

DECIBELS WITHOUT LOGS

By WILLIAM G. MILLER/Industrial Electronics Corp.

A simple method of solving decibel problems in seconds mentally without using charts, tables, or slide rules.

DECIBEL problems can be solved easily without the use of algebraic expressions, log tables, slide rules, or nomograms. As a matter of fact, with a little practice, you should be able to make accurate mental calculations.

To begin with, it is necessary to memorize two key numbers and their associated dB figures. The key number will tell you what to do to the power value when its related dB figure is used.

1. For 10 dB, the key number is 10.
2. For 3 dB, the key number is 2.

This means that for an increase or a +10-dB change, our power level would be multiplied by 10 and for a decrease or -10-dB change, we would divide by 10.

Similarly, a +3-dB change would then indicate that we multiply the power level by 2 and a -3-dB change would mean that we must divide by 2.

While it is quite easy to see how an amplifier with a 3-dB gain will double the input power, it may be more difficult to realize that an amplifier with a 57-dB gain will have double the power output of an amplifier with a 54-dB gain (both referred to the same 0-dB level).

The power is doubled for every 3-dB gain and halved for every 3-dB loss. This means that we had to double the power 18 times to get to 54 dB and once more to get to 57 dB.

By way of another example, an antenna with a 30-dB gain can deliver only one tenth the signal power of an antenna with a 40-dB gain. Note that the power is multiplied by 10 for every 10-dB gain and divided by 10 for every 10-dB loss.

The antenna reference level was multiplied by 10 four times to get to 40 dB and then divided by 10 (-10 dB) to get back down to 30 dB.

Up to this point, we have been using the 10-dB and 3-dB figures separately, but they can be used together to form many combinations.

Problem 1: Increase 4 watts by 13 dB.

Solution: First increase the level by 10 of the 13 dB (to 40 watts). Now increase it by the remaining 3 dB (double the 40 watts).

Answer: 80 watts.

Problem 2: Increase 4 watts by 7 dB.

Solution: First increase the level by 10 dB (40 watts), then subtract 3 dB by dividing by 2.

Answer: 20 watts.

Many combinations of 3 and 10 can be used to arrive at the decibel figure you want and different combinations can be used to achieve the same answer.

Technicians who are familiar with powers of ten can pick up even more speed when it is considered that each 10-dB change means that the decimal point is moved one place.

Problem: Attenuate 6 watts by -33 dB.

Solution: Move the decimal point 3 places to the left and halve the result.

Answer: 0.003 watt.

Voltage and current ratios can also be expressed in decibels but the decibel figure associated with the key number is doubled. 1. For 20 dB the key number is 10. 2. For 6-dB the key number is 2. The same method as described above can then be used for voltage and current ratios. ▲



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