



**INSTRUCTIONS
FOR THE USE OF YOUR
"RICOH"
BAMBOO SLIDE RULE**

"Sole distribution Agent for Great Britain and Northern Ireland"
THE HELIX (UNIVERSAL) CO. LTD.
for
RICOH KEIKI CO., LTD.

CONTENTS

INSTRUCTIONS

FOR THE USE OF YOUR SLIDE RULE

1. GENERAL DESCRIPTION OF SCALES	1
2. MULTIPLICATION AND DIVISION.....	2
(1) How to Use C and D Scales	
(2) How to Use CI Scale	
(3) How to Use DF and CF Scales	
(4) How to Use CIF Scale	
3. PROBLEMS OF PROPORTION	10
(1) Proportion	
(2) Inverse Proportion	
4. SQUARE AND SQUARE ROOT	12
(1) Square	
(2) Square Root	
(3) Multiplication and Division including Square	
(4) Multiplication and Division including Square Root	
5. CUBE AND CUBE ROOT.....	15
(1) Cube	
(2) Cube Root	
6. LOGARITHMS	16
(1) Common Logarithms	
(2) Natural Logarithms	
7. TRIGONOMETRIC FUNCTIONS	17
(1) Sin θ	
(2) Cos θ	
(3) Tan θ	

(4) Other Trigonometric Functions

8. HOW TO USE LL SCALES.....19

(1) Explanation of LL Scales

(2) Natural Logarithms

(3) Powers and Roots

9. HOW TO USE GAUGE MARKS23

(1) $c \div 1.128$

(2) $\pi \div 3.1416$

(3) $\rho \div 57.2958$

INSTRUCTIONS

FOR THE USE OF YOUR SLIDE RULE

1. GENERAL DESCRIPTION OF SCALES

The following is the brief description of the scales.

(a) C and D

These are exactly alike and the fundamental scales of the slide rule. And they are used for general fundamental calculations.

(b) DF and CF

These are the same as the D and C scales, except that they are "folded" at π or $\sqrt{10}$. And in order to avoid resetting when the answer runs off scale, they are used with the C and D scales.

(c) CI

This is an inverted C scale and is used with the C scale in reading directly the reciprocal of a number. And it lets us do multiplication of three factors with just one setting of the slide.

(d) DI

This is an inverted D scale and just the same as the CI scale.

(e) CIF

This is an inverted CF scale and is used with the DF scale in the same relation as the CI scale with the D scale.

(f) A and B

These are exactly alike and are used with the C and D scales to find the square and square root.

(g) K

This is used in finding the cube and cube root.

(h) S

This scale gives the sine and cosine of an angle.

(i) T or T₁

This scale gives the tangent of an angle.

(j) T₂

This scale gives the tangent of an angle greater than 45°.

(k) ST

This scale gives the sine and tangent of an angle less than 6°.

(l) L

This scale is used with the D scale in finding directly the mantissa of the common logarithms of a number.

2. MULTIPLICATION AND DIVISION

(1) How to Use C and D Scales

In the following, the left hand 1 of the C or D scale is called its Left Index, the right hand 1 is called its Right Index.

(Multiplication)

The process of multiplication may be performed by using the C and D scales.

To multiply a by b ,

opposite a on D, set left or right index of C,
 move hairline to b on C,
 under hairline read the product on D.

Example 1. $2.4 \times 3 = 7.2$

Opposite 2.4 on D, set left index of C,
 move hairline to 3 on C,
 under hairline read answer as 7.2 on D.

Example 2. $4.5 \times 3.2 = 14.4$

Opposite 4.5 on D, set right index of C,
 move hairline to 3.2 on C,
 under hairline find 1.44 on D,
 read answer as 14.4.

Note in above case that the reading would have been off scale, if the left index had been used.

(Division)

The process of division is performed by using the C and D scales.

To divide a by b ,

move hairline to a on D,
 set b on C under hairline,
 opposite left or right index of C read the quotient on D.

Example 3. $32 \div 8 = 4$

Move hairline to 3.2 on D,
 set 8 on C under hairline,
 opposite right index of C read answer as 4 on D.

(Combined Multiplication and Division)

To calculate the type form of $\frac{a \times c}{b}$, first divide a by b , and then multiply the result by c . It is greatly that the increase of computation efficiency.

Example 4. $\frac{1.57 \times 32}{44} = 1.142$

Move hairline to 1.57 on D,
 set 4.4 on C under hairline,
 move hairline to 3.2 on C,
 under hairline read answer as 1.142 on D.

(2) How to Use CI Scale

(Multiplication)

The process of multiplication may be performed by using the CI and D scales too. By using of the CI scale, computation can be made quickly.

To multiply a by b ,

move hairline to a on D.

set b on CI under hairline,

opposite left or right index of C read the product on D.

Example 5. $2.3 \times 3.4 = 7.82$

Move hairline to 2.3 on D,

set 3.4 on CI under hairline,

opposite right index of C read answer as 7.82 on D.

To multiply three factors, first multiply two of them, and then multiply the result by third.

Example 6. $1.5 \times 3.2 \times 8 = 38.4$

Move hairline to 1.5 on D,

set 3.2 on CI under hairline.

move hairline to 8 on C.

under hairline find 3.84 on D,

read answer as 38.4.

(Division)

The process of division may be performed by using the CI and D scales too.

To divide a by b ,
 opposite a on D, set left or right index of C,
 move hairline to b on CI,
 under hairline read the quotient on D.

Example 7. $1.2 \div 4 = 0.3$

Opposite 1.2 on D, set left index of C,
 move hairline to 4 on CI,
 under hairline find 3 on D,
 read answer as 0.3.

To divide three factors, first divide two of them, and then divide the result by third.

Example 8. $15.7 \div 3.2 \div 4.4 = 1.115$

Move hairline to 1.57 on D,
 set 3.2 on C under hairline,
 move hairline 4.4 on CI,
 under hairline read answer as 1.115 on D.

(Combined Multiplication and Division)

The calculation of the type form of $\frac{a \times b}{c}$ is worked out the procedure of multiplication \rightarrow division, too.

Example 9. $\frac{8 \times 2}{5} = 3.2$

Move hairline to 8 on D,
 set 2 on CI under hairline,
 move hairline 5 on CI,
 under hairline read answer as 3.2 on D.

(3) How to Use DF and CF Scales

The DF and CF scales are similar to the D and C scales folded at π or $\sqrt{10}$. These scales can often be used in calculation in order to avoid resetting when the answer runs

off scale. When the slide is in any position with a number x on the D scale appearing opposite a number y on the C scale, then this same number x appears also on the DF scale opposite y on the CF scale. If the reading is off scale on the C-D scale it may be found on the CF-DF scale.

Moreover we can use the π folded DF and CF scales in problems requiring multiplication by π . Opposite any number on the D scale, read π times of this number on the DF scale.

These folded scales may be used to perform multiplication and division just as the C and D scales are used.

(Multiplication)

Example 10. $2.5 \times 2.4 \times 1.2 = 7.20$

Move hairline to 2.5 on D,
 set 2.4 on CI under hairline,
 move hairline to 1.2 on CF,
 under hairline read answer as 7.20 on DF.

Example 11. $2 \times 7 \times 8 = 112$

Move hairline to 2 on D,
 set 7 on CI under hairline,
 move hairline to 8 on CF,
 under hairline find 1.12 on DF,
 read answer as 112.

(Division)

Example 12. $9 \div 6 = 1.5$

Move hairline to 9 on DF,
 set 6 on CF under hairline,
 opposite left index of C read answer as 1.5 on D.
 (or opposite middle index of CF read answer as 1.5 on DF.)

Example 13. $9 \div 1.5 \div 4 = 1.5$

Move hairline to 9 on DF,
 set 1.5 on CF under hairline,
 move hairline to 4 on CI,
 under hairline read answer as 1.5 on D.

(Combined Multiplication and Division)

Example 14. $11.2 \div 8.4 \times 2.7 = 3.6$

Move hairline to 1.12 on DF,
 set 8.4 on CF under hairline,
 move hairline to 2.7 on C,
 under hairline read answer as 3.6.

Example 15. $\frac{3.2 \times 1.2 \times 5.8}{8.2 \times 9.5} = 0.286$

Move hairline to 3.2 on D,
 set 8.2 on C under hairline,
 move hairline to 1.2 on CF,
 set 9.5 on CF under hairline,
 move hairline to 5.8 on C,
 under hairline find 2.86 on D,
 read answer as 0.286.

(Computation involving π)

By using the DF scale which is folded to begin and end with π , if the diameter of a circle d is set on the D scale, the circumference πd is given on the DF scale, opposite d on the D scale.

Example 16. Find the circumference of a circle with its diameter of 5 cm. Find the diameter of a circle with its circumference of 46.8 cm.
 Answer 15.71 cm. 14.9 cm.

Move hairline to 5 on D,

under hairline find 1.571 on DF.

read answer as 15.71 cm.

Move hairline to 4.68 on DF,

under hairline find 1.49 on D,

read answer as 14.9 cm.

(4) How to Use CIF Scale

The CIF scale is an inverted CF scale. It may be to perform multiplication and division just as the CI scale is used. Thus, by the use of six scales of the C, D, CI, CF, DF and this CIF the fundamental calculations are performed very quickly and efficiently, without resetting the scale and running off scale.

(Multiplication)

Example 17. $3.1 \times 1.6 \times 1.5 \times 8.8 = 65.5$

Move hairline to 3.1 on D,

set 1.6 on CI under hairline,

move hairline to 1.5 on CF

set 8.8 on CIF under hairline,

opposite right index of C find 6.55 on D

read answer as 65.5.

Example 18. $9 \times 8 \times 3 \times 7 = 1512$

Move hairline to 9 on DF,

set 8 on CIF under hairline,

move hairline to 3 on C,

set 7 on CI under hairline,

opposite left index of C find 1.512 on D,

read answer as 1512.

(Division)

Example 19. $27 \div 5 \div 7.5 = 0.72$

Move hairline to 2.7 on D,
 set 5 on C under hairline,
 move hairline to 7.5 on CIF,
 under hairline find 7.2 on DF,
 read answer as 0.72.

(Combined Multiplication and Division)

Example 20. $3.8 \times 6.5 \div 2 \times 1.96 \div 1.45 = 16.7$

Move hairline to 3.8 on D,
 set 6.5 on CI under hairline,
 move hairline to 2 on CIF,
 set 1.96 on CIF under hairline,
 move hairline to 1.45 on CIF,
 under hairline find 1.67 on DF,
 read answer as 16.7.

Example 21. $\frac{236000 \times 0.0065 \times 188 \times 715}{0.00032 \times 7800000} = 82600$

Move hairline to 2.36 on D,
 set 3.2 on C under hairline,
 move hairline to 6.5 on C,
 set 7.8 on C under hairline,
 move hairline to 1.88 on CF,
 set 7.15 on CIF under hairline,
 opposite right index of C find 8.26 on D,
 read answer as 82600.

The Position of the decimal point is made by rough mental calculation as follows:

$$\begin{aligned} & \frac{236000 \times 0.0065 \times 188 \times 715}{0.00032 \times 7800000} \\ = & \frac{2.36 \times 6.5 \times 1.88 \times 7.15}{3.2 \times 7.8} \times \frac{10^{5-3+2+2}}{10^{-4+6}} \end{aligned}$$

$$\begin{aligned} & \doteq \frac{2 \times 7 \times 2 \times 7}{3 \times 8} \times \frac{10^6}{10^2} = \frac{2 \times 7 \times 2 \times 7}{3 \times 8} \times 10^{6-2} \\ & \doteq \frac{7 \times 7}{6} \times 10^4 \doteq \frac{50}{6} \times 10^4 \doteq 8 \times 10^4 = 80000 \end{aligned}$$

Comparing with 80000 to 8.26 which obtained by the slide rule, the answer is decided as 82600.

3. PROBLEMS OF PROPORTION

Proportion is a special case of multiplication and division.

There are two kinds of proportional problems, one is proportion and another inverse proportion.

(1) Proportion

The problems of proportion are widely applied to conversion, indexes, proportional division and percentage etc.

Proportional calculation is performed by referring to each other C and D or CF and DF scales.

Example 22. Fill the following blanks, given 1 kt = 1.852 km/h.

kt	27	33.4	44
km/h	50*	60*	81.5*

*.....shown answer

Opposite 1.852 on D, set left index of C,
move hairline to 2.7 on C,
under hairline find 5 on D,
read answer as 50.

Move hairline to 3.34 on C,
under hairline find 6 on D,

read answer as 60.

Move hairline to 4.4 on C,

under hairline find 8.15 on C,

read answer as 81.5

Example 23. Find % in the following table.

	Amount	%
A	\$2,410	14.6
B	\$2,640	16.0
C	\$3,400	20.6
D	\$8,050	48.8
Total	\$16,500	100.0

*

*

*.....shown answer

*

*

*

Opposite left index of D, set 1.65 on C,

move hairline to 2.41 on C,

under hairline find 1.46 on D,

read answer as 14.6.

Move hairline to 2.64 on C,

under hairline find 1.60 on D,

read answer as 16.0.

Move hairline to 3.4 on C,

under hairline to find 2.06 on D.

read answer as 20.6.

Move hairline to 8.05 on C,

under hairline find 4.88 on D,

read answer as 48.8.

(2) Inverse Proportion

Inverse proportion is calculated by referring to each other D and CI or DF and CIF scales.

Example 24. There is a job which take 12 days by 45 men. How many days will it take by 30 men? Answer 18 days

Move hairline to 1.2 on D,
set 4.5 on CI under hairline,
move hairline to 3 on CI,
under hairline find 1.8 on D,
read answer as 18.

Example 25, A pulley with 7" diameter revolves 360 per minute. Find number of revolution per minute, when diameter of pulley is 9".

Answer 280 rpm

Move hairline to 3.6 on D,
set 7 on CI under hairline,
move hairline to 9 on CI,
under hairline find 2.8 on D,
read answer as 280.

4. SQUARE AND SQUARE ROOT

(1) Square

Opposite any number on the D scale, read its square on the A scale. Similarly, opposite any number on the C scale, read its square on the B scale.

Example 26. $2^2=4$, $5.63^2=31.7$

Move hairline to 2 on D,
under hairline read answer as 4 on A.

Move hairline to 5.63 on D,
under hairline read answer as 31.7 on A.

(2) Square Root

To find the square root of a number between 1 and 10,

the number would have to be set on the scale A left. To find the square root of a number between 10 and 100, the number would have to be set on the scale A right.

Example 27. $\sqrt{6.56}=2.56$, $\sqrt{6'56'00}=256$,

$$\sqrt{0.00'06'56}=0.0256$$

Move hairline to 6.56 on A left,

under hairline find 2.56 on D.

Example 28. $\sqrt{65.6}=8.1$, $\sqrt{65'60}=81$,

$$\sqrt{0.00'00'65'6}=0.0081$$

Move hairline to 65.6 on A right,

under hairline find 8.1 on D.

(3) Multiplication and Division Including Square

Example 29. $2 \times 4^2=32$

Move hairline to 2 on A left,

set 4 on CI (back face) under hairline,

opposite right index of C read answer as 32 on A right.

Example 30. $1.3^2 \times 6.5^2=71.4$

Move hairline to 1.3 on D.

set 6.5 on CI (back face) under hairline,

opposite right index of C read answer as 71.4 on A right.

Example 31. $30 \div 5^2=1.2$

Move hairline to 30 on A right,

set 5 on C under hairline,

opposite left index of C read answer as 1.2 on A left.

Example 32. $25^2 \div 50=12.5$

Move hairline to 2.5 on D,

set 50 on B right under hairline,

opposite right index of C read answer as 12.5 on A right.

Example 33. $2.4^2 \div 3.82^2 = 0.395$

Move hairline to 2.4 on D,
set 3.82 on C under hairline,
opposite right index of C find 39.5 on A right,
read answer as 0.395.

(4) Multiplication and Division Including Square Root

Example 34. $\sqrt{20} \times 2 = 8.95$

Move hairline to 20 on A right,
set 2 on CI (back face) under hairline,
opposite right index of C read answer as 8.95 on D.

Example 35. $\sqrt{120 \times 36} = 65.7$

Opposite 1.2 on A left, set left index of C,
move hairline to 36 on B right,
under hairline find 6.57 on D,
read answer as 65.7.

Example 36. $\sqrt{36} \div 0.5 = 12$

Move hairline to 36 on A right,
set 5 on C under hairline,
opposite left index of C find 1.2 on D,
read answer as 12.

Example 37. $6 \div \sqrt{16} = 1.5$

Move hairline to 6 on D,
set 16 on B right under hairline,
opposite left index of C read answer as 1.5 on D.

Example 38. $\sqrt{2880 \div 8.35} = 18.57$

Move hairline to 28.8 on A right,
set 8.35 on B left under hairline,

opposite left index of C find 1.857 on D,
read answer as 18.57.

5. CUBE AND CUBE ROOT

(1) Cube

Opposite any number on the D scale, read its cube on the K scale.

Example 39. $2^3=8$, $3^3=27$, $7^3=343$

Move hairline to 2 on D,

under hairline read answer as 8 on K.

Move hairline to 3 on D,

under hairline read answer as 27 on K.

Move hairline to 7 on D,

under hairline read answer as 343 on K.

(2) Cube Root

To find the cube root of a number between 1 and 10, the number would have to be set on the scale K left. To find the cube root of a number between 10 and 100, the number would have to be set on the scale K middle. To find the cube root of a number between 100 and 1000, the number would have to be set on the scale K right.

Example 40. $\sqrt[3]{2.62}=1.379$, $\sqrt[3]{2'620'000}=137.9$

$$\sqrt[3]{0.002'62}=0.1379$$

Move hairline to 2.62 on K left,

under hairline find 1.379 on D.

Example 41. $\sqrt[3]{26.2}=2.97$, $\sqrt[3]{26'200}=29.7$.

$$\sqrt[3]{0.000'026'2}=0.0297$$

Move hairline to 26.2 on K middle,

under hairline find 2.97 on D.

Example 42. $\sqrt[3]{262}=6.4$. $\sqrt[3]{262'000}=64$,

$$\sqrt[3]{0.000'000'262}=0.0064$$

Move hairline to 262 on K right,

nuder hairline find 6.4 on D.

6. LOGARITHMS

(1) Common Logarithms

Common Logarithms are calculated to the base 10 include integer (characteristic) and decimal part (mantissa).

A slide rule gives only the mantissa of common logarithms, and the characteristic can be calculated from the following formula:

(the number of places exceeding decimal point of a given number—1)

viz. the characteristic of any number greater than unity is always 1 less than the unumber of figures at the left of decimal point.

If given number is of n places under the decimal point, the characteristic is also negative; this is indicated by placing the negative sign or bar over the figure as $-n$ or \bar{n} .

Reversing the slide and centering it, the mantissa of a given number is read directly on the L scale, opposite a given number on the D scale.

Example 43. $\log_{10} 3.14=0.497$

Move hairline to 3.14 on D,

under hairline read answer as 0.497 on L.

Example 44. $\log_{10} 0.000342=\bar{4}.534$

Move hairline to 3.42 on D,

under hairline find 0.534 on L,

add characteristic $\bar{4}$, read answer as $\bar{4}.534$.

Example 45. $\log_{10} 887 = 2.948$

Move hairline to 8.87 on D,

under hairline find 0.948 on L,

add characteristic 2, read answer as 2.948.

(2) Natural Logarithms

Logarithms to the base of e (≈ 2.718) are called natural logarithms, they may be found out by multiplying 2.3026 to common logarithms from the following formula:

$$\log_e N = 2.3026 \times \log_{10} N$$

7. TRIGONOMETRIC FUNCTIONS

These computations can be usually obtained by the co-operation of S, T, ST and C scales.

S scale gives the sines of angles ranging from 5.8° to 90° .

T scale gives the tangents of angles ranging from 5.75° to 45° .

ST scale gives the sines or tangents of small angles ranging from 0.58° to 5.7° .

(1) $\sin \theta$

Example 46. $\sin 15^\circ = 0.259$

Move hairline to 15 on S,

under hairline find 2.59 on C,

read answer as 0.259.

When using the S scale to read the value of $\sin \theta$, read the left index of C as 0.1 and the right index as 1.

Example 47. $\sin 1.5^\circ = 0.0262$

Move hairline to 1.5 on ST,

under hairline find 2.62 on C,

read answer as 0.0262.

When using the ST scale to read the value of $\sin \theta$, read the left index of C as 0.01 and the right index as 0.1.

Example 48. $\sin 30^\circ \times 5 = 2.5$

Opposite 5 on C, set right index of S,
move hairline to 30 on S,
under hairline read answer as 2.5 on D.

Example 49. $3.06 \div \sin 43^\circ = 4.49$

Move hairline to 3.06 on D,
set 43 on S under hairline,
opposite right index of S, read answer as 4.49 on D.

(2) $\cos \theta$

We find the value of $\cos \theta$ by reading the sines of the complementary angles as $\cos \theta = \sin(90^\circ - \theta)$. The red numbers on the S and ST scales represent the complements of the angles as shown by the corresponding black numbers on these scales. The red numbers on the S and ST scales are used with the C scale to find the values of the cosines of angles.

Example 50. $\cos 30^\circ = 0.866$

Move hairline to 30 on S (red),
under hairline find 8.66 on C,
read answer as 0.866.

(3) $\tan \theta$

Example 51. $\tan 32.5^\circ = 0.637$

Move hairline to 32.5° on T,
under hairline find 6.37 on C.

Example 52. $\tan 15^\circ = 0.0262$

Move hairline to 1.5 on ST,
under hairline find 2.62 on C,
read answer as 0.0262.

When using the T scale to read the value of $\tan \theta$, read the left index of C as 0.1 and the right index as 1, and using the ST scale to read the value of $\tan \theta$, read the left index of C as 0.01 and the right index as 0.1.

Tangents of angles greater than 45° are calculated by the use of the T_2 scale.

Or we find the value of the tangents of angles greater than 45° by reading the reciprocals of the tangents of the complementary angles as $\tan \theta = \frac{1}{\tan(90^\circ - \theta)}$. The red numbers on the T scale represent the complements of the angles as shown by the corresponding black numbers on this scale. Therefore, the tangents of angles greater than 45 degrees can be read directly between the red numbers on the T scale and DI scale.

Example 54. $\tan 62^\circ = 1.88$

Set C index even with D index,

move hairline to 62 on T (red),

under hairline read answer as 1.88 on DI.

(4) Other Trigonometric Functions

To get $\cot \theta$, $\sec \theta$ and $\operatorname{cosec} \theta$, we use the following formulas.

$$\cot \theta = \frac{1}{\tan \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta}$$

8. HOW TO USE LL SCALES

(1) Explanation of LL Scales

LL represent that the scale is a logarithm of a loga-

rithm. There are two groups of LL scales.

The LL_1 , LL_2 and LL_3 scales ranging from 1.01 to 22000 are used with the C and D scales, and they give the values of e^x , a^n and the natural logarithms of a number greater than unity.

The LL_0 and LL_{00} scales ranging from .00005 to .999 are used with the A and B scales, and they give the values of a^n and the natural logarithms of a number less than unity.

(2) Natural Logarithms

Set the hairline to the given number N on the LL scale, $\log_e N$ will be found out under the hairline on the D or A scale.

When N is set on the $\left\{ \begin{array}{l} LL_3 \\ LL_2 \\ LL_1 \end{array} \right\}$ scale, read the left index of D as $\left\{ \begin{array}{l} 1 \\ 0.1 \\ 0.01 \end{array} \right\}$.

When N is set on the $\left\{ \begin{array}{l} LL_0 \\ LL_{00} \end{array} \right\}$ scale, read the left index of A as $\left\{ \begin{array}{l} 0.001 \\ 0.1 \end{array} \right\}$ and place the negative sign before the figures.

Example 55. $\log_e 5 = 1.609$

Move hairline to 5 on LL_3 ,
under hairline read answer as 1.609 on D.

Example 56. $\log_e 2 = 0.693$

Move hairline to 2 on LL_2 ,
under hairline find 6.93 on D,
read answer as 0.693.

Example 57. $\log_e 1.03 = 0.0296$

Move hairline to 1.03 on LL_1 ,
under hairline find 2.96 on D,
read answer as 0.0296.

Example 58. $\log_e 0.23 = -1.47$

Move hairline to 0.23 on LL_{00} ,
under hairline find 14.7 on A right, read answer as
-1.47.

Example 59. $\log_e 0.625 = -0.47$

Move hairline to 0.625 on LL_{00} ,
under hairline find 4.7 on A left,
read answer as -0.47.

Example 60. $\log_e 0.955 = -0.0461$

Move hairline to 0.955 on LL_0 ,
under hairline find 46.1 on A right,
read answer as -0.0461.

Example 61. $\log_e 0.995 = -0.00501$

Move hairline to 0.995 on LL_0 ,
under hairline find 5.01 on A left,
read answer as -0.00501.

(3) Powers and Roots

The type form of a^n or $a^{\frac{1}{n}}$ is simply calculated by the use of the LL scales in an operation similar to multiplication and division.

Example 62. $4.25^{2.12} = 21.5$

Move hairline to 4.25 on LL_3 ,
set left index of C under hairline,
move hairline to 2.12 on C,
under hairline read answer as 21.5 on LL_3 .

Example 63. $1.96^{2.3} = 4.70$

Move hairline to 1.96 on LL_3 ,
set right index of C under hairline,
move hairline to 2.3 on C,

under hairline read answer as 4.70 on LL_3 .

Example 64. $1.02^{24 \cdot 5} = 1.624$

Move hairline to 1.02 on LL_1 ,

set left index of C under hairline.

move hairline to 2.45 on C,

under hairline read answer as 1.624 on LL_2 .

Example 65. $11.4^{9 \cdot 7} = 5.50$

Move hairline to 11.4 on LL_3 ,

set 7 on CI under hairline,

move hairline to left index of C,

under hairline read answer as 5.50 on LL_3 .

Example 66. $330^{\frac{1}{6 \cdot 2}} = 2.55$

Move hairline to 330 on LL_3 ,

set 6.2 on C under hairline,

move hairline to right index of C,

under hairline read answer as 2.55 on LL_2 .

Example 67. $28.5^{\frac{2 \cdot 91}{3 \cdot 41}} = 17.4$

Move hairline to 28.5 on LL_3 ,

set 3.41 on C under hairline,

move hairline to 2.91 on C,

under hairline read answer as 17.4 on LL_3 .

Example 68. $0.795^{1 \cdot 4} = 0.725$

Move hairline to 0.795 on LL_{00} ,

set left index of B under hairline,

move hairline to 1.4 on B left,

under hairline read answer as 0.725 on LL_{00} .

Example 69. $0.795^{14} = 0.0402$

Move hairline to 0.795 on LL_{00} ,

set left index of B under hairline,

move hairline to 14 on B right,

under hairline read answer as 0.0402 on LL₀₀.

Example 70. $0.99676^{\frac{1}{0.99}} = 0.99854$

Move hairline to 0.99676 on LL₀,
set 2.22 on B left under hairline,
move hairline to left index of B,
under hairline read answer as 0.99854 on LL₀.

Example 71. $e^{1.96} = 7.10$

Move hairline to 1.96 on D,
under hairline read answer as 7.10 on LL₃.

Example 72. $e^{0.94} = 2.56$

Move hairline to . on D,
under hairline read answer as 2.56 on LL₂.

Example 73. $e^{0.056} = 1.0576$

Move hairline to 5.6 on D,
under hairline read answer as 1.0576 on LL₁.

9. HOW TO USE GAUGE MARKS

There are the following gauge marks on our slide rules.

(1) $c \doteq 1.128$

The c mark is placed on the C and D scales at 1.128, and is used for the calculation of a circle area.

Example 74. Find the area of a circle with its diameter of 1.5 cm. Answer 1.77 cm²

Move hairline to 1.5 on D,
set c on C under hairline,
opposite left index of C read answer as 1.77 on A left.

(2) $\pi \doteq 3.1416$

The π mark is placed on the C, D, DF and CF, scales at 3.1416, and shows a ratio of the circumference of a circle to its diameter.

(3) $\rho^\circ \doteq 57.2958$

The ρ° mark is placed on the C and D scales at 5.72958, and is used for converting an angle from degrees to radians.

Example 75. $2.4^\circ = 0.0419$ radians

Move hairline to right index of D,

set ρ° on C under hairline,

move hairline to 2.4 on C,

under hairline find 4.19 on D,

read answer as 0.0419 radians.

$$\left[\begin{array}{l} 1^\circ \doteq 0.02 \text{ radians (approximately)} \\ \therefore 2.4^\circ \doteq 0.02 \times 2.4 = 0.048 \text{ radians.} \end{array} \right]$$

— THE END —