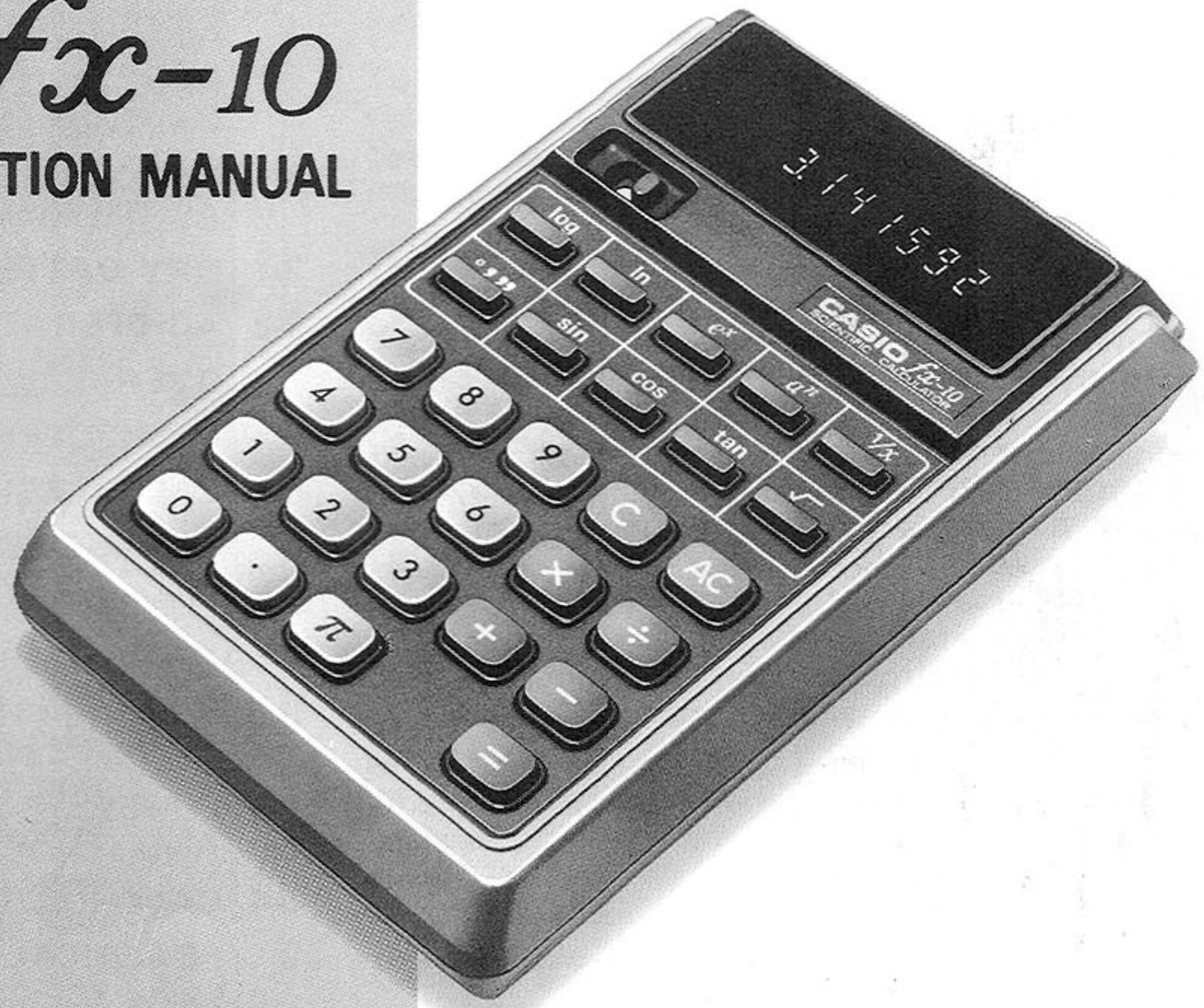
SCIENTIFIC CALCULATOR

Casio fx-10

OPERATOR'S INSTRUCTION MANUAL



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The BM (BM mark) is evidence of a qualified calculator as approved by the JAPAN BUSINESS MACHINE MAKERS ASSOCIATION to be a quality product backed up by adequate service after sale.

INTRODUCTION

Dear customer,

Congratulations on your purchase of this advanced personal electronic calculator.
This sophisticated model has 10 special keys making it highly valuable for scientific and all kind of research work.
Besides the basic capabilities as ordinary personal calculator — constants in all 4 basic functions, full floating decimal system, and a handy palm-sized style — this model is equipped with capabilities for computing 10 specific scientific functions at one touch.
To utilize full features of this calculator, no special training is required but we suggest you take a few minutes to become familiar with this instruction manual.
It has been written to assist you in understanding the various control keys and functions of the calculator through simple examples and their applications.

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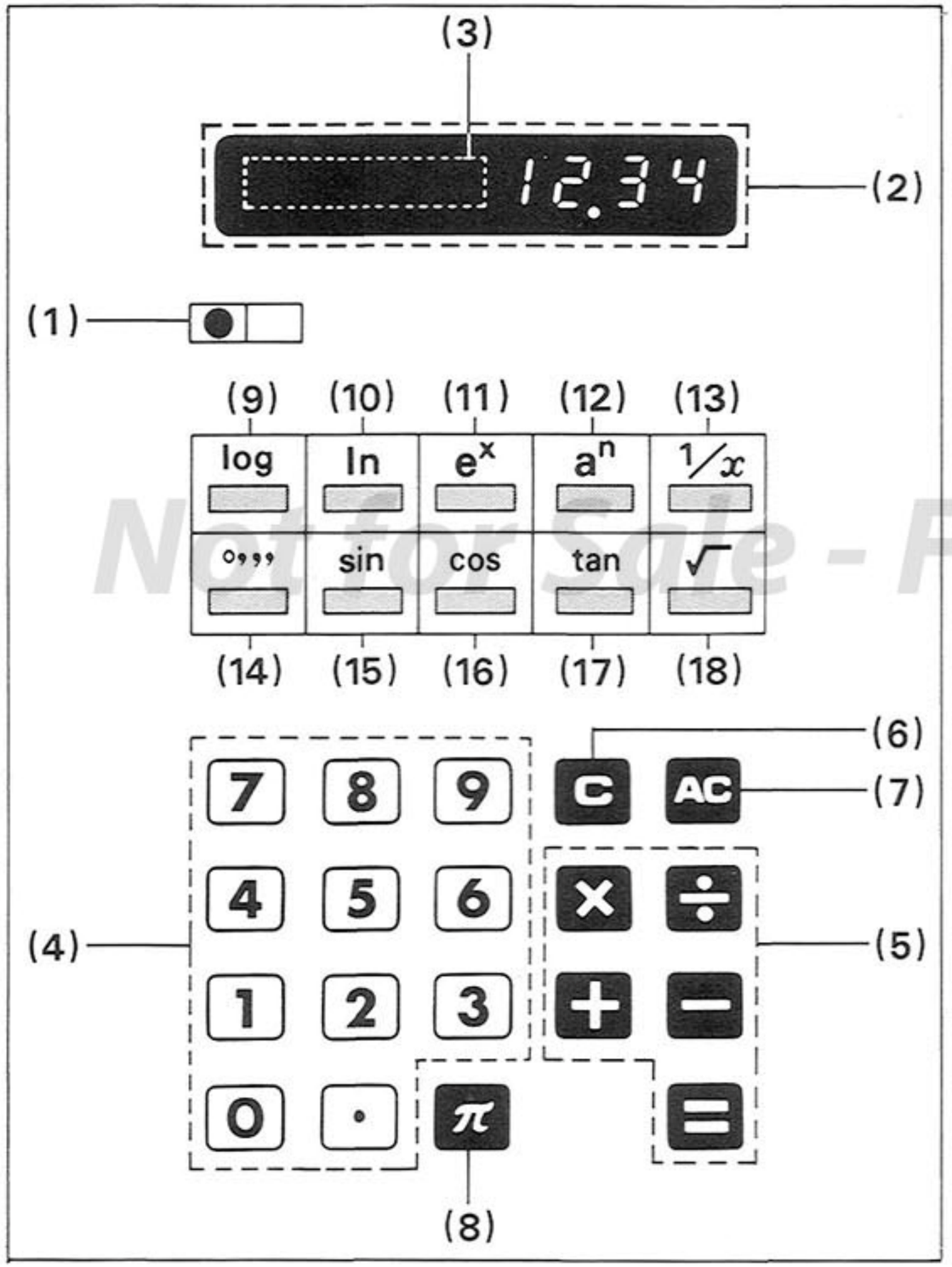
1 /KEYBOARD



(1) ON-OFF SWITCH

To switch on, move the left-hand switch to the right "0." is displayed in the read-out and you can start operation immediately without depressing the AC or C key.

(2) READ-OUT

An 8 digit capacity Digitron tube panel brightly displays each entry, each result whether final or intermediate.

(3) ZERO SUPPRESSION

Unnecessary 0's (zeroes) are suppressed.

(4) 0 ~ 9 · · NUMERAL and DECIMAL POINT KEY

Enters numerals to the read-out. If the number includes the decimal point, use the · key in its logical sequence. For example, to enter the number 12.36, depress 1 2 · 3 6 .
When decimal places are involved, a full floating decimal point system with whole number preference (underflow) is applied automatically in all calculations.

(5) + · − · × · ÷ · = FUNCTION COMMAND and RESULT KEY

Commands the functions (+, −, x or ÷). Depress the appropriate function keys as they appear in

the written problem and the answer is obtained by depressing the ⊟ key.
Note that any commands wrongly made can be corrected by successive depression of the proper command key.

(6) C CLEAR KEY

Clears keyboard entry for correction. When depressed immediately after any of the command keys (⊞, ⊟, ⊠ or ⊡), it does not function.

(7) AC ALL CLEAR KEY

Clears the entire machine and releases the overflow check.

(8) π π KEY

Enters the circular constant in 7 digits (3.141592).

(9) log COMMON LOGARITHM KEY

Obtains the common logarithm of the display.

(10) ln NATURAL LOGARITHM KEY

Obtains the natural logarithm of the display.

(11) e^x EXPONENTIAL KEY

Obtains the exponential of the display.

(12) a^n N-th POWER KEY

Instructs the display to raise to N-th power.

(13) $\frac{1}{x}$ RECIPROCAL KEY

Obtains the reciprocal number of the display.

(14) °′″ SEXAGESIMAL → DECIMAL CONVERSION KEY

Converts the display to the decimal scale.

(15) sin SINE KEY

Obtains the sine of the angle on display.

(16) cos COSINE KEY

Obtains the cosine of the angle on display.

(17) tan TANGENT KEY

Obtains the tangent of the angle on display.

(18) √ SQUARE ROOT KEY

Obtains the square root of the display.

2/HANDLING OF THE CALCULATOR

Before operation, please be sure to check the proper setting of the dry batteries or connection of the AC Adaptor.
The calculator should be operated correctly in accordance with this instruction manual with firm and separate key pressing. Two or more numeral and/or command keys should not be pressed simultaneously, as this may damage the machine.

3/DISPOSABLE DRY BATTERY OR AC OPERATION

This calculator operates on either dry batteries or AC with the use of the AC ADAPTOR.

3-1 DRY BATTERY OPERATION

With four Alkaline dry batteries (AM-3) it operates for approximately 17 hours continuously. Even when battery power decreases, the display will merely darken but cause no miscalculation.
When you have finished your calculation, be sure to switch off the power switch to save battery power.
To change batteries, put the power switch off first. Slide open the battery cover and replace batteries.

3-2 AC OPERATION

If you are in a 117V area, for instance, use a 117V AC ADAPTOR.
When you use an AC ADAPTOR of a different voltage, it may cause damage to both the AC ADAPTOR and calculator.
Plug the applicable AC ADAPTOR (100, 117, 220 or 240V) into the AC outlet and the cord into the calculator. When plugged in, battery power supply stops automatically, so battery power is not wasted.

4/OVERFLOW

Principally, overflow occurs when the integer part of an answer exceeds 8 digits (7, when the figure is negative) and stops further calculation, showing 0's (zeroes) on all columns.
In function calculations, however, the overflow also occurs in the following instances:
a) When either a common or natural logarithm of 0 (zero) is obtained.
b) When the trigonometric functions are performed for a degree exceeding $\pm 1440^{\circ}$.
c) When the exponential function is performed for a number exceeding ± 10.
d) When the answer of a Tangent is larger than ± 1000.
Depress the AC key to release the overflow check prior to starting a new calculation.

5/BASIC OPERATIONAL EXAMPLES

Press the keys in exactly the same sequence as they appear in the problems. There is no need to depress the AC or C key prior to starting each new calculation, as automatic clearing takes place with the new entry when you have finished the previous calculation on the = key.
When the answer is negative, the minus (−) sign appears on the left of the figure.

EXAMPLE	OPERATION	READ-OUT	
23+56+89=168	23 +	23.	
	56 +	79.	(23 + 56)
	89 =	168.	(Answer)
1.2+4.56−52.369=−46.609	1 · 2 +	1.2	
	4 · 56 −	5.76	(1.2 + 4.56)
	52 · 369 =	−46.609	(Answer)
41.36×789.2=32641.312	41 · 36 ×	41.36	
	789 · 2 =	32641.312	(Answer)
3.059÷1.288÷0.222	3 · 059 ÷	3.059	
=10.698198	1 · 288 ÷	2.375	(3.059 ÷ 1.288)
	· 222 =	10.698198	(Answer)
12.36×7.53×8412	12 · 36 ×	12.36	
=782911.56(96)	7 · 53 ×	93.0708	(12.36 × 7.53)
	8412 =	782911.56	(96 is dropped off)

Note: 1) When an answer exceeds 8 digits including decimal places, the underflow system works to drop off the least significant decimals as in the above example.

Note: 2) When a problem commences from a negative figure, operate AC ⊟ ENTRY in its sequence and the negative figure can be entered in all calculations.

6/CALCULATION WITH A CONSTANT

During operation, the number entered immediately before the ⊟ key is automatically set as a constant in all four functions. When a new operation is made, it clears the previous constant and sets the number entered in the same manner as a new constant automatically.

ENTRY ⊠ (÷ , ⊞ , ⊟) ENTRY ⊟

→ To be set as a constant.

PROBLEM	EXAMPLE	OPERATION	READ-OUT	
Constant addition	1+2.3=3.3	1 ⊞ 2 ⊡ 3 ⊟	3.3	(1 + 2.3)
	4+2.3=6.3	4 ⊟	6.3	(4 + 2.3)
	7+2.3=9.3	7 ⊟	9.3	(7 + 2.3)
Constant subtraction	4 −5.6=−1.6	4 ⊟ 5 ⊡ 6 ⊟	−1.6	(4 − 5.6)
	12.3−5.6=6.7	12 ⊡ 3 ⊟	6.7	(12.3 − 5.6)
	78 −5.6=72.4	78 ⊟	72.4	(78 − 5.6)
Constant multiplication	9 ×12=108	9 ⊠ 12 ⊟	108.	(9 x 12)
	4.56×12=54.72	4 ⊡ 56 ⊟	54.72	(4.56 x 12)
	1.2 ×12=14.4	1 ⊡ 2 ⊟	14.4	(1.2 x 12)
Constant division	74÷2.5=29.6	74 ÷ 2 ⊡ 5 ⊟	29.6	(74 ÷ 2.5)
	85÷2.5=34	85 ⊟	34.	(85 ÷ 2.5)
	96÷2.5=38.4	96 ⊟	38.4	(96 ÷ 2.5)

PROBLEM	EXAMPLE	OPERATION	READ-OUT	
Addition/subtraction by repeat	3+9+9−6−6=9	3 ⊞ 9 ⊟	12.	(3 + 9)
		⊟	21.	(12 + 9)
		⊟ 6 ⊟	15.	(21 − 6)
		⊟	9.	(15 − 6)
Square and power calculation	$2.5^2=6.25$	2 ⊡ 5 ⊠ ⊟	6.25	(Square)
	$2.5^3=15.625$	⊟	15.625	(3rd power)
	$2.5^4=39.0625$	⊟	39.0625	(4th power)

Note: When underflow works in addition/subtraction with a constant, the decimal places of the constant is also cut off in accordance with the underflow activity.
For instance, if you perform 12345.6 + 0.1234 = 12345.723(4), 0.123 is set as a constant instead of 0.1234, as the least significant decimal digit is dropped off by the underflow.

7/CORRECTION

Use the ⓒ key to clear a wrongly entered number and re-enter the right number.

EXAMPLE	OPERATION		READ-OUT
11+22+32=65		11 ⊞	11.
		22 ⊞	33.
	(Mistake)	34	34.
	(To clear)	ⓒ	0.
		32 ⊟	65.

Any commands wrongly entered can be corrected by successive depression of the proper command key.
The last command made by either ⊞ , ⊟ , ⊠ or ⊡ key is effective.

EXAMPLE	OPERATION	READ-OUT
8−3=5	8	8.
	(Mistake) ⊡	8.
	(To correct) ⊟	8.
	3 ⊟	5.

8 /FUNCTION CALCULATION

This calculator computes 10 specific scientific functions at one touch independent of the basic arithmetic calculations.
So it is necessary to change the order of operation when you desire to use some of the scientific functions as a subroutine of the basic calculation, in order to perform the scientific functions first and to use the result in basic calculations.
For example, when you perform such an operation as [5 x sin 30°], calculate [sin 30°] first and multiply 5 to the answer of [sin 30°] on display.
However, the [a^n] , [1/x] , [√] and [π] keys can be used as subroutine in the midst of basic calculations.
Note that automatic clearing is also made in function calculations and there is no need to depress the [AC] key prior to starting the new problem.

* This calculator computes as π = 3.141592 and e = 2.7182818 respectively.

SEXAGESIMAL → DECIMAL CONVERSION

The [°'"] key converts the sexagesimal figures (Degree, Minute and Second) to decimal scale.

EXAMPLE	OPERATION	READ-OUT
$47^\circ\ 25'\ 36'' = 47.426666...$	47 °‘‘‘	47.
	25 °‘‘‘	47.416666
	36 °‘‘‘	47.426666

8-1/TRIGONOMETRIC FUNCTION

The sin , cos and tan keys obtain each trigonometric value of the entry. In case the degree is given on the sexagesimal scale, it is necessary to convert the figure to the decimal scale before performing the trigonometric functions.

EXAMPLE	OPERATION	READ-OUT
$\sin 78^\circ = 0.97814\ldots$	78 sin	0.97814
$\sin(-41^\circ) = -0.65605\ldots$	AC − 41 = sin	−0.65605
$\cos 45^\circ = 0.70710\ldots$	45 cos	0.7071
$\tan 123^\circ = -1.53986\ldots$	123 tan	−1.53986
$\tan 85^\circ\ 14'\ 30'' = 12.0134\ldots$	85 °‘‘‘	85.
	14 °‘‘‘	85.233333
	30 °‘‘‘	85.241666
	tan	12.0134
$2 \sin 18^\circ = 0.61802\ldots$	18 sin	0.30901
	×	0.30901
	2 =	0.61802

Note: a) The inverse hyperbolic sine, also called antihyperbolic sine, is defined and denoted as follows:

$$\mathbf{y = \sinh^{-1} x \quad if \quad x = \sinh y.}$$

Similarly for the other inverse functions.
Since the hyperbolic functions are exponential, the inverse functions must be logarithmic. From the following explicit formulas, their values can be found.

(1) $\sinh^{-1} x = \ln (x + \sqrt{x^2 + 1})$;

(2) $\cosh^{-1} x = \ln (x + \sqrt{x^2 - 1})$, $x \geqq 1$.

EXAMPLE	OPERATION	READ-OUT
(1) $\sinh^{-1} 9.2 = 2.91529\ldots$	9 ⊡ 2 [aⁿ] 2 ⊞ 1 ⊟ [√] ⊞ 9 ⊡ 2 ⊟ [ln]	2.91529
(2) $\cosh^{-1} 3.4 = 1.89456$	3 ⊡ 4 [aⁿ] 2 ⊟ 1 ⊟ [√] ⊞ 3 ⊡ 4 ⊟ [ln]	1.89456

Note: b) The value of cot, sec and cosec can also be found from the following formula.

(1) $\cot A = \dfrac{1}{\tan A}$;

(2) $\sec A = \dfrac{1}{\cos A}$;

(3) $\operatorname{cosec} A = \sqrt{1 + \cot^2 A} = \sqrt{1 + (\dfrac{1}{\tan A})^2}$

EXAMPLE	OPERATION	READ-OUT
(1) $\cot 18^\circ = 3.077775\ldots$	18 [tan] [1/x]	3.077775
(2) $\sec 12^\circ = 1.022348\ldots$	12 [cos] [1/x]	1.022348
(3) $\operatorname{cosec} 15^\circ = 3.863826\ldots$	15 [tan] [1/x] [aⁿ] 2 ⊞ 1 ⊟ [√]	3.863826

8-2 / EXPONENTIAL AND LOGARITHMIC FUNCTIONS

The [e^x] key performs an exponential function. ($|x| < 10$).

EXAMPLE	OPERATION	READ-OUT
$e^{5.2} = 181.272\ldots$	5 [·] 2 [e^x]	181.272
$4.56^{1.23} = e^{1.23 \cdot \ln 4.56} = 6.46435\ldots$	4 [·] 56 [ln] [×] 1 [·] 23 [=] [e^x]	6.46435
$\sqrt[3]{216} = 216^{\frac{1}{3}} = e^{\frac{1}{3} \cdot \ln 216} = 6$	216 [ln] [÷] 3 [=] [e^x]	6.
$e^{\frac{\pi}{2}} = 4.81047\ldots$	[π] [÷] 2 [=] [e^x]	4.81047

The [log] key obtains the common logarithmics of the display.

EXAMPLE	OPERATION	READ-OUT
$\log_{10} 41 = \log 41 = 1.61278\ldots$	41 [log]	1.61278
$\log 2.3 = 0.36172\ldots$	2 [·] 3 [log]	0.36172

The [ln] key obtains the natural logarithmics of the display.

EXAMPLE	OPERATION	READ-OUT
$\ln 6.3 = \log_e 6.3 = 1.84055\ldots$	6 [·] 3 [ln]	1.84055
$\ln 0.31 = -1.17118\ldots$	[·] 31 [ln]	−1.17118

8-3 / POWERS, SQUARE ROOTS AND RECIPROCALS

The [a^n] key obtains the N-th power of either entry or result by the successive entry of "n".

EXAMPLE	OPERATION	READ-OUT
$2.3^7 = 340.48252\ldots$	2 [·] 3 [a^n] 7	340.48252
$(4.5 - 5.8)^5 = -3.71293\ldots$	4 [·] 5 [−] 5 [·] 8 [=]	−1.3
	[a^n] 5	−3.71293
$(1.2 \times 3.6)^{-3} = \frac{1}{(1.2 \times 3.6)^3} = 0.0124036\ldots$	1 [·] 2 [×] 3 [·] 6 [=]	4.32
	[a^n] 3	80.621568
	[1/x]	0.0124036
$\frac{1.2 \times 4}{1.2^3 \times 4^3} = 0.0434027\ldots$	1 [·] 2 [×] 4 [÷] 1 [·] 2 [a^n] 3 [÷] 4 [a^n] 3 [=]	0.0434027

The [√] key extracts the square root of either entry or result.

EXAMPLE	OPERATION	READ-OUT
$\sqrt{5} = 2.236067\ldots$	5 [√]	2.236067
$2 \times \sqrt{2} = 2.828426\ldots$	2 [×] 2 [√] [=]	2.828426

The [1/x] key obtains the reciprocal number of either entry or result.

EXAMPLE	OPERATION	READ-OUT
$\frac{1}{0.789} = 1.267427\ldots$	[·] 7 8 9 [1/x]	1.267427
$\frac{1}{3+5} = 0.125$	3 [+] 5 [=] [1/x]	0.125
$3 \times \frac{1}{45} = 0.0666666$	3 [×] 4 5 [1/x] [=]	0.0666666
$\frac{\sqrt{5}}{2 \times \sqrt{3}} = 0.6454972\ldots$	2 [×] 3 [√] [÷] 5 [√] [=] [1/x]	0.6454972

8-4/CALCULATION INVOLVING π

The [π] key enters the circular constant in 7 digits (3.141592).

EXAMPLE	OPERATION	READ-OUT
$\pi = 3.141592\ldots$	[π]	3.141592
$2\pi = 6.283184\ldots$	2 [×] [π] [=]	6.283184
$e - \frac{1}{\pi} = 2.3999701\ldots$	1 [e^x] [−] [π] [1/x] [=]	2.3999701

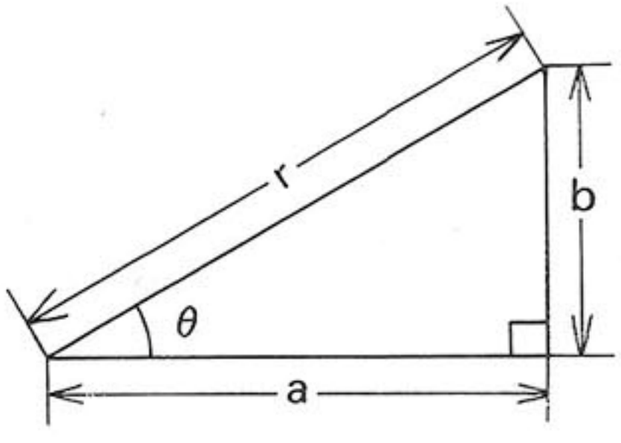
Note: By using the following formula, Degree→Radian conversion (or vice versa) can be performed.

$$1 \text{ rad} = \frac{180}{\pi}$$

EXAMPLE	OPERATION	READ-OUT
1 rad = 57.295779° . . .	180 ÷ π =	57.29579
25° = 0.4363322 . . . rad	25 × π ÷ 180 =	0.4363322
cos (2.5 rad) = cos 143.23947° =−0.80114 . . .	2 . 5 × 180 ÷ π =	143.23947
	cos	−0.80114

9/PRACTICAL APPLICATIONS

1) TRIGONOMETRY



Determine a and b in the figure shown left when r is 4.472 (cm) and θ is 26° 33′ 54″.

[FORMULA] $a = r \cdot \cos\theta$

$b = r \cdot \sin\theta$

OPERATION	READ-OUT
26 °''' 33 °''' 54 °''' cos × 4 . 472 =	3.9998462 (cm) [= a]
26 °''' 33 °''' 54 °''' sin × 4 . 472 =	1.9999231 (cm) [= b]

Note: 1) When a and θ are given, b is also obtained by the following formula.

$b = a \cdot \tan\theta$ $\begin{cases} a = 3.9998462 \text{ (cm)} \\ \theta = 26^\circ\ 33'\ 54'' \end{cases}$

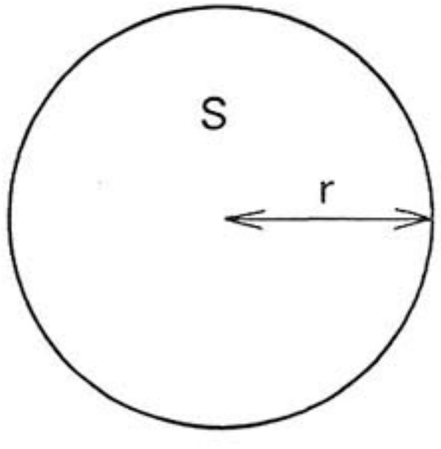
[OPERATION] 26 °''' 33 °''' 54 °''' tan × 3 . 9998462 = ... 1.9998831 (cm)

2) When r and a are given, b is also obtained by the following formula.

$b = \sqrt{r^2 - a^2}$ $\begin{cases} r = 4.472 \text{ (cm)} \\ a = 3.9998462 \text{ (cm)} \end{cases}$

[OPERATION] 4 . 472 a^n 2 − 3 . 9998462 a^n 2 = $\sqrt{}$ .... 2.000003 (cm)

2) AREA OF CIRCLE

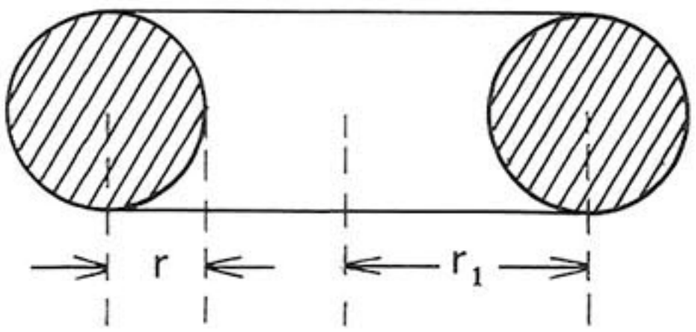


Determine the semi-diameter (r) in the figure shown left when the area of circle (S) is 20 cm^2.

[**FORMULA**] $S = \pi \cdot r^2$ $\therefore$ $r = \sqrt{\frac{S}{\pi}}$

OPERATION	READ-OUT
20 ÷ π = $\sqrt{}$	2.523132 (cm) [= r]

3) CUBIC VOLUME

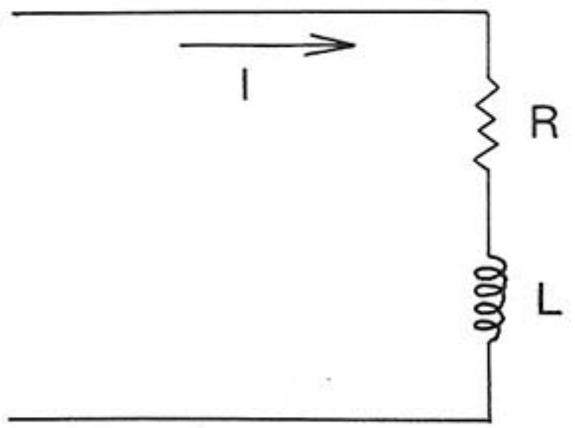


Determine the cubic volume (V) of the figure shown left, when r = 2 (cm) and r_1 = 15 (cm).

[**FORMULA**] $V = 2\pi^2 \cdot r_1 \cdot r^2$

OPERATION	READ-OUT
2 × π a^n 2 = × 15 × 2 a^n 2 =	1184.352 (cm³) [=V]

4) ELECTRIC CURRENT IN TRANSIENT PHENOMENA



Determine the ratio of electric current (i) in the RL circuit (R = 20Ω, L = 3H) shown left 0.2 second after the switch is closed.

[**FORMULA**] $i = \frac{E}{R}(1 - e^{-\frac{R}{L}t})$, $I = \frac{E}{R}$

$$\therefore \frac{i}{I} \times 100 = (1 - e^{-\frac{R}{L}t}) \times 100$$

OPERATION	READ-OUT
AC − 20 ÷ 3 × (2 = e^x − − − + 1 × 100 =	73.641 (%)

10/SPECIFICATIONS

OPERATIONS:

Addition, subtraction, single/chain multiplication, single/chain division, addition/subtraction by repeat, constant calculation in four functions, mixed calculation, true credit balance and calculation involving decimal places.

Trigonometric functions (sin, cos, tan), common and natural logarithms, exponential function, square and powers, square root, reciprocals, sexagesimal/decimal conversion and calculation involving π.

CAPACITY:	Input Range		Output
Entry/basic functions	8 digits	(7 digits when a figure is negative)	8 digits
sin/cos/tan	$-360^\circ \leqq x \leqq 360^\circ$		6 digits
Common/natural logarithms	$0 < x < 10^8$	(Negative figure is processed as positive)	6 digits
N-th power (a^n)	$-10^7 < a < 10^8$	($0 \leqq n \leqq 9$; n = whole number)	8 digits
Exponential function	$-10 < x < 10$		6 digits
Square root	$0 \leqq x < 10^8$	(Negative figure is processed as positive)	7 digits
Reciprocal	$-10^7 < x < 10^8$		8 digits
Sexagesimal/decimal conversion	$0 < x < 10^8$		8 digits
π	7 digits		

DECIMAL POINT: Full floating decimal point system with underflow.

NEGATIVE NUMBER: Indicated by minus (—) sign up to 7 digits.

OVERFLOW: Checked by zero indication on all columns, locking the calculator.

READ-OUT: Green Digitron tube panel and zero suppression.

MAIN COMPONENT: One chip LSI

POWER CONSUMPTION: 0.45W

POWER SOURCE:
AC 100, 117, 220 or 240V (±10V), 50/60Hz with applicable AC Adaptor.
DC UM-3 or SUM-3 (Manganese dry battery) x 4 (pieces).
Continuous operation : Approx. 8 hours.
AM-3 (Alkaline dry battery) x 4 (pieces).
Continuous operation : Approx. 17hours.

USABLE TEMPERATURE: 0° ~ 40°C (32° ~ 104°F)

DIMENSIONS: 33mmH x 95mmW x 150mmD (1-1/4"H x 3-3/4"W x 5-7/8"D)

WEIGHT: 330 g (12 oz), including batteries.

CARE OF YOUR NEW ELECTRONIC CALCULATOR

This calculator is a durable, precision-made instrument which will provide you with years of trouble-free service.
To help ensure this we recommend that the inside of the calculator not be touched. It is also inadvisable to subject the calculator to hard knocks, drops, and unduly strong key pressing.
Extreme cold (below 0°C or 32°F), heat (above 40°C or 104°F) and humidity may also effect the the function of the calculator. When you do not use the calculator for a long period, take out the batteries and store in the carrying case to prevent damage if the batteries leak. Please make sure you switch off the power when you finish your calculations or intend to open the cover to change batteries.
Should the calculator need service, take the unit to the store where purchased or to a nearby dealer.

CASIO®

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