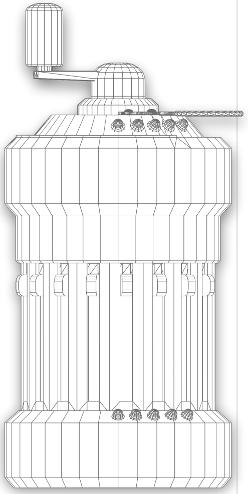
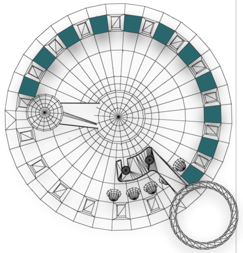
CURTA

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**

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 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+ - - - —	1 2 3 4 3 ▲	1 0 0 4 0 0 9 0 0 1 6 0 0 9 0 0 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 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+ - - - - - +	3 1 - 2 - 3 - 4 - 5 - 6 3 7 ▲	9 6 1 1 0 2 4 1 0 8 9 1 1 5 6 1 2 2 5 1 2 9 6 1 3 6 9 11 10 9 8 7 6 5 4 3 2 ▲

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2b

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 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+ - –	1 2 1 ▲	1 4 1 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 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 11 10 9 8 7 6 5 4 3 2 1	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 15 14 13 12 11 10 9 8 ▲ 6 5 4 3 2 1
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 11 10 9 8 7 6 5 4 3 2 1	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 15 14 13 12 11 10 9 8 7 ▲ 5 4 3 2 1
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 - - - 9 2 4 4 8 11 10 9 8 7 6 5 4 3 2 1	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 15 14 13 12 11 10 9 8 7 6 ▲ 4 3 2 1

2b
↓

	√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	2 4 4 8 1 - - - - 3 - - - - 5 - - - - 7 - - - 8 9 - - - 9 1 - - - - 3 - - - - 5 - - - - 5 2 4 4 9 4 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+ - - - - - - - –	1 2 2 4 1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 - - - - 8 1 2 2 4 7 ▲	1 4 9 8 4 2 0 8 1 - - - - 6 6 5 6 4 - - - - 9 1 0 4 9 - - - 9 1 5 5 3 6 - - - - 4 0 0 2 5 - - - - 6 4 5 1 6 - - - - 8 9 0 0 9 1 5 0 0 1 3 5 0 4 1 4 9 9 8 9 0 0 9 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 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	2 4 4 9 4 1 - - - - - 3 - - - - - 5 - - - - - 7 - - - - - 9 - - - - - 9 2 4 4 9 4 8 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+ - - - - –	1 2 2 4 7 1 - - - - - 2 - - - - - 3 - - - - - 4 - - - - - 5 1 2 2 4 7 4 ▲	1 4 9 9 9 1 4 5 8 4 1 - - - - - 3 9 0 7 8 4 - - - - - 6 3 5 7 2 9 - - - - - 8 8 0 6 7 6 1 5 0 0 0 1 2 5 6 2 5 1 4 9 9 9 8 8 0 6 7 6 15 14 13 12 11 10 9 8 7 6 5 4 ▲ 2 1
7	Same way… Check that the number in SR is twice the number in CR	2 4 4 9 4 8 1 - - - - - - 3 - - - - - - 5 - - - - - - 7 - - - - - - 9 - - - - - - 9 2 4 4 9 4 8 8 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+ - - - - –	1 2 2 4 7 4 1 - - - - - - 2 - - - - - - 3 - - - - - - 4 - - - - - - 5 1 2 2 4 7 4 4 ▲	1 4 9 9 9 9 0 5 1 7 0 8 1 - - - - - - 2 9 6 6 5 6 4 - - - - - - 5 4 1 6 0 4 9 - - - - - - 7 8 6 5 5 3 6 1 5 0 0 0 0 0 3 1 5 0 2 5 1 4 9 9 9 9 7 8 6 5 5 3 6 15 14 13 12 11 10 9 8 7 6 5 4 3 ▲ 1
8	Result: 12.247448	2 4 4 9 4 8 8 1 - - - - - - - 3 - - - - - - - 5 - - - - - - - 7 - - - - - - 8 9 - - - - - - 9 1 - - - - - - - 3 - - - - - - - 5 - - - - - - - 7 2 4 4 9 4 8 9 7 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+ - - - - - - - - –	1 2 2 4 7 4 4 1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7 - - - - - - - 8 - - - - - - - 9 1 2.2 4 7 4 4 8 ▲	1 4 9 9 9 9 8 1 1 0 4 8 4 8 1 - - - - - - - 3 5 5 4 3 3 6 4 - - - - - - - 6 0 0 3 8 2 4 9 - - - - - - - 8 4 5 3 3 1 3 6 - - - - - - 9 0 9 0 2 8 0 2 5 - - - - - - - 3 3 5 2 2 9 1 6 - - - - - - - 5 8 0 1 7 8 0 9 - - - - - - - 8 2 5 1 2 7 0 4 1 5 0 0 0 0 0 0 7 0 0 7 6 0 1 1 4 9.9 9 9 9 8 2 5 1 2 7 0 4 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲

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

2c

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 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	2 2 3 7 11 10 9 8 7 6 ▲ 4 3 2 1
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 8 7 6 5 4 3 2 1	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 11 10 9 8 7 6 ▲ 5 3 2 1
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 8 7 6 5 4 3 2 1	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 11 10 9 8 7 6 5 ▲ 3 2 1

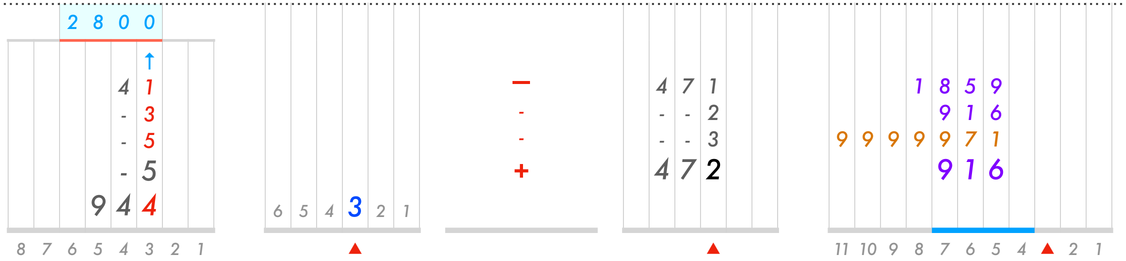
2c
↓

√2237 = ?

Setting | Carriage/Inverter | Turns | Counter | Product

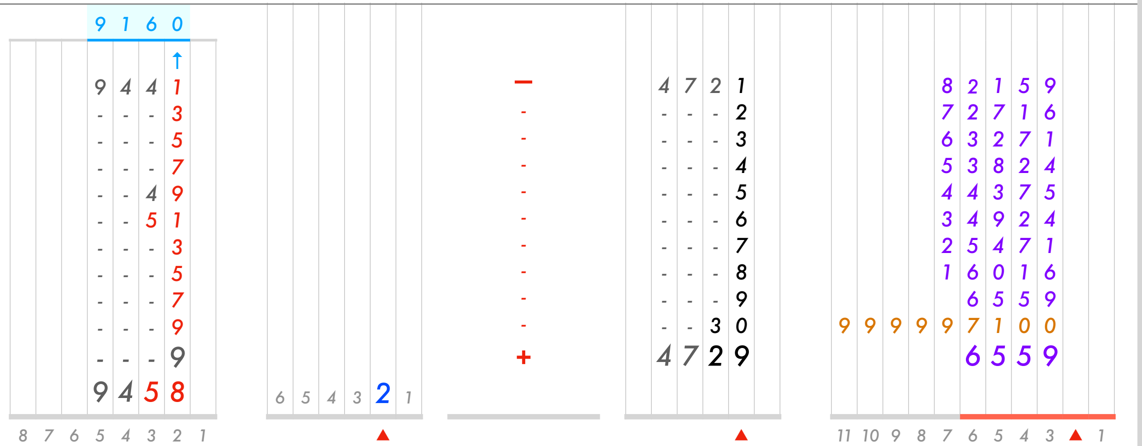
5

Continue in the same way…
Underflow occurs with 5
Positive turn
Decrease the last figure by 1



6

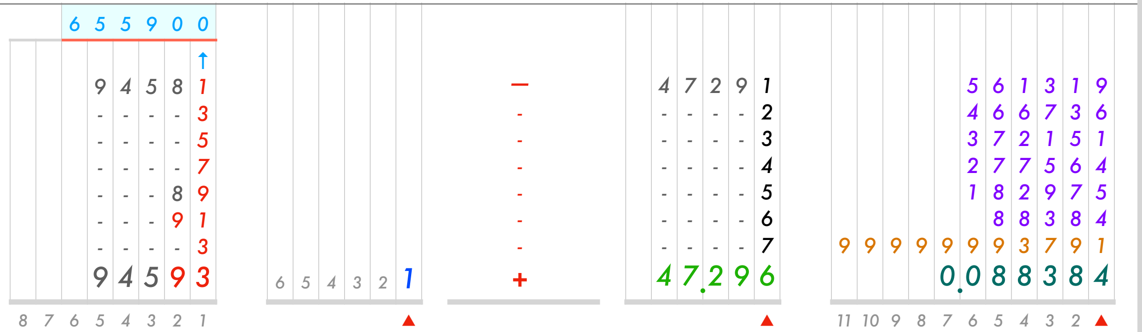
Underflow occurs with 19
Positive turn
Decrease the last figure by 1



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 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	5 +	5 ▲	9 5 9 2 2 11 10 9 8 7 ▲ 5 4 3 2 1
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 8 7 6 5 4 3 2 1	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 11 10 9 8 7 ▲ 5 4 3 2 1

2d
↓

2d

	√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 0 5 - 1 - - 2 - - 3 5 - - - 4 3 0 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	— - - - +	0 9 - 8 - 7 - 6 0 7 ▲	1 1 8 7 2 - 7 7 2 - - 3 4 7 - 9 9 1 2 - 3 4 7 - 11 10 9 8 7 6 ▲ 4 3 2 1
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	4 3 0 5 - - 1 - - - 2 - - - 3 - - - 4 - - - 5 - - - 6 - - - 7 - - - 8 5 - - - - 4 3 8 5 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	— - - - - - - - - +	6 9 - 8 - 7 - 6 - 5 - 4 - 3 - 2 - 1 6 2 ▲	3 0 4 1 5 2 6 1 0 2 1 7 7 5 1 7 4 4 1 3 0 9 5 8 7 4 4 3 7 5 0 0 0 9 9 5 6 1 5 0 0 0 0 0 0 11 10 9 8 7 6 5 ▲ 3 2 1
5	Clear the last '5' in SR, and read result in SR: 438	4 3 8 8 7 6 5 4 3 2 1	4		6 2 ▲	

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	1 5 0 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	5 +	5 ▲	7 5 0 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 1
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	7 5 0 ↑ 0 5 1 5 - - 1 5 11 10 9 8 7 6 5 4 3 2 1	8	− - +	4 3 4 ▲	2 5 7 5 2 5 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 1
3	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	1 0 5 - 1 - - 2 5 - - - 1 2 5 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	− - - +	3 9 - 8 - 7 3 8 ▲	1 4 5 3 9 0 5 3 15 14 13 12 11 10 9 8 ▲ 6 5 4 3 2 1
4	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	1 2 0 5 - - 1 - - - 2 5 - - - - 1 2 3 5 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	− - - +	3 7 9 - - 8 - - 7 3 7 8 ▲	1 7 9 5 5 8 9 9 3 5 5 5 8 15 14 13 12 11 10 9 8 7 ▲ 5 4 3 2 1
5	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	1 2 2 0 5 - - - 1 - - - - 2 - - - - 3 - - - - 4 5 - - - - - 1 2 2 4 5 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	− - - - - +	3 7 7 9 - - - 8 - - - 7 - - - 6 - - - 5 3 7 7 6 ▲	4 5 7 9 5 3 3 5 8 2 1 3 5 5 9 1 2 9 9 9 6 8 8 5 9 1 2 15 14 13 12 11 10 9 8 7 6 ▲ 4 3 2 1

2e ↓

	√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	1 2 2 4 0 5 - - - - 1 - - - - - 2 - - - - - 3 - - - - - 4 - - - - - 5 - - - - - 6 - - - - - 7 5 - - - - - - 12475 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	– - - - - - - - +	3 7 7 5 9 - - - - 8 - - - - 7 - - - - 6 - - - - 5 - - - - 4 - - - - 3 - - - - 2 37753 ▲	7 8 9 5 9 5 6 6 7 1 8 5 4 4 7 5 5 4 2 2 3 2 2 9 9 8 7 5 1 7 7 4 2 5 4 9 5 5 9 9 9 9 3 2 4 8 54955 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 1
7	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	1 2 2 4 7 0 5 - - - - - 1 - - - - - - 2 - - - - - - 3 - - - - - - 4 5 - - - - - - - 122740 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	– - - - - +	3 7 7 5 2 9 - - - - - 8 - - - - - 7 - - - - - 6 - - - - - 5 377526 ▲	4 2 7 0 7 9 5 3 0 4 6 0 8 1 8 2 1 3 5 5 5 9 6 6 2 9 9 9 9 9 3 7 1 8 7 5 59662 15 14 13 12 11 10 9 8 7 6 5 4 ▲ 2 1
8	Clear the '5' Set 5 on the next SR digit to its right Increment in previous digit until underflow occurs Positive turn	1 2 2 4 7 4 0 5 - - - - - - 1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 5 - - - - - - - - 1224745 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	– - - - - +	3 7 7 5 2 5 9 - - - - - - 8 - - - - - - 7 - - - - - - 6 - - - - - - 5 3775256 ▲	4 7 4 1 4 5 9 5 3 5 1 6 7 1 8 2 2 9 1 9 7 5 5 1 0 6 7 2 3 2 9 9 9 9 9 9 8 4 2 4 8 7 5 1067232 15 14 13 12 11 10 9 8 7 6 5 4 3 ▲ 1
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	1 2 2 4 7 4 4 0 5 - - - - - - - 1 - - - - - - - - 2 - - - - - - - - 3 - - - - - - - - 4 - - - - - - - - 5 - - - - - - - - 6 - - - - - - - - 7 - - - - - - - - 8 5 - - - - - - - - - 12.2474480 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	– - - - - - - - - +	3 7 7 5 2 5 5 9 - - - - - - - 8 - - - - - - - 7 - - - - - - - 6 - - - - - - - 5 - - - - - - - 4 - - - - - - - 3 - - - - - - - 2 - - - - - - - 1 37752552 ▲	9 4 4 7 5 7 5 9 5 8 2 2 2 8 3 1 8 6 9 9 8 0 8 7 5 5 5 7 7 3 3 4 3 2 4 5 4 8 5 9 8 7 5 3 3 2 3 8 5 4 2 2 0 9 9 1 0 9 5 5 8 7 4 3 6 4 8 9 9 9 9 9 9 9 6 4 9 6 1 9 9 5 0.000008743648 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲

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

2f

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 $N = A^2 + 2\ AE + E^2$, 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	4	2 +	12.2	148.84
2	Set 2A, twice the approximation	24.4	3	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	1	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	1 5 0	**6** 5 4 3 2 1	+	1	1 5 0
2			⬇		Clear	
3	Set initial approximation A: 12.2 and built it in CR Calculate N — A²	1 2.2	6	—	1	2 8
		1 2 2	5	2 —	1 2	3 6
		1 2.2	6 5 **4** 3 2 1	2 —	1 2.2	1.1 6
4	Set 2A	2 4.4	6 5 4 **3** 2 1	4 —	1 2.2 4	.1 8 4
	Calculate (N — A²) ÷ 2A Division by subtractive method. (See **1**Cc)	2 4 4	2	7 —	1 2 2 4 7	1 3 2
	Result: R = 12.2475	2 4.4	6 5 4 3 2 **1**	5 —	1 2.2 4 7 5	0.0 1

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

2h

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
1	Set the approximation A: 12.2	1 2.2 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	+	1 ▲	1 2.2 11 10 9 8 7 ▲ 5 4 3 2 1
	Calculate N ÷ A Division by additive method. (See **1**Ca) Develop PR as close as possible to 150	1 2 2	5	2 +	1 2	1 4 6 4
		1 2 2	4	2 +	1 2 2	1 4 8 8 4
		1 2 2	3	9 +	1 2 2 9	1 4 9 9 3 8
	Note the result in CR	1 2.2	6 5 4 3 2 1 ▲	5 +	1 2.2 9 5	1 4 9.9 9 9 11 10 9 8 7 6 5 4 3 ▲ 1
2					Clear	Clear
3	Calculate (N ÷ A) + A Bring A in PR	1 2.2	6 5 4 3 2 1 ▲	+	1	1 2.2 11 10 9 8 7 6 5 4 ▲ 2 1
	Set N ÷ A	1 2.2 9 5	1	+	1	2 4.4 9 5 11 10 9 8 7 6 5 4 3 2 ▲

	$\sqrt{150}$ = ?	Setting	Carriage/Inverter	Turns	Counter	Product
4			⬇		Clear	
5		2	6 ▲	—	1	4495
	Set 2	2	5	2 —	12	495
	Calculate the mean: ((N ÷ A) + A) ÷ 2 with division by subtractive method. (See **1**Cc)	2	4	2 —	122	95
		2	3	4 —	1224	15
	Result: R = 12.2475	2	2	7 —	12247	1
		2	1 ▲	5 —	12.2475	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
1		2 1.4 8 7 6 5 4 3 2 1	6 5 4 3 2 1 ▲	2 +	2 ▲	4 2 8 11 10 9 8 7 ▲ 5 4 3 2 1
	Set the approximation A: 21.4	2 1 4	5	+	2 1	4 4 9 4
	Calculate N ÷ A	2 1 4	4	3 +	2 1 3	4 5 5 8 2
	Division by additive method. (See **1**Ca) Develop PR as close as possible to N, 457.315	2 1 4	3	6 +	2 1 3 6	4 5 7 1 0 4
	Result in CR	2 1 4	2	9 +	2 1 3 6 9	4 5 7 2 9 6 6
		2 1.4	6 5 4 3 2 1 ▲	9 +	2 1.3 6 9 9	4 5 7.3 1 5 8 6 11 10 9 8 7 6 5 4 3 2 ▲
2					Clear	Clear
3		2 1.4	1	+	1	2 1.4 11 10 9 8 7 6 5 4 3 2 ▲
	Calculate (N ÷ A) + A	2 1.3 6 9 9	1	+	1	4 2.7 6 9 9 11 10 9 8 7 6 5 4 3 2 1
4			↓		Clear	
5	Set 2 Calculate the mean: ((N ÷ A) + A) ÷ 2 with division by subtractive method. (See **1**Cc) Result: R = 21.3849	2 8 7 6 5 4 3 2 1	6 > 4 3 > 1 ▲ ▲	27 +	2 1.3 8 4 9 ▲ ▲	1 11 10 9 8 7 6 5 4 3 2 ▲

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

2

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	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	5	+	2 1	1 7 3 1 5
7	Subtract 1 in CR with a positive turn	4 0	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	4	4 −	2 1 4	9 9 9 9 1 5
10	Positive turn. Note the two last figures in CR: '13'	4 1	4	+	2 1 3	4 0 1 5
11	Subtract 3 in CR with positive turns	4 1	4	3 +	2 1	1 6 3 1 5

2
↓

	$\sqrt{457.315} = ?$	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 ▲

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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

	$N = 560, \quad A = 8.24, \quad \sqrt[3]{560} = ?$	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 A²: Develop A in CR	8 2 4 11 10 9 8 7 6 5 4 3• 2 1	8 7 6 5 4 3 < 1 ▲ ▲	14 +	8.2 4 ▲ ▲	6 7 8 9 7 6 15 14 13 12 11 10 9 8 7 6 5. 4 ▲ 2 ▲
2	Set A²	6 7 8 9 7 6	3		8 2 4	6 7 8 9 7 6
3					Clear	Clear
4	Calculate 3A² .Develop 3 in CR. In PR, we obtain 3A² Note this number	6 7.8 9 7 6 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	3 +	3 ▲	2 0 3.6 9 2 8 15 14 13 12 11 10 9 8 7 ▲ 5 4 3 2 1
5	Calculate A³ Develop A in CR. A³ in PR	6 7.8 9 7 6 11 10 9 8 7 6 5 4 3 2 1	8 7 6 > 4 3 2 1 ▲ ▲	7 +	8.2 4 ▲ ▲	5 5 9.4 7 6 2 2 4 15 14 13 12 11 10 9 8 7 ▲ 5 ▲ 3 2 1
6	Set 3A²	2 0 3.6 9 2 8 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	+	8.2 5	5 6 1.5 1 3 1 5 2 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 1
	Calculate $A_1 = A + (N - A^3) \div 3A^2$	2 0 3 6 9 2 8	4	−	8 2 4	5 5 9 4 7 6 2 2 4
	Division by additive method. (See **1** Ca)	2 0 3 6 9 2 8	3	2 +	8 2 4 2	5 5 9 8 8 3 6 0 9 6
	Develop PR as close as possible to N	2 0 3 6 9 2 8	2	5 +	8 2 4 2 5	5 5 9 9 8 5 4 5 6
7	Result: 8.24257	2 0 3.6 9 2 8 11 10 9 8 7 6 5 4 3 2 1	1 ▲	7 +	8.2 4 2 5 7 ▲	5 5 9.9 9 9 7 1 4 4 9 6 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲

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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	3.5 4 11 10 9 8 7 6 5 4 3 2 1	8 < 6 < > 3 > 1 ▲ ▲	10 — 46 +	4 4 3 6 1 8 6 4 ▲ ▲	1 5 7.0 4 0 9 9 8 5 6 15 14 13 12 11 10 9 ▲ 7 6 5 4 3 2 ▲
	Set A^4 rounded to 6 digits	1 5 7 0 4 1	1		4 4 3 6 1 8 6 4	1 5 7 0 4 0 9 9 8 5 6
2					Clear	Clear
3	Calculate $5A^4$ Develop 5 in CR. $5A^4$ in PR. Note this number	1 5 7.0 4 1 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	4 +	5 ▲	7 8 5.2 0 5 15 14 13 12 11 10 9 8 7 ▲ 5 4 3 2 1
4	Calculate A^5 Develop R in CR	1 5 7.0 4 1	8 7 6 > 4 3 2 1 ▲ ▲	2 — 9 +	3.5 4 ▲	5 5 5.9 2 5 1 4 15 14 13 12 11 10 9 8 7 6 5 ▲ 3 2 1
5	Set $5A^4$ Calculate $R = A + (N - A^5) \div 3A^4$ Multiplie to develop PR as close as possible to N	7 8 5.2 0 5 11 10 9 8 7 6 5 4 3 2 1	8 7 6 5 4 3 2 1 ▲	5 +	3.5 4 5 ▲	5 5 9.8 5 1 1 6 5 15 14 13 12 11 10 9 8 7 6 5 4 ▲ 2 1
		7 8 5 2 0 5	2	1 +	3 5 4 5 1	5 5 9 9 2 9 6 8 5 5
6	Result: 3.54518 with a slight error due to rounding	7 8 5.2 0 5	8 7 6 5 4 3 2 1 ▲	8 +	3.5 4 5 1 8 ▲	5 5 9.9 9 2 5 0 1 9 15 14 13 12 11 10 9 8 7 6 5 4 3 2 ▲

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