SHARP

ELECTRONIC DESK CALCULATOR

WITH

IC

COMPET-23

MODEL CS-23C

INSTRUCTION MANUAL

CONTENTS

INTRODUCTION

Sharp's amazing CS-23C electronic desk calculator using ICs (Integrated Circuits) marks another major advance in modern business methods. Years of pioneering research and resourcefulness in electronic engineering has enabled Sharp to develop an exceptionally remarkable desk calculator with a memory register.

The CS-23C is thoroughly reliable and carries out complicated calculations with amazing speed and efficiency. This booklet has been prepared to give current users and prospective buyers a detailed understanding of the scope and breadth of the machine's operation.

FEATURES

* **Superior MOS-ICs**
  72 MOS-ICs (Metal Oxide Semiconductor Integrated (Circuits), 76 transistors and 335 diodes drastically reduce the number of working parts, increase dependability.

* **Memory register**
  Stores intermediate answers for continued calculation . . . enables extremely complicated and diverse calculations, such as sum of products, calculations by constant, etc.

* **Compact**
  Thanks to 72 ICs, the CS-23C is amazingly compact and light.

* **Round off device**
  Setting the Round off dial conveniently counts fractions over 1/2 as one, rounds off others.

* **Overflow error check lamp**
  A red error lamp turns on by mis-operation or exceeded capacity in any calculation.

* **Memory indicator**
  When the memory entry is registered, the red Memory lamp turns on.

* **Double-set protection keys**
  Eliminate error, speed up operation . . . no more worry about doublesetting keys.

* **Clear display panel**
  Snap reading with advanced electronic numerical indicators. The newly designed display panel prevents annoying glares caused by light reflecting off the display panel.

* **Simplified exponent calculation**

* **Optional "Memorizer"**
  Sharp's dial unit "Memorizer 10" (CSA-10) or automatic programer "Memorizer 60" (CSA-12) can be easily connected for simplified diverse calculation by constant.

* **Sophisticated space-age styling**
  Lightweight and noiseless, easy-to-carry the CS-23C enhances modern office decors, upgrades working areas, increases efficiency.

SPECIFICATIONS

Power source:	AC 100/110/120 or 200/220/240V, 50 ~ 60 Hz
Capacity:	14 digits, 6 digit decimals Addition & Subtraction: 14 digits ± 14 digits = 14 digits Multiplication: Total digits of multiplier and multiplicand: up to 14 digits (rounding off possible) Division: 13 digits ÷ 13 digits = 14 digits—divisor digits
Decimal point:	In case of addition and subtraction, decimal point is always aligned to the tabulation. In case of multiplication and division, decimal point works based on floating system until it exceeds the tabulation dial number. However, it is treated according to the tabulation if the result exceeds the tabulation.
Sign indication:	Minus indication lamp in the case of Negative
Calculations:	Four arithmetical operations, product ± product with individual products, quotient ± quotient with individual quotients, successive multiplication and division, multiplicand ± multiplicand with individual products, dividend ± dividend with individual quotient, multiplication and division by constant, exponent calculation, mixed calculation, etc.
Calculation speed:	Addition & subtraction 0.05sec Multiplication 0.5sec Division 0.5sec
ICs:	72
Memory register:	1
Transistors:	76
Diodes:	335
Diode arrays:	34
Clock frequency:	50kHz
Temperature:	0°C – 40°C (32°F – 104°F)
Power consumption:	25W
Dimensions:	294mm wide, 133mm high, 317mm deep (11-5/8" x 5-1/4" x 12-1/2")
Weight:	4kg (8.8 lbs.)

KEY DESIGNATION

Tabulation & Round off dial (0 ~ 6)
Specifies decimal places. Set red figure for rounding off. Set black figure for discarding.

K Constant key
Used for carrying out calculations by constant. Push to lock the key. Push again to unlock the key.

CE Clear entry key
Clears figures mistakenly set.

C Clear key
Clears all the contents except memory register.

0 – 9 Numeral keys

• Decimal point key

RC Recall key
Exchanges the contents of No.1 register with those of No.2 register.

× Multiplication key
Orders multiplication. The key lamp turns on when the key is touched.

= Equal key
Derives sum, product, and quotient.

÷ Division key
Orders division. The key lamp turns on when the key is touched.

− Red equal key
Orders subtraction. Starts calculation after changing the sign of the operator.

MR Memory recall key
Summons the stored contents in the memory on the display panel.

M+ Memory plus key
Adds displayed figures to the stored contents in the memory. (No change in the display panel.) Derives sum of products (quotients) in memory calculation. Each product (quotient)is displayed and added to the stored contents in the memory.

M− Memory minus key
Subtracts displayed figures from the contents in the memory. (No change in the display panel.) Derives difference of products (quotients) in memory calculation. Each product (quotient) is displayed and subtracted from the stored contents in the memory.

CM Clear memory key
Clears the contents in the memory only.

E Overflow error lamp

M Memory lamp

− Minus sign lamp

HINTS

1. As highly sensitive ICs, transistors and diodes are used, avoid placing the unit in hot, dusty or humid locations.
2. Be sure to turn off the unit before disconnecting the power cord.
3. Do not jolt or drop the unit.
4. Do not stand it on its side or turn it over.
5. Do not place articles on top of the unit.
6. When cleaning the cabinet, use the enclosed cloth. Do not use a wet cloth or any organic solutions such as kerosene or benzine.
7. When not in use, keep the unit covered.

OPERATION

Connect power cord to an electric outlet, and turn the unit on.
When the unit is turned on, clear the calculator in the following order.

1. Touch [C] key. ([E] lamp goes out.)
2. Touch [CM] key. ([M] lamp goes out.)
3. Except for constant and exponent calculation, [K] key can be in locked or unlocked condition. However, in order to avoid confusion, examples of unlocked condition are given in this operation manual.

1. Addition and Subtraction

* Sum, Difference: Up to 14 (6 digit decimals)

Ex.1 - 1 123 + 456 + 789 = 1368

Steps:

	Operation	Display	Note
1	[0] ●		Tabulation dial
2	[C]	0	
3	123	123	
4	[=]	123	
5	456	456	
6	[=]	579	
7	789	789	
8	[=]	1368	Sum

Ex. 1-2 3.4567 + 2.1 - 1.234 = 4.32
Steps:

	Operation	Display	Note
1	[2] ●		Tabulation dial
2	[C]	0	
3	3.4567	3.4567	
4	[=]	3.45	
5	2.1	2.1	
6	[=]	5.55	
7	1.234	1.234	
8	Red [=]	4.32	Ans.

Ex. 1-3 0.12 + 0.3584 + 0.235 = 0.7134
Steps:

	Operation	Display	Note
1	[4] ●		Tabulation dial
2	[C]	0	
3	.12	0.12	
4	[=]	0.1200	
5	.3584	0.3584	
6	[=]	0.4784	
7	.235	0.235	
8	[=]	0.7134	Ans.

Ex. 1-4 35.62 - 0.53 - 40.15 = -5.06
Steps:

	Operation	Display	Note
1	[2] ●		Tabulation dial
2	[C]	0	
3	35.62	35.62	
4	[=]	35.62	
5	.53	0.53	
6	Red [=]	35.09	
7	40.15	40.15	
8	Red [=]	5.06-	Minus lamp on

Ex. 1-5 462 - 146 - 29 + 212 = 499

Steps:

	Operation	Display	Note
1	[0] ●		Tabulation dial
2	[C]	0	
3	462	462	
4	[=]	462	
5	146	146	
6	Red [=]	316	
7	29	29	
8	Red [=]	287	
9	212	212	
10	[=]	499	Ans.

Note: 1) Use [=] key for addition. Use red [=] key for subtraction.
2) In the case of negative results, minus (-) lamp turns on.

2. Multiplication and Successive multiplication

* Total digits of multiplicand and multiplier: Up to 14 digits (6 digit decimals)
* Product: Up to 14 digits (6 digit decimals)
* Rounding off possible

Note: Set the larger Tabulation dial number (black) than the required decimal digits.

Ex. 2-1 1.1 x 2.2 = 2.42

Steps:

	Operation	Display	Note
1	[2] ●		Tabulation dial
2	[C]	0	
3	1.1	1.1	
4	[×]	1.1	[×] lamp on
5	2.2	2.2	
6	[=]	2.42	[×] lamp off, product

Ex. 2-2 2.2 x 3.3 x 4.4 x 5.5 = 175.692

Steps:

	Operation	Display	Note
1	[4] ●		Tabulation dial
2	[C]	0	
3	2.2	2.2	
4	[×]	2.2	[×] lamp on
5	3.3	3.3	
6	[=]	7.26	[×] lamp off
7	[×]	7.26	[×] lamp on
8	4.4	4.4	
9	[=]	31.944	[×] lamp off
10	[×]	31.944	[×] lamp on
11	5.5	5.5	
12	[=]	175.6920	[×] lamp off (product)

Note: 1) When the decimal digits of the product are smaller than the specified Tabulation dial number, the decimal point is automatically positioned. When the decimal digits of the product are larger than the specified Tabulation dial number, the dial prescribes the decimal digits.

2) When [×] key is touched, the key lamp turns on indicating that multiplication order is registered.

3) For further continued Successive Multiplication, touch the [×] key repeatedly and proceed the calculations.

3. Division and Successive division

* Dividend: Up to 13 digits (6 digit decimals)
* Divisor: Up to 13 digits (6 digit decimals)
* Quotient: 14 digits – divisor digits (6 digit decimals)
* Rounding off possible

Note: Set the Tabulation dial number (black) larger than the required decimal digits.

Ex. 3-1 436.524 ÷ 2 = 218.262
Steps:

	Operation	Display	Note
1	[4] ●		Tabulation dial
2	[C]	0	
3	436.524	436.524	
4	[÷]	436.524	[÷] lamp on
5	2	2	
6	[=]	218.2620	[÷] lamp off (quotient)

Ex. 3-2 256 ÷ 12 ÷ 0.56 = 38.095237
Steps:

	Operation	Display	Note
1	[6] ●		Tabulation dial
2	[C]	0	
3	256	256	
4	[÷]	256	[÷] lamp on
5	12	12	
6	[=]	21.333333	[÷] lamp off
7	[÷]	21.333333	[÷] lamp on
8	56	0.56	
9	[=]	38.095237	[÷] lamp off (quotient)

Note: 1) When [÷] key is touched, the key lamp turns on indicating that the division order is registered.

2) For further continued Successive Division, touch [÷] key repeatedly to proceed the calculations.

4. Multiplication and Division check

* Capacity: Same as for Multiplication and Division.
  After Multiplication (Division) is carried out, get the multiplier (dividend) to check the product (quotient).

Multiplication check

Ex. 4-1 2 x 3* = 6

2: multiplicand
3: multiplier
6: product (to be checked)

Steps:

	Operation	Display	Note
1	[0] ●		Tabulation dial
2	[C]	0	
3	2	2	
4	[×]	2	[×] lamp on
5	3	3	
6	[=]	6	[×] lamp off
7	[÷]	6	[÷] lamp on
8	[RC]	2	
9	[=]	3	* [÷] lamp off

Note: When the number 3 at step 9 is equal to a multiplier 3* in above expression, the calculation is correct.
When the number 4 is read in by mistake instead of 3 at step 5, the number 4 is displayed at step 9. As the number 4 should be a multiplier 3*, we can find that product 8 is not correct.

Ex. 4-2 12* ÷ 2 = 6

12: dividend
2: divisor
6: quotient

Steps:

	Operation	Display	Note
1	[0] ●		Tabulation dial
2	[C]	0	
3	12	12	
4	[÷]	12	[÷] lamp on
5	2	2	

6	[=]	6	[+] lamp off
7	[×]	6	[×] lamp on
8	[RC]	2	
9	[=]	12	[×] lamp off

Note: When 12 at step 9 is equal to a dividend 12* in above expression, the calculation is correct.
When a number 10 is entered by mistake instead of 12 at step 3, the number 10 is displayed at step 9. As the number 10 should be a dividend 12*, we can find that quotient 5 is not correct.

5. Rounding off (Multiplication and Division)

* Capacity: Same as for Multiplication and Division

Ex. 5-1 0.14285 x 7 = 0.99995 Rounding off to the 5th decimal place (Multiplication)

Steps:

	Operation	Display	Note
1	Red [4] ●		Round off dial
2	[C]	0	
3	.14285	0.14285	
4	[×]	0.14285	[×] lamp on
5	7	7	
6	[=]	1.0000	[×] lamp off (rounded off)

Ex. 5-2 5 ÷ 9 = 0.55555 · · · · Rounding off to the 5th decimal place (Division)

Steps:

	Operation	Display	Note
1	Red [4] ●		Round off dial
2	[C]	0	
3	5	5	

4	⊕	5	⊕ lamp on
5	9	9	
6	=	0.5556	⊕ lamp off (rounded off)

Note: When rounding off, be sure to set red number of the Tabulation dial.

6. Negative multiplication and division

* Capacity: Same as for multiplication and division

Ex. 6-1 23 x 45 x (- 67) = - 69345

Steps:

	Operation	Display	Note
1	0 ●		Tabulation dial
2	C	0	
3	23	23	
4	×	23	× lamp on
5	45	45	
6	=	1035	× lamp off
7	×	1035	× lamp on
8	67	67	
9	Red =	69345-	× lamp off (product), minus lamp on

Ex. 6-2 - 78 x (- 9.6) = 748.80

Steps:

	Operation	Display	Note
1	2 ●		Tabulation dial
2	C	0	
3	78	78	
4	Red =	78.00 -	minus lamp on
5	×	78.00 -	× lamp on
6	9.6	9.6	
7	Red =	748.80	× lamp off (product), minus lamp off

Ex. 6-3 $56.55 \div (-7.3) = -7.746575$

Steps:

	Operation	Display	Note
1	[6] ●		Tabulation dial
2	[C]	0	
3	56.55	56.55	
4	[÷]	56.55	[÷] lamp on
5	7.3	7.3	
6	Red [=]	7.746575-	[÷] lamp off (quotient), minus lamp on

Ex. 6-4 $-87.2 \div (-6.33) = 13.775671$

Steps:

	Operation	Display	Note
1	[6] ●		Tabulation dial
2	[C]	0	
3	87.2	87.2	
4	Red [=]	87.200000-	Minus lamp on
5	[÷]	87.200000-	[÷] lamp on
6	6.33	6.33	
7	Red [=]	13.775671	[÷] lamp off (quotient)

7. Sum (Difference) of products and Individual products

* Capacity: Same as for multiplication

Ex. 7-1 (123 x 0.55) + (43 x 0.76) = 100.33

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[2] ●	0	Tabulation dial
4	123	123	
5	[×]	123	[×] lamp on
6	.55	0.55	
7	[M+]	67.65	[×] lamp off, (product), [M] lamp on
8	43	43	
9	[×]	43	[×] lamp on
10	.76	0.76	
11	[M+]	32.68	[×] lamp off (product)
12	[MR]	100.33	Sum of products

Ex. 7-2 (12.3 x 9.8) - (2.3 x 4.32) = 110.6040

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[4] ●	0	Tabulation dial
4	12.3	12.3	
5	[×]	12.3	[×] lamp on
6	9.8	9.8	
7	[M+]	120.5400	[×] lamp off, (product), [M] lamp on
8	2.3	2.3	
9	[×]	2.3	[×] lamp on
10	4.32	4.32	
11	[M−]	9.9360	[×] lamp off (product)
12	[MR]	110.6040	Difference of products

Ex. 7-3 (46.9 x 3.51) + (83.4 x 7.2) - (65.3 x 4.73) = 456.2300

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[4] ●	0	Tabulation dial
4	46.9	46.9	
5	[×]	46.9	[×] lamp on
6	3.51	3.51	
7	[M+]	164.6190	[×] lamp off, (product), [M] lamp on
8	83.4	83.4	
9	[×]	83.4	[×] lamp on
10	7.2	7.2	
11	[M+]	600.4800	[×] lamp off (product)
12	65.3	65.3	
13	[×]	65.3	[×] lamp on
14	4.73	4.73	
15	[M-]	308.8690	[×] lamp off (product)
16	[MR]	456.2300	Ans.

Note: 1) Touch [C] and [CM] keys in order to clear all the contents in the calculator.
2) Touch [M+] for Sum of products. Touch [M-] for Difference of products.
3) For further continued Sum (Difference) of products, repeat the operation.

8. Sum (Difference) of Quotients and Individual Quotients

* Capacity: Same as for Division.

Ex. 8-1 (1288 ÷ 23) + (0.86 ÷ 4) = 56.2150

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[4] ●	0	Tabulation dial
4	1288	1288	
5	[÷]	1288	[÷] lamp on
6	23	23	

7	M+	56.0000	÷ lamp off (quotient), M lamp on
8	.86	0.86	
9	÷	0.86	÷ lamp on
10	4	4	
11	M+	0.2150	÷ lamp off (quotient)
12	MR	56.2150	Sum of quotients

Ex. 8-2 $(11.502 \div 2.7) - (0.96 \div 5) = 4.0680$

Steps:

	Operation	Display	Note
1	C	0	Clears No. 1 register & memory
2	CM	0	
3	4 ●	0	Tabulation dial
4	11.502	11.502	
5	÷	11.502	÷ lamp on
6	2.7	2.7	
7	M+	4.2600	÷ lamp off (quotient), M lamp on
8	.96	0.96	
9	÷	0.96	÷ lamp on
10	5	5	
11	M−	0.1920	÷ lamp off (quotient)
12	MR	4.0680	Difference of quotients

Ex. 8-3 $(568 \div 4) + (0.586 \div 2) - (35.8 \div 9.308) = 138.4468$

Steps:

	Operation	Display	Note
1	C	0	Clears No. 1 register & memory
2	CM	0	
3	4 ●	0	Tabulation dial
4	568	568	
5	÷	568	÷ lamp on
6	4	4	
7	M+	142.0000	÷ lamp off (quotient), M lamp on
8	.586	0.586	

9	÷	0.586	÷ lamp on
10	2	2	
11	M+	0.2930	÷ lamp off (quotient)
12	35.8	35.8	
13	÷	35.8	÷ lamp on
14	9.308	9.308	
15	M−	3.8461	÷ lamp off, (quotient)
16	MR	138.4468	Sum of quotients

Note: Sum (Difference) of Quotient and Product can be obtained in the same way as stated above.

9. Product (Quotient) of Sums (Differences) and individual Sums (Differences)

* Capacity: Same as for Multiplication or Division.

Ex. 9-1 (2 + 3) x (4 + 5) = 45

Steps

	Operation	Display	Note
1	C	0	
2	CM	0	
3	0 ●	0	Tabulation dial
4	2	2	
5	M+	2	M− lamp on
6	3	3	
7	M+	3	
8	C	0	
9	4	4	
10	=	4	
11	5	5	
12	=	9	
13	×	9	× lamp on
14	MR	5	
15	=	45	× lamp off product of sums

Ex. 9-2 (3 - 7) x (2 - 8) = 24

Steps

	Operation	Display	Note
1	C	0	
2	CM	0	
3	0 ●	0	Tabulation dial
4	3	3	
5	M+	3	M+ lamp on
6	7	7	
7	M-	7	
8	C	0	
9	2	2	
10	=	2	
11	8	8	
12	Red =	6-	
13	×	6-	× lamp on
14	MR	4-	
15	=	24	× lamp off

Ex. 9-3 (6 - 26) ÷ (2 + 3) = -4

Steps

	Operation	Display	Note
1	C	0	
2	CM	0	
3	0 ●	0	Tabulation dial
4	2	2	
5	M+	2	M+ lamp on
6	3	3	
7	M+	3	
8	C	0	
9	6	6	
10	=	6	
11	26	26	
12	Red =	20-	

13	[+]	20-	[+] lamp on
14	[MR]	5	
15	[=]	4-	[+] lamp off

10. Multiplication and Division by Constant

* Capacity: Same as for Multiplication or Division
* Constant: Multiplicand or Divisor

Ex. 10-1 1) 99.99 x 11.11 = 1110.8889
2) 99.99 x 33.33 = 3332.6667
3) 99.99 x 44.44 = 4443.5556

Steps:

	Operation	Display	Note
1	[K] ↓		Constant key
2	[4] ●		Tabulation dial
3	99.99	99.99	
4	[×]	99.99	[×] lamp on
5	11.11	11.11	
6	[=]	1110.8889	Product
7	33.33	33.33	
8	[=]	3332.6667	Product
9	44.44	44.44	
10	[=]	4443.5556	Product

Ex. 10-2 1) 11.11 ÷ 77.77 = 0.142857
2) 33.33 ÷ 77.77 = 0.428571
3) 44.44 ÷ 77.77 = 0.571428

Steps:

	Operation	Display	Note
1	[C]	0	
2	[K] ↓	0	Constant key
3	[6] ●	0	Tabulation dial
4	11.11	11.11	
5	[+]	11.11	[+] lamp on
6	77.77	77.77	
7	[=]	0.142857	Quotient
8	33.33	33.33	

9	[=]	0.428571	Quotient
10	44.44	44.44	
11	[=]	0.571428	Quotient

11. Constant addition, Subtraction

Ex. 11-1 2 + 3 + 100 = 105
11-2 2 x 3 - 100 = -94
11-3 2 x 3 + 100 = 106
11-4 2 x (-3) - 100 = -106
11-5 12 ÷ 4 - 100 = -97

Ex. 11-1 2 + 3 + 100 = 105

	Operation	Display	Note
1	[C]	0	} — Clears No. 1 register
2	[CM]	0	} & memory
3	[0] ●	0	Tabulation dial
4	100	100	
5	[M+]	100	[M+] lamp on
6	[C]	0	
7	2	2	
8	[=]	2	
9	3	3	
10	[=]	5	
11	[MR]	100	
12	[=]	105	Ans.

Ex. 11-2 2 x 3 - 100 = -94

Steps:

	Operation	Display	Note
1	[C]	0	} — Clears No. 1 register
2	[CM]	0	} & memory
3	[0] ●	0	Tabulation dial
4	100	100	
5	[M+]	100	[M-] lamp on
6	[C]	0	
7	2	2	
8	[×]	2	[×] lamp on
9	3	3	

10	[=]	6	[×] lamp off
11	[MR]	100	
12	Red [=]	94-	Ans.

Ex. 11-3 2 x 3 + 100 = 106

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[0] ●	0	Tabulation dial
4	100	100	
5	[M+]	100	[M+] lamp on
6	[C]	0	
7	2	2	
8	[×]	2	[×] lamp on
9	3	3	
10	[=]	6	[×] lamp off
11	[MR]	100	
12	[=]	106	Ans.

Ex. 11-4 2 x (-3) - 100 = -106

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[0] ●	0	Tabulation dial
4	100	100	
5	[M+]	100	[M+] lamp on
6	[C]	0	
7	2	2	
8	[×]	2	[×] lamp on
9	3	3	
10	Red [=]	6 -	[×] lamp on
11	[MR]	100	
12	Red [=]	106 -	Ans.

Ex. 11-5 $12 \div 4 - 100 = -97$

Steps:

	Operation	Display	Note
1	[C]	0	} Clears No. 1 register & memory
2	[CM]	0	
3	[0] ●	0	Tabulation dial
4	100	100	
5	[M+]	100	[M+] lamp on
6	[C]	0	
7	12	12	
8	[÷]	12	[÷] lamp on
9	4	4	
10	[=]	3	[÷] lamp off
11	[MR]	100	
12	Red [=]	97 -	Ans.

12. Exponent calculation

* Capacity: Up to 14 digits (6 digit decimals)

Ex. 12 $3^2 = 9$ $3^3 = 27$ $3^4 = 81$

Steps:

	Operation	Display	Note
1	[C]	0	
2	[K] ↓	0	Constant key
3	[0] ●	0	Tabulation dial
4	3	3	
5	[×]	3	[×] lamp on
6	[=]	9	Ans.
7	[=]	27	Ans.
8	[=]	81	Ans.

Note: Repeat the operation for further continued exponent calculation.

13. Geometric progression

$$3 + 3 \times 2 + 3 \times 2^2 + 3 \times 2^3 \ldots\ldots 3 \times 2^{n-1} = \sum_{i=0}^{n-1} (3 \times 2^i)$$

Ex. 13 $3 \times 2 = 6$

$3 \times 2^2 = 12$

$3 \times 2^3 = 24$

$\vdots$

$3 \times 2^{n-1} =$

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[0] ●	0	Tabulation dial
4	[K] ↓	0	Constant key
5	3	3	
6	[M+]	3	$(= 3 \times 2^0)$
7	[×]	3	[×] lamp on
8	2	2	
9	[RC]	3	
10	[M+]	6	$(= 3 \times 2)$
11	[M+]	12	$(= 3 \times 2^2)$
12	[M+]	24	$(= 3 \times 2^3)$
13	[M+]	48	$(= 3 \times 2^4)$
14	[M+]	96	$(= 3 \times 2^5)$
15	[MR]	192	$(= \sum_{i=0}^{6-1} (3 \times 2^i))$

Note: This example is in the case of N = 6.

14. Square root extraction

Express the approximate expression of $\sqrt{R}$ as follows:

$$\sqrt{R} \fallingdotseq (N + R) \times S$$

Steps: (See attached table on page 31.)

1. Take 3 digits from the figures counting from the left.
   Determine N, which is the nearest value in the square root table.
2. Divide R into groups of two digits each counting from the decimal point. When the highest group consists of one digit, determine S from row 1N in the table. When it consists of two digits, determine S from row 10N of the table.
3. Calculate (N + R) x S.

Ex. $\sqrt{53987}$

1. From the table on page 31, N=542=54200 (to equalize the digits.)
2. Then determine S=214768 from the row 1N.
3. Calculate (54200 + 53987) x 214768.

Steps:

	Operation	Display	Note
1	[C]	0	
2	[0]●	0	Tabulation dial
3	54200	54200	
4	[=]	54200	
5	53987	53987	
6	[=]	108187	
7	[×]	108187	[×] lamp on
8	214768	214768	
9	[=]	23235105616	Ans. [×] lamp off

Note: Five digits counting from the higher digit are available.
The position of the decimal point is decided by dividing R into groups of two digits each counting from the decimal point.
Taking $\sqrt{53987}$, for example, 53987 is divided into three* groups (5⁞39⁞87) counting from the decimal point. The decimal point of the answer, therefore is placed between the third* and the fourth digit counting from the left.
The answer is 232.35.

15. Cubic root extraction

Express the approximate expression of $\sqrt[3]{R} = (2N + R) \times S$.

Steps: (See attached table on page 32.)

1. Take 3 digits from the figures counting from the left. Determine N, which is the nearest value in the Cubic Root Table on page 32.
2. Divide R into groups of three digits each counting from the decimal point. Select S from row 1N when the highest groups of figures consists of one digit, row 10N in the case of two digits, and row 100N in the case of three digits.
3. Calculate (2N + R) x S

Ex. $\sqrt[3]{53987}$

1. From the table on page 33, N=542=54200 (to equalize the digits)
2. Then determine S=232744 from the row 10N.
3. Calculate (2 x 54200 + 53987) x 232744

Steps:

	Operation	Display	Note
1	[C]	0	
2	[0] ●	0	Tabulation dial
3	2	2	
4	[×]	2	[×] lamp on
5	54200	54200	
6	[=]	108400	[×] lamp off
7	53987	53987	
8	[=]	162387	
9	[×]	162387	[×] lamp on
10	232744	232744	
11	[=]	37794599928	[×] lamp off

Note: Six digits from the top are available.
Position of the decimal point is decided by dividing R into groups of three digits counting from the decimal point.
Take $\sqrt[3]{53987}$, for example, 53987 is divided into two groups (53$\overset{*}{;}$987). The decimal point of the answer, therefore, must be placed between the 2nd$\overset{*}{}$ and the 3rd digit counting from the left. The answer is 37.7945

16. Mixed calculation

* Capacity: Same as for Addition. Subtraction, Multiplication and Division.

Ex. 13 $\dfrac{(5 + 12) \times 0.2 + 48 - 16}{4} = 8.85$

Note: Be sure to unlock the [×] key.

Steps:

	Operation	Display	Note
1	[C]	0	
2	Red [4] ●	0	Round off dial
3	5	5	
4	[=]	5.0000	
5	12	12	
6	[=]	17.0000	
7	[×]	17.0000	[×] lamp on
8	.2	0.2	
9	[=]	3.4000	[×] lamp off
10	48	48	
11	[=]	51.4000	
12	16	16	
13	Red [=]	35.4000	
14	[÷]	35.4000	[÷] lamp on
15	4	4	
16	[=]	8.8500	[÷] lamp off (Ans.)

17. Ratio calculation

* An advertising budget of 170,760 is distributed among branch offices according to their respective sales.

Branches	Sales	Amount
A	4,275,320	(85,506.40) *1
B	2,363,680	(47,273.60) *2
C	964,710	(19,294.20) *3
D	934,290	(18,685.80) *4
	(8,538,000) *5	170,760.00

(Figures in the parentheses are calculated)

Steps:

	Operation	Display	Note
1	[C]	0	Clears No. 1 register & memory
2	[CM]	0	
3	[2] ●	0	Tabulation dial
4	4275320	4275320	
5	[=]	4275320.00	
6	2363680	2363680	
7	[=]	6639000.00	
8	964710	964710	
9	[=]	7603710.00	
10	934290	934290	
11	[=]	8538000.00	*5
12	[+]	8538000.00	[+] lamp on
13	170760	170760	
14	[RC]	8538000.00	
15	[=]	0.02	[+] lamp off
16	[K] ↓	0.02	Constant key
17	[×]	0.02	[×] lamp on
18	4275320	4275320	
19	[M+]	85506.40	Ans., [M+] lamp on *1
20	2363680	2363680	
21	[M−]	47273.60	Ans. *2
22	964710	964710	
23	[M−]	19294.20	Ans. *3
24	934290	934290	
25	[M+]	18685.80	Ans. *4
26	[MR]	170760.00	Total amount

18. Percentage calculation

Percentage of branches sales to total sales are calculated.

Branches	Sales	Percentage to total sales (%)
A	4,869,785	(0.49) *1
B	536,948	(0.05) *2
C	2,863,276	(0.29) *3
D	1,659,876	(0.17) *4
	(9,929,885) *5	(1.00)

(Figures in the parentheses are calculated)

Steps:

Order	Operation	Display	Note
1	C	0	
2	CM	0	
3	Red 2 ●	0	Round off dial
4	4869785	4869785	
5	=	4869785.00	
6	536948	536948	
7	=	5406733.00	
8	2863276	2863276	
9	=	8270009.00	
10	1659876	1659876	
11	=	9929885.00	(Total sales) * 5
12	K ↓	9929885.00	
13	÷	9929885.00	÷ lamp on
14	4869785	4869785	
15	RC	9929885.00	
16	M−	0.49	M− lamp on * 1
17	536948	536948	
18	M+	0.05	* 2
19	2863276	2863276	
20	M+	0.29	* 3
21	1659876	1659876	
22	M+	0.17	* 4
23	MR	1.00	

19. Correcting mistakes

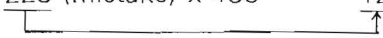
A. Numeral correction (Use [CE] key.) (0 ~ 9, [•] keys)

Ex. 19-1 123 x 556 (mistake) 456 (correct)

	Operation	Display	Note
1	[C]	0	
2	[0] ●	0	Tabulation dial
3	123	123	
4	[×]	123	[×] lamp on
5	556	556	
6			(Correction of 556)
7	[CE]	0	
8	456	456	
9	[=]	56088	[×] lamp off

Note: When [CE] key is touched, 556 is cleared and 456 is set anew.

Ex. 19-2 223 (mistake) x 456 123 (correct)



	Operation	Display	Note
1	[C]	0	
2	[0] ●	0	Tabulation dial
3	223	223	
4	[×]	223	[×] lamp on
5	456	456	
6			(Correction of 223)
7	[RC]	223	
8	[CE]	0	
9	123	123	
10	[=]	56088	[×] lamp off

B. Function key correction ([÷], [×] keys)

Function key correction is possible in multiplication and division as follows:

A [×] [÷] B [=]
A [×] B [÷] [=] } . . . . . in these cases A ÷ B will be performed instead of A x B.

SQUARE ROOT TABLE

N	S		N	S		N	S		N	S	
	1 N	10 N		1 N	10 N		1 N	10 N		1 N	10 N
1.00	500000	158114	1.76	376889	119183	3.00	288675	0912871	5.00	223607	0707107
1.02	495074	156556	1.79	373718	118180	3.04	286770	0906845	5.07	222058	0702208
1.04	490290	155043				3.08	284901	0900937	5.14	220541	0697410
1.06	485643	153574	1.82	370625	117202	3.12	283069	0895144	5.21	219054	0692710
1.08	481125	152145	1.84	367606	116248	3.16	231272	0889460	5.28	217597	0688102
1.10	476731	150756	1.88	364662	115316	3.20	279508	0883883	5.35	216169	0683586
1.12	472456	149404	1.91	361787	114407	3.25	277350	0877058	5.42	214768	0679157
1.14	468293	148087	1.94	358979	113519	3.30	275241	0870388			
1.16	464238	146805	1.97	356235	112651	3.35	273179	0863868	5.50	213201	0674200
1.18	460287	145556				3.40	271163	0857493	5.58	211667	0669349
			2.00	353553	111803	3.45	269191	0851257	5.66	210166	0664602
1.20	456435	144338	2.03	350931	110974				5.74	208696	0659955
1.22	452679	143150	2.06	348367	110163	3.50	267261	0845154	5.82	207257	0655403
1.24	449013	141990	2.09	345857	109370	3.55	265372	0839181	5.90	205847	0650945
1.26	445435	140859	2.12	343401	108593	3.60	263523	0833333	5.98	204465	0646576
1.28	441942	139754	2.15	340997	107833	3.65	261712	0827606			
1.30	438529	138675	2.18	338643	107088	3.70	269938	0821995	6.06	203111	0642294
1.32	435194	137620	2.21	336336	106359	3.75	258199	0816497	6.14	201784	0638096
1.34	431934	136590	2.24	334077	105644	3.80	256495	0811107	6.22	200482	0633979
1.36	428746	135582	2.27	331862	104944	3.86	254493	0804778	6.31	199047	0629441
1.38	425628	134595	2.30	329690	104257	3.92	252538	0798596	6.40	197642	0625000
			2.33	327561	103584	3.98	250627	0792553	6.49	196267	0620651
1.40	422577	133631	2.36	325472	102923				6.58	194920	0616392
1.42	419591	132686	2.40	322749	102062	4.04	248759	0786646	6.67	193601	0612219
1.44	416667	131762	2.44	320092	101222	4.10	246932	0780869	6.76	192308	0608130
1.46	413803	130856	2.48	317500	100402	4.16	245145	0775217	6.85	191040	0604122
1.48	410997	129969				4.22	243396	0769686	6.94	189798	0600192
1.50	408248	129099	2.52	314970	0996024	4.28	241684	0764272			
1.52	405554	128247	2.56	312500	0988212	4.34	240008	0758971	7.03	188579	0596338
1.54	402911	127412	2.60	310087	0980581	4.40	238366	0753778	7.12	187383	0592557
1.56	400320	126592	2.64	307729	0973124	4.46	236757	0748691	7.21	186210	0588847
1.58	397779	125789	2.68	305424	0965834				7.30	185058	0585206
			2.72	303170	0958706	4.52	235180	0743705	7.40	183804	0581238
1.60	395285	125000				4.58	233635	0738818	7.50	182574	0577350
1.62	392837	124226	2.76	300965	0951734	4.65	231869	0733236	7.60	181369	0573539
1.64	390434	123466	2.80	298807	0944911	4.72	230144	0727778	7.70	180187	0569803
1.66	388075	122720	2.84	296695	0938233	4.79	228456	0722441	7.80	179029	0566139
1.68	385758	121988	2.88	294628	0931695	4.86	226805	0717219	7.90	177892	0562544
1.70	383482	121268	2.92	292603	0925292	4.93	225189	0712109			
1.73	380143	120212	2.96	290619	0919018				8.00	176777	0559017

N	S		N	S		N	S		N	S	
	1 N	10 N		1 N	10 N		1 N	10 N		1 N	10 N
8.11	175574	0555213	8.66	169907	0537293	9.12	165567	0523567	9.74	160210	0506630
8.22	174395	0551486	8.77	168838	0533913	9.24	164488	0520156	9.84	159152	0503282
8.33	173240	0547832	8.88	167789	0530595	9.36	163430	0516811			
8.44	172107	0544250				9.48	162392	0513530			
8.55	170996	0540738	9.00	166667	0527046	9.61	161290	0510045	10.00	158114	0500000

CUBIC ROOT TABLE

N	S			N	S			N	S		
	1 N	10 N	100 N		1 N	10 N	100 N		1 N	10 N	100 N
1.00	333333	0718145	0154720	1.60	243668	0524967	0113101	2.44	183916	0396234	00853661
1.02	328962	0708726	0152690	1.62	241658	0520637	0112168	2.48	181933	0391962	00844457
1.04	324731	0699611	0150727	1.64	239690	0516396	0111254				
1.06	320633	0690783	0148825	1.66	237761	0512240	0110359	2.52	180002	0387803	00835497
1.08	316662	0682228	0146982	1.68	235870	0508166	0109481	2.56	178122	0383753	00826771
1.10	312812	0673933	0145195	1.70	234016	0504173	0108621	2.60	176291	0379807	00818270
1.12	309077	0665886	0143461	1.73	231303	0498327	0107361	2.64	174506	0375961	00809983
1.14	305451	0658075	0141778	1.76	228667	0492648	0106138	2.68	172765	0372211	00801904
1.16	301930	0650489	0140144	1.79	226105	0487128	0104949	2.72	171067	0368553	00794022
1.18	298509	0643118	0138556								
				1.82	223613	0481760	0103792	2.76	169410	0364983	00786332
1.20	295183	0635952	0137012	1.85	221189	0476538	0102667	2.80	167793	0361499	00778825
1.22	291948	0628983	0135510	1.88	218830	0471755	0101572	2.84	166214	0358096	00771495
1.24	288800	0622201	0134049	1.91	216533	0466505	0100506	2.88	164671	0354773	00764335
1.26	285736	0615600	0132627	1.94	214294	0461683	00994667	2.92	163164	0351526	00757339
1.28	282752	0609170	0131242	1.97	212113	0456984	00984543	2.96	161690	0348351	00750500
1.30	279844	0602906	0129892								
1.32	277010	0596801	0128577	2.00	209987	0452403	00974673	3.00	160250	0345248	00743814
1.34	274247	0590848	0127294	2.03	207913	0447935	00965046	3.40	158841	0342213	00737275
1.36	271552	0585041	0126043	2.06	205889	0443575	00955654	3.08	157463	0339244	00730878
1.38	268922	0579374	0124822	2.09	203914	0439320	00946487	3.12	156114	0336338	00724618
				2.12	201986	0435166	00937536	3.16	154794	0334935	00718490
1.40	266351	0573843	0123631	2.15	200103	0431108	00928795	3.20	153501	0330709	00712490
1.42	263878	0568442	0122467	2.18	198263	0427144	00920254	3.25	151923	0327308	00705164
1.44	261399	0563167	0121331	2.21	196464	0423270	00911907	3.30	150384	0323992	00698023
1.46	259006	0558012	0120220	2.24	194706	0419482	00903747	3.35	148884	0320761	00691060
1.48	256668	0552973	0119135					3.40	147421	0317609	00684268
1.50	254381	0548047	0118073	2.27	192987	0415778	00895767	3.45	145993	0314533	00677640
1.52	252143	0543229	0117035	2.30	191305	0412155	00887960				
1.54	249957	0538516	0116020	2.33	189060	0408609	00880322	3.50	144599	0311530	00671171
1.56	247816	0533903	0115026	2.36	188049	0405139	00872846	3.55	143239	0308598	00664854
1.58	245720	0529388	0114053	2.40	185954	0400625	00863120	3.60	141909	0305734	00658684

N	S			N	S			N	S		
	1 N	10 N	100 N		1 N	10 N	100 N		1 N	10 N	100 N
3.65	140610	0302935	00652655	5.21	110914	0238957	00514818	7.30	0885789	0190837	00411147
3.70	139341	0300200	00646762	5.28	109932	0236841	00510258	7.40	0877791	0189114	00407434
3.75	138099	0297526	00641000	5.35	108971	0234770	00505797	7.50	0869971	0187429	00403805
3.80	136885	0294910	00635365	5.42	108030	0232744	00501433	7.60	0862322	0185782	00400255
3.86	135463	0291846	00628763					7.70	0854840	0184170	00396782
3.92	134077	0288860	00622331	5.50	106980	0230482	00496558	7.80	0847518	0182592	00393383
3.98	132726	0285950	00616060	5.58	105955	0228274	00491801	7.90	0840351	0181048	00390056
				5.66	104955	0226118	00487156				
4.04	131409	0283112	00609946	5.74	103977	0224012	00482619	8.00	0833333	0179536	00386799
4.10	130124	0280343	00603980	5.82	103022	0221954	00478186	8.11	0825781	0177909	00383294
4.16	128869	0277641	00598159	5.90	102089	0219943	00473853	8.22	0818397	0176318	00379866
4.22	127645	0275003	00592476	5.98	101176	0217977	00469618	8.33	0811177	0174763	00376515
4.28	126449	0272427	00586925					8.44	0804113	0173241	00373236
4.34	125281	0269910	00581503	6.06	100284	0216055	00465476	8.55	0797201	0171752	00370028
4.40	124140	0267451	00576205	6.14	0994107	0214174	00461424	8.66	0790436	0170294	00366888
4.46	123024	0265047	00571025	6.22	0985565	0212333	00457459	8.77	0783813	0168867	00363814
				6.31	0976171	0210310	00453098	8.88	0777326	0167470	00360803
4.52	121933	0262696	00565961	6.40	0966998	0208333	00448841				
4.58	120865	0260396	00561007	6.49	0958037	0206403	00444681	9.00	0770401	0165978	00357589
4.65	119649	0257777	00555363	6.58	0949281	0204516	00440617	9.12	0763629	0164519	00354445
4.72	118463	0255222	00549858	6.67	0940722	0202673	00436645	9.24	0757003	0163091	00351370
4.79	117306	0252729	00544488	6.76	0932354	0200870	00432761	9.36	0750519	0161694	00348360
4.86	116177	0250296	00539247	6.85	0924170	0199106	00428962	9.48	0744172	0160327	00345414
4.93	115075	0247921	00534131	6.94	0916162	0197381	00425245	9.61	0737445	0158878	00342292
								9.74	0730869	0157461	00339239
5.00	113998	0245602	00529134	7.03	0908326	0195693	00421608	9.87	0724437	0156075	00336254
5.07	112947	0243336	00524252	7.12	0900656	0194040	00418047				
5.14	111919	0241122	00519481	7.21	0893145	0192422	00414561	10.00	0718145	0154720	00333333

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