

THE DECIBEL

THE DECIBEL (dB) IS A UNIT OF MEASURE THAT PERMITS TWO DIFFERENT SIGNALS TO BE COMPARED ON A LOGARITHMIC SCALE. THE SENSITIVITY OF RECEIVERS AND THE GAIN OF AMPLIFIERS ARE OFTEN GIVEN IN DECIBELS. THE DIFFERENCE IN dB BETWEEN THE POWER OF A SIGNAL AT THE INPUT OF AN AMPLIFIER (P1) AND THE POWER OF THE AMPLIFIER'S OUTPUT (P2) IS:

$$dB = 10 \log (P2/P1)$$

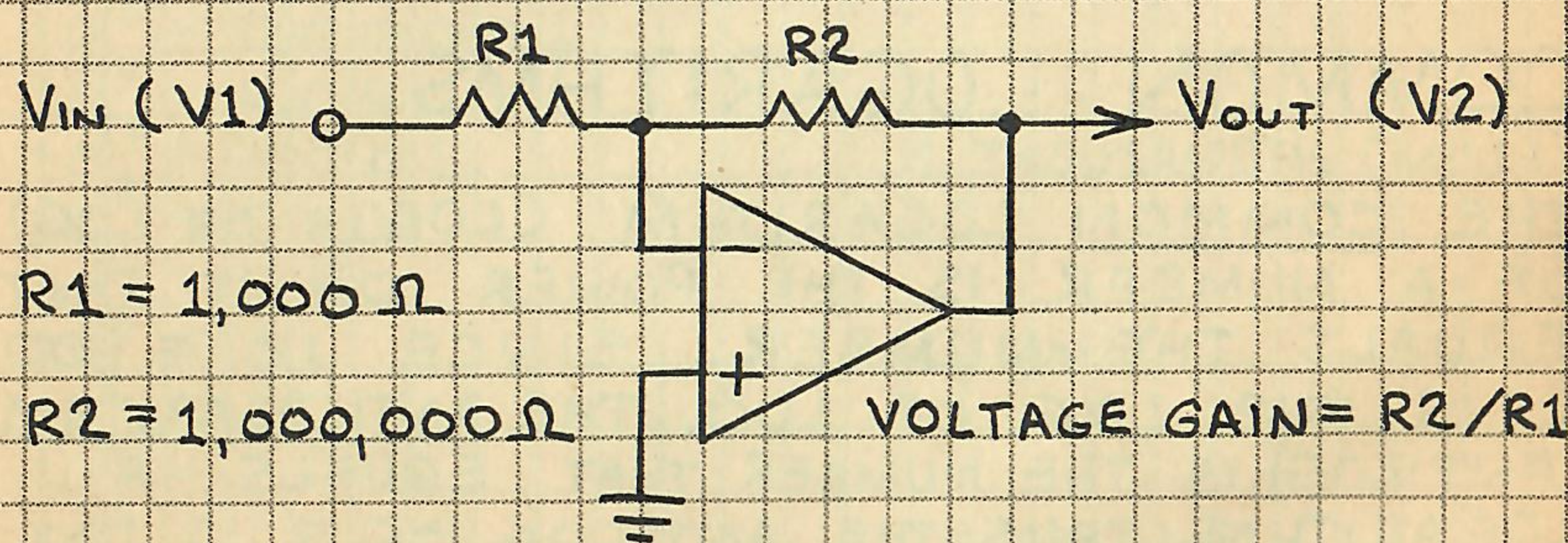
THE DIFFERENCE IN dB BETWEEN THE VOLTAGE (V) AND CURRENT (I) AT THE INPUT (V1 AND I1) AND OUTPUT (V2 AND I2) OF AN AMPLIFIER IS:

$$dB = 20 \log (V2/V1)$$

$$dB = 20 \log (I2/I1)$$

NOTE THAT DECIBELS DEFINE THE RATIO BETWEEN TWO SIGNAL LEVELS, NOT THEIR ABSOLUTE VALUE.

EXAMPLE: DETERMINE THE VOLTAGE GAIN IN dB OF THIS OPERATIONAL AMPLIFIER.



$$R1 = 1,000 \Omega$$

$$R2 = 1,000,000 \Omega$$

$$\text{VOLTAGE GAIN} = R2/R1$$

$$dB = 20 \log (V2/V1)$$

$$dB = 20 \log (1,000 / 1) = 20 \log 1,000$$

$$\log 1,000 = 3 \text{ (FROM TABLE OR CALCULATOR)}$$

$$\text{GAIN} = 20 \times 3 = 60 \text{ dB}$$

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DECIBEL (dB) TABLE

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VOLTAGE OR CURRENT RATIO	POWER RATIO	dB	VOLTAGE OR CURRENT RATIO	POWER RATIO
1.0000	1.0000	0	1.0000	1.0000
.8913	.7943	1	1.1220	1.2589
.7943	.6310	2	1.2589	1.5849
.7079	.5012	3	1.4125	1.9953
.6310	.3981	4	1.5849	2.5119
.5623	.3162	5	1.7783	3.1623
.5012	.2512	6	1.9953	3.9811
.4467	.1995	7	2.2387	5.0119
.3981	.1585	8	2.5119	6.3096
.3548	.1259	9	2.8184	7.9433
.3162	.1000	10	3.1623	10.000
.1000	.0100	20	10.000	100.00
.0316	.0010	30	31.623	1,000.0
.0100	.0001	40	100.00	10,000
.0032	.00001	50	316.23	100,000
.0010	10 ⁻⁶	60	1,000.0	10 ⁶
.0003	10 ⁻⁷	70	3,162.3	10 ⁷
.0001	10 ⁻⁸	80	10,000	10 ⁸
.00003	10 ⁻⁹	90	31,623	10 ⁹
.00001	10 ⁻¹⁰	100	100,000	10 ¹⁰

POWER - dBm EQUIVALENTS

RECEIVER SENSITIVITY IS OFTEN GIVEN IN dB WITH RESPECT TO 1 MILLIWATT.

dBm	POWER (mW)	UNITS
10	10,000,000	10 MILLIWATTS
0	1,000,000	1 MILLIWATT
-10	.100,000	100 MICROWATTS
-20	.010,000	10 MICROWATTS
-30	.001,000	1 MICROWATT
-40	.000100	100 NANOWATTS
-50	.000010	10 NANOWATTS
-60	.000001	1 NANOWATT

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