STERLING

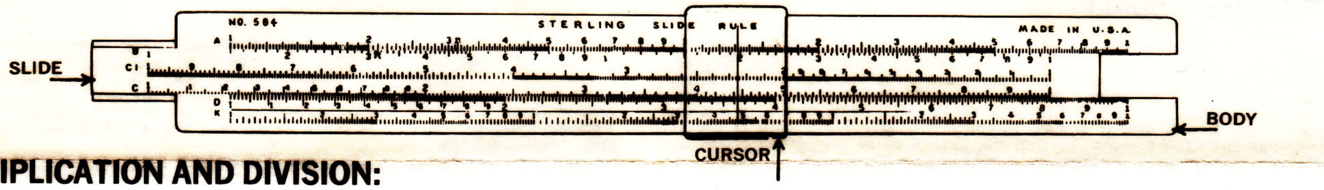
SLIDE RULE

A QUALITY INSTRUMENT FOR STUDENT OR PROFESSIONAL

OPERATING INSTRUCTIONS

A complete course in use and operation of the slide rule

The Sterling Student Slide Rule is an accurate and convenient instrument for use in computing multiplication, division, proportion, square and cube root problems, as well as sine, tangent and logarithm solutions.
The reading of any slide rule is accurate to the second place, therefore, the third place number can be approximated by mental calculation, by multiplying the last two numbers together and using the last figure as third number in these calculations. Accurate figures beyond this must be done by actual multiplication on paper.
The Sterling Slide Rule has standard A, B, C, CI, D, and K scales. The A, D, and K scales are on the **body**, the B, CI and C scales on the **slide.** The **cursor** travels the full length of the body, and the hairline crosses these scales for direct comparison. On the reverse side of the slide, the S, L, and T scales appear, and the slide may be removed and reversed for use in calculating these values.



MULTIPLICATION AND DIVISION:

For this work, we use only the C and D scales, and in some cases the CI scale. The C and D scale are logarithmic, and start with the unit 1 at the left, thru the unit 10 (or 1) at the right. The space between 1 and 2 has small numbers indicating the "teens" following the left hand 1 or 10. The lines between the figures divide each segment into 10ths. The markings between 2 and 4 again represent individual numbers following 2 or 20, but the markings between unit numbers are in 5ths, or 2/10ths. From 4 to the right hand 1 or 10, each unit space is divided in halves, or 5/10ths. As you read the rule, therefore, these variations of the unit measures must be observed. The diagram below shows these as they appear on the rule, and gives readings as they appear:

MULTIPLICATION:

On a logarithmic scale, the progression of numbers is constant, therefore the multiple of any unit or number of units can be read only if we place the factor 1 on the line of one of the factors in the problem. **The problem of 2 X 2 is therefore solved as follows:**

1—move the slide until the figure 1 at the **left** is over the 2 on the D scale. (Move the slide to the **right**.)
2—move the cursor until the hairline is over the 2 on the C scale on the slide.
3—the hair line will be over 4 on the D scale.

Similarly you will note 3 X 2 = 6, 4 X 2 = 8, 5 X 2 = 10 as you read across the scale.
Bear in mind that this 2 or the 2 on the C scale can represent, 2, 20 or 200. This must be remembered in writing down answers. Also remember that the answer to the problem **always** appears on the same scale from which you **started,** usually the D scale.

DIVISION:

Since division is the reverse of multiplication, we reverse the procedure shown in multiplication, as follows: **Problem:** divide 4 by 2. Start with 4 on the D scale. Move slide to **right** until 2 is over the 4. Against 1 to the **left**, read 2.

NOW TRY THESE PROBLEMS
5 X 2 (1 of C over 5 of D—read 1 or 10 against 2 of C)
3 X 3 (1 of C over 3 of D—read 9 against 3 of C)
8 ÷ 2 (2 of C over 8 of D—read 4 against 1 of C)
5 ÷ 4 (4 of C over 5 of D—read 1.25 against 1 of C) (SEE BELOW)

For numbers which when multiplied are more than 10, it is necessary to achieve the same effect by using the **right** hand 1 (or ten) as the factor. For instance. 2 X 6 = 12. By placing the **right** hand 1 over 6 and reading against the 2 on the C scale, the cursor will indicate the 12 on the D scale. (**Left** hand 1 or 10 plus the small 2 equals 12).
Similarly, for division, 12 on D divided by 2 on C will read 6 under the **right** hand 1 of the slide.

NOW TRY THESE PROBLEMS
7 X 4 (**right** hand 1 on C over 7 on D. Read 28 on D below the 4 on C)
8 X 9 (**right** hand 1 on C over 9 on D. Read 72 on D below the 8 on C)
64 ÷ 8 (over 64 on D. place 8 on C. Against **right** hand 1 on C. read 8)
72 ÷ 9 (over 72 on D, place 9 on C. Against **right** hand 1 on C, read 8)

Some mulplication problems will "run off the rule." In this case, reverse the slide, using the **right** hand or **left** hand 1, and read the answer as shown.

EXAMPLE: 4 X 4—put **left** hand 1 on C against 4 on D. The 4 on C is "off the rule." Slide the slide to the **left** until the **right** hand 1 is over 4 on D. Against 4 on C, read 16 on D.

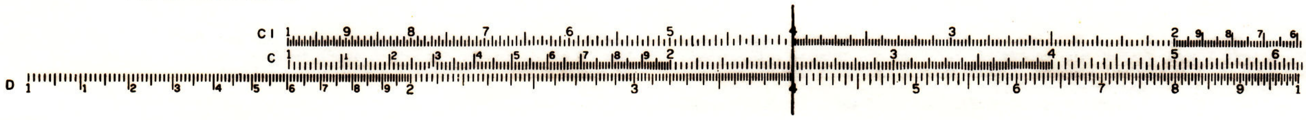
USING THE CI SCALE:

The CI scale is the same as the C scale, except that it reads from **right** to **left.** This scale ("C Inverted") is therefore the RECIPROCAL of the C scale, and can be used to avoid the necessity of moving the slide **left** or **right.**

EXAMPLE: 4 X 4—Reading from the RIGHT on CI place the 4 above the 4 on D—against the **left** hand 1 on CI, read 16 on D. You are now using CI, the reversed or reciprocal scale in place of the C scale, so read these two, CI and D against each other. (SEE BELOW)
24 ÷ 4—place **left** hand 1 on CI above 24 on D—Against 4 on CI read 6 on D.

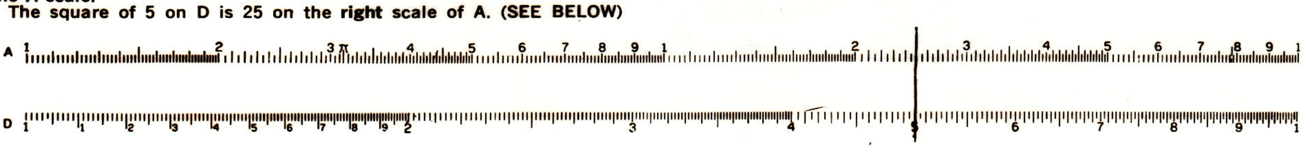
By reading the C scale against the CI scale, you will note that the product of the two numbers always equals 1 or 10 when multiplied together. Also, the C scale represents the fraction (decimal) of the CI scale.

EXAMPLE: 1/8 = .125—Against 8 on CI read .125 on C. (SEE BELOW)



USING THE A OR B SCALE:

The A and B scales are made up of 2 half size or half length logarithmic scales, therefore they are the SQUARE of the C and D scales. We can therefore square numbers shown on the C or D scale by reading the number times itself on the A or B scale. For practice, remove the slide. You now can clearly read the A against the D scale. Slide the cursor along, until the hairline is over 3 on D—you will read 9 on **left** half of the A scale. Slide it further along to 4 on D—you will read 16 on the **right** half of the A scale.
The square of 5 on D is 25 on the **right** scale of A. (SEE BELOW)
The square of 26 is 676 on the **left** scale of A.
The square of 19 is 361 on **left** scale of A.
The square of 55 is 3025 on the **right** scale of A.
Note that the products have **even** and **odd** numbers of digits. Example 1 and 4 have **even** numbers of digits. Examples 2 and 3 have **odd** numbers of digits. When square root is learned, this factor is most important in determining which half of the A scale to use.



SQUARE ROOT:

Since the A scale is the square of the numbers on D, the numbers on D are the square roots of the numbers on scale A. Of prime importance here is which half of the A scale to use when putting the number whose square root is desired "into the rule." The rule for this is simple. If ODD number of digits, use the **left** scale. If EVEN number of digits, use the **right** scale:

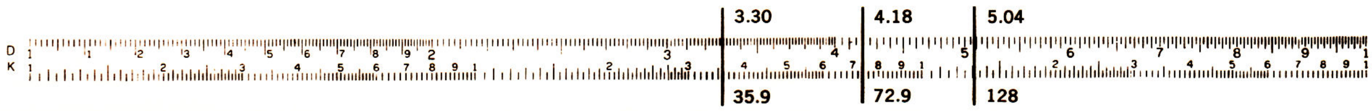
The square root of 25 (even number of digits—**right** scale) is 5 on D.
The square root of 250 (odd number of digits—**left** scale) is 15.81+ on D scale.
The square root of 2500 (even number of digits—**right** scale) is 50.

USING THE K SCALE:

The K scale, you will note, consists of 3 log scales instead of 2 as in A. The result is that these figures are the CUBE of the D scale figures. 3 X 3 X 3 = 27, or the cube of 3 can be read directly on K by placing the cursor over 3 on D and reading 27 on the MIDDLE part of K scale. Also, the CUBE ROOT of 64 read on K on MIDDLE scale, is 4 (4 X 4 X 4). Cube root: Use K and D scales, in much the way the A and D scales are used for square roots. To find the cube root of a number, move its decimal point over (if necessary) 3 places at a time until a number between 1 and 1000 is obtained. If the resulting number is between 1 and 10, set the cursor to it in the **left** K scale; if between 10 and 100, use the **center** K scale; if between 100 and 1000, use the **right** scale. Then read the value on the D scale. Finally, move the decimal point one third as many places as it was moved in the original number, but in the opposite direction. Example, find the cube root of 35.9; since this is between 10 and 100, set the cursor to 35.9 on the center K scale, and read the cube root, 3.30, on the D scale.

To find the cube root of 0.0729, move the decimal point to the right three places; the resulting value, 72.9, is between 10 and 100, therefore the cursor is set to 72.9 on the **center** K scale, and the reading on the D scale is found, 4.18. Since in the original number the decimal point was moved three places to the right, in the number from the D scale the decimal must be moved one place to the left, giving 0.418, which is the cube root of 0.0729.

To find the cube root of 0.128, move the decimal point to the right three places; the resulting value, 128, is between 100 and 1000, therefore the cursor is set to 128 on the **right** K scale, and the reading on the D scale is found, 5.04. Since in the original number the decimal point was moved three places to the right, in the number from the D scale the decimal must be moved one place to the left, giving 0.504, which is the cube root of 0.128.

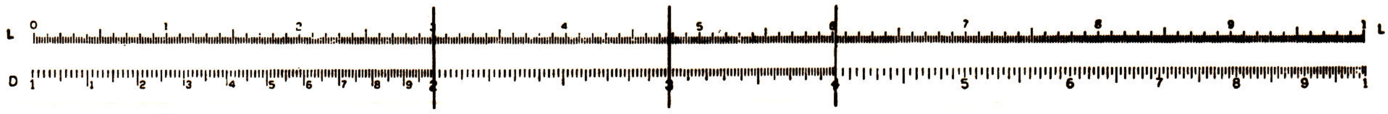


THE L SCALE:

This is a scale exactly 250 millimeters long, graduated into 500 equal parts. By reading a number on this scale, we can find the "mantissa" (decimal portion) of the logarithm of any number on the D scale. Note that the numbers on the L scale are preceded by a decimal point, reading therefore from 0 to 1.0. The D and L scales should be matched for direct reading. The "characteristic" or whole-number portion of the logarithm is equal to one less than the number of digits to the left of the decimal point in the original number. For example, the log of 26.3 is 1.420 (the mantissa .420 from the L scale, the characteristic 1 because in the number 26.3 there are two digits preceding the decimal point); but the log of 263 is 2.420 (characacteristic 2 because there are three digits preceding the decimal point).

EXAMPLES: log 4 (D scale) is 0.6021 (L scale) (SEE BELOW)
log 2 (D scale) is 0.301 (L scale)
log 30 (D scale) is 1.477 (L scale)
log 5000 (D scale) is 3.699 (L scale)

In each of these, only the mantissa (decimal portion) is from the L scale.

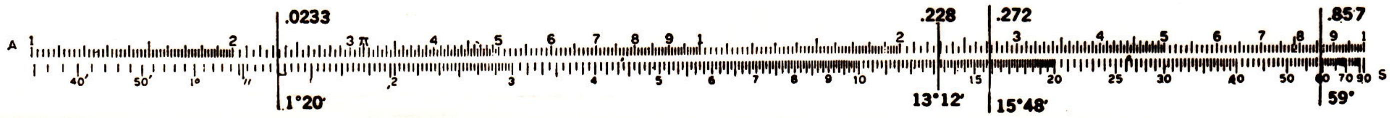


THE S SCALE:

This scale is for direct reading of the sines of angles. The scale is divided in degrees, minutes and seconds. (60' EQUAL 1°). The scale is used in conjunction with the A scale to read the answer directly. It must be noted that sines above 60° must be carefully judged, since the scale decreases rapidly.

To determine the Sine of an angle, follow this example:

Sin 15°48'—Set hairline over 15°48' on S scale—read .272 on A. (SEE BELOW)
Sin 59°—Set hairline over 59 on S scale—read .857 on A.
Sin 1°20'—Set hairline over 1°20' on S scale—read .0233 on A. (Remember that the **left** scale on A is .1 of **right** scale, therefore an additional decimal is required.)
Sin 4°20' is .0756.



THE T SCALE:

The tangent scale starts at 5.7° and increases up to 45° on the **right**. To find the tangent of 6°45' or 6.75° place the hairline over 6°45' and read .1184 on the D scale. (SEE BELOW)

SPECIAL π MARKINGS: Pi (π) 3.1416 and ($\frac{\pi}{4}$) .7854.

For calculations involving π or $\frac{\pi}{4}$, the A & B scales are clearly marked at 3.1416 and .7854 for accurate readings.

In quick review, here is a problem in each of the scales: check your answers with these, and if any question, refer to the proper instruction:
24.5 X 13.7 (C & D scales) **Answer:** 335.65 (last 2 numbers approximated)
924 ÷ 16 (C & D scales) **Answer:** 57.75
42 X 42 (42^2) (D & A scales) **Answer:** 1764 (end 2 of each number multiplied together gives last 4)
Square root of 2450. **Answer:** 49.5 (A scale—right half—answer on D)
9 X 9 X 9 (9^3) D and K scale. **Answer:** 729 (approx. 730 on scale)
Cube root of 125 (D & K scales—right third of K because of 3 digits)
Answer is 5 on D scale.

Log 6—(REVERSE SLIDE—Use L and D scale)—.778
Sin 13.4° or 13°24'—S and A scale **Answer:** .232
Tangent 6.75° or 6°45'—T and D scale—.1184

STERLING PLASTICS CO.
MANUFACTURERS OF QUALITY SCHOOL SUPPLIES
MOUNTAINSIDE, N. J.

Printed in U. S. A.