1. (a) What is the Laplace Transform of \( f(t) = 3 e^{-2t} u(t) \)?

\[
F(s) = \frac{3}{s + 2}
\]

(b) If \( g(t) = 3e^{-2t}u(t-1) \) find its LT.

\[
g(t) = 3 e^{-2(t-1+1)} u(t-1) = 3 e^{-2} e^{-2(t-1)} u(t-1)
\]

\[
G(s) = \frac{3}{s + 2} e^{-2}
\]

(c) First simplify the function \( f(t) = \delta(t-4) \cos(3t) u(t) + 5u(t-2) \) and then determine its Laplace transform. Mark the poles in the S-plane.

\[
f(t) = \delta(t-4) \cos(3t) u(t) + 5u(t-2)
\]

\[
F(s) = e^{-4s} \cos(3t) + \frac{5 e^{-2s}}{s}
\]

2. Given the equation \( \frac{dy}{dt} + 3y(t) = 3e^{-t/0.5} u(t), \) and \( y(0) = 0 \)

(a) Find \( Y(s) \) and then using partial fractions find \( y(t) \).

\[
\frac{dy}{dt} + 3y(t) = 3 e^{-2t} u(t)
\]

\[
8Y(s) + 3Y(s) = \frac{3}{s + 2}
\]

\[
Y(s) = \frac{3}{(s + 2)(s + 3)} = \frac{k_1}{s + 2} + \frac{k_2}{s + 3}
\]

\[
k_1 = 3, \quad k_2 = -3 \quad y(t) = 3 \left[ e^{-2t} - e^{-3t} \right] u(t)
\]
3. In the circuit below, the switch has been closed for a long time and it is switched open at $t = 0$. Keep all results in terms of capacitance $C$ Farads.

![Figure 1: Circuit diagram](image)

(a) Determine voltage across capacitor $v_c(0-)$

$$v_c(0-) = 30V = v_c(0+)$$

(b) Draw the circuit for $t > 0$ using Laplace transforms for all elements, voltages and currents.

![Laplace transformed circuit diagram](image)

(c) Find $V_c(s)$

\[
V_c(s) \left[ \frac{1}{10} \right] = 30C
\]

\[
V_c(s) \left[ sC + \frac{1}{10} \right] = 30C
\]

\[
V_c(s) = \frac{30C \times 10}{10C(s + 1/10)} = \frac{300C}{10C(s + 1/10)}
\]

\[
V_c(s) = \frac{30}{s + \frac{1}{10C}}
\]