

# Decibel

Decibels are a logarithmic relationship that allowed Bell engineers to use addition instead of multiplication in early telephone system design. It was adopted by radio engineers for the same reason. Remember computers and electronic calculators were not available in those times. Despite the availability of computers and calculators today, using decibels is still very common.

The relationship is  $dB = 10 \times \log\left(\frac{P_{out}}{P_{in}}\right)$

The following table will answer all decibel related problems on the exam

Power Ratio	Decibels, dB
1	0
2	3
4	6
10	10
0.5	-3
0.25	-6
0.1	-10

## Questions

T5B09 (B)

What is the approximate amount of change, measured in decibels (dB), of a power increase from 5 watts to 10 watts?

- A. 2 dB
- B. 3 dB
- C. 5 dB
- D. 10 dB

The power ratio is  $\frac{10}{5} = 2$  and using the table the answer is 3 dB. Or using the relationship

$dB = 10 \times \log\left(\frac{10}{5}\right) = 3.01$  and the answer is B. You would need to use a scientific calculator to make this calculation. A four-function calculator will not have the log function.

T5B10 (C)

What is the approximate amount of change, measured in decibels (dB), of a power decrease from 12 watts to 3 watts?

- A. -1 dB

- B. -3 dB
- C. -6 dB
- D. -9 dB

The power ratio is  $\frac{3}{12} = \frac{1}{4} = 0.25$  . From the table that would be -6 dB and the answer is C.

Another approach is  $\frac{1}{4} = \frac{1}{2} \times \frac{1}{2}$  in logarithms you add to perform multiplication. This  $\frac{1}{2} \times \frac{1}{2}$  in logarithms  $(-3) + (-3) = -6$  . Or by the calculator  $dB = 10 \times \log\left(\frac{3}{12}\right) = -6.02$  and C is still the correct answer.

T5B11 (A)

What is the approximate amount of change, measured in decibels (dB), of a power increase from 20 watts to 200 watts?

- A. 10 dB
- B. 12 dB
- C. 18 dB
- D. 28 dB

The power ratio is  $\frac{200}{20} = 10$  and from the table the answer is 10. Or from the calculator

$$dB = 10 \times \log\left(\frac{200}{20}\right) = 10 \times \log 10 = 10 \times 1 = 10$$

In either case the answer is A.

T7C06 (D)

What does an SWR reading of 4:1 indicate?

- A. Loss of -4dB
- B. Good impedance match
- C. Gain of +4dB
- D. Impedance mismatch

While some of the detractors are in dB, the SWR (Standing wave ratio) is related to input power to reflected power ratio and not normally measured in dB.