a) Eq. differential

\[ e = 2\cos 3t \]

\[ i = 0.1 \frac{d\theta}{dt} + \frac{\theta}{4} \]  

(1)  

\[ e = 2i + 0.1 \frac{di}{dt} + \theta \]  

(2)  

Substitute \( e \) in (1) and (2)  

\[ 2\cos 3t = 0.2 \frac{d\theta}{dt} + \frac{\theta}{2} + 0.1 \frac{d}{dt} (0.1 \frac{d\theta}{dt} + \frac{\theta}{4}) + \theta \]

Rearranging

\[ 0.01 \frac{d^2 \theta}{dt^2} + 0.225 \frac{d\theta}{dt} + 1.5\theta = 2\cos 3t \]

\[ \frac{d^2 \theta}{dt^2} + 22.5 \frac{d\theta}{dt} + 150\theta = 200\cos 3t \]

\[ 2\alpha = 22.5 \rightarrow \alpha = 11.25 \text{ rad}^{-1} \]

\[ \omega_0^2 = 150 \rightarrow \omega_0 = \sqrt{150} \approx 12.24 \text{ rad}^{-1} \]
\[ y(t) = A \cos 3t + B \sin 3t \]

Substituting into the differential equation:

\[ \frac{d^2 y}{dt^2} + 22t \frac{dy}{dt} + 150 y = 200 \cos 3t \]

\[ \frac{dy}{dt} = -3A \sin 3t + 3B \cos 3t \]

\[ \frac{d^2 y}{dt^2} = -9A \cos 3t - 9B \sin 3t \]

\[ -9A \cos 3t - 9B \sin 3t + 22t \left( -3A \sin 3t + 3B \cos 3t \right) + 150 \left( A \cos 3t + B \sin 3t \right) = 200 \cos 3t \]

\[ \cos 3t \left( -9A + 3 \times 22 \cos 3t + 150A \right) \]

\[ \sin 3t \left( -9B - 3 \times 22 \sin 3t + 150B \right) = 200 \cos 3t \]

\[ -141A + 67.5B = 200 \]

\[ -67.5A + 141B = 0 \]

\[ \begin{bmatrix} A = 1.154 \ V \\ B = 0.5524 \ V \end{bmatrix} \]

\[ y(t) = 1.154 \ cos 3t + 0.5524 x \sin 3t \]
\[ t < 0: \begin{align*} \vphi(0) &= E = 10V \\ \vphi(0) &= 10V \end{align*} \]

\[ t \geq 0: \]

\begin{align*}
\text{Diagram:} & \quad 2A \\
\text{Diagram:} & \quad 2A = 0 \to 2 \times 3.1 = 6.2V \\
\vphi(t) &= 2t + A e^{t/6} \\
\vphi(0) &= 0 = 6.2 + A \\
\therefore A &= 3.8V \\
\therefore \vphi(t) &= 6.2 + 3.8 e^{t/6} 
\end{align*}
Prova B
\[ V(0^+) = 15 \text{V} \]
\[ V(t) = 1,42 + 13,5 + \exp\left(-\frac{t}{1,42}\right) \]

Prova C
\[ V(0^+) = 18 \text{V} \]
\[ V_t = 3,48 \text{V} \quad R = 0,686 \Omega \]
\[ A = 14,57 \]
\[ V(t) = 3,48 + 14,57 \exp\left(-\frac{t}{0,686}\right) \text{ V} \]
\[ = 24/2 \]

Prova D
\[ V(0^+) = 6 \text{V} \]
\[ V = 273 + 3,27 \exp\left(-\frac{t}{0,273}\right) \]
\[ \delta = 0,1 \times 30 = \frac{3}{11} \]
Eq. de Thévenin do circuito visto pelo indutor:

\[ V_{th} = 0 \]

Portanto, \( V_{th} = 0 \), fazendo \( V_0 \) fonte no circuito

\[ V_{th} = 0 \]

\[ \theta_0 = 3 \, \text{V} \]

\[ 6 + 3i_1 = 3(1 - i_1) \]

\[ \theta = 3 - 3i_1 - 3i_1 \]

\[ \theta = -6i_1 \Rightarrow i_1 = -1/2 \, \text{A} \]

\[ V_0 = 90 + 3i_1 + 20 \]

\[ V_0 = 3 - 1.5 + 6 = 7.5 \, \text{V} \]

\[ I = \frac{V_x}{R} = 1.5 \, \text{V} \]
Problem B:
\[ R_L = 45 \ \Omega, \quad \beta = 0.22 = 2/9 \ \text{A} \]
\[ i(t) = 3e^{-t/0.22} = 8e^{-9t/2} \]

Problem C:
\[ R_L = 75 \ \Omega, \quad \beta = 0.0667 = 1/15 \ \text{A} \]
\[ i(t) = 3e^{-t/0.066} = 3e^{-15t} \]

Problem D:
\[ R_L = 82.5 \ \Omega, \quad \beta = 11.79 \ \text{A} \]
\[ i(t) = 3e^{-t/11.79} \ \text{A} \]
\( q(t) = 2 \quad \forall \quad t \in \mathbb{R} \)

1) \( t \leq 0 \):
   - **Usando substituições da fonte:**
   - Indutor: quanto
   - Capacitor: absoluto
   - \( i(0^-) = 0 \)
   - \( v(0^-) = 2V \)

2) \( t > 0 \) \quad \Rightarrow \quad **CHAVE FECHADA**

**Solução do sinal**

\[
\begin{align*}
\Phi(t) &= A e^{at} + B e^{bt} + g(t) \\
\end{align*}
\]

\[
\begin{align*}
A_1 &= 1 + \sqrt{1 - \frac{1}{2}} = -0,29 \ \tilde{A} \\
A_2 &= 1 - \sqrt{1 - \frac{1}{2}} = -1,71 \\
\end{align*}
\]
\[ A, B \to \]
\[ v(0^+) = 2V \]
\[ \frac{dv}{dt} \bigg|_{t=0^+} = ? \quad \frac{dv}{dt} = \frac{i_c}{C} \]
\[ \therefore \frac{dv}{dt} \bigg|_{t=0^+} = \frac{i_c(0^+)}{C} \]

\[ t = 0^+ \]

\[ v = v_f + v_n \]
\[ v_f = ? \]
\[ v_n = -4V \]

\[ i_c = i = 0 \]

\[ v(0^+) = 2V \]

\[ v_f = Ae^{-0.29t} + Be^{1.71t} \]
\[ A = 7.24V \]
\[ B = -1.24 \]
$g(0^+) = 2 = -4 + A + B \rightarrow (A + B = 6)$

\[
\frac{dg}{dt}|_{t=0^+} = -0.294 - 1.71B = 0
\]

Resolviendo el sistema:

\[
\begin{align*}
A &= 7.24 V \\
B &= -1.24 V
\end{align*}
\]

\[
g(t) = -4 + 7.24 e^{-0.294t} - 1.24 e^{-1.71t} V
\]

$g(0^+) = 2V$  $g(t) = -4V$  Sobre amplitud
**Проблема B:**
\[ \Phi(0^+) = -6V \quad \alpha = 3 \]
\[ \Phi = -12V \quad \omega_0 = 0,1\text{А} \]
\[ A_1 = -0,084 \text{А} \]
\[ A_2 = -0,92 \text{А} \]
\[ A = 6,084 \text{В} \]
\[ B = -0,084 \text{В} \]

**Проблема C:**
\[ \Phi(0^+) = -6V \quad \alpha = 0,75 \text{А} \]
\[ \Phi = -9V \quad \omega_0 = 0,408 \text{А} \]
\[ A_1 = -0,121 \text{А} \]
\[ A_2 = -1,38 \text{А} \]
\[ A = 3,29 \text{В} \]
\[ B = -0,288 \text{В} \]

**Проблема D:**
\[ \Phi(0^+) = -28V \quad \alpha = 2 \text{А} \]
\[ \Phi = -82V \quad \omega_0 = 1 \text{А} \]
\[ A_1 = -0,268 \text{А} \]
\[ A_2 = -3,23 \text{А} \]
\[ A = 4,31 \text{В} \]
\[ B = -0,31 \text{В} \]