ELECTRONIC-CALCULATOR

EC-281

OWNER'S MANUAL

PLEASE READ BEFORE USING THIS EQUIPMENT

REALISTIC®

CUSTOM MANUFACTURED FOR RADIO SHACK TC A DIVISION OF TANDY CORPORATION

CAT. NO. 65-841

INTRODUCTION

The Radio Shack Model EC-281 Scientific Slide Rule Calculator incorporates the very latest in solid-state techonology. The electronic "brain" which makes possible the 41 functions of this remarkable instrument is a tiny silicon chip containing thousands of individual transistors and many other electronic components.

The model EC-281 is a completely portable AC/DC unit with an easy-to-read electro-fluorescent display. With more features and functions than many far more costly machines, the EC-281 will provide you with many years of painless, carefree problem solving.

NOTE: Limits of accuracy are stated on page 30.

EC-281 OPERATING FEATURES

Your calculator is equipped with a recently developed electronic device, the MOS/LSI CF599 chip. This special chip affords a wide variety of features as listed below:

- Number entry in floating point or scientific notation.
- 9 digit output with 5 digits of the mantissa displayed, 2 digits for the exponent, and 1 digit for the sign of the mantissa and 1 digit for the exponent.
- 8 digit display and sign for numbers not requiring scientific notation, or for the display of the 5 most significant digits of a number that is in scientific notation.
- Basic Arithmetic ($+, -, \times, \div$)
- Percent (add-on and discount)
- Scientific functions: sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, lnX , e^x log 10, and 10^x.
- Convenience functions: $\sqrt{X}$, 1/X, Y^x, X^2, +/−
- Two levels of parentheses.
- Trigonometric functions are performed in degrees or radians.
- π key to display the value of π .
- Trailing zero supression.

PREPARING TO USE THE CALCULATOR

The EC-281 can be used with either of three types of power.

1. Standard Batteries.
2. Rechargeable Ni-Cad Batteries.
3. A. C. Power.

Battery Installation

To install Batteries, remove the Battery Compartment Cover from the back by pressing in the direction of the arrow.

Install 4 size AA penlight cells—be sure to observe proper polarity as indicated inside the compartment. Replace the Battery Compartment Cover.

AC Operation

If you'd rather save the cost of Batteries, obtain an optional AC Adapter for your Calculator.

Use only Radio Shack's 14-854.

Plug one end into a source of 120 volts, 60 Hz AC power, connect the other end to the jack on the rear of the calculator.

NOTE: For Battery operation, we urge you to consider using rechargeable Ni-Cads. With the AC Adapter/Charger, you can use these batteries hundreds and hundreds of times. To fully recharge Ni-Cads, leave the AC Adapter/Charger connected overnight. Typically, when you get them, Ni-Cads will be in a discharged condition – so you must charge them overnight before using the Calculator.

If you don't use Ni-Cads, we recommend that you use heavy duty type batteries – such as Radio Shack's 23-582, or 23-552 for extra-long life.

CAUTION

If you are using the AC Adapter/Charger (and are not charging Ni-Cads) remove the Batteries. Operation from AC power, with batteries still installed, may cause the batteries to swell and erupt. Also, never leave Ni-Cads on charge for more than 24 hours.

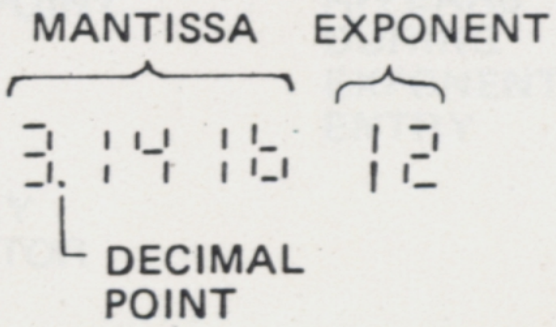
Never leave weak or dead batteries in your Calculator. If you don't intend to use the Calculator for a few weeks or months, remove the Batteries.

BATTERY REPLACEMENT

When the display becomes dim or if the Calculator begins operating abnormally, it is time to replace the batteries or recharge Ni-Cads. Always use quality, sealed 1.5 volt AA penlight cells such as Radio Shack Alkaline or Triple Life ENERCELL. These batteries provide longer operating times than the conventional cells, and they incorporate specially developed seals to provide greater leakage protection.

DISPLAY DESCRIPTION

Your EC-281 calculator has a bright green electro-fluorescent display with 9 character positions. The leftmost character position is reserved for the minus sign (—) and a special ERROR signal (E). The next five positions are reserved for the number being entered into or out of the calculator. The remaining three character positions are reserved for very small or very large numbers. If a number appears in the last two of these positions, it is called the exponent and the preceeding number is called the mantissa. For example, the display 3.1416 12 is equivalent to 3.1416×10^{12}. The character space between the mantissa and exponent shows a minus sign (—) when the exponent is negative.



DISPLAY METHODS

The method used by the EC-281 to display very small and very large numbers with the assistance of an exponent is called scientific notation. Simply defined, scientific notation is a convenient means for expressing very small or very large numbers as multiples of 10 to a specified power. For example 5000 is expressed as 5×10^{3} in scientific notation. Similarly, 28321 is 2.8321×10^{4} in scientific notation. Numbers less than one have a negative exponent when expressed in scientific notation. For example, 0.07 is equivalent to 7.0×10^{-2}.

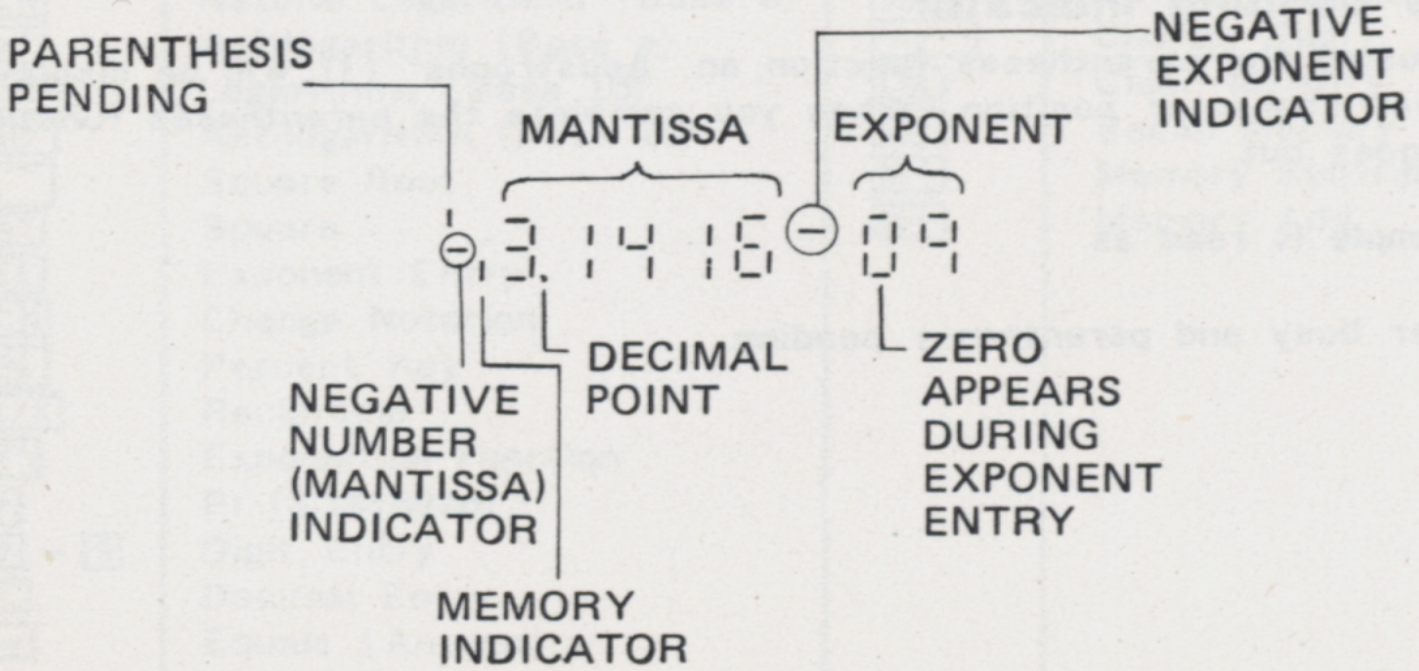
It's easy to enter numbers expressed in scientific notation into your calculator. To enter 3.4×10^{17}, for example, press the following keys: [3] [·] [4] [EE] [1] [7]. If the number is less than one, it has a negative exponent which is so indicated by pressing the [+/−] key after the exponent is entered. For example, 2.18×10^{-5} is entered as follows: [2] [·] [1] [8] [EE] [5] [+/−]. An error condition is indicated by the letter E in the leftmost display position. Typical errors are improper keystroke sequences and illegal operations such as division by zero. When memory register is in use, a segment " , " in the leftmost character position glows.

SPECIAL DISPLAY INDICATORS

The display of your EC-281 incorporates several status indicators. These include negative mantissa and exponent, error and memory busy. Each of the indicators is explained below.

Negative Mantissa and Exponent Indicator

A minus sign (—) in the first (leftmost) display position indicates a negative mantissa. A minus sign in the seventh display position indicates a negative exponent.



Error Indicator

An error condition is indicated by the letter E in the leftmost display position. Typical errors are improper keystroke sequences and illegal operations such as division by zero.

Memory Busy Indicator

When the memory is in use, a slash mark (/) in the leftmost character position glows. (This will remind you that the memory register is in use.)

parentheses pending Indicator

When you are using the parentheses function, an "Apostrophe" (') will be displayed in the left most character position. When you complete the parentheses function, this indicator goes out.

The display sample is read as

-3.1416×10^{-9}

Memory register busy and parenthesis pending.

Description of Keys:

Key	Use	Key	Use
C/CE	Clear, Clear Entry	÷	Divide
ARC	Inverse Trig	×	Multiply
SIN	Sin (Trig)	−	Subtract
COS	Cos (Trig)	+	Add
TAN	Tan (Trig)	( )	Brackets/Parenthesis
LN	Natural Logarithms (Base e)	MEX	Memory Exchange
e^x	Antilogarithm (Base e)	+/−	Change Sign
LOG	Logarithms (Base 10)	CM	Clear Memory
10^x	Antilogarithm (Base 10)	RM	Recall Memory
$\sqrt{\ }$	Square Root	M−	Memory Subtract
X^2	Square	M+	Memory Add
EE	Exponent Entry		
CN	Change Notation		
%	Percent Key		
1/X	Reciprocal		
Y^x	Exponential Function		
π	Pi (3.1415926)		
0 — 9	Digit Entry		
.	Decimal Entry		
=	Equals (Answer)		

INSTRUCTIONS FOR OPERATION

The EC-281 calculator has 41 keys, The following explanation will help you understand the operation and uses of each key.

DIGIT ENTRY KEYS

[0] - - - [9] : Pressing any digit key enters that digit and causes it to appear in the display. To enter the number 32, press [3] first, then [2].

DECIMAL POINT ENTRY

[·] : Pressing the [·] key places the decimal point in your entries.

EXPONENT ENTRY KEY

[EE] : Pressing the [EE] key instructs the calculator that the following number entry is an exponent of 10 (scientific notation).

PI KEY

[π] : Pressing the [π] key enters the 8-digit value of π (3.1415926) into the display. This key, following a number entry, clears the number entered and causes immediate entry of π , and vice versa.

ARITHMETIC FUNCTION KEYS

[+] ADD, [−] SUBTRACT, [×] MULTIPLY, [÷] DIVIDE: Pressing any of these four keys selects the next operation to be performed by the calculator and causes the previously selected operation to be executed. During calculations, intermediate results are automatically displayed after these keys are pressed.

ANSWER KEY

[=] : Pressing the [=] key causes your answer to appear in the display and establishes a constant, then terminates the calculation. The answer can be retained as the first number for your next calculation. The [=] can be used inside parentheses to execute arithmetic functions, and the answer used in a scientific function.

OPEN BRACKET AND PARENTHESIS KEY

[(] : Pressing the [(] key once enters the open parenthesis. Pressing it twice enters the open bracket and open parenthesis in sequence. Pressing this key actually causes storage of the intermediate result and prior function into a separate "submemory", and conditions the calculator to solve sub – problems within parentheses.

CLOSE PARENTHESIS AND BRACKET KEY

[)] : Pressing the [)] key once enters the close parenthesis. Pressing it twice enters the close parenthesis and close bracket in sequence. Pressing this key actually causes execution of a prior function, display of the result of the sub-problem within parentheses, and recall of the previous intermediate result and prior function stored in the submemories at the time the [(] key was pressed.

CLEAR KEY

[C/CE] : Pressing the [C/CE] key clears the display of erroneous entries, cancels overflow conditions, or clears the calculator of stored numbers and functions. See CLEAR OPERATIONS later on for a complete description.

CHANGE SIGN KEY

[+/−] : Pressing the [+/−] key changes the sign of the displayed number. To enter a negative number, first enter the number and then press the [+/−] key. Pressing the [+/−] key after the [EE] key changes the sign of the exponent.

BASIC OPERATION

The EC-281 uses algebraic logic. This means your calculator works the same way you think. Entries are made the same way you would write an algebraic equation. Notice that the display shows each new numerical entry as you press the number entry keys.

Problem:

Addition 4 + 5 = 9

Problem:

Subtraction 9 − 6 = 3

Keyboard Entry	Display
4	4.
⊞ 5	5.
=	9.

Problem:

Multiplication $2 \times 7 = 14$

Keyboard Entry	Display
2	2.
⊠ 7	7.
=	14.

Keyboard Entry	Display
9	9.
⊟ 6	6.
=	3.

Problem:

Division $48 \div 4 = 12$

Keyboard Entry	Display
48	48.
÷ 4	4.
=	12.

Mixed Calculations

The following example shows how the calculator is used to solve complex mathematical problems with a minimum of key pressings. The example also illustrates how the arithmetic function keys execute preceding operations and cause intermediate results to be displayed.

Problem: $\dfrac{(4+6)\,8-7}{8} = 9.125$

Keyboard Entry	Display	Comments
4	4.	
⊞ 6	6.	
⊠	10.	(4+6) executed
8	8.	
⊟	80.	(4+6) 8 executed
7	7.	
÷	73.	(4+6) 8—7 executed
8	8.	
=	9.125	Final result

CONSTANT OPERATIONS

The automatic constant is another time-saving feature. This feature enables you to add, subtract, multiply, or divide each number in a series by the same (constant) number, repeatedly without re-entering the number for each new calculation. The number entered after the last arithmetic function key pressed is always saved as the constant (addend, subtrahend, multiplier or divisor).

Problem: 4+3=7 8+3=11

Keyboard Entry	Display	Comments
4	4.	
[+] 3	3.	Constant addend=3
[=]	7.	
8	8.	
[=]	11.	

CALCULATIONS USING PARENTHESES KEYS

NOTE: In the following example, parentheses and brackets are entered in the same sequence as the problem is written.

Problem: [(2×3)+(3÷4)]÷[(3+5)×(7−9)]=−0.421875

Keyboard Entry	Display	Comments
[(] [(] 2	12.	
[×] 3	13.	
[)] [+] [(]	10.	(2×3) executed, addition operation established

3	3.	
÷ 4	4.	
)	0.75	(3÷4) executed
) ÷ ((	0.	(2×3)+(3÷4) executed, division operation established
3	3.	
+ 5	5.	
) × (	0.	(3+5) exccuted, multiplication operation established
7	7.	
− 9	9.	
)	2.	(7−9) executed
)	−16.	(3+5)×(7−9) executed
=	−0.421875	

CLEAR OPERATIONS

There are two clear keys and they perform the following functions: C/CE clear entry/clear calculator and CM clear memory register.

1. Clear Entry (Enter Correction): A single depressing of the C/CE key after entry of a number clears the displayed number but does not affect the stored constants or the operation in progress.

Example: 12+43=55

Keyboard Entry	Display	Comments
12	12.	
⊞ 46	46.	Error, wrong number entered
C/CE	0.	Clear entry
43	43.	
=	55.	

2. Clear Calculator (Except Memory): A double depression of the C/CE key clears any operation in progress and clears the calculator except memory registers.

Example: 4+5

Keyboard Entry	Display	Comments
4	4.	
⊞ 5	5.	
C/CE	0.	Entry cleared
C/CE	0.	Calculator cleared

NOTE: Pressing [C/CE] key once after an arithmetic function key, answer key, π key or exchange key clears the calculator.

3. Clear Memory: Pressing [CM] clears memory register.

CHANGE SIGN OPERATION

Pressing the [+/−] key changes the sign of the number in the display.

Problem: $\frac{4^2\,(-3)}{6} = -8$

Keyboard Entry	Display	Comments
4	4.	
[X²]	16.	
[X]	16.	
3	3.	
[+/−]	−3.	Negative indicator glows
[÷]	−48.	
6	6.	
[=]	−8.	

CONSTANT π KEY

The value of π may be entered into the display at any time by pressing the [π] key. The display will be 3.1415926.

Problem: Area of circle: Find area (A) of a circle 6 feet in diameter (D).

Formula $A=\frac{\pi D^2}{4}$ $A=28.274332\ ft^2$

Keyboard Entry	Display	Comments
[π]	3.1415926	
[X]	3.1415926	
6	6.	Diameter (D)
[X^2]	36.	D^2
[÷] 4	4.	
[=]	28.274332	Area (A) in square feet

EXPONENT ENTRY KEY

Numbers may be entered into the EC-281 in scientific notation, that is, expressed as a base number (mantissa) multiplied by 10 raised to an exponent: $X \cdot 10^y$, where X is the base number and Y is the exponent. For example, 123 can be expressed as 1.23×10^2. The base number is 1.23 and the exponent is 2. The procedure for entering numbers in scientific notation is described in the example below:

Number	Keyboard Entry	Display	Comments
-3.14×10^{-9}	3.14	3.14	
	[+/−]	−3.14	
	[EE]	−3.14 00	
	9	−3.14 09	
	[+/−]	−3.14 -09	

TRIGONOMETRIC FUNCTIONS

Pressing the [SIN], [COS] or [TAN] key will cause the calculator to compute and display the appropriate trigonometric function for the value of the angle that was displayed initially. The inverse (ARC) trigonometric function of a displayed number will be computed and displayed when the [ARC] key is pressed followed by the [SIN], [COS], [TAN] key. Trig functions can be calculated for degrees or radians (depending on setting of DEG/RAD switch).

Problem: Sin 30° = 0.5

Keyboard Entry	Display	Comments
30	30	Set DEG/RAD switch to DEG
[SIN]	0.5	

Problem: arcSIN 0.2 = 11.5369°

Keyboard Entry	Display	Comments
0.2	0.2	Set DEG/RAD switch to DEG
[ARC] [SIN]	11.5369	

DEG/RAD SWITCH: The position of the DEG/RAD switch determines whether the trigonometric functions are to be computed with angles in degrees or radians.

Problem: Sin 63° = 0.891006

Keyboard Entry	Display	Comments
63	63.	Set DEG/RAD switch to "DEG"
[SIN]	0.891006	

Problem: Tan 2 radians = −2.18504

Keyboard Entry	Display	Comments
2	2.	Set DEG/RAD switch to "RAD"
[TAN]	− 2.18504	

SQUARE ROOT

Pressing [√‾] causes the square root of the number in the display to be computed and displayed.

Problem: $\sqrt{64} = 8$

Keyboard Entry	Display
64	64.
[√‾]	8.

SQUARE

Pressing [X²] causes the square of the number in the display to be computed and displayed.

Problem: $12.4^2 = 153.76$

Keyboard Entry	Display
12.4	12.4
[X²]	153.76

RECIPROCALS

Pressing the [1/X] key causes the reciprocal of the number being displayed to be computed and displayed.

Problem: $\frac{1}{40} = 0.025$

Keyboard Entry	Display
40	40.
[1/X]	0.025

COMMON LOGARITHMS FUNCTION (Log)

Pressing the [LOG] key causes the common logarithm of the displayed number to be computed and displayed.

Problem: $\log 10^{1000} = 3$

Keyboard Entry	Display
1000	1000.
[LOG]	3.

NATURAL LOGARITHMS FUNCTION (Ln)

Pressing the [LN] key causes the natural logarithm of the displayed number to be computed and displayed.

Problem: $\text{Ln}\ (32^3) = 3\ \text{Ln}\ 32 = 10.397209$

Keyboard Entry	Display
32	32.
[LN]	3.4657364
[X] 3	3.
[=]	10.397209

ANTILOGARITHMS FUNCTIONS [e^x], [10^x]

Pressing the [e^x] or [10^x] keys as desired causes the antilogarithms of the displayed number of the base e or base 10 to be computed and displayed.

Problem: $10^3 = 1000$

Keyboard Entry	Display
3	3.
[10^x]	1000.

Problem: $e^{-3} = 0.0497871$

Keyboard Entry	Display
3	3.
[+/−]	−3.
[e^x]	0.0497871

EXPONENTIAL FUNCTION (Y^x)

The exponential function raises Y (first number entered) to the power X (second number entered) for real values of X. The function is completed by entering X and pressing the [=] key.

Problem: $2^4 = 16$

Keyboard Entry	Display
2	2.
[Y^x]	3.0102—01 (common log of 2)
4	4.
[=]	16.

The Y^x function can be chained with other operations by use of parentheses as follows:

Problem: $3 \times (4^{2.5}) = 96$

Keyboard Entry	Display
3 [×] [(]	0.
4	4.

[Y^x]	0.6020601
2.5	2.5
[=] [)]	32.
[=]	96.

CHANGE NOTATION KEY (CN):

Pressing the [CN] key will convert the displayed number to scientific notation. For example, the displayed number 45638; when you press the [CN] key, the displayed number will be 4.5638 04. In scientific notation 45638 is the same as 4.5638×10^4. The function also works backwards. Thus if you are in the scientific notation mode, and want to see the full number displayed, accurate to eight places, press this key.

PERCENT KEY [%]

The EC-281 is equipped with a fully active percent function [%] key. It will figure discounts, add-ons, mark-ups and totals. Percent is operational after a sequence of "A" × "B", where "A" is any number and "B" is in percent. The [%] key performs the operation and displays the result. For discount or add-on, use A [−] B [%] [=] or A [+] B [%] [=]. Go through the following examples.

Example: 200×15%

Keyboard Entry	Display
C/CE	0.
200 × 15	15.
%	30.

Example: An article selling for $ 4.95 is on sale at 25% discount. What is the new selling price? (4.95 - 25% of 4.95)

Keyboard Entry	Display
C/CE	0.
4.95 −	4.95
25 % =	3.7125

Example: An article is purchased for $ 12.95 not including 5% sales tax. What is the total cost to buyer? (12.95+5% of 12.95)

Keyboard Entry	Display
C/CE	0.
12.95 +	12.95
5 % =	13.5975

MEMORY ADD, MEMORY SUBTRACT, RECALL MEMORY AND CLEAR MEMORY KEYS

[M+] [M—] [RM] [CM] : The EC-281 incorporates a completely addressable Memory Bank to enable you to solve complex problems beyond those normally solved on standard four function calculators. The following examples explain the use of the Memory and the meaning of the Memory Address Keys.

Example: $\frac{(25\times 3)-(5\times 5)}{5\times 2}=5$

Keyboard Entry	Display
[C/CE]	0.
[CM]	0.
25 [×] 3 [=]	75.
[M+]	75.
5 [×] 5 [=]	25.
[M—]	25.
[RM]	50.
[÷] 5 [÷] 2	2.
[=]	5.

MEMORY EXCHANGE KEY

[MEX] : Pressing the [MEX] key changes the displayed number to the number in the memory register, and vice versa.

Example: $\frac{(12\times 3)-(15\div 3)}{2}=15.5$

Keyboard Entry	Display	Comments
[C/CE] [CM] 12 [×] 3 [=][M+]	,36.	Product stored in Memory
15 [÷] 3 [=] [M−]	,5.	Second Product Subtracted from Memory
[MEX]	,31.	Exchange the displayed number with the stored number
[÷] 2 [=]	,15.5	

ERROR CONDITIONS:

A. Result Errors

A calculation can be performed which produces an intermediate or final result outside the permissible range of the Calculator. These errors are refered to as overflow if the magnitude of the result is greater than $9.9999999\times 10^{+99}$ or underflow if the magnitude of the result is smaller than 1×10^{-99}. When this occurs, an error symbol "E" appears in the display.

B. Input Argument Errors

Specific functions cannot be executed over the full range of numbers which may be entered from the keyboard or developed as intermediate results during calculation. The following table provides a summary of the permitted range of arguments for each of the functions performed by the EC-281 calculator.

$+, -, \times, \div$	$1\times10^{-99} \leqq \lvert X \rvert \leqq 9.9999999\times10^{99}$
$1/X$	$1\times10^{-99} \leqq \lvert X \rvert \leqq 9.9999999\times10^{99};\ X \neq 0$
$\sqrt{X}$	$0 \leqq X \leqq 9.9999999\times10^{99}$
$\ln X$	$0 < X \leqq 9.9999999\times10^{99}$
e^x	$\lvert X \rvert < 100 \ln 10\ (\lvert X \rvert < 230.25)$
$\sin X$	$1\times10^{-99} \leqq \lvert X \rvert \leqq 9.9999999\times10^{99}$
$\cos X$	$1\times10^{-99} \leqq \lvert X \rvert \leqq 9.9999999\times10^{99}$
$\tan X$	$X \neq 90°, 270°, 450°$ etc
$\sin^{-1} X$	$\lvert X \rvert \leqq 1$
$\cos^{-1} X$	$\lvert X \rvert \leqq 1$
$\tan^{-1} X$	$0 \leqq \lvert X \rvert \leqq 9.9999999\times10^{99}$
Y^x	$X < \frac{100\times\ln10}{\ln y}$ $\quad 0 < Y \leqq 9.9999999\times10^{99}$

ACCURACY

There are two sources of error in calculations done by the EC-281. The first is truncation errors, which occur when the mantissa of a result is rounded to eight digits. The second is algorithmic errors, which are caused by the limited precision of the constants and algorithms used in the complex function calculations. For some functions the accuracy becomes less for certain ranges of the input argument. All functions are accurate within two counts in the eighth digit of mantissa. The value of the exponent (or the location of the decimal) can be considered exact.

SAMPLE PROBLEMS

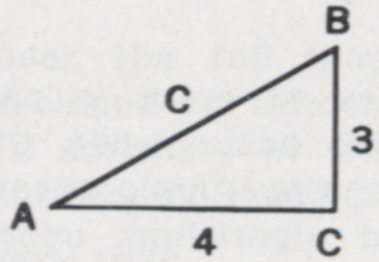
The Radio Shack EC-281 scientific Slide Rule calculator is a versatile problem solving tool. Several practical examples were chosen from different fields of interest to familiarize you with your calculator. We recommend that you gain familiarity with your calculator by working the sample problems.

MATHEMATICS

Pythagorean Theorem

$$C = \sqrt{(3^2 + 4^2)}$$

$$C = 5$$



Keyboard Entry	Display
3	3.
[X²]	9.
[+]	9.
4	4.
[X²]	16.
[=] [√]	5.

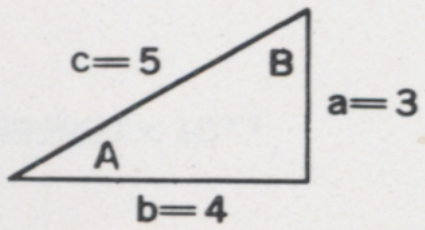
Law of Cosines:

Problem: Given three sides of illustrated triangle, find angle A.

Formula: $a^2 = c^2 + b^2 - 2bc \cos A$

$$A = \cos^{-1}\left(\frac{c^2 + b^2 - a^2}{2bc}\right)$$

$$A = 36.8699°$$



Set DEG/RAD switch to DEG.

Keyboard Entry	Display	Comments
2	2.	
[×]	2.	
5	5.	c
[×]	10.	2c
4	4.	b
[=]	40.	2bc
[M+]	,40.	Memory indicator illuminated
5	,5.	
[X^2]	,25.	c^2
[+]	,25.	
4	,4.	
[X^2]	,16.	b^2
[−]	,41.	
3	,3.	
[X^2] [÷]	,32.	$c^2 + b^2 - a^2$
[RM]	,40.	
[=]	,0.8	$c^2 + b^2 - a^2/2bc$
[ARC] [COS]	,36.8699	

ELECTRONICS

Problem: Three resistors of 5 ohms, 20 ohms and 10 ohms are connected in parallel. What is the equivalent resistance?

Formula: $Re = \dfrac{1}{\frac{1}{R1}+\frac{1}{R2}+\frac{1}{R3}}$

$Re = 2.8571428$ ohms

Keyboard Entry	Display	Comments
5	5.	R1
[1/X]	0.2	1/R1
[+]	0.2	
20	20.	R2
[1/X]	0.05	1/R2
[+]	0.25	1/R1+1/R2
10	10.	R3
[1/X]	0.1	1/R3
[=]	0.35	1/R1+1/R2+1/R3
[1/X]	2.8571428	Re

CHEMISTRY

Problem: 20ml of 0.5N HCl is diluted with water to 100ml and the resulting solution is titrated with 8ml 0.5N NaOH. Find the PH value.

Un-neutralized HCl $20-8=12$ (ml)

Solution $100+8=108$ (ml)

$PH=-\log(H^+)$

$(H^+)=\frac{V\times N}{Vo}$, $V=12ml$, $N=0.5$, $Vo=108ml$

$PH=1.2553$

Keyboard Entry	Display	Comments
12 [×] 0.5 [÷]	6.	
108 [=]	5.5555—02	(H^+)
[LOG]	—1.2552725	
[+/—]	1.2552725	PH

PHYSICS

Problem: Find the torque of a loop of wire carrying 3 Amps in a magnetic field of 0.5 weber/m^2.

$B = 0.5$ weber/m^2

$\phi = 30°$

$r = 1.75$ m

$I = 3$ Amps

A (area of loop) $= \pi r^2$

Torque $T = IAB \sin \phi$

Note: Set DEG/RAD switch to DEG.

Keyboard Entry	Display
[CM] 1.75 [X^2] [X] [π] [X]	9.6211273
3 [X] .5 [=] [M+]	14.43169
30 [sin] [X] [RM] [=]	7.215845

SURVEYING

In determining the height of a large object, it is seldom practical to measure directly, often it may even be impossible to reach the base of the object.

AB is 75 feet

α is 48.5°

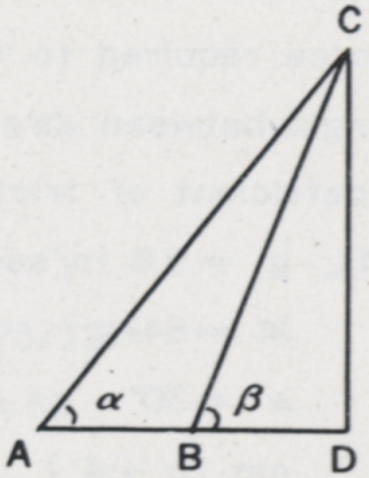
β is 72.3°

$h = BC \sin \beta$

In triangle ABC, angle $C = \beta - \alpha$

$\therefore$ by the law of sines $\frac{BC}{AB} = \frac{\sin \alpha}{\sin (\beta - \alpha)}$

$\therefore h = AB \frac{\sin \alpha \ \sin \beta}{\sin (\beta - \alpha)}$



Note: Set DEG/RAD switch to DEG.

Keyboard Entry	Display
48.5 [sin] [MEX]	0.
72.3 [sin]	0.952662
[X] [RM] [=] [MEX]	0.748956
72.3 [−] 48.5 [=] [sin]	0.403545
[1/X] [X] [RM] [=]	1.768085
[X] 75 [=]	132.60637

MECHANICS

Problem: Find the force required to pull an object up an inclined plane.

F = force required to move mass M up the plane whose inclination is α.

β = angle between direction of force and the plane.

μ = coefficient of friction = $\tan \phi$

$W = Mg$, $g = 9.8$ m/sec^2 $\quad \beta = 10°$

$M = 64$kg $\quad \mu = 0.5$

$\alpha = 30°$

$$F = Mg \frac{\sin(\alpha + \phi)}{\cos(\beta - \phi)}$$

Note: Set DEG/RAD switch to DEG.

Keyboard Entry	Display
.5 [ARC] [TAN] [MEX]	,0.
10 [−] [RM] [=]	−,16.565
[COS]	,0.958497
[MEX] [+] 30 [=] [SIN]	,0.834511
[÷] [RM] [X]	,8.7064−01
64 [X] 9.8 [=]	,546.06877

BUSINESS

Problem: What will be monthly payment on a $ 150,000 loan, borrowed for 5 years at an interest of 12¾% per year?

$$M = P\frac{i(1+i)^{n}}{(1+i)^{n}-1}$$

Where M = monthly payment

P = principal

i = monthly interest rate = .1275/12

n = number of periods = 12 × 5 = 60

Keyboard Entry	Display
CM .1275 ÷ 12 + 1 =	1.010625
Y^x 60 =	1.88539
M+ − 1 = 1/X X RM	,1.88539
X .1275 ÷ 12 X	,2.2625-02
150000 =	,3393.8038

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