dB 101

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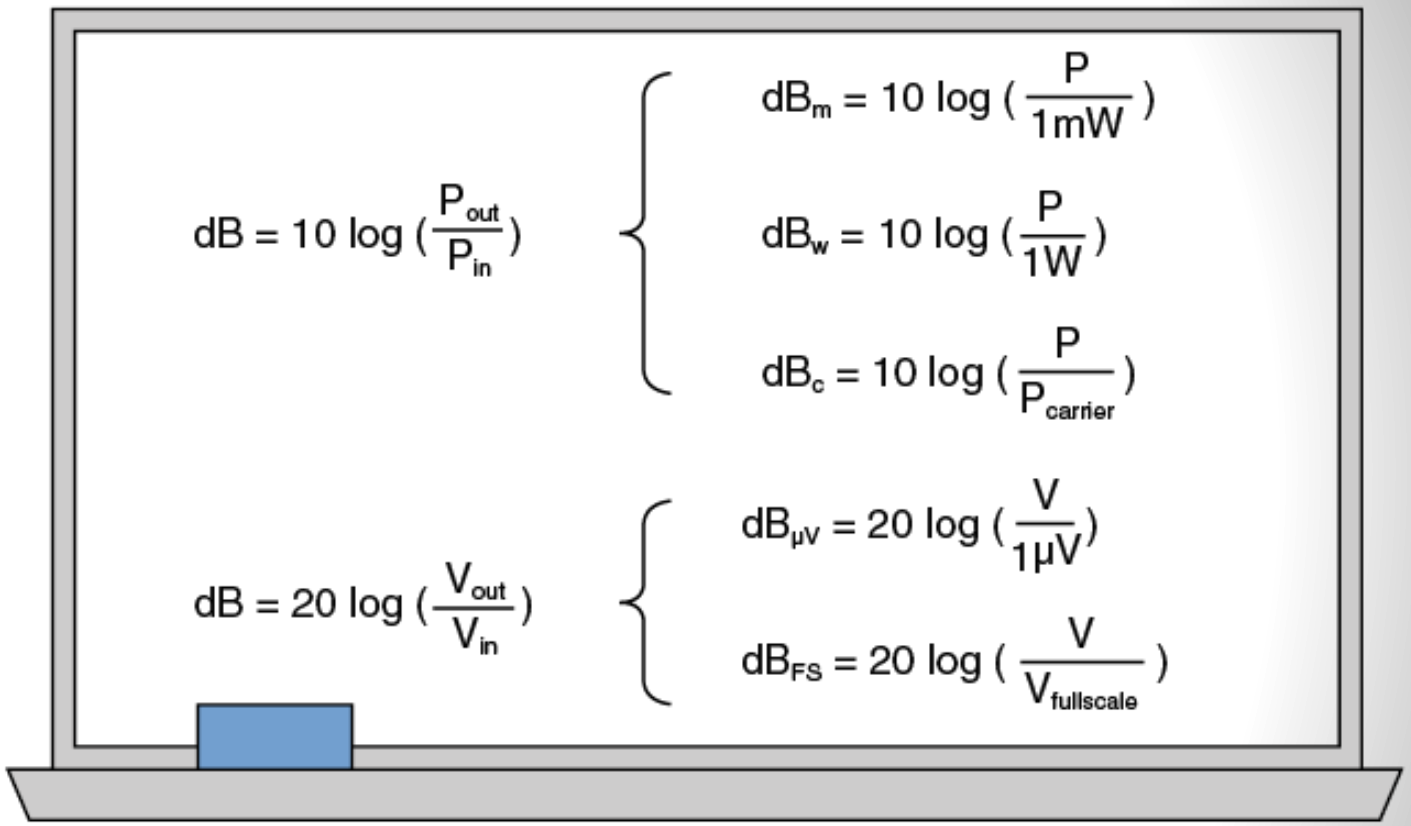
W2SUB

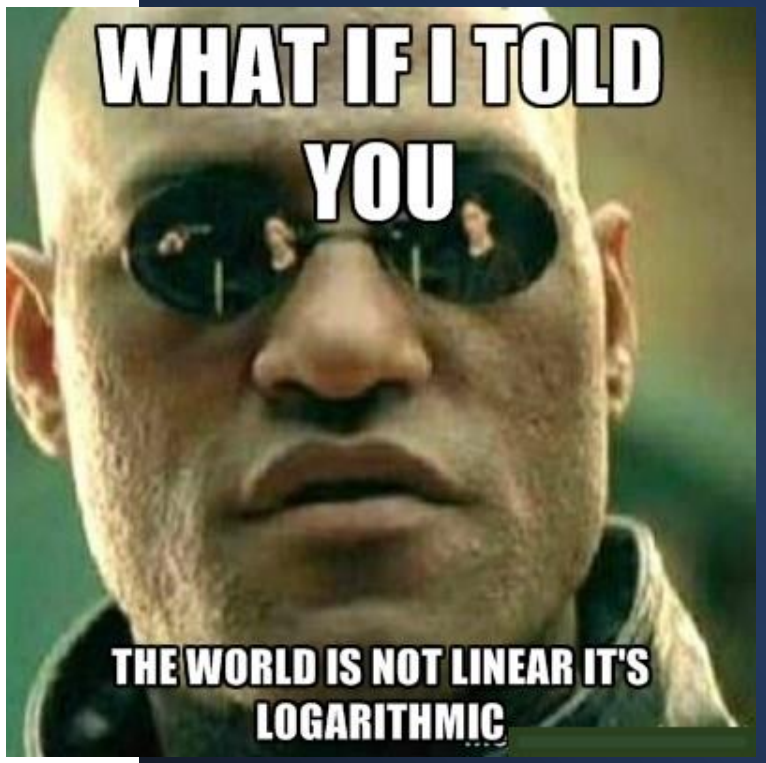


Basic Logarithms

- **Log(x) = y Means that $x = 10^y$**

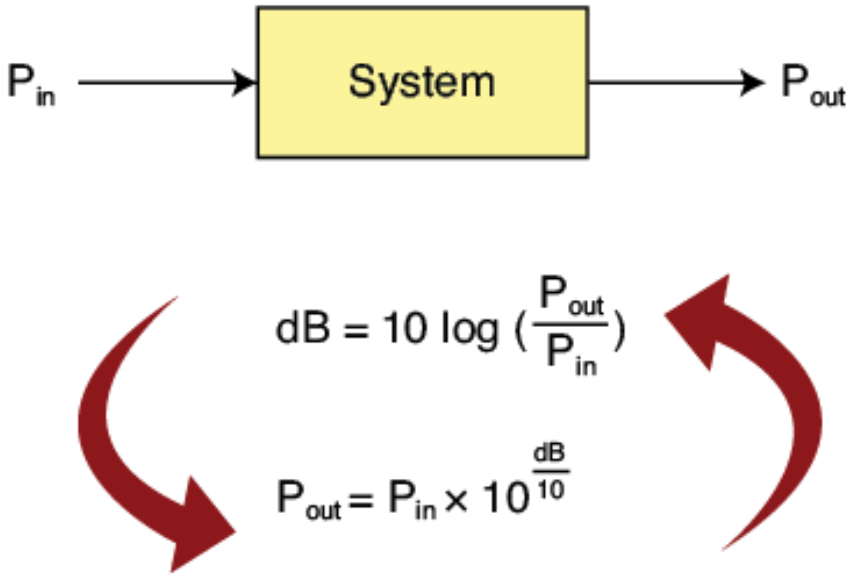
- Therefore log(10)=1 because $10^1=10$,
- log(100)=2 because $10^2=100$ and so on.

- Similarly, log(0.01)= -2 because $10^{-2}=0.01$ and log(1)=0 because $10^0=1$



What the heck is a decibel?

The decibel is one-tenth of a "Bel" ("deci"=1/10), resulting in the "10" in the formula above

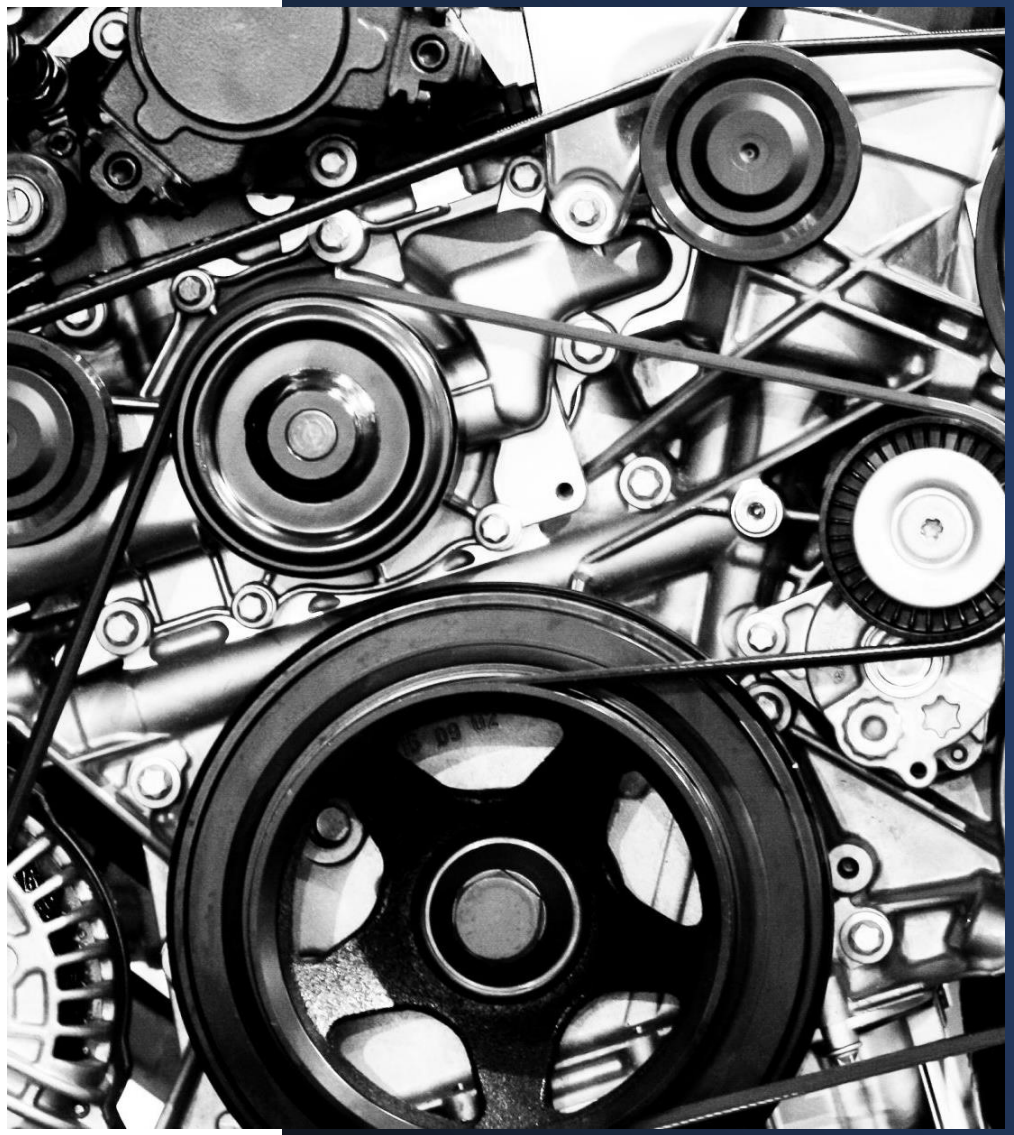


P_{out}/P_{in}	dB
0.000001	–50 dB
0.01	–20 dB
0.1	–10 dB
0.5	–3 dB
0.8	–1 dB
1	0 dB
1.2	+1 dB
2	+3 dB
10	+10 dB
100	+20 dB
100,000	+50 dB

Everyday decibel levels

Here are some common sounds from everyday life and their decibel ratings:

- **Near total silence**: 0 dB
- **A whisper**: 15 dB
- **Normal conversation**: 60 dB
- **A lawn mower**: 90 dB
- **A car horn**: 110 dB
- **A rock concert or a jet engine**: 120 dB
- **A gunshot or firecracker**: 140 dB



Easy Thumbrules

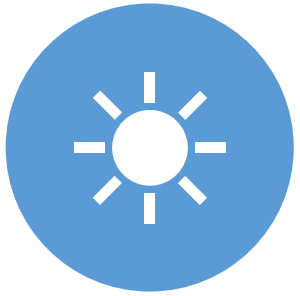
Change in dB	Change in sound energy
3 dB *increase*	sound energy is doubled
3 dB decrease	sound energy is halved
10 dB *increase*	sound energy is increased by a factor of 10
10 dB decrease	sound energy is decreased by a factor of 10
20 dB *increase*	sound energy is increased by a factor of 100
20 dB decrease	sound energy is decreased by a factor of 100

Example of adding decibels

Imagine that you have a 100 mW signal, and chain two attenuators valued at -20 dB and -3 dB respectively.

What would be the output power?

-20 dB means /100, and -3 dB means /2, so overall 200.



The output power will be 100 mW / 200 = 0.5 mW

What about dBA and dBm?

- In sound measurement, dB (decibels) is a general unit for measuring sound pressure level, while dBA (A-weighted decibels) is a specific measurement that accounts for how the human ear perceives sound at different frequencies.
  - dBA is a more realistic representation of how loud something sounds to a human, as it downweights low and high frequencies where the human ear is less sensitive.

- dB (decibel) and dBm (decibel-milliwatt) are both logarithmic units used in electronics and communication, but they differ in how they quantify power or signal levels.
  - dB is a relative measurement, expressing the ratio between two power levels, while dBm is an absolute measurement, referencing a signal's power relative to a fixed level of 1 milliwatt (mW)

Sources for self study

https://circuitcellar.com/research-design-hub/db-for-dummies/

https://pulsarinstruments.com/news/understanding-decibels-decibel-scale-and-noise-measurement-units/