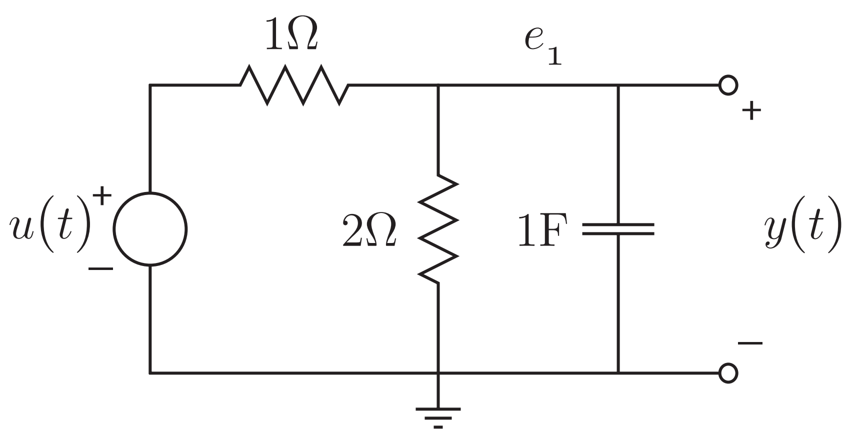
RC Circuit Step Response I

Find the differential equation that describes the circuit below:



Press “1” on your PRS remote when you are finished.

RC Circuit Step Response I

The differential equation that describes the circuit is

$$\frac{d}{dt}e_1(t) + 1.5e_1(t) = u(t)$$

My answer

1. Was completely correct
2. Was mostly correct, with one or two minor errors
3. Had many errors
4. Was completely incorrect

Limits of Integration

The system G has impulse respnse

$$g(t) = e^{-1.5t}\sigma(t)$$

If the input to the system is

$$u(t) = e^{-t}\sigma(t)$$

the output can be found using the convolution integral as

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} g(t-\tau)u(\tau)\,d\tau \\ &= \int_{-\infty}^{\infty} e^{-1.5(t-\tau)}\sigma(t-\tau)e^{-\tau}\sigma(\tau)\,d\tau \\ &= \int_{?}^{?} e^{-1.5(t-\tau)}e^{-\tau}\,d\tau \end{aligned}$$

What should the limits of integration be if $t > 0$?

Limits of Integration I

In the integral,

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} e^{-1.5(t-\tau)}\sigma(t-\tau)e^{-\tau}\sigma(\tau)\,d\tau \\ &= \int_{?}^{?} e^{-1.5(t-\tau)}e^{-\tau}\,d\tau \end{aligned}$$

what should the limits of integration be if $t > 0$?

1. $\displaystyle\int_{-\infty}^{\infty}$
2. $\displaystyle\int_{-\infty}^{t}$
3. $\displaystyle\int_{t}^{\infty}$
4. $\displaystyle\int_{0}^{\infty}$
5. $\displaystyle\int_{0}^{t}$
6. $\displaystyle\int_{-\infty}^{0}$
7. $\displaystyle\int_{0}^{0}$

Limits of Integration I

In the integral,

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} e^{-1.5(t-\tau)}\sigma(t-\tau)e^{-\tau}\sigma(\tau)\,d\tau \\ &= \int_{?}^{?} e^{-1.5(t-\tau)}e^{-\tau}\,d\tau \end{aligned}$$

what should the limits of integration be if $t > 0$?

The correct answer is:

1. $\int_{-\infty}^{\infty}$
2. $\int_{-\infty}^{t}$
3. $\int_{t}^{\infty}$
4. $\int_{0}^{\infty}$
5. ♡ $\int_{0}^{t}$
6. $\int_{-\infty}^{0}$
7. $\int_{0}^{0}$

Limits of Integration II

In the integral,

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} e^{-1.5(t-\tau)}\sigma(t-\tau)e^{-\tau}\sigma(\tau)\,d\tau \\ &= \int_{?}^{?} e^{-1.5(t-\tau)}e^{-\tau}\,d\tau \end{aligned}$$

what should the limits of integration be if $t < 0$?

1. $\int_{-\infty}^{\infty}$
2. $\int_{-\infty}^{t}$
3. $\int_{t}^{\infty}$
4. $\int_{0}^{\infty}$
5. $\int_{0}^{t}$
6. $\int_{-\infty}^{0}$
7. $\int_{0}^{0}$

Limits of Integration II

In the integral,

$$
\begin{aligned}
y(t) &= \int_{-\infty}^{\infty} e^{-1.5(t-\tau)}\sigma(t-\tau)e^{-\tau}\sigma(\tau)\,d\tau \\
&= \int_{?}^{?} e^{-1.5(t-\tau)}e^{-\tau}\,d\tau
\end{aligned}
$$

what should the limits of integration be if $t < 0$?

The correct answer is:

1. $\int_{-\infty}^{\infty}$
2. $\int_{-\infty}^{t}$
3. $\int_{t}^{\infty}$
4. $\int_{0}^{\infty}$
5. $\int_{0}^{t}$
6. $\int_{-\infty}^{0}$
7. ♡ $\int_{0}^{0}$