$$X(0) = x\, e^{-\lambda \cdot 0} + \frac{\gamma}{\lambda}\left(1 - e^{-\lambda \cdot 0}\right) + \int_0^0 \dots$$

$$= x \cdot 1 + \frac{\gamma}{\lambda} \cdot (1 - 1) + 0$$

$$= x \quad \checkmark$$

$$X(t) = x\, e^{-\lambda t} + \frac{\gamma}{\lambda}\left(1 - e^{-\lambda t}\right) + \int_0^t e^{-\lambda(t-s)}\, \sigma\, dW(s)$$

$$U(t) = e^{-\lambda t} \quad ; \quad V(t) = \int_0^t e^{\lambda s}\, \sigma\, dW(s)$$

$$\hookrightarrow X(t) = U(t) \cdot \left(x + \frac{\gamma}{\lambda U(t)} - \frac{\gamma}{\lambda} + V(t) \right)$$

$$dU(t) = -\lambda e^{-\lambda t}\, dt$$

$$d\left(x + \frac{\gamma}{\lambda U(t)} - \frac{\gamma}{\lambda} + V(t)\right) = \gamma e^{\lambda t}\, dt + e^{\lambda t}\, \sigma\, dW(t)$$

$$\hookrightarrow dX(t) = dU(t) \cdot \left(x + \frac{\gamma}{\lambda U(t)} - \frac{\gamma}{\lambda} + V(t)\right)$$

$$= \left(x + \frac{\gamma}{\lambda U(t)} - \frac{\gamma}{\lambda} + V(t)\right)(-\lambda) e^{-\lambda t}\, dt + \left(\gamma e^{\lambda t}\, dt + e^{\lambda t}\, \sigma\, dW(t)\right) \cdot e^{-\lambda t}$$

$$+\, d[\dots]$$

$$= X(t)(-\lambda)\, dt + \gamma\, dt + \sigma\, dW(t) + 0$$

$$= \left((-\lambda) X(t) + \gamma\right) dt + \sigma\, dW(t) \quad \checkmark$$