Μπορείτε να πάρετε οποιαδήποτε άσκηση ή πρόβλημα από το υλικό τού 1ου εξαμήνου και να το λύσετε με μετασχηματισμό Laplace: το αποτέλεσμα πρέπει να βγει ίδιο!

ΕΠΙΠΡΟΣΘΕΤΑ ΠΡΟΒΛΗΜΑΤΑ ΜΕ ΤΕΛΙΚΗ ΑΠΑΝΤΗΣΗ

P 14.8-1 Using Laplace transforms, find the response $i_L(t)$ for $t > 0$ for the circuit of Figure P 14.8-1.

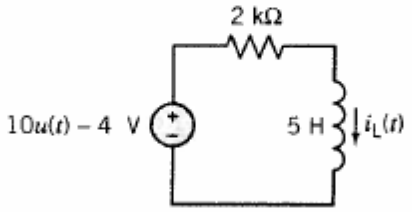


Figure P 14.8-1

$$i_L(t) = \begin{cases} -2 \text{ mA} & t < 0 \\ 3 - 5e^{-400t} \text{ mA} & t > 0 \end{cases}$$

P 14.8-2 Using Laplace transforms, find the response $i_L(t)$ for $t > 0$ for the circuit of Figure P 14.8-2.

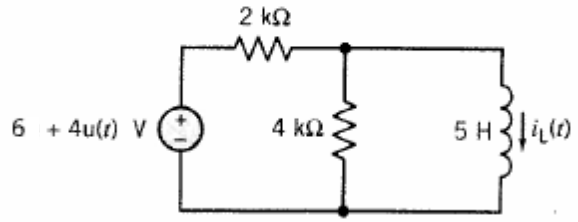


Figure P 14.8-2

$$i_L(t) = 5 - 2e^{-\frac{4000}{15}t} \text{ mA}, \; t > 0$$

P 14.8-3 Using Laplace transforms, find the response $v_c(t)$ for $t > 0$ for the circuit of Figure P 14.8-3.

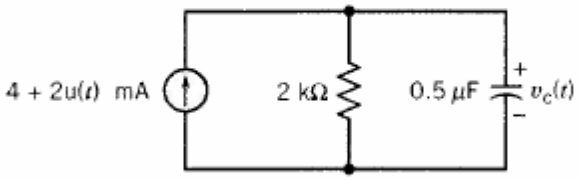


Figure P 14.8-3

$$V_c(t) = 12 - 4e^{-1000t} \text{ V}, \; t > 0$$

P 14.8-4 Using Laplace transforms, find the response $v_c(t)$ for $t > 0$ for the circuit of Figure P 14.8-4.

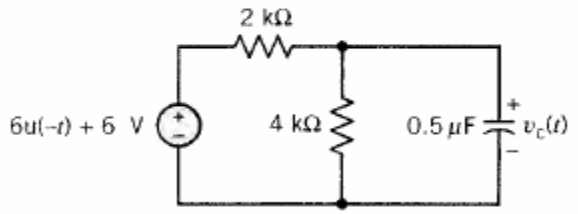


Figure P 14.8-4

$$v_c(t) = 4 + 4e^{-1500t} \text{ V}, \; t > 0$$

P 14.8-5 Using Laplace transforms, find the response $v(t)$ for $t > 0$ for the circuit of Figure P 14.8-5 when $v_s = 6e^{-3t}\,u(t)$ V.
Answer: $v = \frac{44}{3}e^{-2t} + \frac{1}{3}e^{-5t} - 9e^{-3t}$ V

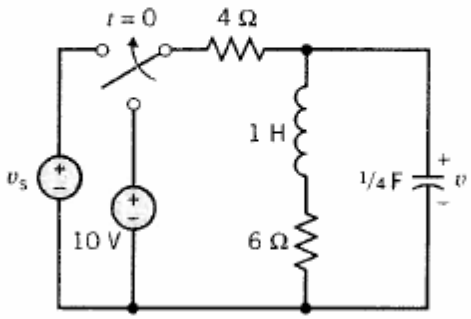
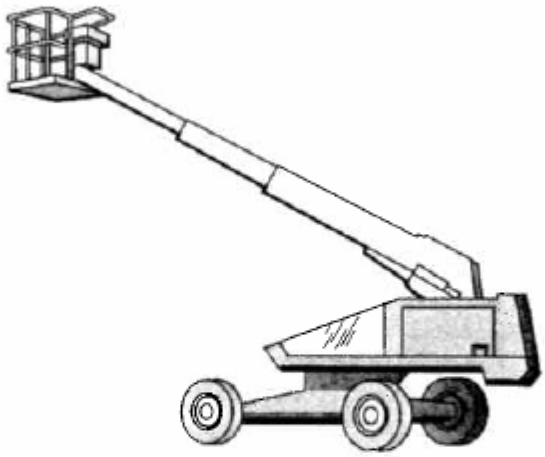


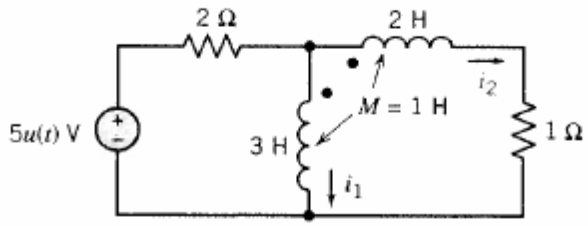
Figure P 14.8-5

$v_c(t) = 44/3\,e^{-2t} - 9e^{-3t} + (1/3)e^{-5t}$ V

P 14.8-7 The motor circuit for driving the snorkel shown in Figure P 14.8-7*a* is shown in Figure P 14.8-7*b*. Find the motor current $I_2(s)$ when the initial conditions are $i_1(0^-) = 2$ A and $i_2(0^-) = 3$ A. Determine $i_2(t)$ and sketch it for 10 seconds. Does the motor current smoothly drive the snorkel?



(a)



(b)

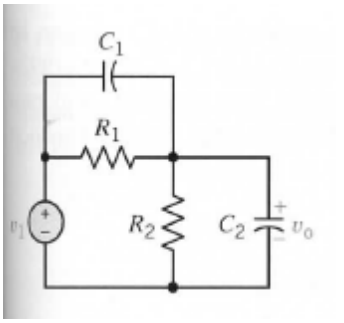
Figure P 14.8-7 Motor drive circuit for snorkel device.

$i_2(t) = 0.64e^{-0.26t} + 2.36e^{-1.54t}$ A for $t > 0$

ΠΙΟ ΠΡΟΧΩΡΗΜΕΝΑ ΠΡΟΒΛΗΜΑΤΑ

P 14.9-1 Consider the circuit of Figure P 14.9-1, where the combination of R_2 and C_2 represents the input of an oscilloscope. The combination of R_1 and C_1 is added to the probe of the oscilloscope to shape the response $v_0(t)$ so that it will equal $v_1(t)$ as closely as possible. Find the necessary relationship for the resistors and capacitors so that $v_0 = av_1$ where a is a constant.

Hint: Find the transfer function $V_0(s)/V_1(s)$. Choose R_1 and C_1 so that the transfer function does not depend on s.



$R_1C_1 = R_2C_2$

P 14.9-2 Consider the circuit shown in Figure P 14.9-2. Show that by proper choice of L, the input impedance $Z = V_1(s)/I_1(s)$ can be made independent of s. What value of L satisfies this condition? What is the value of Z when it is independent of s?

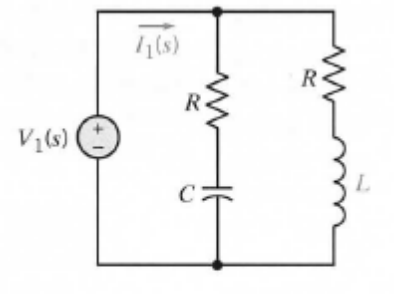


Figure P 14.9-2

$L = R^2C$ then $Z = R$

P 14.9-3 A bridged-T circuit is often used as a filter and i shown in Figure P 14.9-3. Show that the transfer function o the circuit is

$$\frac{V_{out}(s)}{V_{in}(s)} = \frac{1 + (2R_1 + R_2)Cs + R_1R_2C^2s^2}{1 + 2R_1Cs + R_1R_2C^2s^2}$$