

# Logarithmic Plots

Decibels and Semi-Log Axes

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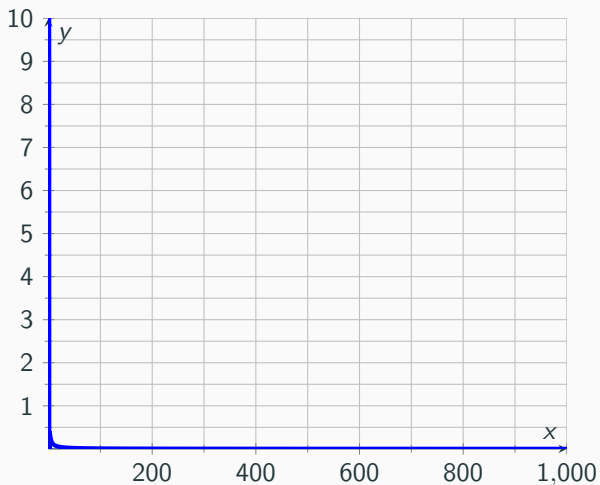
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# Introduction

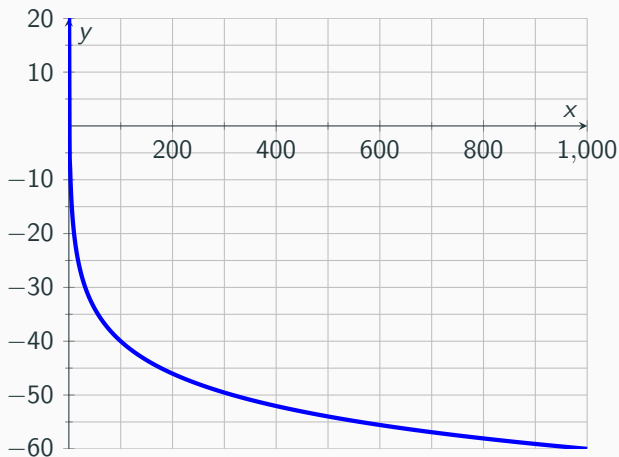
- Comparing values over several orders of magnitude can be difficult
- We'll use this mostly for gain of circuits
- Several orders of magnitude of frequency are shown in Bode plots
- Next 3 plots all show  $f(x) = \frac{1}{x}$  plotted between 0.1 and 1000

# Linear Axes



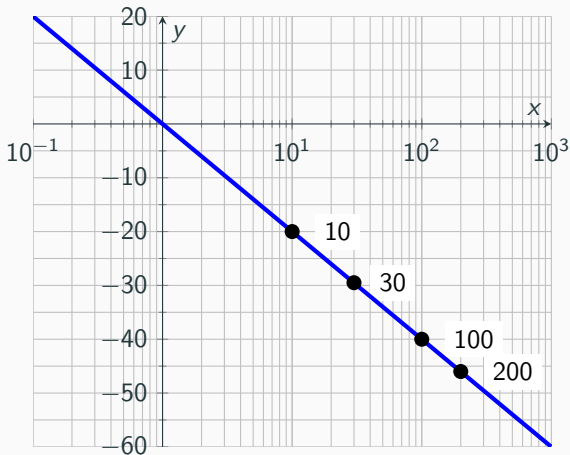
Determine the difference between the function's value at  $x=100$  and  $x=200$

## Decibels on Vertical Axis



- Find difference between the function's value at  $x=100$  and  $x=200$
- Find difference between the function's value at  $x=10$  and  $x=30$

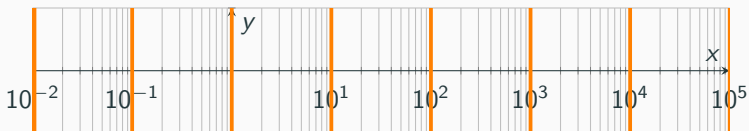
## Decibels on Vertical Axis



- Find difference between the function's value at  $x=100$  and  $x=200$
- Find difference between the function's value at  $x=10$  and  $x=30$

# Using a Logarithmic Axis

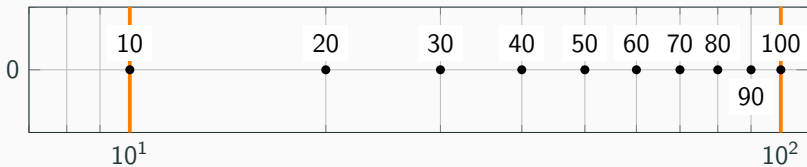
- Decade lines, powers of 10
- Locate the decade lines (in orange here)
- To the left of the “big gaps”



- Minor grid lines in between the decade lines
- Let's zoom in on a single decade

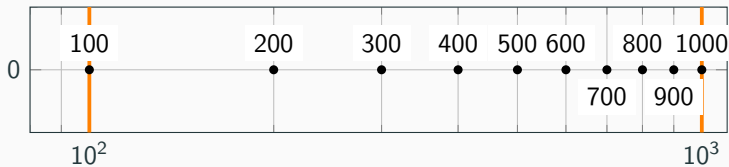
# Minor Grid Lines

- This decade is between 10 and 100
- Minor grid lines count by 10s



# Minor Grid Lines

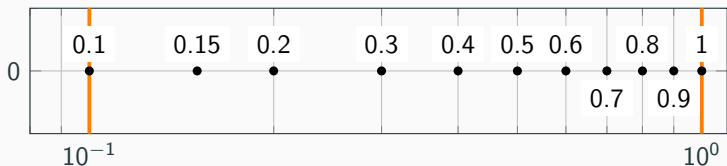
- This decade is between 100 and 1000
- Minor grid lines count by 100s





# Minor Grid Lines

- Works for values less than 1
- This decade is between 0.1 and 1
- Minor grid lines count by 0.1s

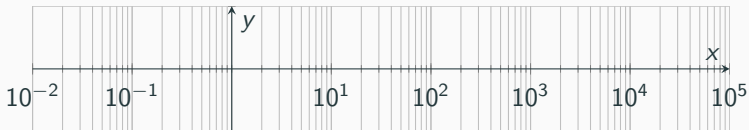


- Values between minor grid lines not linearly spaced
- 0.15 no midway between 0.1 and 0.2

# Practice

Find the following values:

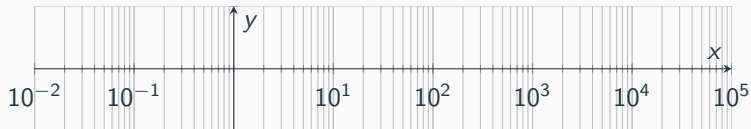
1. 10
2. 100
3. 1000
4. 10000
5. 100000
6. 0.1
7. 0.01
8. 1



# Practice

A little trickier:

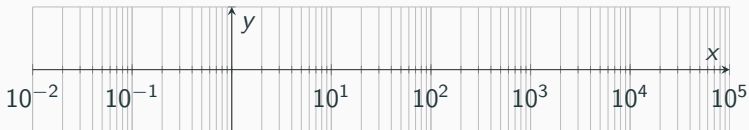
1. 20
2. 80
3. 3000
4. 40000
5. 0.6
6. 0.08



# Practice

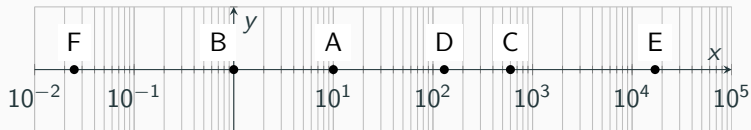
Lastly:

1. 1500
2. 45
3. 22000
4. 0.25



# Practice

Determine the values labeled on the plot:



# Practice

Try it on a plot of data. Find value of function at these frequencies:

- 100 Hz
- 20 kHz
- 1.5 MHz

