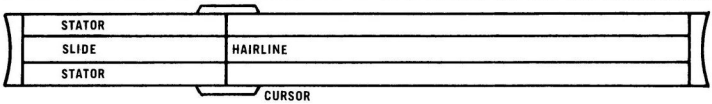
PICKETT 80

HOW TO USE YOUR MODEL 80 PICKETT SLIDE RULE

This instruction guide will help you teach yourself the fundamentals of using your Pickett Model 80 Slide Rule to obtain answers to mathematical problems. Accuracy and understanding are most important in using your slide rule—speed will come with experience. Study each phase of these instructions and be confident of each operation before you go on to the next one. Teach yourself in this sequence: (1) Learn the parts of the slide rule and how to read the scales; (2) Learn multiplication, division and proportion using the C, D and CI Scales; (3) Learn to use the A, B and K Scales to find squares of numbers, square roots, cubes of numbers and cube roots; (4) Learn to use the L, S and T Scales to find Logarithms, Sines, Cosines, Tangents and Cotangents for trigonometric calculations.

KNOW YOUR SLIDE RULE

To simplify explanations, the parts of your slide rule and their proper names are shown below. All references in these instructions will be in accordance with this identification.



READING THE SCALES

Ths is the most important part of learning how to use your slide rule; formulas can be memorized or written down for reference, but only you can read a correct answer from your rule. In general, slide rules provide answers accurate to three, and sometimes four, significant figures. A significant figure is the first digit of a number that is not a zero, regardless of where the decimal point is located; a zero is a significant figure only when it is found between one or more significant figures. The following are samples of numbers with only three significant figures:

6230	0.375	0.00895	0.703
7.23	756,000	0.0128	7.150

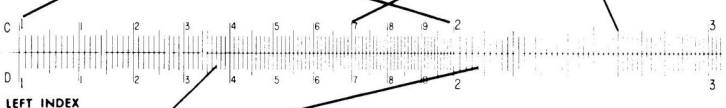
Since your slide rule can only provide three, possibly four, significant figures and will not locate a decimal point, we rely upon the problem itself and our own mental appraisal to determine the number of zeros and the location of the decimal point in the answer. This will be discussed below.

The C and D Scales are identical and they are basic for multiplication and division; if you learn to read these scales, you will be able to read all other scales because the same principles are applied. For the learning example, we will use the D Scale.

The D Scale is divided into Primary, Secondary and Tertiary divisions, each being represented by a mark (or graduation) on the scale. We locate a number by reading the graduations to determine a primary, secondary and tertiary significant figure.

These are the primary graduations which locate the first (primary) significant figure.

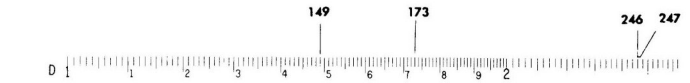
These are the secondary graduations which locate the second significant figure.



These are the tertiary graduations which locate the third significant number of an answer. Note that as the Secondary and Primary divisions are placed closer together, the value of the Tertiary division changes. This should be remembered when reading an answer.

Practice finding three significant figure numbers so that you can find them at any point on the D Scale. When you feel you can read these numbers accurately, go on to multiplication.

To find a number on the D Scale, we locate the proper Primary, Secondary and Tertiary graduations, and read what we find. Here are some samples:



DECIMAL LOCATION

Common sense can usually guide placement of the decimal point. In multiplying 133.4 × 12.4, the scale reading for the result is 1655; mentally, we can multiply 10 × 133 = 1330 and decide that 1655 and not 165.5, nor 16.55, must be the proper answer.

MULTIPLICATION: C AND D SCALES

To multiply two numbers (factors), **set the index of the C Scale over one of the factors to be multiplied on the D Scale; locate the other factor to be multiplied on the C Scale using the hairline of the cursor and read the answer directly below on the D Scale.** Example: To multiply 2 × 4, set the Left Index of the C Scale over 2 on the D Scale; set the hairline on 4 of the C Scale and read your answer, 8, directly under the hairline on the D Scale. Sometimes, in setting up a problem, (i.e., 2 × 6), the answer is "off the rule"; if this happens, reverse your problem (i.e. 6 × 2) and use the opposite Index (right instead of left). Now, test your understanding of multiplication and see if you arrive at the same answers to these problems:

5 × 7 = 35	15 × 3.7 = 55.5
4.2 × 19 = 79.8	9.3 × 8.7 = 80.9

DIVISION: C AND D SCALES

Division is the reverse of multiplication, as can be illustrated by 2 × 4 = 8 and 8 ÷ 4 = 2. The basic rule is **set the divisor on the C Scale opposite the number to be divided on the D Scale; read the result, or quotient, on the D Scale under the index of the C Scale.** Example: To divide 8 by 4, place the Divisor, 4, on the C Scale over the number to be divided, 8, on the D Scale and read your answer, 2, on the D Scale directly under the left index of the C Scale. In essence, you set up a fraction and read the answer under the Index. Test your understanding with these problems:

83 ÷ 7 = 11.86	47 ÷ 29 = 1.62
69 ÷ 79 = 0.873	75 ÷ 92 = 0.815

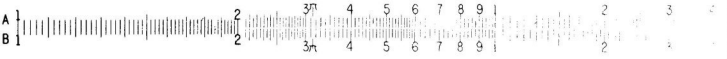
PROPORTION: C AND D SCALES

In working your multiplication problems, you will note that when you multiply 2 × 2 = 4 the rule also shows 2 × 3 = 6; 2 × 5 = 10, etc. Further, you will see that 1:2 = 2:4; 1:2 = 3:6; 1:2 = 3.5:7, etc. For proportion, the rule is **any number located on the C Scale and placed directly above a number on the D Scale is in direct proportion to all other C to D Scale readings.**

CI: THE RECIPROCAL C SCALE

This is an inverted, or reciprocal, C Scale. In comparing the two, you will note that the product of any two numbers, one above the other, is always one or ten. In example: 5 is over 2.5 × 2 = 10; 4 is over 2.5, 4 × 2.5 = 10. This scale is used to replace division with multiplication, and to help you avoid settings where the slide projects far outside the rule. To illustrate, set up the problem 16 ÷ 8 using the C and D Scales; you will see the slide extends far out to the left.

Now, think of the problem as 16 × ⅛. Set the left index of the C Scale over 16 on the D Scale, move the hairline to 8 on the CI Scale and read your answer, 2, on the D Scale directly below.



A AND B SCALE: SQUARES AND SQUARE ROOTS

The A and B Scales, which are identical, are made up of two half-length D (or C) Scales; they are used to find the square of any given number located on the D or C Scale. **To find the square of any number, locate it on the D Scale and read the square of that number directly above on the A Scale.** Move the hairline along the D Scale, reading on the A Scale, and you will see 4 (2 × 2) is directly over 2; 25 (5 × 5) is directly over 5; 81 (9 × 9) is directly over 9. To reverse this process and find the square root of a number, locate the number on the A or B Scale and read the square root on the C or D Scale. Remember there are two complete scales in the A Scale; one is for odd-number digits and the other is for even-number digits. The rule is **when the number has an odd number of digits, the square root is determined from the left hand A or B Scale, if the number has an even number of digits, the square root is determined from the right hand A or B Scale.** Check your understanding of this by squaring 3 and 5 to see which scale provides the answer. In determining whether a number has odd or even numbers of digits, consider it as a whole number or a fractional number, never both (i.e. 2.73 and 273 have an odd number of digits, 27.3 has an even number of digits).

Test yourself with these problems: Find the square root of: 81, 25, 625, 9. Find the square of: 9, 5, 25, 3.

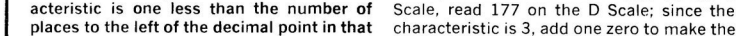
K SCALE: CUBES AND CUBE ROOTS

Just as the A and B Scales were half-length D (or C) Scales, the K Scale consists of three one-third length D (or C) Scales. And, as with squares and square roots, **the cube of any number located on the D Scale is found directly above on the K Scale.** By examination, 8 (2 × 2 × 2) on the K Scale is directly above 2 on the D Scale; 27 (3 × 3 × 3) is over 3, and 125 (5 × 5 ×5) is over 5. Bear these examples in mind because the rule to find Cube Roots is **divide the number into units of three from the decimal point, disregard complete units of three and if the remainder is one digit use the left part of the K Scale; if the remainder is two digits use the middle part of the K Scale; if the remainder is three digits use the right part of the K Scale.** Example: To find the Cube Root of 6.4, count from the left of the decimal point (6.4 is a number greater than 1) and you have a remainder of one; set the hairline over 6.4 on the left part of the K Scale and read your answer, 1.857, below on the D Scale. 64 has two digits, therefore from the middle part of the K Scale we read 4 on the D Scale; 640 has three digits, therefore the setting is from the right part of the K Scale and the answer, 8.62, is found below on the D Scale.

L SCALE: LOGARITHMS

This is another direct reading scale. The logarithm of any number consists of two parts: The Characteristic which is found to the left of the decimal point and the Mantissa which is found to the right of the decimal point. **To find the logarithm (to Base 10) of any number, locate the number on the D Scale and read the Mantissa of its logarithm on the L Scale.** And, to complete the logarithm, determine the characteristics with this rule: **For all numbers greater than one, the characteristic is one less than the number of places to the left of the decimal point in that number; for all numbers less than one (decimal fractions), the characteristic is negative and its numerical value is one more than the number of zeros between the decimal point and the first significant figure.** Example: to find the logarithm of 425, set the hairline over 425 on the D Scale and read the mantissa of the logarith, 0.628, on the L Scale; since 425 has three digits, the characteristic is one less, or 2, and the complete logarithm is 2.628.

Example: If the logarithm is known, i.e. 3.248, set the hairline over 248 on the L Scale, read 177 on the D Scale; since the characteristic is 3, add one zero to make the number 1770, which is correct.



S SCALE: SINES AND COSINES

This scale gives a direct reading of the sines and cosines of all angles between 5.7 and 90 degrees. In using your S Scale, read Sines left-to-right and Cosines right-to-left. Because angles are usually expressed in terms of degrees and minutes, it is necessary to translate the minutes into tenths of degrees. Six minutes equal 1/10 of one degree, e.g. 15° 30′ equals 15.5°. **To find the sine (or cosine) of an angle on the S Scale, set the hairline on the graduation that represents the angle and read the sine (or Cosine) on the D Scale; the decimal point is always placed at the left of your answer as read from the D Scale.**

T SCALE: TANGENTS AND COTANGENTS

The T Scale works in the same fashion as the S Scale, except it reads from 5.7 to 45 degrees and tangents and cotangents are found on both the CI and the D Scales. **To find angle values of tangents, set the hairline on the graduation that represents the angle and read (a) on the D Scale, tangents of angles from 5.7 to 45 degrees, cotangents of angles from 45 to 84.3 degrees; (b) on the CI Scale, read tangents of angles from 45 to 84.3 degrees, cotangents of angles from 5.7 to 45 degrees. Further, if the tangent or cotangent value is read on the D Scale, the decimal point is at the left of the first digit read; if the value read is on the CI Scale, the decimal point is at the right of the first digit read.** By setting the left index of the CI Scale directly over the left index of the D Scale, it is possible to read Log Sin and Log Cos values. Further, by reversing the procedures outlined, it is possible to determine angles when the sine, cosine, tangent or cotangent is known.

PICKETT

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