 4 3 2 1	1	+	2 ▲	3306 11 10 9 8 7 6 5 4 3 2 ▲
3	Set c Positive turn Result: 49,726,106 In CR, the number of terms added	49722800 8 7 6 5 4 3 2 1	1	+	3 ▲	49726106 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Addition of numbers with decimal places

1,254.05 + 171.4 + 19.075 + 214 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a + b + c + d		Clear	⬆		Clear	Clear
1	Set a. Set the decimal markers in accordance with the greatest number of decimal places. (3) Bring a in PR	1 2 5 4.0 5 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	1 2 5 4.0 5 11 10 9 8 7 6 5 4 3 2 ▲
2	Set b Positive turn	1 7 1.4 8 7 6 5 4 3 2 1	1	+	2 ▲	1 4 2 5.4 5 11 10 9 8 7 6 5 4 3 2 ▲
3	Set c Positive turn	1 9.0 7 5 8 7 6 5 4 3 2 1	1	+	3 ▲	1 4 4 4.5 2 5 11 10 9 8 7 6 5 4 3 2 ▲
4	Set d Positive turn Result: 1,658.525 In CR, the number of terms added	2 1 4.0 8 7 6 5 4 3 2 1	1	+	4 ▲	1 6 5 8.5 2 5 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Addition of whole numbers when the number to be set exceeds the capacity of SR with type I

72,655,829 + 43,759,681,119 + 5,431,789,854 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a + b + c		Clear	⬆		Clear	Clear
1	Set a Bring it to PR	7 2 6 5 5 8 2 9 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	7 2 6 5 5 8 2 9 11 10 9 8 7 6 5 4 3 2 ▲
2	Set the eight last figures of b in slots 1 to 8 Positive turn	5 9 6 8 1 1 1 9 8 7 6 5 4 3 2 1	1 ▲	+	2 ▲	1 3 2 3 3 6 9 4 8 11 10 9 8 7 6 5 4 3 2 ▲
3	Carriage 4 Set the first three figures of b in slots 6 to 8 Positive turn	4 3 7 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 2 ▲	4 3 8 3 2 3 3 6 9 4 8 11 10 9 8 7 6 5 ▲ 3 2 1
4	Carriage 1 Set the eight last figures of c in slots 1 to 8 Positive turn	3 1 7 8 9 8 5 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 3 ▲	4 3 8 6 4 1 2 6 8 0 2 11 10 9 8 7 6 5 4 3 2 ▲
5	Carriage 4 Set the first two figures of c in slots 6 to 7 Positive turn In CR, the figure 3 is the total number of terms added and the figure 2 shows how many of them had more than eight digits Result: 49,264,126,802	5 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	2 3 ▲	4 9 2 6 4 1 2 6 8 0 2 11 10 9 8 7 6 5 ▲ 3 2 1

Source: " Instructions for use of the Curta " , Contina / Bernard Stabile - 2023

1A
d

Subtraction with positive remainder with counting the numder of terms subtracted

Begin with inverter down

2,467.75 – 48 – 834.32 – 1,207.5 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
a — b — c — d	Clear	⬇		Clear	Clear
1 Inverter down. Set a. Bring it to PR Set the decimal markers The greatest number of decimal places is 2	2 4 6 7.7 5 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	9 9 9 9 9 9 ▲	2 4 6 7.7 5 11 10 9 8 7 6 5 4 3 2 ▲
2				Clear	
3 Set b Negative turn	4 8.0 8 7 6 5 4 3 2 1	1	–	1 ▲	2 4 1 9.7 5 11 10 9 8 7 6 5 4 3 2 ▲
4 Set c Negative turn	8 3 4.3 2 8 7 6 5 4 3 2 1	1	–	2 ▲	1 5 8 5.4 3 11 10 9 8 7 6 5 4 3 2 ▲
5 Set d Negative turn Result: 377.93 In CR: the number of terms subtacted	1 2 0 7.5 8 7 6 5 4 3 2 1	1	–	3 ▲	3 7 7.9 3 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Instructions for use of the Curta " ,Contina / Bernard Stabile - 2023

1A
d

Subtraction with negative remainder - 1

34 – 81 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
	a – b	Clear	⬆		Clear	Clear
1	Set a Bring it to PR	3 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	3 4 11 10 9 8 7 6 5 4 3 2 ▲
2	Set b Negative turn The row of '9' indicates a negative result (underflow). This is the complement of the result	8 1 8 7 6 5 4 3 2 1	1	–		9 9 9 9 9 9 9 9 9 5 3 11 10 9 8 7 6 5 4 3 2 ▲
3	Set the two last figures of the result Negative turn	5 3 8 7 6 5 4 3 2 1	1	–	9 9 9 9 9 9 ▲	9 9 9 9 9 9 9 9 9 11 10 9 8 7 6 5 4 3 2 ▲
4	Another negative turn gives the result: – 47	5 3	1	–	9 9 9 9 9 8 ▲	9 9 9 9 9 9 9 9 8 4 7 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Subtraction with negative remainder - 2

643,781 – 1,274,481 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a – b		Clear	⬆		Clear	Clear
1	Set a Bring it to PR	643781	1	+	1	643781
2	Set b Negative turn In PR, the complement of the result	1274481	1	–		99999369300
3	Set the complement Negative turn	99369300	1	–	999999	
4	Another negative turn Result: – 630700	99369300	1	–	999998	630700

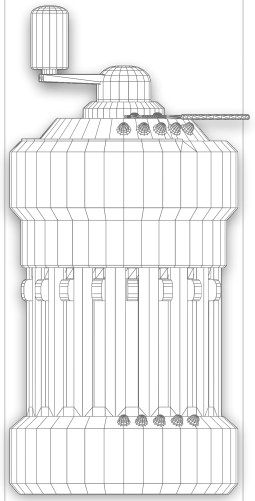
Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

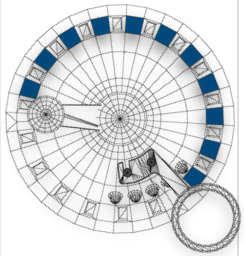
CURTA

ALGORITHMS

1 B

MULTIPLICATION





a	Basic **multiplication**
b	**Multiplication** with constant factor
c	Shortened method of **multiplication - 1**
d	Shortened method of **multiplication - 2**
e	Shortened method of **multiplication - 3**
f	**Multiplication** with multiplicand already in CR

Decimal rule for multiplication:

Decimal places in SR + decimal places in CR = **decimal places of the result**

Marking : dpSR + dpCR = dpR

1 B

Basic **multiplication**

8,549.2 x 0.03204 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
a x b	Clear	⬆		Clear	Clear
1 Set the longest factor Develop the other factor in CR with positives turns and successive Carriage positions	8 5 4 9.2	6 5 4 3 2 1	4 +	4	3 4 1 9 6 8
2 The next digit of the multiplier being zero…	8 5 4 9 2	2	o	0 4	3 4 1 9 6 8
3 … Next carriage. Develop 2 in CR	8 5 4 9 2	3	2 +	2 0 4	1 7 4 4 0 3 6 8
4 Next digit. Develop 3 with Carriage 4 Decimal rule: dpSR + dpCR = dpR, 1 + 5 = 6 Result: 273.91368	8 5 4 9.2	6 5 4 3 2 1	3 +	0.0 3 2 0 4	2 7 3.9 1 6 3 6 8

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Multiplication with constant factor

8,549.2 x 0.00304 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
	a x b					
1	Live the machine as it is at the end of previous example	8 5 4 9.2	4		3 2 0 4	2 7 3 9 1 3 6 8
2	Eliminate the figure 3 in CR	8 5 4 9 2	4	3 —	0 2 0 4	1 7 4 4 0 3 6 8
3	Develop 3 with a positive turn. Decimal rule: dpSR + dpCR = dpR, 1 + 5 = 6 Result: 25.989568	8 5 4 9.2	6 5 4 **3** 2 1 ▲	+	0.0 0 3 0 4 ▲	2 5.9 8 9 5 6 8 11 10 9 8 7 6 5 4 ▲ 2 1

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

1B
C

Shortened method of **multiplication - 1**

13,974 x 9 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b		Clear	⬆		Clear	Clear
1	Set a Instead of multiplying 13,974 by 9, we can calculate 13,974 x (10 — 1), or — 13,974 + (13,974 x 10)	1 3 9 7 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	–	9 9 9 9 9 9 ▲	9 9 9 9 9 9 8 6 0 2 6 11 10 9 8 7 6 5 4 3 2 ▲
2	Multiplication by 10: one positive turn at Carriage 2 This turn is a ***zero turn***. Result with 2 turns instead of 9. Result: 125,766	1 3 9 7 4	6 5 4 3 2 1 ▲	+	9 ▲	1 2 5 7 6 6 11 10 9 8 7 6 5 4 3 ▲ 1

Source: " Instructions for use of the Curta " , Contina / Bernard Stabile - 2023

1B
C

1B
d

Shortened method of **multiplication - 2**

784.45 x 927.9 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b		Clear	⬆		Clear	Clear
1	Set a Negative turn The last figure in CR is the last digit of the multiplier	7 8 4.4 5 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	–	9 9 9 9 9 9 ▲	9 9 9 9 9 9 2 1 5 5 5 11 10 9 8 7 6 5 4 3 2 ▲
2	Carriage 2. The next '9' in CR must be a '7'	7 8 4 4 5	2	2 –	9 9 9 9 7 9	9 9 9 9 8 3 5 2 6 5 5
3	The next '9' must be a '2'. Making a ***zero turn***	7 8 4 4 5	3	+	7 9	6 1 9 7 1 5 5
4	Two additive turns to Develop the '2'	7 8 4 4 5	3	2 +	2 7 9	2 1 8 8 6 1 5 5
5	Two subtractive turns produces a '9', the first figure of the multiplier	7 8 4 4 5	4	–	9 9 9 2 7 9	9 9 9 4 3 4 4 1 1 5 5
6	Decimal rule: dpSR + dpCR = dpR, 2 + 1 = 3 The other '9' can be eliminated by a ***zero turn***. Result: 727,891.155 We have used 8 turns instead of 27	7 8 4.4 5	6 5 4 3 2 1 ▲	+	9 2 7 9 ▲	7 2 7 8 9 1.1 5 5 11 10 9 8 7 6 ▲ 4 3 2 1

Source: " Instructions for use of the Curta " , Contina / Bernard Stabile - 2023

1B
d

1B
e

Shortened method of **multiplication - 3**

58,821 x 21,878 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b		Clear	⬆		Clear	Clear
1	Set a Gradually develop 21,878 in CR starting with negative turns	5 8 8 2 1 8 7 6 5 4 3 2 1	6 5 4 3 2 **1** ▲	2 –	9 9 9 9 9 **8** ▲	9 9 9 9 9 8 8 2 3 5 8 11 10 9 8 7 6 5 4 3 2 ▲
2		5 8 8 2 1	**2**	2 –	9 9 9 9 **7** 8	9 9 9 9 8 7 0 5 9 3 8
		5 8 8 2 1	**3**	–	9 9 9 **8** 7 8	9 9 9 9 2 8 2 3 8 3 8
3	Develop 1 with one ***zero turn*** and one positive turn	5 8 8 2 1	**4**	+	**8 7 8**	5 1 6 4 4 8 8 8
		5 8 8 2 1	4	+	**1 8 7 8**	1 1 0 4 6 5 8 3 8
4	Result: 1,286,885,838	5 8 8 2 1	6 **5** 4 3 2 1 ▲	2 +	**2 1 8 7 8** ▲	**1 2 8 6 8 8 5 8 3 8** 11 10 9 8 7 6 ▲ 4 3 2 1

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

1B
e

Multiplication with multiplicand present in CR.

21,878 x 24 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b		Clear	⬇			Clear
1	Live the machine with CR of the previous example Inverter down		5		2 1 8 7 8 ▲	
2	Reduce successively the figures in CR to 0	2 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	2 +	0 1 8 7 8 ▲	4 8 11 10 9 8 7 6 ▲ 4 3 2 1
		2 4	4	+	0 8 7 8	5 0 4
		2 4	3	8 +	0 7 8	5 2 3 2
		2 4	2	7 +	0 8	5 2 4 8 8
3	Result: 525,072	2 4	6 5 4 3 2 1 ▲	8 +	0 ▲	5 2 5 0 7 2 11 10 9 8 7 6 5 4 3 2 ▲

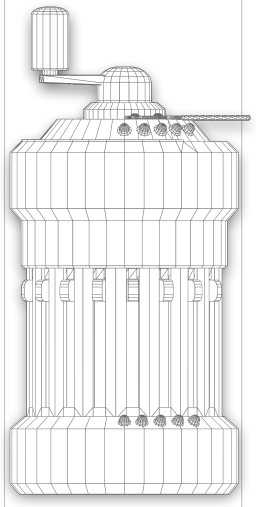
Source: " Curta calculating techniques " / Bernard Stabile - 2023

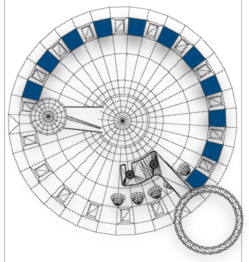
CURTA

ALGORITHMS

1 C

DIVISION





a	**Division -** additive method - 1
b	**Division -** additive method - 2
c	**Division -** Subtractive method. (Useful when a result already exists in PR)
d	**Successive division.** (to get a result in PR)

Decimal rule for division:

Decimal places in PR – decimal places in SR = **decimal places of the result**

Marking : dpPR – dpSR = dpR

1 C

Division - additive method - 1

729 ÷ 32.4 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
a ÷ b	Clear	⬆		Clear	Clear
Set the divisor b	32.4	6 5 4 3 2 1 ▲	3 +	3 ▲	972 ▲
1 Carriage at the maximum displacement Develop PR as close as possible to the dividend 729 by positive turns Negative turn when the dividend is exceeded (overflow)	324	6	–	2	648
	324	5	3 +	23	7452
	324	5	–	22	7128
2 5 decimal places at PR and 1 in SR By applying the rule of decimal places for the division dpPR – dpSR = dpR, 5 — 1 = 4, Result: 22.5	32.4	6 5 4 ▲ 3 2 1	5 +	22.5 ▲	729 ▲

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Division - additive method - 2

0.4847 ÷ 0.0085998 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a ÷ b		Clear	⬆		Clear	Clear
		0.0085998 (8 7 6 5 4 3 2 1)	6 (6 5 4 3 2 1) ▲	6 +	6 ▲	515988 (11 10 9 8 7 ▲ 5 4 3 2 1)
1	Set the divisor b Develop PR as close as possible to the dividend 0.4847 by positive turns Negative turn when overflow occurs	85998	6	–	5	42999
		85998	5	7 +	57	4901886
		85998	5	–	56	4815888
		85998	4	4 +	564	4850287 2
		85998	4	–	563	4841687 4
		85998	3	7 +	5637	4847072 6
		85998	3	–	5636	4846847 2 8
		85998	2	2 +	56362	4847019 2 7 6
		85998	2	–	56361	4846933 2 7 8
2	11 decimal places at PR and 7 in SR By applying the rule of decimal places for the division dpPR – dpSR = dpR, 11 – 7 = 4, Result: 56.3618	0.0085998	6 5 4 3 2 1 ▲	8 +	56.3618 ▲	.4847002076 4 (11 10 9 8 7 6 5 4 3 2 ▲)

Source: " Instructions for use of the Curta " , Contina / Bernard Stabile - 2023

Division - Subtractive method. (Useful when a result already exists in PR)

(8.858 + 9.33 + 7.506 + 9) ÷ 393.632 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
(a + b + c + d) ÷ e		Clear	⬆		Clear	Clear
1	The additions Set a	8.858	4	+	1	8.858
2	Set b	9.33	4	+	2	18.188
3	Set c	7.506	4	+	3	25.694
4	Set d	9	4	+	4	34.694
5			⬇		Clear	
6	Set the divisor e as far to the left hand as possible but making sure that the dividend in corresponding position above, is relatively greater than the divisor Make many negative turns as possible to reduce PR to 0 When the '9' appear, the result is negative (underflow): positive turn	393.632	4	9 −	9	9926712
		393632	4	+	8	3203444
		393632	3	9 −	89	99607528
		393632	3	+	88	54384

(8.858 + 9.33 + 7.506 + 9) ÷ 393.632 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
6	The same think to the successive Carriages	3 9 3 6 3 2	2	2 —	8 8 2	9 9 9 7 5 6 5 7 6
		3 9 3 6 3 2	2	+	8 8 1	1 5 0 2 0 8
		3 9 3 6 3 2	1	4 —	8 8 1 4	9 9 9 9 9 2 7 5 5 2
7	Decimal rule for division, dpPR – dpSR = dpR, 9 — 4 = 5 In PR, the remainder: 0.03… In CR, the result: 0.08813	3 9 3.6 3 2	1	+	0.0 8 8 1 3 ▲	0.0 0 3 2 1 1 8 4 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Instructions for use of the Curta " , Contina / Bernard Stabile - 2023

Successive division. (To get a result in PR)

Suppose we have a figure in PR at some stage of calculation, and we want to divide it by some divisor and obtain the quotient in PR, perhaps because we want to divide the quotient by another figure. We use a method which we have called 'Successive Division', because of the analogy to successive multiplication. The method is sometimes called 'Complementary Division'.

Note that although extra figures may be produced in PR, the quotient can only be obtained accurately to the same number of figures as the capacity of CR.

Note that the quotient is also produced in CR and this can he used as a check that the calculation has been performed accurately.

Successive division can be very useful but takes a little practice. The operator should carry the two left hand figures of the divisor in his mind during the operation.

Since the quotient remains in PR, it can be divided by a further divisor, either by subtractive division or by successive division.

567 ÷ 456 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a ÷ b		Clear	⬆		Clear	Clear
1	Set the dividend a Bring it in PR	5 6 7 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	5 6 7 11 10 9 8 7 ▲ 5 4 3 2 1
2					Clear	
3	Set the complement of the divisor 456 (544) preceded by a '9' Note the left hand figures of the divisor, 95	9 5 4 4 8 7 6 5 4 3 2 1	6			5 6 7
4	Watch for the two figures in front of the first two digits of SR Compensate with a negative turn when they become more than 95	9 5 4 4	6	2 +	2	1 9 6 5 5 9 5 4 4
		9 5 4 4	6	–	1	1 0 1 1 1
		9 5 4 4	5	3 +	1 3	1 2 9 7 4 2 9 5 4 4
		9 5 4 4	5	–	1 2	1 2 0 1 9 8

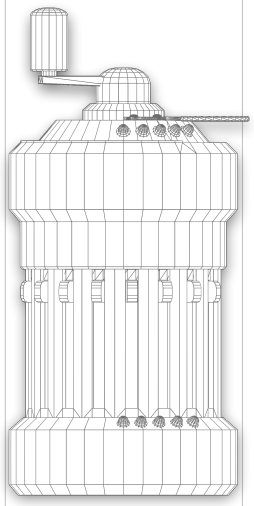
	567 ÷ 456 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
4	Repeat the procedure with successive positions of the Carriage…	9 5 4 4	4	5 +	1 2 5	1 2 4 9 7 9 5 4 4
		9 5 4 4	4	–	1 2 4	1 2 4 0 1 5 6
		9 5 4 4	3	4 +	1 2 4 4	1 2 4 3 9 7 3 6 9 5 4 4
		9 5 4 4	3	–	1 2 4 3	1 2 4 3 0 1 9 2
		9 5 4 4	2	5 +	1 2 4 3 5	1 2 4 3 4 9 6 4 9 5 4 4
		9 5 4 4	2	–	1 2 4 3 4	1 2 4 3 4 0 0 9 6
		9 5 4 4	1	3 +	1 2 4 3 4 3	1 2 4 3 4 2 9 5 9 2 9 5 4 4
5	Decimal rule for division, dpPR – dpSR = dpR, 5 – 0 = 5 The quotient is produced in PR and CR a check that the calculation has been well performed. Result: 1.24342	9 5 4 4	1	–	1.2 4 3 4 2 ▲	1.2 4 3 4 2 0 0 4 8 11 10 9 8 7 6 5 4 3 2 ▲

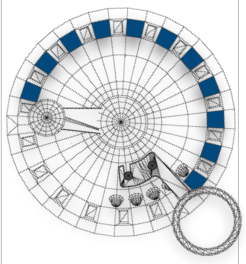
Source: " Curta calculating techniques " / Bernard Stabile - 2023

CURTA ALGORITHMS

1D

RULE OF THREE





a	**Rule of three** - 1st method
b	**Rule of three** - 2nd method
c	**Rule of three** - 3rd method - Simultaneous calculation
d	**Rule of three** with complementary division - Type II
e	Extended **rule of three**

1D

Rule of three - 1st method

(180 x 46) ÷ 144		Setting	Carriage/Inverter	Turns	Counter	Product
(a x b) ÷ c = ?		Clear	⬆		Clear	Clear
	Set b	46	6 5 4 3 2 1 ▲	2 +	2 ▲	92 ▲
1	Calculate a x b with shortened multiplication. 46 x (200 - 20). (See 1Bc) Partial result in PR: 8280.000	46	6 5 4 3 2 1 ▲	2 —	180 ▲	8280.0 ▲
2			⬇		Clear	
	Set c	144	5	5 —	5 ▲	108 ▲
3	Calculate (a x b) ÷ c with division by subtractive method. (See 1Cc) Bring PR to 0	144	4	7 —	57	72
4	Décimal rule, dpPR — dpSR = dpR, 3 — 0 = 3 Result: 57.5, no remainder	144	6 5 4 3 2 1 ▲	5 —	57.5 ▲	

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Rule of three - 2nd method

	(180 x 46) ÷ 144	Setting	Carriage/Inverter	Turns	Counter	Product
	(a x b) ÷ c = ?	Clear	⬆		Clear	Clear
1	Set c	144	6 5 4 3 2 1 ▲	+	1 ▲	144 ▲
	Calculate a ÷ c with division by additive method. (See **1**Ca) Develop 180 in PR	144	6	+	1	144
		144	5	2 +	12	1728
2	Décimal rule, dpPR — dpSR = dpR, 5 — 0 = 3 Partial Result: 1.25	144	6 5 4 3 2 1 ▲	5 +	1.25 ▲	180 ▲
3			⬇			Clear
4	Set b	46	6 5 4 3 2 1 ▲	5 +	120 ▲	23 ▲
	Calculate (a ÷ c) x b with multiplication **1**Bf Make additive turns until the counter is clear	46	5	2 +	10	115
5	Décimal rule, dpPR — dpSR = dpR, 5 — 0 = 3 Result: 57.5	46	6 5 4 3 2 1 ▲	+	0 ▲	57.5 ▲

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Rule of three - 3rd method - Simultaneous calculation

(180 x 46) ÷ 144		Setting	Carriage/Inverter	Turns	Counter	Product
(a x b) ÷ c = ?		Clear	⬆		Clear	Clear
1	Set c in the left hand of SR and b in the right hand of SR Calculate a ÷ c with division by additive method. (See **1**Ca) The quotient of this division is multiplied by b in the right hand of PR	1 4 4 . . . . 4 6 8 7 6 5 4 3 2 1	6 5 **4** 3 2 1 ▲	+	1 ▲	1 4 4 . . 4 6 11 10 9 8 7 6 5 ▲ 3 2 1
		1 4 4 . . . . 4 6	. . . **3** . .	2 +	1 2	1 7 2 8 . . 5 5 2
2	Décimal rule, dpPR — dpSR = dpR, 3 — 0 = 3 Result in the right hand of PR: 57.5	1 4 4 . . . . 4 6	6 5 4 3 **2** 1 ▲	5 +	1 2 **5** ▲	1 8 0 . . 5 7.5 11 10 9 8 7 6 5 4 3 ▲ 1

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Rule of three with complementary division - Type II

For Curta type II. In a division calculation, instead of setting the dividend in PR and proceeding by subtractive division, there may, in some cases, be an advantage in setting the complement of the dividend in PR and develop PR to zero with the divisor set in SR.
This is particularly the case with such calculations as a rule of three carried out in one operation, when we wish to obtain the maximum capacity of which the machine is capable. Begin with inverter down.

(123 x 456789) ÷ 234567 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
(a x b) ÷ c = ?		Clear	⬇		Clear	Clear
1	Inverter down. Set the second factor b Find the complement of the second factor in PR	456789	6	–	1	9995432111
2			⬆		Clear	
		123 2345678	6	+	1	1229777778
	Set c in right hand of SR and a in right hand of SR	123 2345678	5	10 +	20	24600123450
	Calculate a x (b ÷ c) in left of PR Right PR tends towards 0	123 2345678	5	–	19	23369888883
3		123 2345678	4	5 +	195	23985006165
	Positive turns until 0 appears in front of the '0' of SR Then bring the right hand of PR negative with a negative turn	123 2345678	4	–	194	23861982709 8
		123 2345678	3	8 +	1948	23960401475160
		123 2345678	3	–	1947	23948091294900

	(123 x 456789) ÷ 234567 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
		1 2 3 2 3 4 5 6 7	2	4 +	1 9 4 7 4	2 3 9 5 3 0 2 0 0 6 7 7 5 8
						1 2 3 ↑ 2 3 4 5 6 7
3		1 2 3 2 3 4 5 6 7	2	–	1 9 4 7 3	2 3 9 5 1 7 8 9 8 3 3 1 9 1
		1 2 3 2 3 4 5 6 7	1	8 +	1 9 4 7 3 8	2 3 9 5 2 7 7 4 0 2 0 8 4 4 6
						1 2 3 ↑ 2 3 4 5 6 7
4	Décimal rule, dpPR — dpSR = dpR, 5 — 0 = 5 In CR, we find the quotient of b ÷ c, 1.94737 Result in left hand of PR: 239.5265	1 2 3 2 3 4 5 6 7	1	–	1.9 4 7 3 7	2 3 9.5 2 6 5 0 9 9 7 3 8 7 9
					▲	15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲

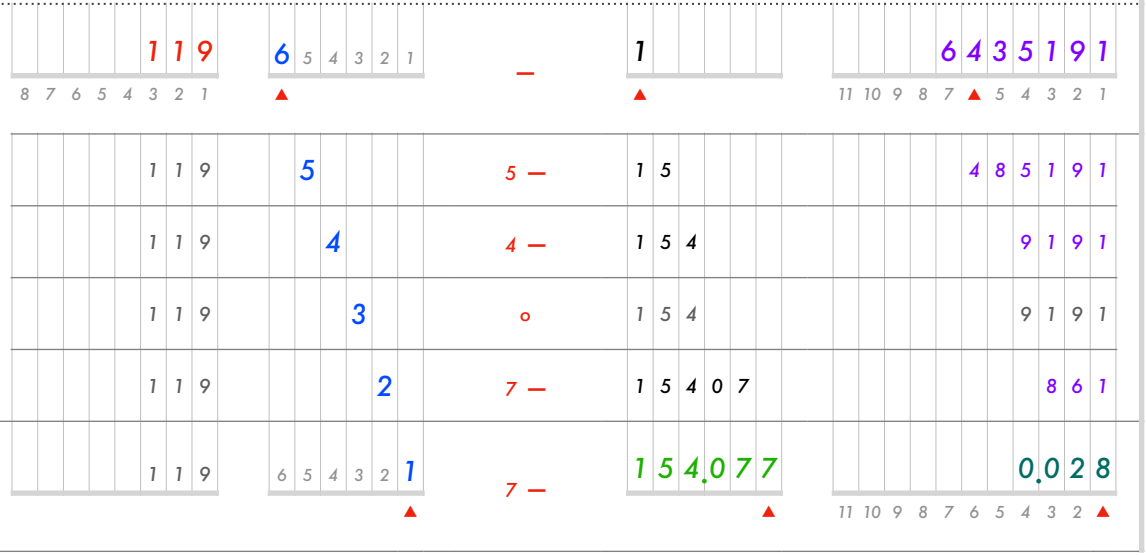
Source: " Curta calculating techniques " / Bernard Stabile - 2023

Extended **rule of three**

A = a ÷ c, B = A x b, C = B ÷ d

(325 x 677) ÷ (12 x 119) = ?		Setting	Carriage/Inverter	Turns	Counter	Product
(a x b) ÷ (c x d) = ?		Clear	⬆		Clear	Clear
	Set c	12	65	3 +	3	36
1	Calculate A = a ÷ c with division by additive method. (See 1Ca) Develop PR as close as possible to a (325)	12	4	3 −	27	324
		12	3	+	271	3252
		12	2	2 −	2708	32496
2	Décimal rule, dpPR – dpSR = dpR, 3 – 0 = 3 Partial result A = 27.083	12	1	3 +	27.083	324.996
3			⬇			Clear
	Set b	677	1	3 +	27.080	2031
4	Calculate B = A x b with multiplication 1Bf Reduce CR to 0 with positive turns	677	2	8 +	2700	56191
		677	4	7 +	20	4795191
5	Décimal rule, dpSR + dpCR = dpR, 0 + 3 = 3 Partial Result B = 18335.191	677	65	2 +	0	18335.191

(325 x 677) ÷ (12 x 119) = ?



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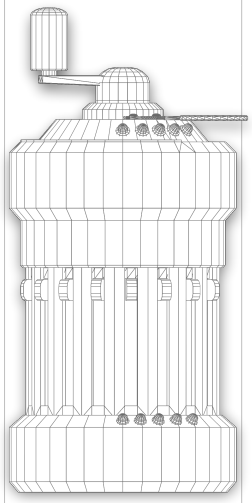
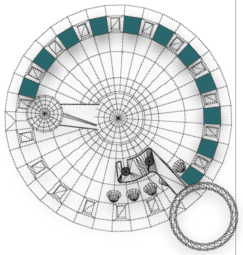
CURTA

ALGORITHMS

2

ROOTS





a	**Square root -** without initial approximation - Töpler's method 1 - Type II
b	**Square root -** without initial approximation - Töpler's method 2
c	**Square root -** without initial approximation - Töpler's method 3
d	**Square root -** without initial approximation - Friden style 1
e	**Square root -** without initial approximation - Friden style 2 - Type II
f	**Square root -** Hermann's method
g	**Square root -** Hermann's reverse method
h	**Square root -** Sabielny's method 1
i	**Square root -** Sabielny's method 2
j	**Square root -** classical method
k	**Cube root**
l	n **root**

2

Square root - without initial approximation - Töpler's method 1

In the arithmetic series of odd numbers 1 + 3 + 5 + 7 + 9 + 11...., the n^{th} term is always 2n — 1 and the sum of the first n terms is n^2, e.g. 1 + 3 + 5 + 7= 16 = 4^2.
In the example below ($\sqrt{1369} = x$), the root will have 2 digits 'a' is the tens digit and 'b' the units digit:
$\sqrt{1369} = 10a + b$,
$\sqrt{1369} = \sqrt{(10a + b)^2} = \sqrt{(100a^2 + 20ab + b^2)}$
Following this we develop the radicand in PR.

$\sqrt{1369} = ?$	Setting	Carriage/Inverter	Turns	Counter	Product
$\sqrt{10a + b} = ?$	Clear	⬆		Clear	Clear
1 a is to be found in the tens column (=10a). For that, develop the square of 10a (100a) with addition of the odd numbers. Watch PR as close as possible to 1369. Overflow occurs with the addition of '7': negative turn. Decrease the last figure by 1. The missing value between 900 and 1369 corresponds to $20ab + b^2$	1 3 5 7 7 6	6 5 4 3 2 1	+ - - - –	1 2 3 4 3	100 400 900 1600 900
	8 7 6 5 4 3 2 1	▲		▲	11 10 9 8 7 6 5 4 3 ▲ 1

Now calculate b. The value of b^2 is found by building up the series from setting slot 1 until the expression $20ab + b^2$ becomes equal to the value needed to complete 900 to 1369
For that, 20a must also be set. This is obtained by increasing the last figure set by 1. (The n^{th} term was 2n-1)
Each turn of handle will transfer not only b^2 but also 20ab
thus adding the required value of $20ab + b^2$ which is lacking in the PR

2 Carriage 1, positive turns, adding the next serie in slot 1. To add 11, set 1 in slot 1 and increase the '6' in the slot 2 by 1. For 13, it is only necessary to set 3 in slot 1. With '13', the desired value is reached. (1369 in PR) Result: 37	6 1 - 3 - 5 - 7 6 9 7 1 7 3	6 5 4 3 2 1	+ - - - - - - +	3 1 - 2 - 3 - 4 - 5 - 6 3 7	961 1024 1089 1156 1225 1296 1369
	8 7 6 5 4 3 2 1	▲		▲	11 10 9 8 7 6 5 4 3 2 ▲

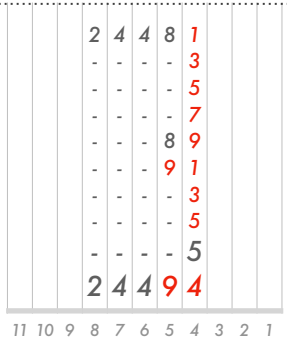
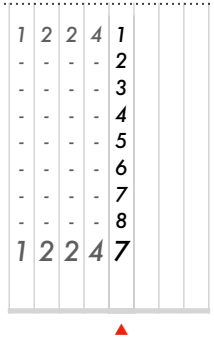
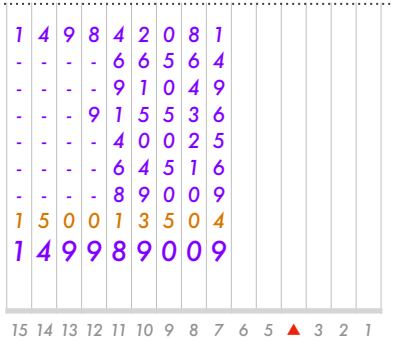
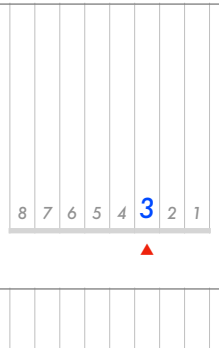
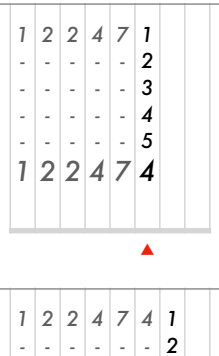
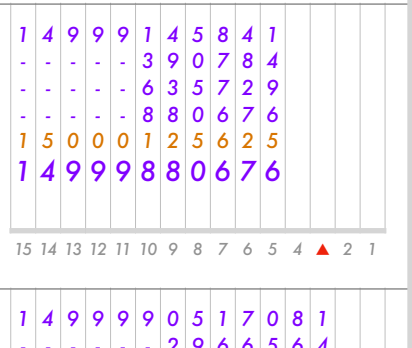
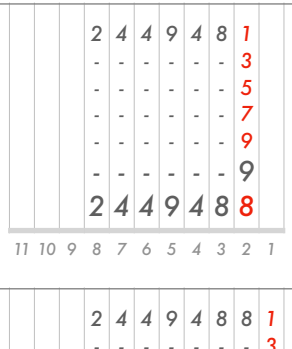
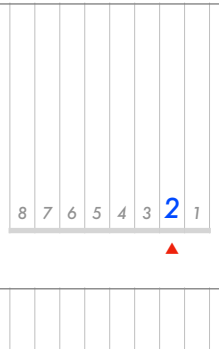
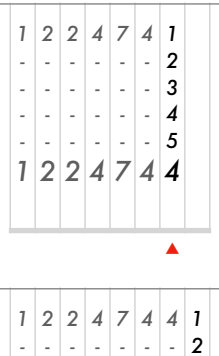
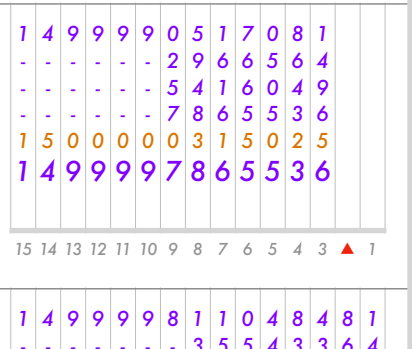
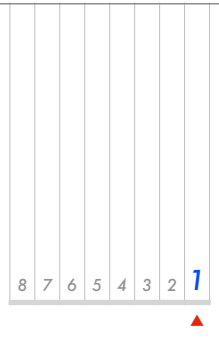
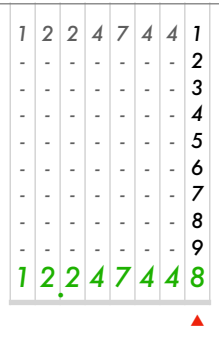
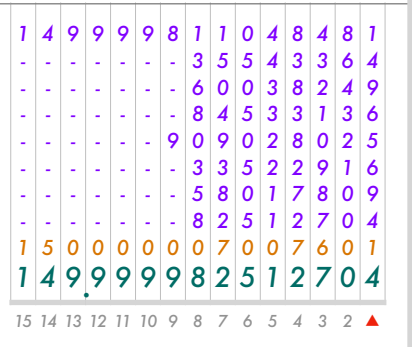
Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Square root - without initial approximation - Töpler's method 2 - Type II

With a type I, begin with Carriage and slot 5 and develop the radicand N in PR.

√150 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√N = ?		Clear	⬆		Clear	Clear
1	Develop the first serie of odd numbers in slot 8/Carriage 8 with an additive turn after each one Overflow occurs with '3'. Negative turn Decrease the last number by 1	1 3 3 2	8 7 6 5 4 3 2 1	+ - —	1 2 1	1 4 1
2	Develop the next serie of odd numbers in slot 7/Carriage 7 Overflow occurs with '5'. Negative turn Decrease the last number by 1	2 1 - 3 - 5 - 5 2 4	8 7 6 5 4 3 2 1	+ - - —	1 1 - 2 - 3 1 2	1 2 1 - 4 4 1 6 9 1 4 4
3	Develop the next serie of odd numbers in slot 6/Carriage 6 Overflow occurs with '5'. Negative turn Decrease the last number by 1	2 4 1 - - 3 - - 5 - - 5 2 4 4	8 7 6 5 4 3 2 1	+ - - —	1 2 1 - - 2 - - 3 1 2 2	1 4 6 4 1 - - 8 8 4 1 5 1 2 9 1 4 8 8 4
4	Develop the next serie of odd numbers in slot 5/Carriage 5 Overflow occurs with '9'. Negative turn Decrease the last number by 1 At each time, the number in SR will be twice the digit in CR	2 4 4 1 - - - 3 - - - 5 - - - 7 - - - 9 2 4 4 8	8 7 6 5 4 3 2 1	+ - - - —	1 2 2 1 - - - 2 - - - 3 - - - 4 - - - 5 1 2 2 4	1 4 9 0 8 4 1 - - - 3 2 8 4 - - - 5 7 2 9 - - - 8 1 7 6 1 5 0 0 6 2 5 1 4 9 8 1 7 6

√150 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
5	After 9, increase the figure in slot 5 by 1 and set 1 in slot 6. We thus obtain a '11' For 13, 15, it is only necessary to set 3, 5, in slot 4 Overflow occurs with '15'. Negative turn Decrease the last number by 1					
6	Develop the next serie of odd numbers in slot 3/Carriage 3 with an additive turn after each one Overflow occurs with '9'. Negative turn					
7	Same way… Check that the number in SR is twice the number in CR					
8	Result: 12.247448					

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Square root - without initial approximation - Töpler's method 3

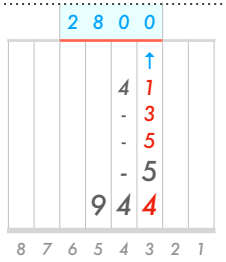
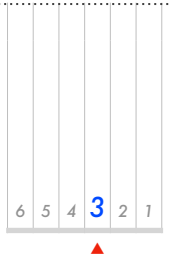
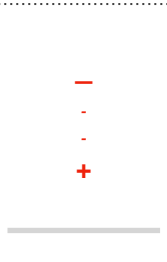
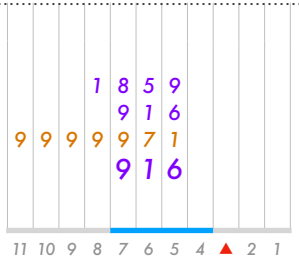
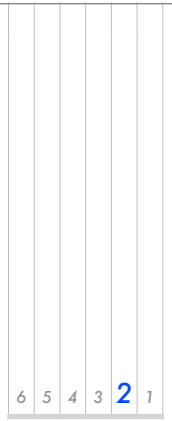
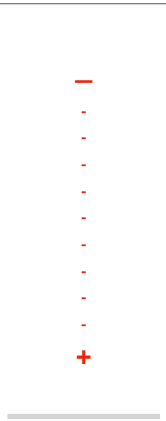
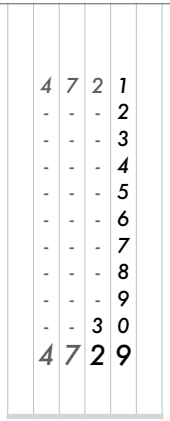
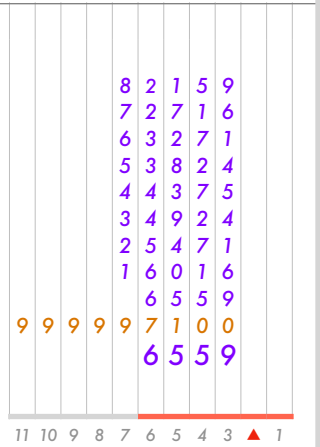
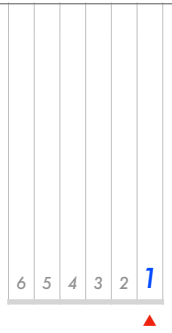
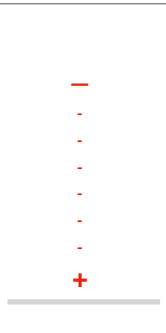
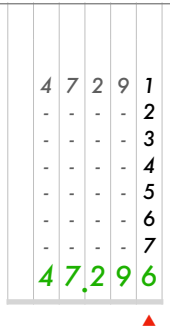
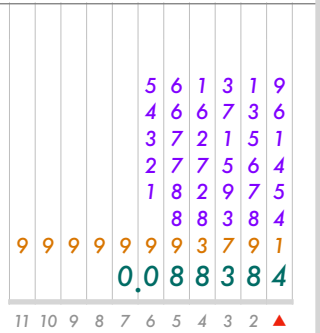
Here is another way to extract a square root according to Töpler. It will not be necessary to control the radicand N.

The appearance of the '9' will be the signal. The number is to be split up into groups of two digits.

I 22 I 37 I. Each pair correspond to one digit of the root.

√2237 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√N = ?		Clear	⬆		Clear	Clear
1	Set the radicand Bring it in PR	2 2 3 7	6 5 4 3 2 1	+	1	2 2 3 7
2			⬇		Clear	
3	Reduce PR as close as possible to 0 The first slice of the radicant (22) has two digits. We must place the units under the unit of this slice Place the first odd numbers each followed by a negative turn Underflow occurs with 9 Positive turn Decrease the last figure by 1	2 2 3 7 1 3 5 7 9 9 8	5	- - - - +	1 2 3 4 5 4	2 1 3 7 1 8 3 7 1 3 3 7 6 3 7 9 9 7 3 7 6 3 7
4	Develop the next serie of odd numbers in slot 4/Carriage 4 After 9, increase the figure in the slot 5 by 1 and set a 1 in slot 4 We thus obtain a '11' For 13, 15, it is only necessary to set 3, 5, in slot 4 Overflow occurs with 15 Positive turn Decrease the last number by 1	6 3 7 8 1 - 3 - 5 - 7 8 9 9 1 - 3 - 5 - 5 9 4	6 5 4 3 2 1	- - - - - - - - - +	4 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 4 7	5 5 6 4 7 3 3 8 8 3 0 1 2 1 2 1 2 1 2 8 9 9 9 3 3 2 8

√2237 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
5	Continue in the same way… Underflow occurs with 5 Positive turn Decrease the last figure by 1					
6	Underflow occurs with 19 Positive turn Decrease the last figure by 1					
7	Underflow occurs with 13 Positive turn Result: 47.296					

Source: " Instructions for use of the Curta ", Contina / Bernard Stabile - 2023

Square root - without initial approximation - Friden style 1

A transposition to the Curta of the algorithm from the Friden machine

This method uses the odd integer series in which the square of a number n can be computed by the sum of the odd integers from 1 to (2n – 1), i.e.:

$1^2 = 1$,

$2^2 = 1 + 3$,

$3^2 = 1 + 3 + 5$...,

$n^2 = 1 + 3 + ... + (2n – 1)$

This recalls the Töpler method. Here we use the same series multiplied by 5:

$5 \times 1^2 = 5 \times (1) = 5$

$5 \times 2^2 = 5 \times (1 + 3) = 5 + 15$

$5 \times 3^2 = 5 \times (1 + 3 + 5) = 5 + 15 + 25$

$5 \times n^2 = 5 \times (1 + 3 + ... + (2n – 1)) = 5 + 15 + ... + (10n – 5)$

We have to subtract

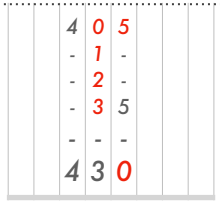
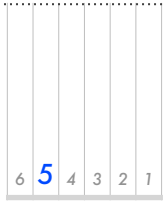
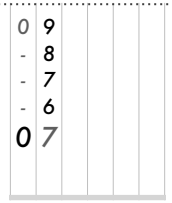
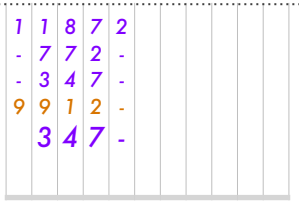
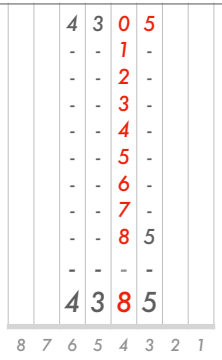
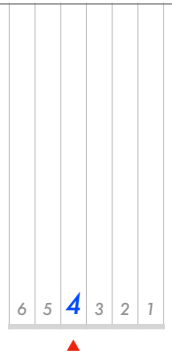
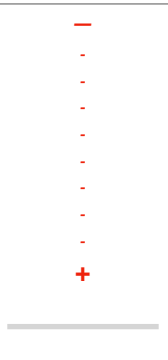
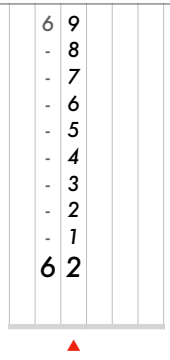
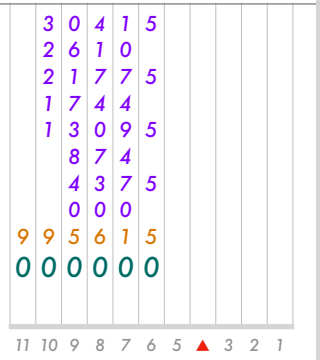
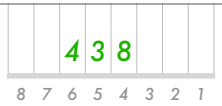
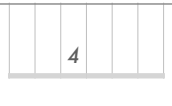
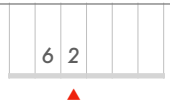
05.....

15.....

25.....,

until the result becomes negative. Carriage after carriage, the square root is built in SR

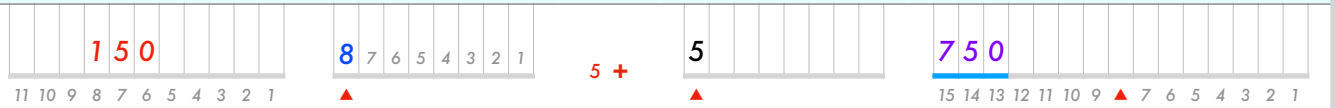
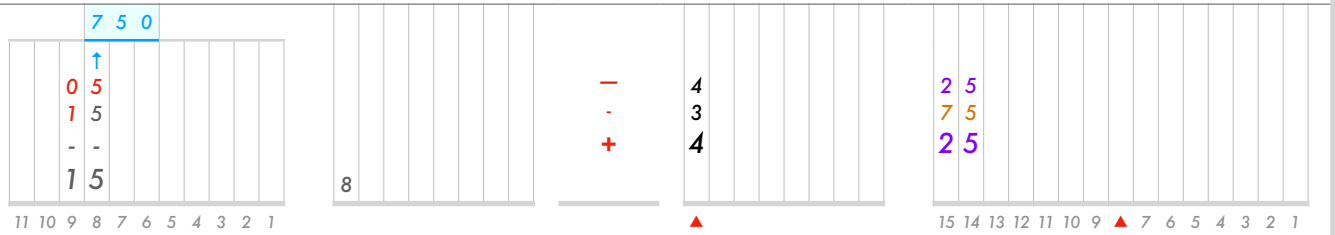
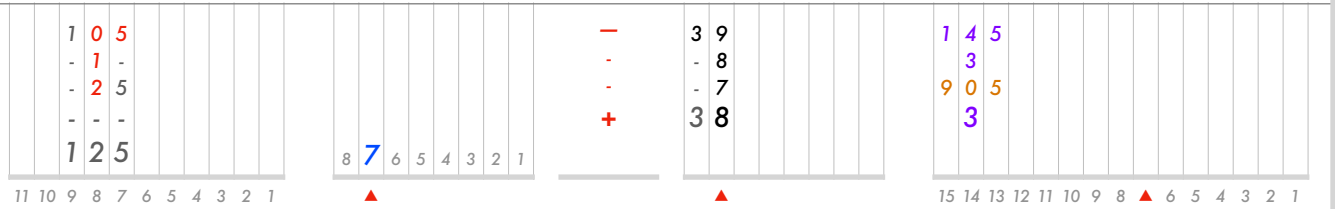
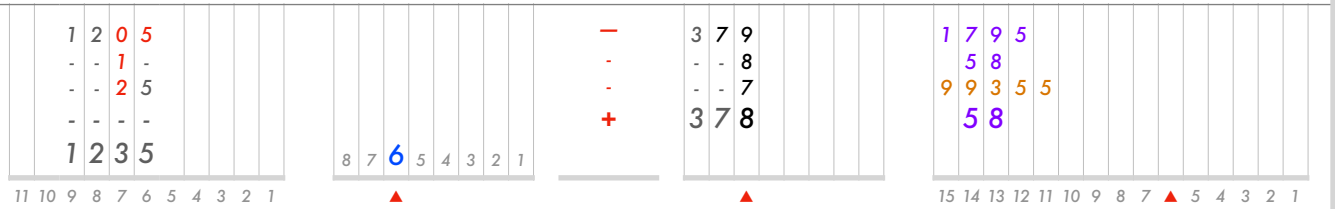
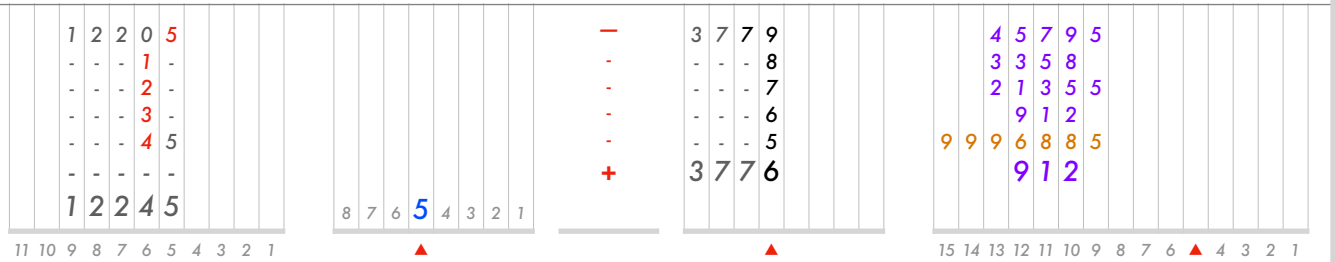
√191844 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√ N = ?		Clear	⬆		Clear	Clear
1	Set the radicand and multiplication by 5	1 9 1 8 4 4	6	5 +	5	9 5 9 2 2
2	If the square × 5 (now in PR) has an even number of digits to the left of the decimal point, set 5 in front of the 2nd most significant digit of PR Negative turn (subtract 50,000). If no negative result, set 1 in SR slot to the left of the '5', and subtract once more (150,000) Continue incrementing in previous digit until underflow occurs (with 450,000) Positive turn. Retain the left-most SR digit	9 5 9 2 2 0 5 1 - 2 - 3 - 4 5 - - 4 5	6	– - - - - +	4 3 2 1 0 1	9 0 9 2 2 7 5 - - - 5 0 - - - 1 5 - - - 7 0 - - - 1 5 9 2 2

	√191844 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
3	Clear the '5'. Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs (with 35,000) Positive turn. Retain the left-most SR digit					
4	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs (with 8,500) Retain the left-most SR digit					
5	Clear the last '5' in SR, and read result in SR: 438					

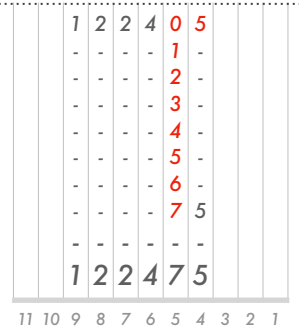
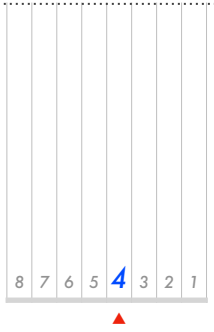
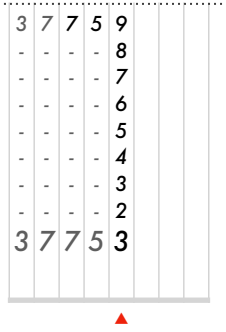
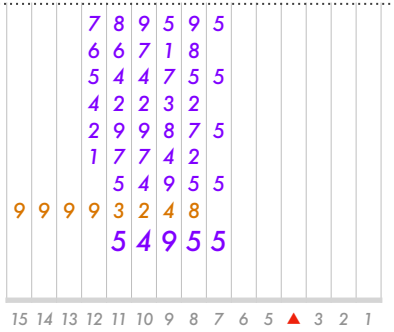
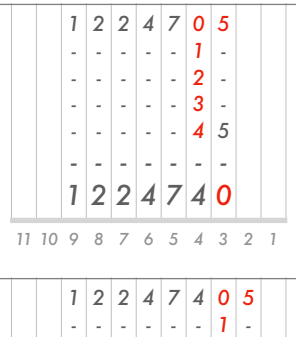
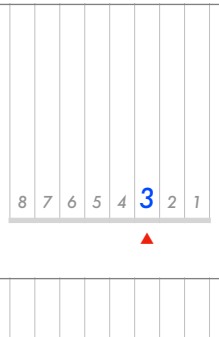
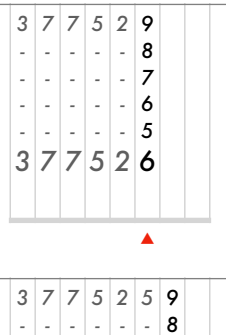
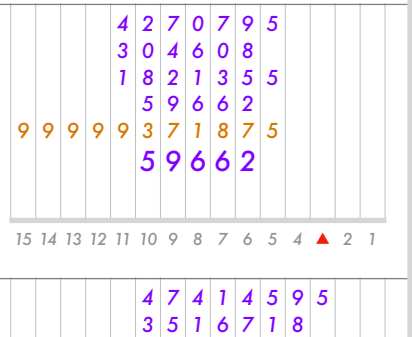
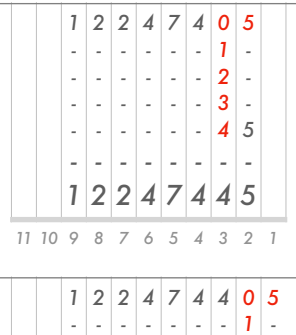
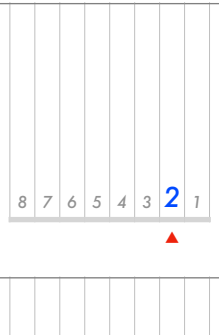
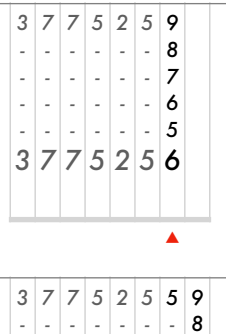
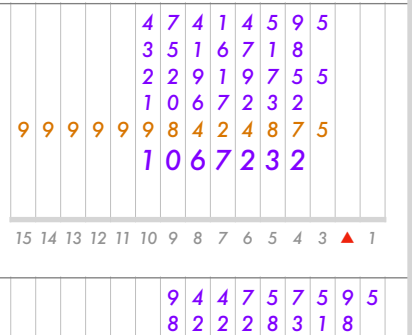
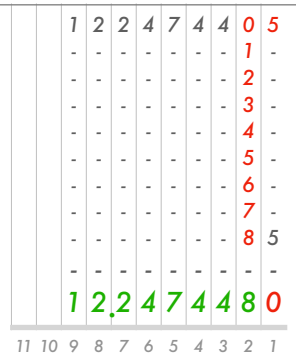
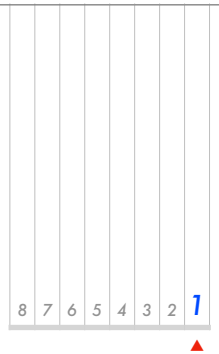
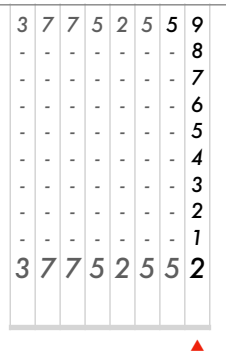
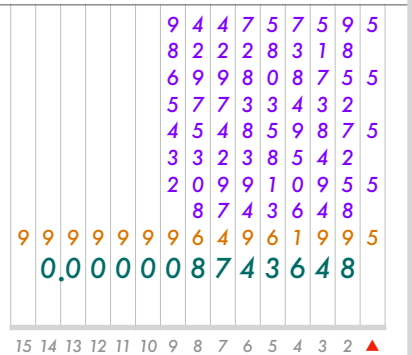
Source: " Calculating square roots on a Curta Calculator ", Daniel F F Ford - vcalc.net / Bernard Stabile - 2023

Square root - without initial approximation - Friden style 2 - Type II

√150 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
√N = ?	Clear	⬆		Clear	Clear

1	Set the radicand and multiplication by 5	
2	The square x 5 has and odd number of digits: set 5 in front of the 1st most significant digit of PR Negative turn. Then set 1 in the left of 5, negative turn Underflow occurs (PR increases despite subtraction) Positive turn	
3	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	
4	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	
5	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	

√150 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
6	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn					
7	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn					
8	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn					
9	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn Clear the '5' Result in SR: 12.247448					

Source: " Calculating square roots on a Curta Calculator ", Daniel F F Ford - vcalc.net / Bernard Stabile - 2023

Square root - Hermann's method

It is supposed that an approximate square root has been found and we wish obtain a better approximation. (i.e. in the previous example)
Let A be the approximate value of R, the square root of N, and denote the error in the approximation by E, so that R = A + E.
The method proceed by setting A in SR multiplying by A to procude A^2 in PR.
Since $N = A^2 + 2AE + E^2$, E is added to CR. Since it already contains A, it now read A + E , the new approximation.

	√150 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
	√ N = R = ?	Clear	⬆		Clear	Clear
1	Set the initial approximation A: 12.2	12.2	6	+	1	12.2
	Bring it in PR Calculate A^2	122	5	2 +	12	1464
	Develop 12.2 in CR	122	54	2 +	12.2	148.84
2	Set 2A, twice the approximation	24.4	543	4 +	12.24	149.816
	Calculate (N — A^2) ÷ 2A with division by additive method. (See **1**Ca) Develop PR as close as possible to N:150	244	2	7 +	12247	1499868
	Result: R = 12.2475	24.4	541	5 +	12.2475	149.999

Source: " Computing examples for the Curta ", Contina / Bernard Stabile - 2023

Square root - Hermann's reverse method

Useful when a square or result is already in PR

It is supposed that an approximate square root N has been found and we wish obtain a better approximation R.

$R = A + ((N - A^2) \div 2A)$.

√150 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√ N = R = ?		Clear	⬆		Clear	Clear
1	Set the radicand	150	6 5 4 3 2 1 ▲	+	1 ▲	150
2			⬇		Clear	
3	Set initial approximation A: 12.2 and built it in CR	12.2	6	–	1 ▲	28
	Calculate $N - A^2$	122	5	2 –	12	36
		12.2	6 5 4 3 2 1 ▲	2 –	12.2 ▲	1.16
4	Set 2A	24.4	6 5 4 3 2 1 ▲	4 –	12.24 ▲	.184
	Calculate $(N - A^2) \div 2A$	244	2	7 –	12247	132
	Division by subtractive method. (See **1**Cc)					
	Result: R = 12.2475	24.4	6 5 4 3 2 1 ▲	5 –	12.2475 ▲	0.01

Source: " Curta examples de calcul ", Contina / Bernard Stabile - 2023

Square root - Sabielny's method 1

This uses the expression R = ((N ÷ A) + A) ÷ 2
A root A is guessed, or found on a slide rule or from tables, and this is divided into N.
The mean of the quotient and A gives the second order approximation.

√150 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√N = R = ?		Clear	⬆		Clear	Clear
		12.2	654321 ▲	+	1 ▲	12.2 ▲
	Set the approximation A: 12.2	122	5	2 +	12	1464
1	Calculate N ÷ A Division by additive method. (See **1**Ca) Develop PR as close as possible to 150	122	4	2 +	122	14884
		122	3	9 +	1229	149938
	Note the result in CR	12.2	65432 1 ▲	5 +	12.295	149.999 ▲
2					Clear	Clear
	Calculate (N ÷ A) + A	12.2	65432 1 ▲	+	1	12.2 ▲
3	Bring A in PR Set N ÷ A	12.295	1	+	1	24.495 ▲

√150 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
4			⬇		Clear	
		2 (8 7 6 5 4 3 2 1)	6 (6 5 4 3 2 1) ▲	–	1	4 4 9 5 (11 10 9 8 7 6 5 4 3 2 1)
5	Set 2	2	5	2 –	1 2	4 9 5
	Calculate the mean: ((N ÷ A) + A) ÷ 2 with division by subtractive method. (See **1**Cc)	2	4	2 –	1 2 2	9 5
		2	3	4 –	1 2 2 4	1 5
	Result: R = 12.2475	2	2	7 –	1 2 2 4 7	1
		2	6 5 4 3 2 1 ▲	5 –	1 2.2 4 7 5	0

Source: " Curta calculating techniques " / Bernard Stabile - 2023

Square root - Sabielny's method 2

	√457.315 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
	√ N = R = ?	Clear	⬆		Clear	Clear
		21.4	654321	2 +	2	428
		8 7 6 5 4 3 2 1	▲		▲	11 10 9 8 7 ▲ 5 4 3 2 1
	Set the approximation A: 21.4	214	5	+	21	4494
	Calculate N ÷ A	214	4	3 +	213	45582
1	Division by additive method. (See **1**Ca)	214	3	6 +	2136	457104
	Develop PR as close as possible to N, 457.315	214	2	9 +	21369	4572966
	Result in CR	21.4	654321	9 +	21.3699	457.31586
			▲			11 10 9 8 7 6 5 4 3 2 ▲
2					Clear	Clear
		21.4	1	+	1	21.4
						11 10 9 8 7 6 5 4 3 2 ▲
3	Calculate (N ÷ A) + A	21.3699	1	+	1	42.7699
						11 10 9 8 7 6 5 4 3 2 1
4			⬇		Clear	
		2	6 > 4 3 > 1	27 +	21.3849	1
5	Set 2	8 7 6 5 4 3 2 1	▲ ▲		▲ ▲	11 10 9 8 7 6 5 4 3 2 ▲
	Calculate the mean: ((N ÷ A) + A) ÷ 2					
	with division by subtractive method. (See **1**Cc)					
	Result: R = 21.3849					

Source: " Curta calculating techniques " / Bernard Stabile - 2023

Square root - classical method

We set the radicand on PR, set the approximate root on the left hand group, or the nearest figure below it, say x, and subtract it x times. We add x, move the carriage to the next position and set a figure y in the next column so that if we subtract y times, we shall not reduce PR below zero. Then we add y and carry on as before.

√457.315 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
√ a = ?		Clear	⬆		Clear	Clear
1	Set the radicand Bring it in PR	4 5 7 3 1 5 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	4 5 7 3 1 5 11 10 9 8 7 ▲ 5 4 3 2 1
2			⬇		Clear	
3	Set the initial approximation 20.0 in SR Negative turns until underflow occurs	2 . 8 7 6 5 4 3 2 1	6	3 –	3 ▲	8 5 7 3 1 5 11 10 9 8 7 ▲ 5 4 3 2 1
4	Positive turn	2 8 7 6 5 4 3 2 1	6	+	2	5 7 3 1 5
5	Carriage 5. Add the figure in CR to the setting in SR Negative turns until underflow occurs	+ 2 4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	2 –	2 2 ▲	9 7 7 3 1 5 11 10 9 8 7 6 ▲ 4 3 2 1
6	Positive turn. Note the last figure in CR: '1'	4 8 7 6 5 4 3 2 1	5	+	2 1	1 7 3 1 5
7	Subtract 1 in CR with a positive turn	4 0 8 7 6 5 4 3 2 1	5	+	2	5 7 3 1 5
8	Add 1 to SR, and restore it in CR with a negative turn	+ 1 4 1 8 7 6 5 4 3 2 1	5	–	2 1 ▲	1 6 3 1 5 11 10 9 8 7 6 ▲ 4 3 2 1
9	Carriage 4. Negative turns until underflow occurs	4 1 8 7 6 5 4 3 2 1	4	4 –	2 1 4 ▲	9 9 9 9 1 5 11 10 9 8 7 6 ▲ 4 3 2 1
10	Positive turn. Note the two last figures in CR: '13'	4 1 8 7 6 5 4 3 2 1	4	+	2 1 3 ▲	4 0 1 5 11 10 9 8 7 6 ▲ 4 3 2 1
11	Subtract 3 in CR with positive turns	4 1 8 7 6 5 4 3 2 1	4	3 +	2 1 ▲	1 6 3 1 5 11 10 9 8 7 6 ▲ 4 3 2 1

	√457.315 = ?	Setting	Carriage/Inverter	Turns	Counter	Product
12	Add 13 to SR, and restore 3 in CR with negative turns	+ 1 3 4 2 3 8 7 6 5 4 3 2 1	4	3 —	2 1.3 ▲	3.6 2 5 11 10 9 8 7 6 5 ▲ 3 2 1
13	Carriage 3. Negative turns until underflow occurs	4 2 3	3	9 —	2 1 3	9 9 9 8 1 8
14	Positive turn. Note the two last figures in CR: '38'	4 2 3	3	+	2 1 3 8	2 4 1
15	Subtract 8 in CR with positive turns	4 2 3	3	8 +	2 1 3	3 6 2 5
16	Add 38 to SR, and restore 8 in CR with negative turns	+ 3 8 4 2 6 8 8 7 6 5 4 3 2 1	3	8 —	2 1.3 8 ▲	.2 1 0 6 11 10 9 8 7 6 5 4 ▲ 2 1
17	Carriage 2. Negative turns until underflow occurs	4 2 6 8	2	5 —	2 1 3 8 5	9 9 9 9 9 7 2
18	Positive turn. Note the two last figures in CR: '84'	4 2 6 8	2	+	2 1 3 8 4	3 9 8 8
19	Subtract 4 in CR with positive turns	4 2 6 8	2	4 +	2 1 3 8	2 1 0 6
20	Add 84 to SR, and restore 4 in CR with negative turns	+ 8 4 4 2 7 6 4 8 7 6 5 4 3 2 1	2	4 —	2 1.3 8 4 ▲	. 3 9 5 4 4 11 10 9 8 7 6 5 4 3 ▲ 1
21	Carriage 1. Negative turns until underflow occurs	4 2 7 6 4	1	10 —	2 1 3 8 5	9 9 9 9 9 6 7 8
22	Positive turn Result: 21.3849	4 2 7 6 4	1	+	2 1.3 8 4 9 ▲	0.0 0 1 0 5 6 4 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Curta calculating techniques " / Bernard Stabile - 2023

Cube root - Type II

Let $\sqrt[3]{N}$ be determined. Let us assume that we already have an approximation A. Let $\sqrt[3]{N} = A + d$, hence $N = A^3 + 3A^2d + 3Ad^2 + d^3$

By neglecting the terms in d^2 and d^3, we obtain an approximation d_1 for d and consequently an approximation R for $\sqrt[3]{N}$

$d_1 = (N - A^2) \div 3A^2$, $R = A + d_1 = A + (N - A^3) \div 3A^2$ (The error is practically $d_1^2 \div A$) This expression is easily calculated using the Curta

$N = 560$, $A = 8.24$, $\sqrt[3]{560} = ?$	Setting	Carriage/Inverter	Turns	Counter	Product
$\sqrt[3]{N} = A + (N - A^3) \div 3A^2$	Clear	⬆		Clear	Clear
1 Set the initial approximation A = 8.24 Calculate A^2: Develop A in CR	824	3 < 1	14 +	8.24	678976
2 Set A^2	678976	3		824	678976
3				Clear	Clear
4 Calculate $3A^2$ .Develop 3 in CR. In PR, we obtain $3A^2$ Note this number	678976	6	3 +	3	2036928
5 Calculate A^3 Develop A in CR. A^3 in PR	678976	6 > 4	7 +	8.24	559.476224
6 Set $3A^2$	2036928	4	+	8.25	561.513152
Calculate $A_1 = A + (N - A^3) \div 3A^2$ Division by additive method. (See **1**Ca) Develop PR as close as possible to N	2036928	4	–	824	559476224
	2036928	3	2 +	8242	559883096
	2036928	2	5 +	82425	559985456
7 Result: 8.24257	2036928	1	7 +	8.24257	559.997144496

Source: " Curta exemples de calcul ", Contina / Bernard Stabile - 2023

n root

The process explained for cubic roots obviously generalizes to calculate $\sqrt[n]{N}$ if A is a first approximation,
$R = A + (N - A^n) \div 3A^{n-1}$

	$\sqrt[5]{560} = ?$	Setting	Carriage/Inverter	Turns	Counter	Product
	$\sqrt[5]{N} = A + (N - A^5) \div 3A^4$	Clear	⬆		Clear	Clear
1	Set the first approximation: A = 3.54 Develop A^4 by the method described in **3**c	3.54	8 < 6 < > 3 > 1	10 — 46 +	44361864	157.040998 56
	Set A^4 rounded to 6 digits	157041	1		44361864	157040998 56
2					Clear	Clear
3	Calculate $5A^4$ Develop 5 in CR. $5A^4$ in PR. Note this number	157.041	8 7 6 5 4 3 2 1	4 +	5	785.205
4	Calculate A^5 Develop R in CR	157.041	8 7 6 > 4 3 2 1	2 — 9 +	3.54	555.9251 4
5	Set $5A^4$ Calculate $R = A + (N - A^5) \div 3A^4$ Multiplie to develop PR as close as possible to N	785.205	8 7 6 5 4 3 2 1	5 +	3.545	559.8511 65
		78520 5	2	1 +	35451	559929685 5
6	Result: 3.54518 with a slight error due to rounding	785.205	8 7 6 5 4 3 2 1	8 +	3.54518	559.9925019

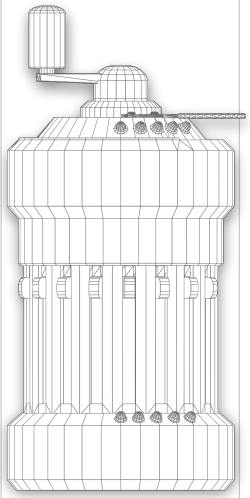
Source: " Curta, exemples de calcul ", Contina / Bernard Stabile - 2023

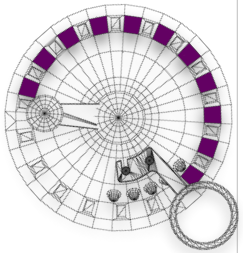
CURTA

ALGORITHMS

3

SERIAL CALCULATIONS



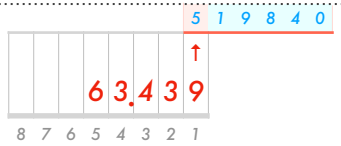
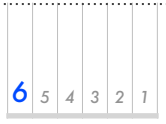
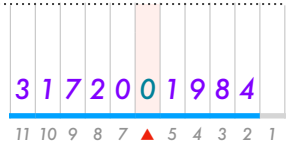
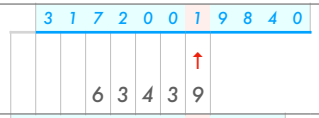
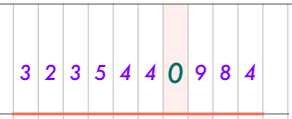
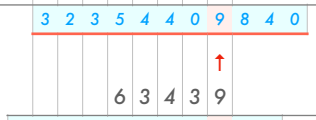
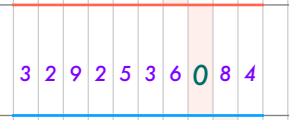
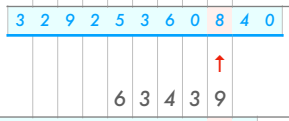
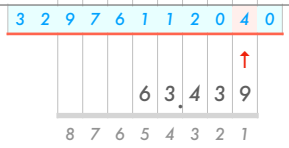
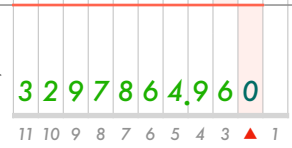


3

Continued multiplication 1 - with optical control

38 x 24 x 57 x 63.44 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b x c x d = ?		Clear	⬆		Clear	Clear
1	Set a Develop 24 in CR. Partial product 1: 912	38	21	6 +	24	912
2	Set the last figure of c diminished by 0.1: 56.9 and place the last figure on the right of SR under the first figure of the partial product 1 (Carriage 3) Positive turns until the 1st figure in PR above the '9' of SR goes to 0	912 56.9	3	9 +	924	513012
4	Same thing with Carriage 2…	513012 569	2	1 +	934	518702
5	… And Carriage 1 Partial product 2: 51,984 = (56.9 x Partial product 1) + 0.1 One decimal place in PR because 56.9 was set instead of 57	518702 56.9	1	2 +	936	5198 4.0

38 x 24 x 57 x 63.44 = ?

		Setting	Carriage/Inverter	Turns	Counter	Product
6	Set the last figure of d diminished by 0.1: 63.439 Place the last figure of SR under the 1st figure of partial product 2 Positive turns until the 1st figure in PR above the '9' in SR goes to 0			5 +	500936	
8	Continue with Carriage 5			+	510936	
9	Continue in the same way…			9 +	519936	
				8 +	520736	
10	Decimal rule: dpSR + dpPR = dpR, 3 + 1 = 4 The last digit is already 0. Result: 3297864.9600			4 +	520776	

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Continued multiplication 2

This method differs from the previous one in that the third factor is reduced by a unit in the last figure. Products development is also different.

38 x 24 x 57 x 63.44 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
a x b x c x d = ?		Clear	⬆		Clear	Clear
1	Set a Develop 24 in CR (normal multiplication) Partial product 1: 912. Note it	38	21	6 +	24	912
2					Clear	
3	Set the next factor diminished by a unit (56) Place the last figure in SR under the first figure of the partial product 1 (Carriage 3)	912 56	3	9 +	9	51312
	Develop the partial product 1 in CR	56	2	+	91	51872
	Partial product 2: 51,984. Note it	56	1	2 +	912	51984
4					Clear	
5	Set the last factor with its last figure diminished by a unit: 63.43 and place the last figure on the right of SR under the first figure of the partial product 2	51984 6343	5	5 +	5	3172019844
	Develop the partial product 51984 in CR with positive turns	6343	4	+	51	3235449844
		6343	3	9 +	519	3292536844
	Decimal rule: dpSR + dpPR = dpR, 2 + 0 = 2	6343	2	8 +	5198	3297611244
	Result: 3297864.96	6343	1	4 +	51984	32978649 6

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Powers calculation in series

Using wisely the Carriage, the power calculation in series is fast and provides a visual control.

	32^2, 32^3, 32^4, ...	Setting	Carriage/Inverter	Turns	Counter	Product
	a^2 , a^3 , a^4, ...	Clear	⬆		Clear	Clear
1	Set a Develop 32 in CR Result in PR: $32^2 = 1024$	3 2	6 5 4 3 2 1	5 +	3 2	1 0 2 4
2	Place the PR arrow in front of the first digit of the result Develop it in CR in front of the CR arrow	1 0 2 4 3 2	4	+	1 0 3 2	3 3 0 2 4
3	Carriage 3. The arrow targets 0, pass to the next Carriage	3 3 0 2 4 3 2	3	∘	1 0 3 2	3 3 0 2 4
4	Place the PR arrow in front of the next digit Develop it in CR with a negative turn	3 3 0 2 4 3 2	2	−	1 0 2 2	3 2 7 0 4
5	And so on… Result: $32^3 = 32768$	3 2 7 0 4 3 2	6 5 4 3 2 1	2 +	1 0 2 4	3 2 7 6 8
6	Place the PR arrow in front of the first digit of the result Buildit in CR in front of the CR arrow	3 2 7 6 8 3 2	5	3 +	3 1 0 2 4	9 9 2 7 6 8

32^2, 32^3, 32^4, ...

		Setting	Carriage/Inverter	Turns	Counter	Product
7	Continue in the same way with successive Carriages	9 9 2 7 6 8 ↑ 3 2	4	+	3 2 0 2 4	1 0 2 4 7 6 8
		1 0 2 4 7 6 8 ↑ 3 2	3	7 +	3 2 7 2 4	1 0 4 7 1 6 8
		1 0 4 7 1 6 8 ↑ 3 2	2	4 +	3 2 7 6 4	1 0 4 8 4 4 8
8	Result: 32^4 = 1048576 With a Type II we can continue until 32^6	1 0 4 8 4 4 8 ↑ 3 2 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	4 +	3 2 7 6 8 ▲	1 0 4 8 5 7 6 11 10 9 8 7 6 5 4 3 2 ▲

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Accumulation of quotients 1

Quotients can be accumulated on CR with division by additive division.

(32.45 ÷ 1.39) + (69.8 ÷ 7.465) – (101.34 ÷ 11.7)	Setting	Carriage/Inverter	Turns	Counter	Product
(a ÷ b) + (c ÷ d) — (e ÷ f)	Clear	⬆		Clear	Clear
	1.39	6	2 +	2	278
1 Set the first divisor b by checking decimal places (max 3)	1 3 9	5	3 +	2 3	3 1 9 7
1 Calculate a ÷ b with division by additive method. (See 1Ca) Develop PR as close as possible to 32.45	1 3 9	4	3 +	2 3 3	3 2 3 8 7
	1 3 9	3	4 +	2 3 3 4	3 2 4 4 2 6
	1 3 9	2	5 +	2 3 3 4 5	3 2 4 4 9 5 5
2 Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4 Partial result 1: 23.3453	1.39	1	3 +	23.3453	32.449967
3					Clear
4 Set the second divisor d	7.465	6	+	3 3 3 4 5 3	7465
4 Calculate c ÷ d with division by additive method Develop PR as close as possible to 69.8	7 4 6 5	5	–	3 2 3 4 5 3	6 7 1 8 5
	7 4 6 5	4	3 +	3 2 6 4 5 3	6 9 4 2 4 5

(32.45 ÷ 1.39) + (69.8 ÷ 7.465) – (101.34 ÷ 11.7)

		Setting	Carriage/Inverter	Turns	Counter	Product
6		7.465	3	5 +	3 2 6 9 5 3	6 9 7 9 7 7 5
		7.465	2	o	3 2 6 9 5 3	6 9 7 9 7 7 5
7	Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4 Partial result 2: 32.6956	7.465	1	3 +	32.6956	69.799895
8			⬇			Clear
		11.7	6	+	226956	117
9	Set the third divisor f by checking decimal places	117	5	2 –	246956	936
	Calculate e ÷ f with division by additive method Develop PR as close as possible to 101.34	117	4	6 +	240956	10062
		117	3	6 +	240356	101322
		117	2	+	240346	1013337
10	Decimal rule, dpPR – dpSR = dpR, 7 – 3 = 4 Final result: 24.0341	11.7	1	5 +	24.0341	101.33955

Source: " Curta Calculating techniques" / Bernard Stabile - 2023

Accumulation of quotients 2

((a — b) ÷ c) + ((d + e) ÷ f) — (g ÷ h)

A = (a — b) ÷ c

B = (d + e) ÷ f

C = g ÷ h

((13.475 — 5.75) ÷ 6.29) + ((17.24 + 3.92) ÷ 7.86) — (18.715 ÷ 9.5)		Setting	Carriage/Inverter	Turns	Counter	Product
	A + B + C	Clear	⬇		Clear	Clear
1	Set the first term of the first dividend a by checking decimal places (3 in SR, 4 in CR, 7 in PR) Set it in PR with Inverter down	13.475	65	+	99	13.475
2	Set b Calculate a — b	5.75	5	—		7.725
3		6.29	5	—	1	1.435
	Set the first divisor c	629	4	2 —	12	177
	Calculate A with division by subtractive method. (See 1Cc)	629	3	2 —	122	512
		629	2	8 +	1228	88
4	Result A: 1.2281	6.29	65432**1**	—	1.2281	0.000251
5						Clear

((13.475 – 5.75) ÷ 6.29) + ((17.24 + 3.92) ÷ 7.86) – (18.715 ÷ 9.5)

		Setting	Carriage/Inverter	Turns	Counter	Product
6	Set the first term of the second dividend d Set it in PR	17.24	5	+	.2281	17.24
7	Set e Calculate d + e	3.92	5	+	9.2281	21.16
8		Clear				
9	Two negative turns to clear CR		5	2 –	12281	2116
10		7.86	5	2 –	3.2281	5.44
	Set the second divisor f	786	4	6 –	38281	724
	Calculate A + B with division by subtractive method	786	3	9 –	39181	166
		786	2	2 +	39201	88
11	Result A + B: 3.9202	7.86	000001	–	3.9202	0.000094
12						Clear
13	The last quotient can be obtained by building-up division, but we keep the Inverter down because it has to be subtracted Set the third divisor h Calculate A + B — C with division by additive method. (See 1Ca) Develop PR as close as possible to the last dividend g Final result: 1.95	9.5	5	+	2.9202	95
		95	4	9 +	20202	1805
		9.5	3	7 +	1.9502	18.715

Source: " Curta Calculating techniques" / Bernard Stabile - 2023

Transfer multiplication

(a x b x c) ÷ (d x e), this calculation is made in stages:

A = a x b in PR

B = A ÷ d in CR

C = B x c in PR

D = C ÷ e in CR

(123 x 345 x 567) ÷ (234 x 456)		Setting	Carriage/Inverter	Turns	Counter	Product
	(a x b x c) ÷ (d x e)	Clear	⬆		Clear	Clear
1	Set b Calculate A = a x b. Develop 123 in CR Partial result A = 42435	345	6 < 4 3 2 1	6 +	123	42435,0
2			⬇		Clear	
3		234	6 5 4 3 2 1	–	1	19035
	Set d	234	5	8 –	18	315
	Calculate B = A ÷ d with division by subtractive method. (See 1Cc) Bring PR as close as possible to 0	234	4	–	181	81
		234	3	3 –	1813	108
		234	2	4 –	18134	144
4	dpPR – dpSR = dpR, 3 – 0 = 3 Partial result B = 181.346	234	6 5 4 3 2 1	6 –	181,346	0,036
5						Clear

(123 x 345 x 567) ÷ (234 x 456)

		Setting	Carriage/Inverter	Turns	Counter	Product
		5 6 7 (8 7 6 5 4 3 2 1)	1	6 +	1 8 1 3 4 0 ▲	3 4 0 2 (11 10 9 8 7 6 5 4 3 2 ▲)
6	Set c	5 6 7	2	4 +	1 8 1 3 0	2 6 0 8 2
	Calculate C = B x c with multiplication 2f Bring CR to 0 whith successive carriages	5 6 7	3	3 +	1 8 1 0	1 9 6 1 8 2
		5 6 7	4	+	1 8 0	7 6 3 1 8 2
		5 6 7	5	8 +	1 0	4 6 1 2 3 1 8 2
7	Partial result C = 102823.182	5 6 7	6 5 4 3 2 1 ▲	+	0 ▲	1 0 2 8 2 3.1 8 2 (11 10 9 8 7 ▲ 5 4 3 2 1)
		4 5 6 (8 7 6 5 4 3 2 1)	6	2 —	2 ▲	1 1 6 2 3 1 8 2 (11 10 9 8 7 ▲ 5 4 3 2 1)
9	Set e	4 5 6	5	2 —	2 2	2 5 0 3 1 8 2
	Calculate D = C ÷ e with division by subtractive method Bring PR as close as possible to 0	4 5 6	4	5 —	2 2 5	2 2 3 1 8 2
		4 5 6	3	4 —	2 2 5 4	4 0 7 8 2
		4 5 6	2	8 —	2 2 5 4 8	4 3 0 2
10	dpPR – dpSR = dpR, (3 – 0) = 3 Final result D = 225.489	4 5 6	6 5 4 3 2 1 ▲	9 —	2 2 5.4 8 9 ▲	0.1 9 8 (11 10 9 8 7 6 5 4 3 2 ▲)

Source: " Curta Calculating techniques" / Bernard Stabile - 2023

Evaluation of series

Convergent series can be evaluated on type II in a continuous operation.
We split SR and PR, and set a_1 on the left of SR and a_2 on the right. If we develop a up to 1 on the left of PR, we shall obtain $a_1 \div a_2$ on the right.
We may either clear the left side of PR or develop to 1 to the left of the 15th dial of PR, i.e. off the register.
So we now have 0 on the left and the 1st term of the series on the right of PR.
We change the settings to b_1 and b_2 and develop the left hand side of PR to the amount which showed on the right hand side, i.e. $a_1 \div a_2$.
Thus we add $(a_1 \div a_2) \times (b_1 \div b_2)$ to the right hand side.
We now have the 1st term on the left and the sum of the first two terms on the right. We proceed in this way until the left and right hand sides of PR agree to the required number of significant figures, obtaining the sum of n terms on the left and n + 1 terms on the right.

This is our convergent serie: $3 + \frac{0.3 \times 0.5}{2} + \frac{0.3 \times 0.5 \times 0.7}{2 \times 3} + \frac{0.3 \times 0.5 \times 0.7 \times 0.9}{2 \times 3 \times 4}$,.....

		Setting	Carriage/Inverter	Turns	Counter	Product
		Clear	⬆		Clear	Clear
1	Set 3 in right of PR CR is purely anecdotal	3	8 7 6 5 4 3 2 1	+	1	3
2	Divisors in left hand SR. Dividends in right hand SR. Note the right hand of PR (3). With setting 2 - 5, develop it in left hand of PR with Carriage 7- 6	2 0.5	8 7 6 5 4 3 2 1	6 +	1 1 5	3 .3 7 5
3	With setting 3 - 7, develop 375 in left hand of PR	3 0.7	8 7 6 5 4 3 2 1	7 +	1 1 7 5	.3 7 5 .3 9 2 5
4	With setting 4 - 9, develop 3925 in left hand of PR	4 0.9	8 7 6 5 > > 2 1	19 +	1 1 7 9 3 7 5	.3 9 2 5 .3 9 6 4 3 7 5
5	Continue in the same way Develop the right hand of PR in left hand of PR as close as possible	5 1.1	8 7 6 5 4 > > 1	27 +	1 1 8 0 1 6 2 5	.3 9 6 4 3 7 5 .3 9 7 3 0 3 7 5
		6 1.3	8 7 6 5 4 > > 1	14 +	1 1 8 0 3 0 6 9	.3 9 7 3 0 3 9 .3 9 7 4 9 1 4 7

		Setting	Carriage/Inverter	Turns	Counter	Product
5	The two parts of PR are gradually converging	7 1.5	8 7 6 5 4 3 > 1	16 +	1 1 8 0 3 3 3 7	.3 9 7 4 9 1 5 , 3 9 7 5 3 1 6 7
		8 1.7	8 7 6 5 4 3 2 1	6 +	1 1 8 0 3 3 8 7	.3 9 7 5 3 1 5 , 3 9 7 5 4 0 1 7
		9 1.9	8 7 6 5 4 3 2 1	9 +	1 1 8 0 3 3 9 7	.3 9 7 5 4 0 5 , 3 9 7 5 4 2 0 7
		10 2.1	1	+	1 1 8 0 3 3 9 8	.3 9 7 5 4 1 5 , 3 9 7 5 4 2 2 8
6	Result: 0.3975426	11 2.3	1	+	1 1 8 0 3 3 9 9	.3 9 7 5 4 2 6 , 3 9 7 5 4 2 5 1

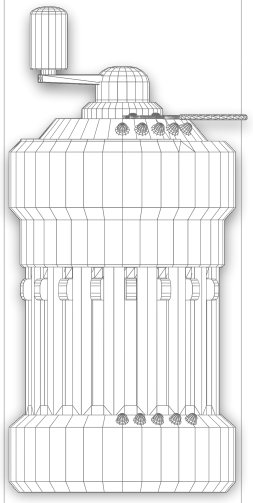
Source: " Curta Calculating techniques" / Bernard Stabile - 2023

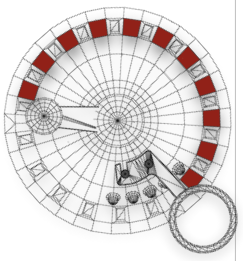
CURTA

ALGORITHMS

4

GEOMETRY





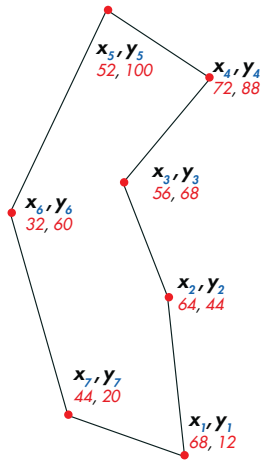
a	**Calculation of area** from co-ordinates (shoelace method)
b	**Sides of a triangle -** Pythagoras theorem
c	**Distance between two points -** Pythagoras theorem
d	**Calculation of co-ordinates**
e	**Determination of a side** of an obtuse - angled triangle

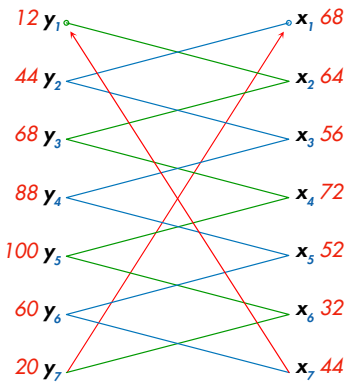
4

Calculation of area from co-ordinates (shoelace method)

The area to be computed is defined by the following co-ordinates which are juxtaposed for the purpose of calculation: $2S = \sum (y_{n+1} - y_{n-1}) x_n$ (x axis) $2S = \sum (x_{n+1} - x_{n-1}) y_n$ (y axis)
If the number of points is even, in practice we enter the last point twice. Depending on the order chosen in which to traverse the points,it may occur that the final result is negative.
The correct result in this case is the complement of this number.

	S = ?	Setting	Carriage/Inverter	Turns	Counter	Product
		Clear	↑		Clear	Clear
1	Develop y_1 in CR		6 5 4 3 **2 1** ▲ ▲	3 +	**1 2** ▲ ▲	
2	Set x_2 (64) in SR. It must be multiplied by (y_1 - y_3) thus change it to 68 in CR	**6 4** 8 7 6 5 4 3 2 1	6 5 4 3 **2 1** ▲ ▲	11 +	**6 8** ▲ ▲	**3 5 8 4** 11 10 9 8 7 6 5 4 3 ▲ ▲
3	Same way for the points following the path of the "shoelace"	**7 2** 8 7 6 5 4 3 2 1	6 5 4 **3** < **1** ▲ ▲	+ 14 −	**1 0 0** ▲ ▲	**5 8 8 8** 11 10 9 8 7 6 5 4 ▲ 2 ▲
		3 2 8 7 6 5 4 3 2 1	6 5 4 **3 2** 1 ▲ ▲	2 + −	**2 0** ▲ ▲	**3 3 2 8** 11 10 9 8 7 6 5 4 ▲ ▲ 1
		6 8 8 7 6 5 4 3 2 1	6 5 4 3 **2 1** ▲ ▲	6 +	**4 4** ▲ ▲	**4 9 6 0** 11 10 9 8 7 6 5 4 3 ▲ ▲
		5 6 8 7 6 5 4 3 2 1	6 5 4 3 **2 1** ▲ ▲	8 +	**8 8** ▲ ▲	**7 4 2 4** 11 10 9 8 7 6 5 4 3 ▲ ▲
		5 2 8 7 6 5 4 3 2 1	6 5 4 3 **2 1** ▲ ▲	10 −	**6 0** ▲ ▲	**5 9 6 8** 11 10 9 8 7 6 5 4 3 ▲ ▲
4	Result: 2S = 3856 Area = 1928	**4 4** 8 7 6 5 4 3 2 1	6 5 4 3 **2 1** ▲ ▲	2 + 5 −	**1 2** ▲ ▲	**3 8 5 6** 11 10 9 8 7 6 5 4 3 ▲ ▲

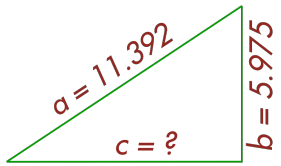


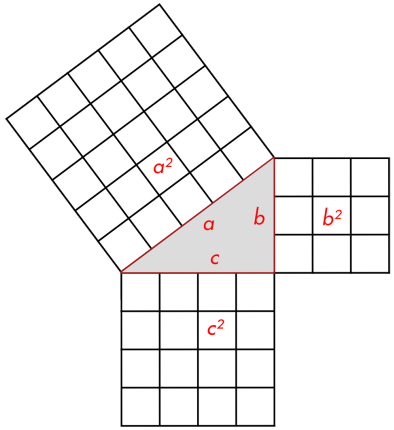


Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Sides of a triangle - Pythagoras' theorem

The operation consist of finding $c = \sqrt{(a^2 \pm b^2)}$



$c = \sqrt{(11.392^2 - 5.975^2)}$		Setting	Carriage/Inverter	Turns	Counter	Product
$c = \sqrt{(a^2 \pm b^2)}$		Clear	↑		Clear	Clear
1	Set a Develop a in CR. In PR: a^2	11.392	5 < 3 > 1	16 +	11.392	129.77664
2			↓		Clear	
3	Set b Develop b in CR. In PR, the radicand: $a^2 - b^2$ Décimal rule, dpSR + dpCR = dpR, 3 + 3 = 6	5.975	4 < > 1	26 −	5.975	94.07039
4					Clear	
5	 Calculate the square root $\sqrt{(a^2 - b^2)}$ with Töpler's method (or other…) Here: the same method as 6c Result: 9.699	1 1 1 3 3 3 5 5 5 7 7 7 9 1 9 9 1 1 3 1 1 - 3 5 3 3 - 5 7 5 5 - 7 9 7 7 - 8 1 8 9 - 9 3 9 9 1 9 3 9 8	4	− - - - - - - - - - +	9.699	16158 - 4217 5 - 2279 - 0340 3 8401 4 6462 3 4523 2583 5 643 8 99999998 7039 6438

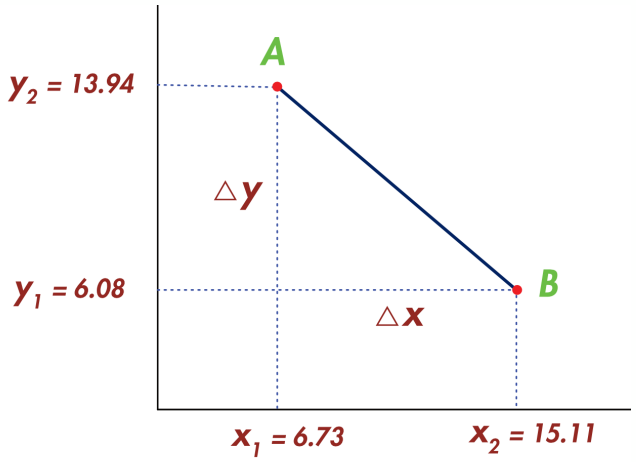
Source: " Curta Calculating techniques" / Bernard Stabile - 2023

Distance between two points - Pythagoras' theorem

$\Delta x = x_2 - x_1$

$\Delta y = y_2 - y_1$

$AB^2 = \Delta x^2 + \Delta y^2$; $AB = \sqrt{(\Delta x^2 + \Delta y^2)}$



$\sqrt{(8.38^2 + 7.86^2)}$		Setting	Carriage/Inverter	Turns	Counter	Product
$AB = \sqrt{(\Delta x^2 + \Delta y^2)}$		Clear	⬆		Clear	Clear
1	Set x_2	15.11	1	+	1	15.11
2	Set x_1 Calculate Δx. Subtraction. Note the result	6.73	1	−		8.38
3						Clear
4	Set y_2	13.94	1	+	1	15.11
5	Set y_1 Calculate Δy. Subtraction. Note the result	6.08	1	−		7.86
6						Clear

$\sqrt{(8.38^2 + 7.86^2)}$

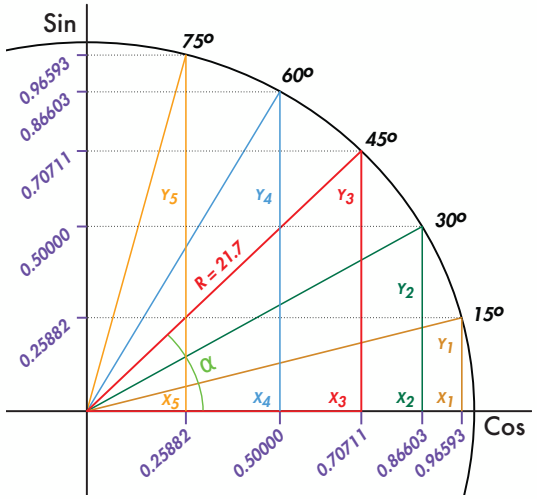
		Setting	Carriage/Inverter	Turns	Counter	Product
7	Set Δx Calculate Δx^2 Develop Δx in CR	8.38	6 < 4	19 +	8.38	70.2244
8					Clear	
9	Set Δy Calculate $AB^2 = \Delta x^2 + \Delta y^2$ Develop Δy in CR	7.86	6 > 4	21 +	7.86	132.004
10			↓		Clear	
11	Calculate AB with Herman's reverse method (or other…) Here: the same method as **2**g Set the first approximation R: 11.5 Calculate R^2	11.5	6 < 4	7 −	11.5	99.9754
12	Set 2R Calculate $N - R^2 \div 2R$ Division by subtractive method. (See **1**Cc) Result: 11.4893	23	6 5 4 > > 1	+ 20 −	11.4893	1

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Calculation of co-ordinates

$X_n = R \times \cos \alpha$

$Y_n = R \times \sin \alpha$

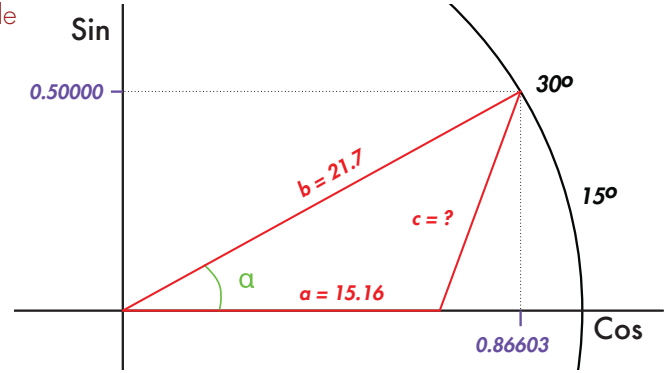


	(X_1, Y_1) $(X_2 Y_2)$ (X_3, Y_3) (X_4, Y_4) (X_5, Y_5)	Setting	Carriage/Inverter	Turns	Counter	Product
		Clear	⬆		Clear	Clear
1	Set R Develop cos 15°/sin 75° in CR. We obtain X_1 and Y_5 : 20.960681	217	65<3>1	32 —	096593	20960681
2	Develop cos 30°/sin 60° in CR. We obtain X_2 and Y_4 : 18.792851	217	65<3>1	+ 10 —	086603	18792851
3	Develop cos 45°/sin 45° in CR. We obtain X_3 and Y_3 : 15.344287	217	65<3>1	+ 9 —	070711	15344287
4	Develop cos 60°/sin 60° in CR. We obtain X_4 and Y_2 : 10.85	217	654321	+ 10 —	05	1085
5	Develop cos 75°/sin 75° in CR. We obtain X_5 and Y_1 : 5.616394	217	65<3>1	+ 10 —	025882	5616394

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Determination of a side of an obtuse angled triangle

The classical formula:
$c^2 = a^2 + b^2 - 2a \times b \times \cos \alpha$
is computationally incovenient
due to the large size of numbers involved.
The best method is as follows:
Compute the values of sin α, cos α (see the shema)
Compute x cos α and ± b ± a x sin α
Then Pythagoras' theorem:
$c = \sqrt{((a \times \sin \alpha)^2 + (\pm b \pm a \times \sin \alpha)^2)}$



a = 15.16, b = 21.7, α = 30°		Setting	Carriage/Inverter	Turns	Counter	Product
$c = \sqrt{((a \times \sin \alpha)^2 + (\pm b \pm a \times \sin \alpha)^2)}$		Clear	⬆		Clear	Clear
1	Set a Calculate a x sin α Develop sin 30° in CR. Note the result	15.16	6 5 4 3 2 1 ▲	5 +	0.5 ▲	7.58 ▲
2	Calculate a x cos α Develop cos 30° in CR	15.16	6 5 < 3 > 1 ▲ ▲	18 +	0.86603 ▲ ▲	13.129014 8 ▲
3	Set b to correspond with the number in PR (Carriage 6). Negative turn If b < a x cos α, set directly the result in RR If b > a x cos α a complement appear in PR (underflow, like here)	21.7	6 5 4 3 2 1 ▲	−	986603 ▲	9991429014 8 ▲
4	Calculate b − a x cos α Set the complement (8.57) With a positive turn, check if 0000... or 9999... appears in PR	8.57	6	+	0.86603 ▲	9999999014 8 ▲
5					Clear	Clear

	a = 15.16, b = 21.7, α = 30°	Setting	Carriage/Inverter	Turns	Counter	Product
6	Multiply the complement by itself	8.57	6 > 4 3 2 1	20 +	8.57	73.4449
7					Clear	
8	Calculate $c^2 = (a \times \sin \alpha)^2 + (b - a \times \cos \alpha)^2$ Set $a \times \sin \alpha$ (The number noted) and multiply it by itself	7.58	6 5 4 > 2 1	20 +	7.58	130.9013
9			⬇		Clear	
10	Calculate c with Herman's reverse method (or other…) Here: the same method as **2**g Set the first approximation R: 11.5 Calculate R^2	11.5	6 < 4 3 2 1	7 −	11.5	999.8651 3
11	Set 2R Calculate $N - R^2 \div 2R$ Division by subtractive method. (See **1**Cc) Result: 11.4413	23	6 5 4 > > 1	+ 8 −	11.4413	14

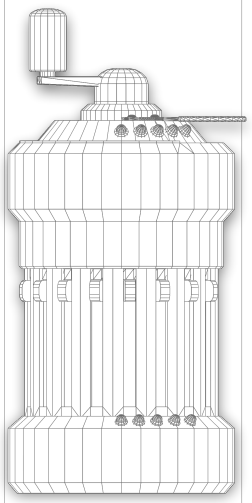
Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

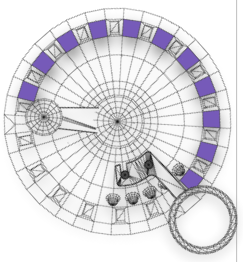
CURTA

ALGORITHMS

5

STATISTICS





a	Calculation of a **sum and a sum of squares** - Type II
b	Calculation with the '9' bridge - Type II
c	**Serial Percentages** with simultaneous control - Type II
d	**Computation of arithmetic mean and standart deviation**

5

Calculation of a **sum and a sum of squares** - Type II

6925+3289−1721+2987=?, $6925^2+3289^2-1721^2+2987^2$=?	Setting	Carriage/Inverter	Turns	Counter	Product
$a + b - c + d = s$, $a^2 + b^2 - c^2 + d^2 = S$	Clear	⬆		Clear	Clear
1 Set 1 in left hand, and a in right hand Calculate a^2 Develop a in the left hand of PR (and in CR) The right hand of PR shows a^2	1 6925	8 7 6 5 4 < > 1	22 +	6925	6925 47955625
2					Clear left hand
3 Set b Calculate a + b and $a^2 + b^2$ Develop b in the left hand of PR (as a check) On CR, a + b , on right hand of PR, $a^2 + b^2$	1 3289	8 7 6 5 4 < > 1	22 +	10214	3289 58773146
4		⬇			Clear left hand
5 Set c Calculate a + b + c and $a^2 + b^2 + c^2$ Develop c in the left hand of PR Note that c^2 is of course positive	1 1721	8 7 6 5 4 < > 1	11 +	8493	1721 61734987
6		⬆			Clear left hand
7 Set d Calculate s = a + b + c + d and $S = a^2 + b^2 + c^2 + d^2$ Develop d in the left hand of PR Result: s = 11,480, S = 70,665,156	1 2987	8 7 6 5 4 < > 1	26 +	11480	2987 70657156

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Calculation with the '9' bridge - Type II

Let be a number from which we want to deduce several numbers successively:

$X - a = X_1$

$X_1 - b = X_2$

$X_2 - c = X_3$

We want to know the successive results X_1, X_2, X_3 as well as the sum of the deductions for each operation:

a + b, a + b + c, …

X=847814, a=13, b=156, c=-1267		Setting	Carriage/Inverter	Turns	Counter	Product
X – a, X_1 – b, X_2 – c		Clear	⬆		Clear	Clear
1	Set X Bring it to PR	8 4 7 8 1 4 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	1 +	1 ▲	8 4 7 8 1 4 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲
2					Clear	
3	Set the '9' bridge Develop a in CR. it was deducted from X and added at the left hand of PR	9 9 9 9 9 9 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲ ▲	4 +	1 3 ▲ ▲	1 3 8 4 7 8 0 1 15 14 13 12 11 10 9 8 7 6 5 4 3 ▲ ▲
5					Clear	
6	Develop b in CR. it was deducted from X_1 and added at the left hand of PR (a + b) In the right hand of PR: X_2	9 9 9 9 9 9 9	8 7 6 5 4 3 < 1 ▲ ▲	12 +	1 5 6 ▲ ▲	1 6 9 8 4 7 6 4 5 15 14 13 12 11 10 9 8 7 6 5 4 ▲ 2 ▲
7					Clear	
8	Develop c in CR. it was deducted from X_2 and added at the left hand of PR (a + b + c) In the right hand of PR: X_3	9 9 9 9 9 9 9	8 7 6 5 4 < > 1 ▲ ▲	16 +	1 2 6 7 ▲ ▲	1 4 3 6 8 4 6 3 7 8 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 ▲

Source: " Exemples de calcul avec la Curta", Contina, curta.li / Bernard Stabile - 2023

Serial Percentages with simultaneous control - Type II

We want to know the proportion (in percentages) of a follows numbers compared to their sum: A + B + C = S
a = (A ÷ S) × 100, b = (B ÷ S) × 100, c = (C ÷ S) × 100, and automatically check that a + b + c = 100

3,545 + 6,893 + 2,360 =12,798		Setting	Carriage/Inverter	Turns	Counter	Product
	A + B + C = S	Clear	⬆		Clear	Clear
1	Set S Calculate a = A ÷ S with additive method. (See **1**Ca) Develop A as close as possible in the right hand of PR	1 12798	5	3 +	3	3 38394
		1 12798	4	2 –	28	358344
2	First percentage a = 27.7 % appears in CR and in the left hand of PR	1 12798	3	3 –	27.7	27.7 3545046
3						Clear
4	Calculate b = B ÷ S with division by additive method Develop B as close as possible in the right hand of PR	1 12798	5	5 +	777	5 6399
		1 12798	4	4 +	817	53 691092
		1 12798	3	–	816	539 6898122
5	In PR, percentage b = 53.86 % In CR, the two percentages have been accumulated: 81.56 %	1 12798	2	4 –	81.56	53.86 68930028
6						Clear
7	Calculate c = C ÷ S with division by additive method Develop C as close as possible in the right hand of PR	1 12798	5	2 +	10156	2 255964
		1 12798	4	2 –	9956	18 230364
		1 12798	3	4 +	9996	184 2354832
8	In PR, percentage c = 18.44 % As a check, the sum of the three percentages in CR: 100 %	1 12798	2	4 +	100.0	18.44 23599512

Source: " Computing examples for the Curta", Contina / Bernard Stabile - 2023

Computation of arithmetic mean and standart deviation

Given N observations $x_1, x_2, ,\ldots x_n$. The arithmetic mean is given by: $x = (\sum (x_i - x_0)) \div N$ and the standard deviation by: $\Delta x = \pm \sqrt{ (\sum (x_i - x_0)^2 \div N (N - 1)) }$

In order to facilitate the calculation, we reduce each observation by a known constant x_0, and in this manner reduce the number of figures used in the calculation.

We have: $x = x_0 + \sum (x_i - x_0)^2 \div N$ and $\sum (x_i - x)^2 = \sum (x_i - x_0)^2 - N (x - x_0)^2$

The calculation can be carried out by the Curta I and Curta II if the number of figures is too large. Observations:

$x_1 = 215.3$, $x_2 = 216.4$, $x_3 = 214.7$, $x_4 = 217.1$, $x_5 = 213.8$, $x_6 = 217.3$, $x_7 = 216.6$

We proceed with $x_0 = 210$, thus $x_1 - x_0 = 5.3$, $x_2 - x_0 = 6.4$ and so on.

	$N = 7, x_0 = 210$	Setting	Carriage/Inverter	Turns	Counter	Product
	$x = x0 + \sum (x_i - x_0)^2 \div N$	Clear	⬆		Clear	Clear
1	Set $x_1 - x_0$ in left hand, and 1 in right hand of SR Multiply by 5.3 Set the decimal markers	5.3 1	6 5 4 3 2 1	8 +	5 3	2 8.0 9 5.3
2					Clear	
3	Set $x_2 - x_0$ in left hand of SR Multiply by 6.4 In PR: $(x_1 - x_0)^2 + (x_2 - x_0)^2 / (x_1 - x_0) + (x_2 - x_0)$	6.4 1	6 5 4 3 2 1	10 +	6 4	6 9.0 5 1 1.7
4					Clear	
5	Set $x_3 - x_0$ in left hand of SR Multiply by 4.7	4.7 1	6 5 4 3 2 1	11 +	4 7	9 1.1 4 1 6.4
6					Clear	
7	Set $x_4 - x_0$ in left hand of SR Multiply by 7.1	7.1 1	6 5 4 3 2 1	8 +	7 1	1 4 1.5 5 2 3.5
8					Clear	
9	Set $x_4 - x_0$ in left hand of SR Multiply by 3.8	3.8 1	6 5 4 3 2 1	11 +	3 8	1 5 5.9 9 2 7.3
10					Clear	

		Setting	Carriage/Inverter	Turns	Counter	Product
11	Set $x_4 - x_0$ in left hand of SR Multiply by 7.1	7.3 1	6 5 **4 3** 2 1	10 +	7 3	2 0 9.2 8 3 4.6
12					Clear	
13	Set $x_4 - x_0$ in left hand of SR Multiply by 3.8 In PR $\sum (x_i - x_0)^2 \ / \ \sum (x_i - x_0)$	6.6 1	6 5 **4 3** 2 1	12 +	3 8	2 5 2.8 4 4 1.2
14			⬇		Clear	
15	Set $\sum (x_i - x_0)$ in left hand, and N in right hand of SR Calculate $\sum (x_i - x_0) \div N$ with division by subtractive method. (See **1**Cc) Result: 5.885 Decimal rule, dpPR − dpSR = dpR, 3 − 0 = 3 The mean value of the observations is: x = 210 + 5.885 = 215.885	4 1.2 7	6 5 **4** > > **1**	26 −	5.8 8 5	1 0.3 7 8 5
16					Clear	
17	Reminder: $\Delta x = \pm \sqrt{ (\sum (x_i - x_0)^2 \div N (N - 1))}$ Set N (N − 1) = 42 Calculate $\sum (x_i - x_0)^2 \div N (N - 1)$ with division by subtractive method	4 2	6 5 4 **3** > **1**	13 −	.2 4 7	4 5
18			⬆		Clear	Clear
19	Calculate Δx with Herman's metho. See **2**f Set the initial approximation: 0.5 Develop 5 in CR. In PR 5^2	5	6 5 4 **3** 2 1	5 +	5	2 5
20	Set twice the approximation Develop PR as close as possible to 0.247	1 0	6 5 4 3 **2** 1	1 −	4 9	2 4
21	Result: 0.497 Thus x = 215.885 ± 0.497	1 0	6 5 4 3 2 **1**	7 +	.4 9 7	2 4 7

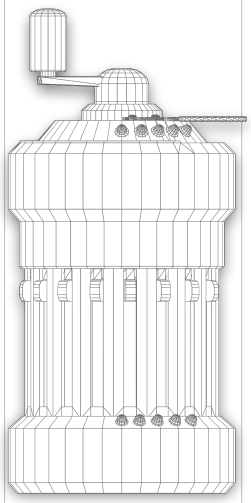
Source: " Computing examples for the Curta ", Contina / Bernard Stabile - 2023

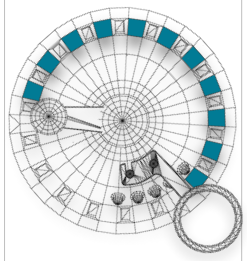
CURTA

ALGORITHMS

6

NUMBER GAMES





a **Collatz conjecture (Syracuse problem) (3x+1 algorithm)**

b **Golden ratio** with Fibonacci sequence

c **Multiplication** by the Vedic method

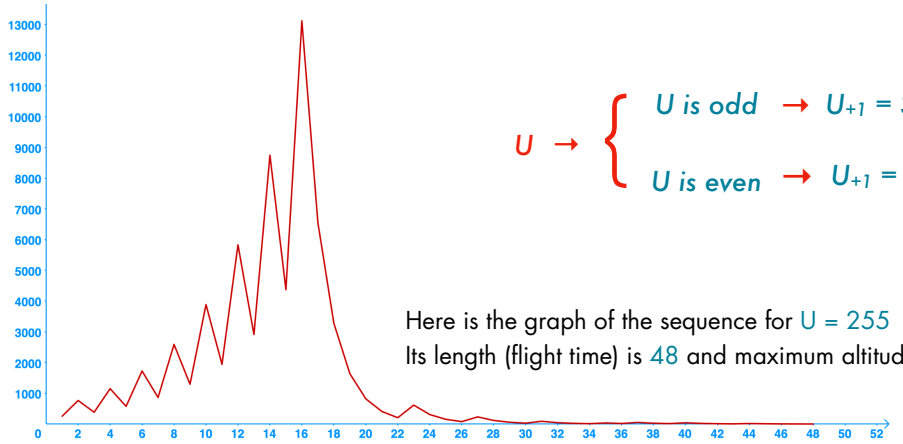
d **Converting a decimal number to binary**

e **Converting a binary number to decimal**

6

Collatz conjecture (Syracuse problem) (3x + 1 algorithm)

The Collatz conjecture is one of the most famous problems in mathematics.
The conjecture asks whether repeating
two simple arithmetic operations will transform every positive integer into 1
It's a sequence of numbers in which each term
is obtained from the previous as follows:
if the previous term is even,
the next term is one half of the previous term.
If the previous term is odd,
the next term is 3 times the previous term plus 1.
The 3x + 1 algorithm became widespread in the 1950s and 60s.
It is a safe bet that the researchers carried out the first calculations on Curta,
like this one:



$$U \rightarrow \begin{cases} U \text{ is odd} \rightarrow U_{+1} = 3U + 1 \\ U \text{ is even} \rightarrow U_{+1} = U \div 2 \end{cases}$$

Here is the graph of the sequence for U = 255
Its length (flight time) is 48 and maximum altitude 13120

255	Setting	Carriage/Inverter	Turns	Counter	Product
	Clear	⬆		Clear	Clear
First number is odd : Set and multiplie by 3	2 5 5	6 5 4 3 2 **1** ▲	3 +	3 ▲	7 6 5 ▲
••••••• Add 1. In PR: $U_{+1} = 3U + 1$	1	1	+	4	7 6 6
		⬇		Clear	
••••• Division by subtractive method	2	3 > 1	14 —	3 8 3	
Multiplie by 3 by bringing CR to 0	3	3 < 1	14 +	0 0 0	1 1 4 9
•••••••• Add 1 to result	1	1	+	9 9 9 9 9 9	1 1 5 0
				Clear	
•••••• Division by subtractive method	2	3 > 1	17 —	5 7 5	
Multiplie by 3 by bringing CR to 0	3	3 < 1	17 +	0 0 0	1 7 2 5
••••••••• Add 1 to result	1	1	+	9 9 9 9 9 9	1 7 2 6
				Clear	

		Setting	Carriage/Inverter	Turns	Counter	Product
•••••••	Division by subtractive method	2	3 > 1	17 −	863	
	Multiplie by 3 by bringing CR to 0	3	3 < 1	17 +	0000	2589
••••••••••••	Add 1 to result	1	1	+	999999	2590
					Clear	
•••••••••	Division by subtractive method	2	4 > > 1	17 +	1295	
	Multiplie by 3 by bringing CR to 0	3	4 < < 1	17 +	0000	3885
••••••••••••••••	Add 1 to result	1	1	+	999999	3886
					Clear	
•••••••••••	Division by subtractive method	2	4 > > 1	17 +	1943	
	Multiplie by 3 by bringing CR to 0	3	4 < < 1	17 +	0000	5829
••••••••••••••••••••	Add 1 to result	1	1	+	999999	5830
					Clear	
••••••••••••	Division by subtractive method	2	4 > > 1	17 +	2915	
	Multiplie by 3 by bringing CR to 0	3	4 < < 1	17 +	0000	8745
•••••••••••••••••••••••••••	Add 1 to result	1	1	+	999999	8746
					Clear	
••••••••••••••••	Division by subtractive method	2	4 > > 1	17 −	4373	
	Multiplie by 3 by bringing CR to 0	3	4 < < 1	17 +	0000	13119
••••••••••••••••••••••••••••••••••••	Add 1 to result	1	1	+	999999	13120

	Setting	Carriage/Inverter	Turns	Counter	Product
				Clear	
•••••••••••••••••••••••••• Division by subtractive method	2	4 > 2	17 —	6560	
		⬆		Clear	
•••••••••••••••••• Even in CR: additive division. Reconstruct 6560 in PR	2	4 > 2	13 +	3280	6560
				Clear	Clear
•••••••••••••• Reconstruct 3280 in PR	2	4 > 2	13 +	1640	3280
				Clear	Clear
•••••••••••• Reconstruct 1664 in PR	2	3 2	10 +	820	1640
				Clear	Clear
••••• Reconstruct 820 in PR	2	3 2	5 +	410	820
				Clear	Clear
•• Reconstruct 410 in PR	2	4 > > 1	7 +	205	410

Continuing, we understand that after having flown
like a leaf in the wind,
the values decrease
and whatever the starting number,
We will always obtain 1, like the leaf that lands on the ground
Then, a cycle is established between 1 and 4

			Clear	Clear
2	1	4 +	4	8
			Clear	Clear
2	1	2 +	2	4
			Clear	Clear
2	1	+	1	2

If an 8 year old child can easily understand this problem, mathematicians remain unable to prove it...

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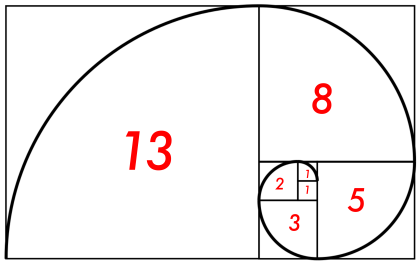
The golden ratio with the Fibonacci sequence

	Φ = ?	Carriage/Inverter	Product	Setting	Turns	Counter
		⬆	Clear	Clear		Clear
1	Exploring the Fibonacci sequence… $F_n = F_{n-1} + F_{n-2}$	8 7 6 5 4 3 2 **1** ▲	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1	11 10 9 8 7 6 5 4 3 2 1 **1**	+	**1** ▲
2		1	**1**	1 > > > > > > **1**	+	2
3		1	**2**	**1** > > > > > 1 > > > > > > 1	+	3
4	Right of SR in left of SR then Left of PR in right of SR	1	**3**	**2** > > > > > **2** 1	+	4
5		1	**5**	**3** 2 > > > > > > **2**		
6	Same method to develop the Fibonacci sequence without having to note	1	5	3 > > > > > **3** 2	+	5
7		1	**8**	**5** 3 > > > > > > **3**		
8	The golden ratio Φ is calculated by dividing a number in the Fibonacci sequence by the one preceding it	1	8	5 > > > > > **5** 3	+	6
9		1	**1 3**	**8** 5 > > > > > > **5**		
10		1	1 3	8 > > > > > **8** 5	+	7
11	$\Phi = F_n = F_{n-1}$	1	**2 1**	**1 3** 8 > > > > > > **8**		
12		1	2 1	1 3 > > > > **1 3** 8	+	8
13	The result becomes more and more precise as we advance in the sequence	1	**3 4**	**2 1** 1 3 > > > > > **1 3**		
14		1	3 4	2 1 > > > > **2 1** 1 3	+	9
15	The golden ratio is also given by the formula:	1	**5 5**	**3 4** 2 1 > > > > > **2 1**		
16		1	5 5	3 4 > > > > **3 4** 2 1	+	1 0
17	$\Phi = \frac{1 + \sqrt{5}}{2}$	1	**8 9**	**5 5** 3 4 > > > > > **3 4**		
18		1	8 9	5 5 > > > > **5 5** 3 4	+	1 1
19		1	**1 4 4**	**8 9** 5 5 > > > > > **5 5**		



	Carriage/Inverter	Product	Setting	Turns	Counter
20	1	144	89 > > > > 89	+	12
21	1	233	144	89 > > > > > 89	
22	1	233	144 > > > 144	+	13
23	1	377	233	144 > > > > 144	
24	1	377	233 > > > 233	+	14
25	1	610	377	233 > > > > 233	
26	1	610	377 > > > 377	+	15
27	1	987	610	377 > > > > 377	
28	1	987	610 > > > 610	+	16
29	1	1597	987	610 > > > > 610	
30	1	1597	987 > > > 987	+	17
31	1	2584	1597	987 > > > > 987	
32	1	2584	1597 > > 1597	+	18
33	1	4181	2584	1597 > > > 1597	
34	1	4181	2584 > > 2584	+	19
35	1	6765	4181	2584 > > > 2584	
36	↓	Clear right hand	Clear left hand		Clear
37	Set the right hand of PR in right hand of SR	8 7 6 5 4 3 2 1 ▲	6765 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 1	4181 11 10 9 8 7 6 5 4 3 2 1	
38	Division by subtractive method. (See 1Cc) Decimal rule for division dpPR – dpSR = dpR, 5 – 0 = 5 Result, the golden ratio: 1.618039	8 > 6 > > 3 > 1 ▲ ▲	2641 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 ▲	4181 11 10 9 8 7 6 5 4 3 2 1	31 +	1.618039 ▲ ▲

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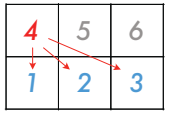
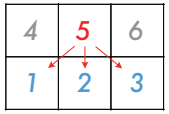
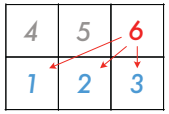
Multiplication by the Vedic method

Here is an algorithm inspired by a calculation method described in the Hindu Vedic mathematical writings.
It is certain that it becomes long beyond three digits, but we only use one cursor in SR.
In addition, the calculation with the Curta generates a curiosity with the division of the result by the figure in CR.

456 x 123		Setting	Carriage/Inverter	Turns	Counter	Product
		Clear	⬆		Clear	Clear
1	 Set the first figure of the first factor Develop the second factor in CR	4	8 < 6 5 4 3 2 1	6 +	1 2 3	4 9 2
2	 Set the second figure of the first factor Develop the second factor in CR without clearing	5	8 7 > 5 4 3 2 1	3 +	1 3 5 3	5 5 3 5
3	 Result: 56,088	6	8 7 6 < 4 3 2 1	3 +	1 3 6 5 3	5 6 0 8 8
4			⬇		Clear	
5	Set the figure in CR Division by subtractive method. (See **3**c) We obtain a number with periodic decimal places 56088 ÷ 13653 = 4.1081081... This is because in CR we obtain the product of the multiplicand by 111 By adding the figures of the period up to the last, we will always obtain 9, (1 + 0 + 8)	1 3 6 5 3	8 > 6 > > 3 > 1	23 +	4.1 0 8 1 0 8 1	1 1 0 7

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Converting a decimal number to binary

A little revenge for Curta. It is quite easy to transform a binary number to decimal. The opposite is more complicated.
Here is an algorithm that allows Curta to do it simply.
Those who practice computing are familiar with this power of '2' sequence.

128	64	32	16	8	4	2	1

With a type II, we go up to 128, and with a type I, up to 32.

a = 207	Setting	Carriage/Inverter	Turns	Counter	Product
	Clear	⬆		Clear	Clear
1	Determine a in binary Starting from the first number < a in the sequence: 128 Carriage 8	8	+	1	128
2	Shift the next digit in the series in SR at the same time as the Carriage	7	+	11	192
3	Overflow with 32	6	+	111	224
4	Negative turn	6	–	110	192
5	Overflow again with 16	5	+	1101	208
6	Negative turn	5	–	1100	192
7	Continue in the same way…	4	+	11001	200
8		3	+	110011	204
9		2	+	1100111	206
10	Here is 207 in 8-bit binary in CR: 11001111	1	+	11001111	207

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Converting a binary number to decimal

We can, of course, do the opposite

11001111 = ?		Setting	Carriage/Inverter	Turns	Counter	Product
		Clear	⬆		Clear	Clear
1	Develop the binary number in CR		8 < 6 < > 3 > 1	6 +	1 1 0 0 1 1 1 1	
2	Determine 11001111 in decimal The CR will serve as a control. Carriage 1	1	1	+	1 1 0 0 1 1 1 2	1
3	Shift the next digit in the series in SR at the same time as the Carriage	1 2	2	+	1 1 0 0 1 1 2 2	3
4		3 4	3	+	1 1 0 0 1 2 2 2	7
5		7 8	4	+	1 1 0 0 2 2 2 2	1 5
7	We have two '0' in CR, go directly to Carriage 7	1 8 6 4	7	+	1 2 0 0 2 2 2 2	7 9
8	The Result: 207	7 9 1 2 8 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1	+	2 2 0 0 2 2 2 2	2 0 7 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 1

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