Application of an Inverse Function

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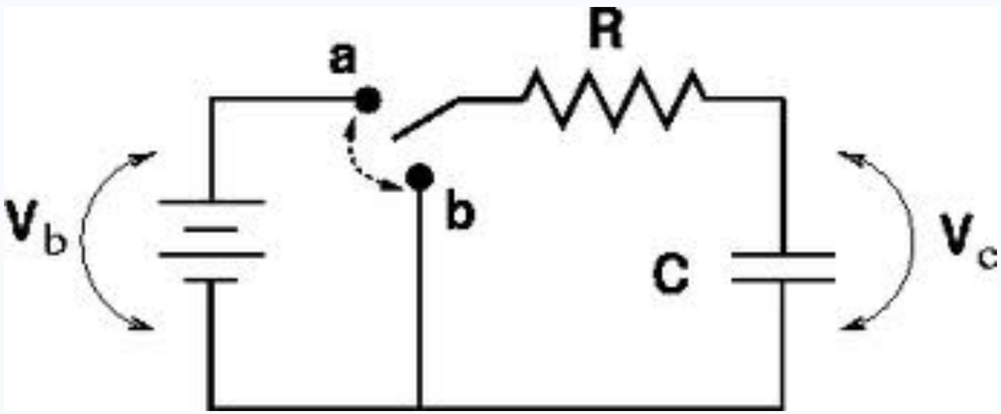
Recall from Last Lecture



- We found that the voltage across the capacitor decayed exponentially according to the formula

$$V_C = V_b\, e^{-\left(\frac{t}{\tau}\right)}$$

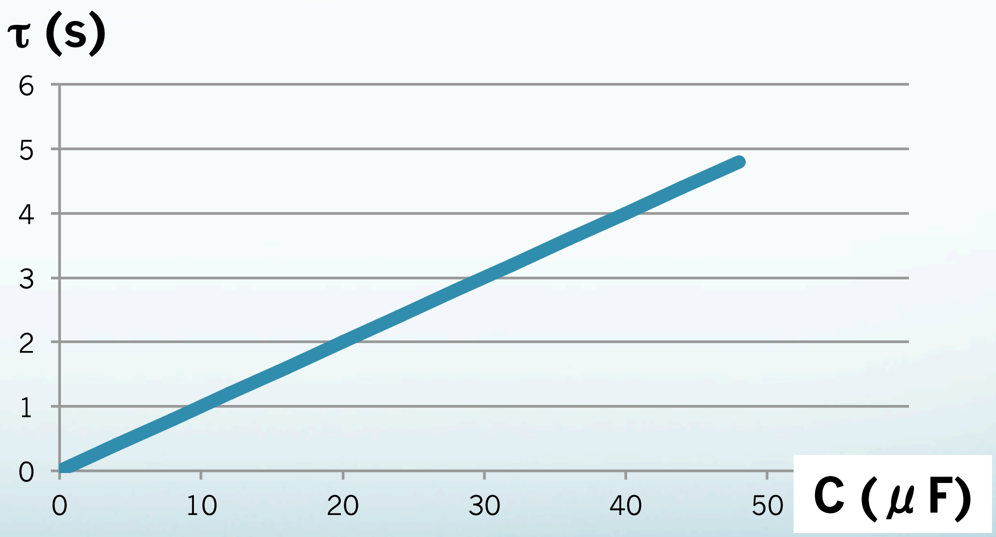
- where $\tau = RC$

Time Constant

- Suppose we fix the value for R to be constant. We can think of the time constant as a function of C.

$$\tau = f(C) = RC$$

C	Tau
0	0
4	0.4
8	0.8
12	1.2
16	1.6
20	2
24	2.4
28	2.8
32	3.2
36	3.6
40	4
44	4.4
48	4.8



Alternative View

- Alternatively, we can solve the equation for C

$$\tau = f(C) = RC$$

$$\frac{\tau}{R} = C$$

$$C = f^{-1}(\tau) = \left(\frac{1}{R}\right)\tau$$

- Thus we may use the inverse function to express C in terms of τ.

Table and Plot of Inverse Function

$$C = f^{-1}(\tau) = \left(\frac{1}{R}\right)\tau$$

Tau	C
0	0
0.4	4
0.8	8
1.2	12
1.6	16
2	20
2.4	24
2.8	28
3.2	32
3.6	36
4	40
4.4	44
4.8	48