POST

1452W-TEN INCH

Justly popular, this universal slide rule has A, B, C, CI, D, and K scales on the face; with inch and metric scales on edges. Reverse side of slide has S, L, and T scales. Crystal clear glass indicator in durable metal frame. In slip cap case and instructions. 1452WL same as 1452W in Leather case.

1447 TEN INCH STUDENT SLIDE RULE

Face has A, B, C, CI, D and K scales. Reverse side of slide has S, L and T scales. Metal-glass indicator. Professional accuracy. In sturdy case with instructions.

1444K—FIVE INCH

Perfect for "on-the-spot" calculations. Mannheim type with A, B, C, CI, D and K scales. Reverse side has S, L and T scales. Inch scale on beveled edge, metal-glass indicator, leather case and instructions.

1441—FOUR INCH

Fits in the vest pocket with the greatest of ease. Mannheim type with A, B, C, CI, and D scales. Reverse side has S, L, and T scales. Inch scale on beveled edge. Metal-glass magnifying indicator, leather case and instructions.

AF-198, printed in U. S. A.

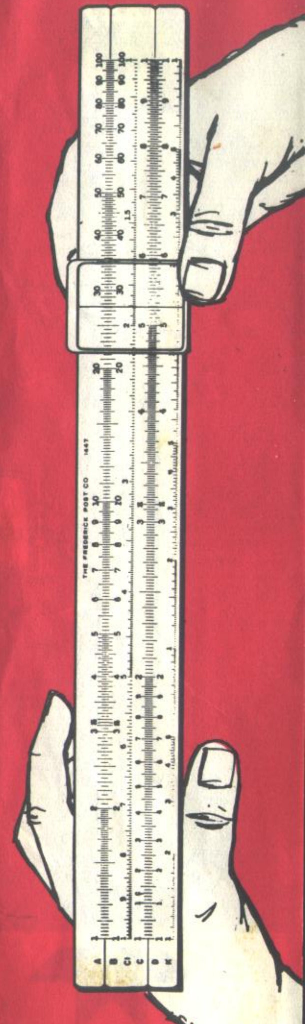
how to use your

POST

SLIDE RULE

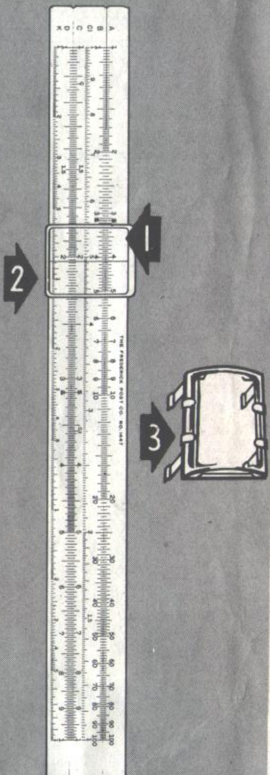
easy to understand

INSTRUCTIONS



1447

STUDENT SLIDE RULE PARTS LIST



1. **Indicator Glass #1471-G**
2. **Complete Indicator With Glass #1471**
3. **Snap-on Magnifier #1480GM**
   optional accessory

The cursor on your Student Slide Rule can never fall off accidentally. To remove the cursor for cleaning or replacement, hold the rule vertically, move cursor to center of rule, press down on top of cursor, and flip bottom of cursor off.

FREDERICK POST

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A TELEDYNE COMPANY

BEFORE WE START

If this is the first time you are preparing to use a slide rule, perhaps these preliminary remarks will be helpful.

Don't let all those graduations on the scales alarm you. Just a few minutes spent reading the first pages of this booklet with a slide rule in front of you will quickly prove that the scales *are* easy to read. You start with multiplication and division, and then go on to simple examples of other slide rule calculations.

As each section is completed, work out additional similar problems before continuing to the next section.

Very soon, you will be able to use your slide rule easily and quickly.

Reading the Scales

The C and D scales are most commonly used for multiplication and division. These scales have identical graduations and appear on all slide rules.

Their left and right-hand ends are marked with the numeral "1", and are called *left index* and *right index*, respectively. The major divisions are marked from 2 through 9. Each major division is further divided into tenths. More complete divisions are given for values between 1 and 2, covering the left-hand end of the scale. This section is further sub-divided into ten major sub-divisions from 1 to 9, representing the values 11 to 19 (on the Post four inch rule, only the 15 mark is numbered, due to lack of space). The tenths are still further subdivided into tenths, fifths or halves, as space permits.

On the fold-out pages at the back of this booklet, you will find that Figure 1 (10 inch rules) and Figure 2 (5 inch rules) illustrate how to read various values on a typical slide rule scale. Familiarize yourself with the scale so you will know how to find 205, 250, 255, etc.

First Digit is Guide

Note that all numbers that begin with the numeral 1, regardless of the position of the decimal point, are found somewhere between

the left index and the major division 2. This space covers approximately the left-hand third of the entire scale. All numbers beginning in 2 are found between the major divisions 2 and 3, numbers beginning in 3 between major divisions 3 and 4, and so on.

When it is necessary to read a scale at a point between two graduations, the setting must be estimated to the nearest fraction of a division.

All numbers that have the same digit value (e.g. 0.00274, 2.74, or 27,400) are found at the same point on the slide rule scale, regardless of the position of the decimal point.

MULTIPLICATION

To illustrate a typical slide rule procedure, solve the following simple problem as shown in Figure 3:

$$2 \times 3 = 6$$

Set the left index of the C scale over 2 on the D scale. Set the cursor hairline over 3 on the C scale. Find the answer 6 on the D scale under the hairline.

The slide rule solves more complex problems with equal ease. For example: $1960 \times 3.25 = 6370$.

Set the left index on C over 196 on D. Set hairline over 325 on C and find the slide rule answer 637 on D.

Decimal Points

In the above example, the location of the decimal point can be determined by a quick mental calculation using round figures close to the numbers in the problem. Thus: 2000 x 3 = 6000. Our answer, therefore, must be 4 digits to the left of the decimal point, or 6370.

Use of Right Index

If the values in a problem are such that the multiplier on the C scale extends out beyond the limits of the D scale, then use the *right index* of C instead of the left index. See Figure 4 for an illustration of this example:

$$6 \times 2 = 12$$

If we set the left index of C over 6 on the D scale, we find that 2 on the C scale goes beyond the right-hand end of the D scale. So we proceed as follows: Set the *right index* of the C scale over 6 on the D scale. Under 2 on the C scale, we now find the answer 12 on the D scale.

Here is another example: 71.5 x 1.63 = 116.5. Set the right index of the C over 715 on the D scale. Set the cursor hairline over 163 on the C scale and read the slide rule answer 1165 under the hairline on the D scale.

The decimal point is located by making a quick mental calculation (70 x 1.5 . . 105.0). Thus the answer in this example is 116.5.

DIVISION

The slide rule procedure for division is just the reverse of multiplication. For example to solve (See Figure 3): $\frac{6}{3} = 2$. Set 3 on the C scale over 6 on the D scale. Under the left index of the C scale read the answer 2 on the D scale.

If the slide extends to the left, as for example when dividing $\frac{12}{2}$, as shown in Figure 4, then read the answer 6 on the D scale under the right-hand index of the C scale.

OTHER METHODS TO MULTIPLY AND DIVIDE

The A and B scales, which are identical in scale arrangement, are similar in construction to the C and D scales, except that they are half size. This makes it possible to place two segments end to end in the same length occupied by the C and D scales. For convenience in use, the right-hand half of the A and B scales is numbered from 10 to 100, since this section is actually a continuation of the left half (on Post's pocket size rules, the zeros are omitted because of lack of space).

In Figure 3, the setting of the slide rule illustrates the solution to the problem 4 x 9 = 36 solved on the A and B scales. The left index of B is set under 4 on the A scale. Over 9 on the B scale we read the answer 36 on the A scale.

Dividing with A and B Scales

For division we follow the reverse procedure. Example shown in Figure 3: $\frac{36}{9}=4$. Set 9 on the B scale under 36 on the A scale. Over the left index of the B scale, read the answer 4 on the A scale.

Use of CI Scale

Multiplication problems can be solved very efficiently using the CI scale in conjunction with the D scale. The CI scale is exactly the same as the C scale except that it has been turned end for end, and consequently reads from right to left.

To multiply using the CI and D combination of scales, refer to the setting in Figure 3 for the solution of the problem 6 x 3.33=20.

With the cursor hairline set over 6 on the D scale, draw the slide to bring 333 on the CI scale under the hairline. Under the left index of the CI scale, we find the slide rule answer 2 on the D scale.

To locate the decimal point, we take as round figures 6 x 3=18. Our answer, therefore, is 20.

Multiplying More Than Two Factors

The CI—C—D scale combination is particularly useful in solving multiplication problems involving more than two factors. For example: Find the volume of a wall 15.5 feet long by 8 feet high by 0.55 feet thick.

Solution: Set the cursor hairline over 8 on the D scale. Set the slide to bring 155 on the CI scale under the hairline. Now set the hairline over 55 on the C scale. Read 682 under the hairline on the D scale.

To locate the decimal point solve mentally: 15 x 8 x .5=15 x 4=60. The correct answer, therefore, is 68.2 cubic feet.

Notice that in the above example only one setting of the slide is necessary to solve two multiplications simultaneously. The partial answer 124, from 8 x 15.5 is on the D scale under the left index of the C scale. Since the second step in the problem is to multiply by 0.55, it is necessary only to set the hairline to 55 on the C scale and read the answer, 68.2, on the D scale without any regard to the partial answer.

OTHER CALCULATIONS

Squares and Square Roots

Note that the relationship between the A and the D scales is such that for numbers appearing on the D scale the squares can be found directly above on the A scale. Conversely, the square roots of numbers appearing on the A scale are read directly below on the D scale.

Thus, to find the square of any number, set the cursor hairline over that number on the D scale. The square will be found under the hairline on the A scale.

To find the square root of a number, the reverse procedure is followed. The hairline is set over the number on the A scale, and the root is found under the hairline on the D scale.

If the A scale number has an *odd* number of digits to the left of the decimal point, it is located on the *left-hand half* of the A scale. If it has an *even* number of digits to the left of the decimal point, then it is located on the *right-hand half* of the A scale. Thus, 125 would be found on the left-hand half of the scale and 12.5 would be found on the right half.

Cubes and Cube Roots (use of the K scale)

By using the D scale and K scale in combination, cubes and cube roots can be found directly on your slide rule (the K scale does not appear on the Post 4 inch rule). Note that the K scale is made up of three identical sections placed end to end. Each section is similar in construction to the D scale except that it is exactly one-third its length.

To find the cube of a number, set the cursor hairline to that number on the D scale, and read the answer under the hairline on the K scale.

To find the cube root of a number, the procedure is reversed, setting the hairline first to the number on the K scale and reading the cube root under the hairline on the D scale.

Locating Numbers on the K Scale

The three segments of the K scale cover numbers ranging from 1 to 10 for the left-hand section, from 10 to 100 for the center section and from 100 to 1000 for the right-hand section. Thus, for any number between 1 and 10 on the D scale, the cube can be read directly off of the K scale somewhere between 1 and 1000. Conversely, for numbers between 1 and 1000 on the K scale, the cube roots will be read directly on the D scale somewhere between 1 and 10. For numbers less than 1 or greater than 10 on the D scale, or less than 1 and greater than 1000 on the K scale, the decimal point may be moved both before and after the operation to obtain a number within the range of the scales. In such cases a definite rule may be followed.

If the decimal point is moved n number of places in a value set on D, it must be moved back 3n places in the cube, which is read on the K scale; or if the decimal point is moved n number of places in a value set on the K scale, it must be moved back $\frac{3}{n}$ places in the cube root, which is read on the D scale.

For example, to find the cube of 0.456, we move the decimal point 1 place to the right. By setting the hairline at 4.56 on the D scale, we obtain 95 at the hairline on the K scale. According to the above rule, we now move the decimal point to the left three places and obtain the answer 0.095.

To find the cube of 1214, we move the decimal point three places to the left. Setting the hairline to 1.214 on D, we find the cube

1.79 on K. We now move the decimal point back nine places to the right, giving us the answer 1,790,000,000.

To find the cube root of 0.0052, the decimal point is moved three places to the right. The hairline is now set over 5.2 on the left hand segment of the K scale, and the result, 1.73, is read off of the D scale. According to the above rule, the decimal point is now moved back one place to the left, giving the answer 0.173.

Reciprocals

The relationship of the C and CI scales is such that the reciprocal of any number on either scale can be read for that number directly opposite on the other scale. For example: The reciprocal of $2 = \frac{1}{2} = 0.5$

To solve on the slide rule, set the cursor hairline over 2 on the C scale. Under the hairline on the CI scale, read the reciprocal 0.5. The position of the decimal point in any reciprocal can be determined by a mental calculation using round numbers as explained in the section on multiplication. The procedure may be reversed by setting the hairline to 2 on the CI scale and reading the reciprocal 0.5 directly below on the C scale.

Logarithms

The L scale on the back of the slide is a uniformly divided scale which gives the mantissas of logarithms of numbers read on the D scale. Example: Find the logarithm of 2.

Set the left index of the C scale over 2 on the D scale. Turn the slide rule over, and read the mantissa 301 on the L scale under the fixed hairline on the back of the rule. From the principle of logarithms, it is known that the characteristic for 2 is zero; the logarithm, therefore, is 0.301.

TRIGONOMETRIC FUNCTIONS

The two scales on the back of the slide marked S and T are the sine and tangent scales respectively.

Sines

The S scale is divided to read in degrees and minutes from about 0°34′ to 90°. It is designed to be used with the A and B scales.

Example: Find the sine of 21°.

Set the slide to bring 21 on the S scale under the right-hand fixed hairline on the back of the rule. Turn the rule over, and read 358 on

the B scale under the right index of the A scale. Note that the values of sines found on the right-hand half of the A and B scales range from 0.1 to 1.0 and those on the left-hand half range from 0.01 to 0.1. Therefore, our answer in this example is 0.358.

When given the sine, the procedure is reversed to find the angle.

Example: Find the angle whose sine is 0.126.

Since the sine is greater than 0.1, 0.126 is located on the right-hand segment of the B scale. Draw the slide to bring 126 on the right half of the B scale under the right index of the A scale. Turn the rule over, and read the angle 7°15′ on the S scale under the fixed hairline.

Alternate Method (Sines)

Remove the slide from the rule and re-insert so that the S, L and T scales are face up. With the slide centered so that the indices of the A scale line up with the ends of the S scale, sines can be read on the A scale directly opposite any angle on the S scale. Thus, to find the value of sin 7°, set the cursor hairline over 7 on the S scale and read the answer 0.122 under the hairline on the A scale.

Tangents

The T scale is divided to read in degrees and minutes from about 5°45′ to 45°. It is designed to be used with the C and D scales.

Example: Find the value of tan 35°.

Set 35 on the T scale under the right-hand fixed hairline on the back of the rule. Turn the rule over and read the answer 0.700 on the C scale over the right index of the D scale. Note that the values of tangents of angles from 5°45′ to 45° range from 0.1 to 1.0.

Alternate Method (Tangents)

Turn the slide over as described in the alternate method for using the S scale and read directly from the T scale to the D scale or vice versa.

Tangents of Angles from 0°34′ to 5°45′

The values of tangents and sines of angles smaller than 5°45′ are so nearly alike that they may be considered identical for slide rule computations. Consequently, for angles from 0°34′ to 5°45′, tangents can be read directly using the S scale and the left half of the A or B scales, as described in the section on sines.

Tangents of Angles Greater Than 45°

Using the relationship $\tan x = \frac{1}{\tan(90-x)}$, tangents for angles greater than 45° can be directly computed on the slide rule.

Example: Find tan 69°.

Solution: 90—69 = 21. Set 21 on the T scale under the right-hand fixed hairline. The answer, which is the reciprocal of tan 21, is read directly on the D scale under the left index of the C scale as 2.605. Note that for angles between 45° and approximately 84° the value of the tangent ranges from 1 to 10.

When in the above relationship 90—x is less than 5°45′, the left half of the S scale is used in making the computation. As pointed out above, the sines and tangents of small angles may be considered equal for slide rule purposes.

Example: Find tan 88°.

Set 2 on the S scale (90—88) under the right-hand fixed hairline. Turn the slide rule over and read the answer 28.6 on the A scale over the left index of the B scale. Using this method, tangents of angles up to 89°25′ can be read directly.

Sines and Tangents of Very Small Angles

For determining the sine or tangent of a very small angle, two gauge points are provided on the S scale. The one identified by the symbol (′) is called the minutes gauge point and is found next to the 2° mark on the S scale. The seconds gauge point marked (″) is found near the 1°10′ mark on the S scale. They represent the value of the angle in radians. Their use is based on the fact that for very small angles, sin x = tan x = x (in radians), approximately.

Example: Find sin 3′.

Since sin 3′ = 3′ (in radians), solve 3 x 1′ (in radians). The procedure when using these gauge points is the same as the use of the CI and D scale combination for multiplication. With the slide turned so that the trig scales are face up, set the minutes gauge mark under 3 on the A scale. Over the right index of the S scale, read 0.000873 on the A scale.

Example: Find sin 3″.

Set the seconds gauge mark under 3 on the A scale. Over the left index of the S scale, read 0.0000145 on the A scale.

The decimal point in the above examples is located by noting that:

1′ —0.0003 radians (approximately)

1″—0.000005 radians (approximately)

EXPLANATION OF OTHER GAUGE POINTS

A graduation identified with the symbol (π) appears at the value 3.1416 on the A, B, C and D scales for convenience in making computations involving this constant.

An unidentified line is graduated on the right-hand end of the A and B scales at the value 785. This represents $\frac{\pi}{4}$ and is useful in making calculations involving areas of circles. For example, when the right index of the B scale is set under this gauge point on the A scale, the relationship of the C scale to the A scale becomes such that the area of a circle can be read at the hairline on the A scale, when the cursor hairline is set to its diameter read on the C scale.

The gauge point on the C scale marked (c) represents the constant $\sqrt{\frac{4}{\pi}}$

No attempt has been made in this booklet to go beyond fundamental slide rule operations, nor to discuss the theory on which the slide rule is based. For a more detailed treatment of the subject, you will find a great deal of helpful material in the Instruction Manual accompanying the POST Versalog. This can be obtained through your Post dealer.

FIG. 1

D SCALE ON TYPICAL 10" RULE

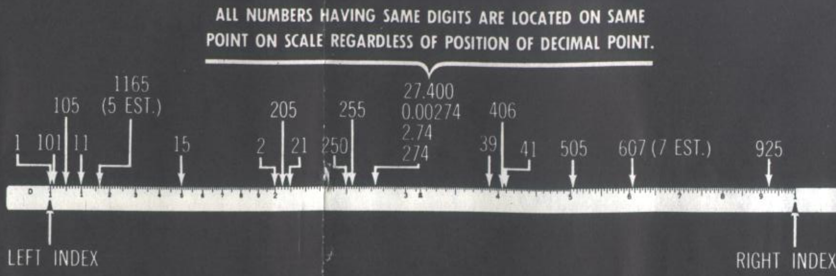


FIG. 2

D SCALE ON TYPICAL POCKET RULE

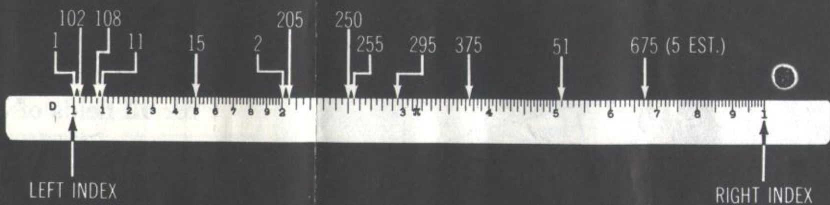


FIG. 3

EXAMPLE OF MULTIPLICATION AND DIVISION ON A, B, C & D SCALES

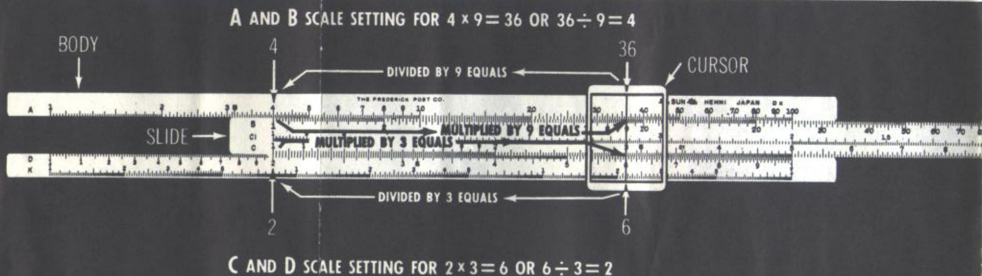
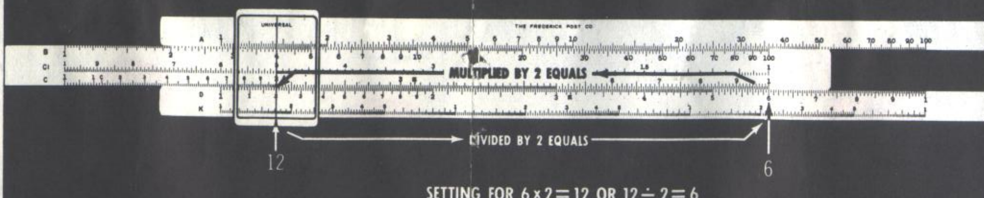


FIG. 4

EXAMPLE OF MULTIPLICATION AND DIVISION WHEN SLIDE EXTENDS TO LEFT



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