problem 2 HW #9_2

a) $v(t) = -7u(t)$, where $u(t)$ is a step function

$$f(t) \xleftrightarrow{LT} F(s) = \int_{-\infty}^{\infty} f(t)\, e^{-st}\, dt$$

$$v(t) = -7u(t) \Rightarrow V(s) = -7\int_{-\infty}^{\infty} e^{-st}\, dt \Rightarrow -7\left[\frac{-1}{s} e^{-st}\right]_0^{\infty} = \frac{7}{s}$$ ROC: $s \geq 0$

$$\boxed{V(s) = 7/s}$$

b) $v(t) = 8e^{-5t} \Rightarrow V(s) = 8\int_0^{\infty} e^{-st} \cdot e^{-5t}\, dt = 8\int_0^{\infty} e^{-t(s+5)}\, dt$

$$\Rightarrow \frac{-8}{s+5}(0-1) = \boxed{\frac{8}{s+5}}$$

c) $v(t) = (10e^{-1000t} - 5)\, u(t) \Rightarrow \frac{10}{s+1000} - \frac{5}{s} = \frac{10s - 5(s+1000)}{s(s+1000)}$

$$\boxed{V(s) = \frac{(5s - 5000)}{s(s+1000)}}$$

d) $v(t) = e^{-2t} + 4t - u(t) \Rightarrow \boxed{\frac{1}{s+2} + \frac{4}{s^2} - \frac{1}{s}}$

e) $v(t) = 2u(t) + 2\sin(2t) - 2\cos(2t)$

$$V(s) = \frac{2}{s} + 2 \cdot \frac{2}{s^2+2^2} - 2 \cdot \frac{s}{s^2+2^2}$$

$$\boxed{V(s) = \frac{2}{s} + \frac{4}{s^2+4} - \frac{2s}{s^2+4}}$$