
TOOL: Decibel (dB) values are a logarithmic scaling of values. (Physical units are unaffected.) The formula for conversion to a dB scale is

$$x \text{ in dB} = 20\log_{10} x.$$

Summing functions plotted on a dB scale is equivalent to multiplying the original functions. For Bode plots, using a dB scale allows us to plot individual root terms in a transfer function and then sum the plots to get the overall transfer function response.

The multiplication by 20 in the dB value is a convenient ploy that yields approximately integer (or half-integer) dB values for most integer magnitude values from 1 to 20 plus a few other useful values. Table I shows some dB values:

Table I Decibel (or dB) approximate values

value	$\text{dB} = 20\log_{10}(\text{value})$	approx dB
0.5	-6.02	-6
1	0.00	0
$\sqrt{2}$	3.01	3
2	6.02	6
3	9.54	9.5
4	12.04	12
5	13.98	14
6	15.56	15.5
2π	15.96	16
7	16.90	17
8	18.06	18
9	19.08	19
10	20.00	20
12	21.58	21.5
14	22.92	23
16	24.08	24
18	25.11	25
20	26.02	26

Summing/subtracting dB values gives the dB value of the product/quotient of the original values