

Illustration:

$$\sqrt{2} \times \sqrt{2} = 2^{\frac{1}{2}} \times 2^{\frac{1}{2}} = 2^{\frac{1}{2} + \frac{1}{2}} = 2^1 = 2$$

37. Logarithms.

The laws for the multiplication and division of quantities which involve exponents gives a powerful tool for simplifying computation. For example, we can multiply 16 and 64 by changing 16 to read 2^4 and 64 to 2^6 . Then $2^4 \times 2^6 = 2^{10}$. We see now that it is necessary to have a table of the powers of 2 so that

we can look up to 2^{10} and find the answer to our

problem quickly. Such a table is called table of ~~logs~~ ^{it such table is no longer used.} logarithms. Logarithms are exponents.

Since our system is a decimal system (expressed in terms of the powers of 10), logarithms ~~are~~ ^{we use calculators} most commonly used are simply the power of 10 necessary

to represent all of the numbers. Thus it is found in a log table:

Ex: $10^{1.1761} = 15$ AND $10^{2.2625} = 183$ AND IF WE WISH A BOOK

TO MULTIPLY 15 BY 183 WE ADD 1.1761 AND 2.2625 AND LOOK

THIS RESULT UP IN THE TABLE OF LOGARITHMS TO FIND WHAT

NUMBER IS REPRESENTED BY $10^{3.4386}$. SIMILARLY, IF WE WISH

TO DIVIDE 183 BY 15, WE SUBTRACT THE LOGARITHMS AND

LOOK UP THE RESULT IN THE TABLE. INTERESTING TO NOTE

THAT LOGARITHMS CAN BE USED TO FIND THE SQUARE ROOT OF

A NUMBER BY DIVIDING THE LOGARITHM OF THE NUMBER

BY 2 AND REFERRING TO THE TABLE. IN THE EXAMPLE WORKED

BY MECHANICAL RULES, WE FOUND $\sqrt{175}$. THIS COULD BE DONE

BY LOGARITHMS AS FOLLOWS:

$$10^{2.5596} = 175 \quad \text{therefore, } \log 175 = 2.5596$$

DIVIDING THE LOG BY 2, WE GET

$$10^{1.2798} = 13.23 \quad \text{THEREFORE THE SQUARE ROOT OF 175}$$

IS VERY NEARLY 13.23.

38. Equations of the third degree.

WE HAVE USED THE PROBLEM OF AREA RELATED TO SQUARES AND

RECTANGLES AS A BASIS FOR OUR DISCUSSION OF QUADRATICS.

FORMULAS FOR THE VOLUMES OF CUBES AND SPHERES

($V = S^3$, $V = \frac{4}{3} \pi R^3$) SHOW THAT WE ARE ALSO CONCERNED

WITH EQUATIONS OF THIRD DEGREE, IN WHICH THE HIGHEST

EXPONENT ON THE UNKNOWN IS 3.

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