

FEARNS TECHNICAL CALCULATORS

Are simple-to-operate instruments, on the Circular Slide Rule principle, for the rapid and accurate solution of complete calculations in specialised fields:—

International Conversions Calculator
Hardness Conversions Calculator
Inches/Millimetres Conversions Calculator
Machining Time Calculators—Lathework
 Milling
 Drilling
Production Engineer's Calculator
Ratefixer's Calculator
Economic Batch Size Calculator
Gear Horsepower Calculators—Spurs & Helicals
 Bevels
 Worm Gears
Costing and Estimating Calculator
Conveyor Calculator
Horsepower Calculator
Shaft Size Calculator
Buyer's Calculator
Surveyor's Calculator
Weight Calculator for Castings & Forgings
Weight Calculator for Plates & Sheets
Inertia Calculator for Rotating Masses
Tank Capacity Calculator
Transmission Belt Drive Calculator
Time Clerks Calculator
Fearn's Odontograph for Gear Tooth Geometrical Construction

FEARNS CALCULATORS

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INSTRUCTION LEAFLET

for the FEARNS CIRCULAR SLIDE RULE

Special Note. If, after being used the first few times, one or two specks of red colouring appear between the dials, they should be removed by wiping off with a smooth cloth, after dismantling. (This colouring is not the colour filling from the engraved scales, but is polishing compound used during the manufacturing process, and it should not re-appear).

The Fearn's Circular Slide Rule consists of:—a main dial, a transparent top dial, and a movable cursor to facilitate reading the scales. Calculations are performed automatically by setting the top dial in the appropriate position in relation to the main dial and reading off the answer. The cursor is of particular use for interpolating, between graduations, for three or four figure numbers.

THE BASIC SCALE (C & D)

This is the outer red scale on the top transparent dial and its corresponding blue scale on the main dial. It is used for all normal multiplication, division, and proportion calculations and, having the widest spread, gives the greatest accuracy. The scale is calibrated from 1 to 10 and, as on all slide rules, the decimal point is ignored so that it represents at the same time:—0.1 to 1; 10 to 100; 100 to 1,000 etc.

Multiplication. Using these scales, set the red number 1 opposite any number on the blue scale. You have now immediately multiplied this blue number by **all** the numbers on the red scale, and the answers are read off, on the blue scale, opposite each red number.

Thus, if the red 1 points to 3, for example, you may read $3 \times 2 = 6$ (opposite red 2); $3 \times 3 = 9$ (opposite red 3); $3 \times 4 = 12$ (opposite red 4); $3 \times 5 = 15$ etc. (NOTE—in the two latter instances answers actually given are 1.2 and 1.5, and the decimal point position must be separately determined).

When multiplying more than two numbers together, bring the cursor into use, e.g. $3 \times 5 \times 6$:—Set red 1 to 3, bring cursor to red 5, then, without moving cursor, re-set red 1 under cursor line and read off answer (90) opposite red 6.

Division is simply the reverse of multiplication. Any number on the blue scale is automatically divided by the number on the red scale which is set against it, and the answer is read, on the blue scale, against the red 1.

e.g. $4.5 \div 2$, Set red 2 opposite 4.5 on blue scale and read off answer 2.25 against red 1. (At the same setting it will be seen that $6.75 \div 3 = 2.25$, $9 \div 4 = 2.25$, etc.).

Bring the cursor into use for repeated divisions, in a similar manner to repeated multiplication, and when a calculation requires a number of divisions and multiplications it is quickest to divide and multiply alternatively.

Percentages. What percentage of 160 is 56? This necessitates dividing 56 by 160 and multiplying by 100, thus, set red 1·6 to blue 56 and read off $3\cdot5 = 35\%$.

To add 30% to £180.—Multiply 180 by 130 and divide by 100, thus, set red 1 to 1·8 and read off against red 1·3 = £234.

THE SQUARE SCALE (A & B)

This is the inner red scale on the transparent dial and its corresponding blue scale on the main dial. All the numbers on these scales are the squares of those on the basic (C & D) scales. Calibration is from 1 to 100 which may represent at same time 100 to 10,000, or ·01 to 1·0 etc.

To Square a number say 7. Set red 1 on basic scale to blue 7. Read answer 49 opposite red 1 on square scale.

To obtain a Square Root of say 38. Set red 1 to blue 38 on square scale and read off 6·16, on basic blue scale, opposite red 1.

For larger numbers than 100 mark off the numbers in sets of two digits from the decimal point. The figure in the first, or left hand, group will lie between 1 and 100 and will indicate which section of the square scale is used, e.g. $3/86/00$ set to 3·86; for $38/60$ set to 38·6.

To Multiply a Square Root by a number say $\sqrt{84} \times 5$. Set red 1 to 84 on blue square scale and read off opposite red 5 on the basic blue scale. Answer 45·8.

To Multiply a Square by a number say $4^2 \times 27$. Set red 1 to 4 on the basic blue scale and read off opposite red 27 on the blue square scale. Answer 432.

THE CUBE SCALE

This is the scale around the outer edge of the main dial. All the numbers on it are the cubes of those on the blue basic scale. Calibration is from 1 to 1,000 which represents at the same time 1,000 to 1,000,000; ·001 to 1·0 etc.

To Cube a number say 7. Set the cursor to the blue 7 on the basic scale and read off on the cube scale. Answer 343.

To obtain Cube Root of say 38. Set the cursor to 38 on the cube scale and read off 3·36 on the basic blue scale.

For numbers larger than 1,000, or for decimals, mark off from the decimal point, as for square roots, but in groups of three.

To Multiply a Cube Root by a number say $\sqrt[3]{38} \times 3\cdot5$. Set cursor to 38 on cube scale. Set red 1 under cursor line and read off answer 11·76 opposite red 3·5.

THE LOG LOG SCALE

This is the spiral blue scale on the main dial immediately inside the square scale. It has a little over three complete laps and is calibrated from 1·01 to 1,000,000. The numbers on each scale are the tenth root of those on the next outer one, and it is used for obtaining any power of a number, whether the power be a whole number or a decimal.

To find the Power of a number say $83^{1\cdot4}$. Set the red hair line over 83 on the log log scale. Set the cursor to 1·4 on the red basic scale, and read off under the cursor line on log log scale. Answer 482.

To find the Root of a number say $5\cdot3\sqrt[5]{320}$. Set the cursor to 320 on the log log scale. Set 5·3 on the red basic scale under the cursor and read off the answer 2·97 on the log log scale under the red hair line.

If the number or its root falls below the scale limits, multiply the number by some convenient factor, and the root of the Product divided by the root of the factor gives the root of the number. Similarly, if the number is above scale limits, divide by a factor.

For numbers below 1 operate on the reciprocal and the reciprocal of this answer is the required solution.

Compound interest problems can readily be solved on the log log scale. e.g. £100 for 7 years @ 5% added annually = $100 \times 1\cdot05^7 = £140\cdot7$.

THE TANGENT SCALE

This is the extreme inner blue scale on the main dial and it gives the tangents of angles from 7° to 45°. (These have values between 0·1 and 1·0).

To find the Tangent of an angle set the red hair line to angle and read off tangent opposite red 1 on basic scale (Divide actual reading by 10).

THE SINE SCALE

This is the blue scale immediately adjacent to the Tangent scale and is calibrated from 7° to 90°.

To find the Sine of an angle set the red hair line over angle and read off Sine opposite red 1 on basic scale (Divide actual reading by 10).

To find the Cosine of an angle. This is the same as the sine of the complementary angle (As instructions on instrument).

It will be noted that, as sines, cosines, and tangents are evaluated on the basic scales, numbers can be multiplied or divided directly by these functions. e.g. to find $23 \times \sin 40^\circ$:—Set red hair line to 40° on sine scale and read off opposite red 23 on basic scale. Answer 14·78.