

Decibel-to-Factor Conversions Without a Calculator

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Below are quick methods for approximating the dB-to-multiplying factors of single-digit dB values ranging from 1 dB to 9 dB. Remember that 3 dB represents a multiplying factor of 1.995 and that -3 dB represents a multiplying factor of 0.501, so the conversions below are approximations, although they are very good ones.

First, memorize two dB-to-multiplying factor conversions. The first one is a very good approximation; the second one is exact:

$$3 \text{ dB} \leftrightarrow \times 2$$

$$10 \text{ dB} \leftrightarrow \times 10$$

Use those conversions to determine the multiplying factor for any other single-digit dB value (actual conversion factors to three-digit accuracy are included in parentheses):

$$1 \text{ dB} = 10 \text{ dB} - 3 \text{ dB} - 3 \text{ dB} - 3 \text{ dB} \leftrightarrow \times 10 \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \times \frac{10}{8} = \times \frac{5}{4} = \times 1.25 \text{ (1.26)}$$

$$2 \text{ dB} = 10 \text{ dB} - 4 \text{ dB} - 4 \text{ dB} \leftrightarrow \times 10 \times \frac{1}{2.5} \times \frac{1}{2.5} = \times \frac{10}{6.25} \times \frac{4}{4} = \times \frac{40}{25} = \times \frac{8}{5} = 1.6 \text{ (1.58)}$$

$$3 \text{ dB} \leftrightarrow \times 2 \text{ (2.00)}$$

$$4 \text{ dB} = 10 \text{ dB} - 3 \text{ dB} - 3 \text{ dB} \leftrightarrow \times 10 \times \frac{1}{2} \times \frac{1}{2} = \times \frac{10}{4} = \times 2.5 \text{ (2.51)}$$

$$5 \text{ dB} = 4 \text{ dB} + 1 \text{ dB} \leftrightarrow \times 2.5 \times 1.25 = \times 3.125 \text{ (3.16)}$$

$$6 \text{ dB} = 3 \text{ dB} + 3 \text{ dB} \leftrightarrow \times 2 \times 2 = \times 4 \text{ (3.98)}$$

$$7 \text{ dB} = 10 \text{ dB} - 3 \text{ dB} \leftrightarrow \times 10 \times \frac{1}{2} = \times 5 \text{ (5.01)}$$

$$8 \text{ dB} = 4 \text{ dB} + 4 \text{ dB} \leftrightarrow \times 2.5 \times 2.5 = \times 6.25 \text{ (6.31)}$$

$$9 \text{ dB} = 3 \text{ dB} + 3 \text{ dB} + 3 \text{ dB} \leftrightarrow \times 2 \times 2 \times 2 = \times 8 \text{ (7.94)}$$

This approach is easily extended to dB values with two or more digits. Any digits in the dB value before the ones digit are interpreted as the appropriate power of ten. Some examples are below:

$$13 \text{ dB} \leftrightarrow \times 10^1 \times 2 = 20 \quad 37 \text{ dB} \leftrightarrow \times 10^3 \times 5 = 5,000 \quad 64 \text{ dB} \leftrightarrow \times 10^6 \times 2.5 = 2,500,000$$