a) $P(A) = \sum_{i=1}^{n} P(A / B_i) \cdot P(B_i)$

let $P(\{X(\xi, t) = x_i\}) = P_i$

$$\frac{1}{3}(1 + 2e^{-|\tau|}) = a$$

$$\frac{1}{3}(1 - e^{-|\tau|}) = b$$

$$P_1 = a P_1 + b P_2 + b P_3 \rightarrow ①$$
$$P_2 = a P_2 + b P_1 + b P_3 \rightarrow ②$$
$$P_3 = a P_3 + b P_1 + b P_2 \rightarrow ③$$

$\Rightarrow P_1 - P_2 = a(P_1 - P_2) + b(P_2 - P_1)$

$\Rightarrow P_1 - aP_1 + bP_1 = P_2 - aP_2 + bP_2$

$\Rightarrow \boxed{P_1 = P_2}$

③ $\Rightarrow P_3 - aP_3 = 2bP_1$

$$P_3 - \frac{1}{3}P_3 - \frac{2}{3}e^{-|\tau|}P_3 = \frac{2}{3}P_1 - \frac{2}{3}e^{-|\tau|}P_1$$

$$\frac{2}{3}P_3(1 - e^{-|\tau|}) = \frac{2}{3}P_1(1 - e^{-|\tau|})$$

$$\boxed{P_1 = P_2 = P_3}$$

As $P_1 + P_2 + P_3 = 1$

$$\boxed{P_1 = P_2 = P_3 = 1/3}$$

ⓑ $R_{xx}(\tau) = E\{X(\xi, t+\tau), X(\xi, t)\}$

$$= \sum_{i=1}^{3} \sum_{j=1}^{3} x_i \cdot x_j \, P(\{X(\xi, t+\tau) = x_i \mid X(\xi, t) = x_j\}) \, P(\{X(\xi, t) = x_j\})$$

$$= 1\cdot 1\cdot \frac{1}{3}\left(1+2e^{-|\tau|}\right)\cdot\frac{1}{3} + (-1)(-1)\cdot\frac{1}{3}\left(1+2e^{-|\tau|}\right)\cdot\frac{1}{3}$$

$$+ (-1)(1)\cdot\frac{1}{3}\left(1-e^{-|\tau|}\right)\cdot\frac{1}{3} + (1)(-1)\cdot\frac{1}{3}\left(1-e^{-|\tau|}\right)\cdot\frac{1}{3}$$

$$= \frac{2}{9}\left(1+2e^{-|\tau|}\right) - \frac{2}{9}\left(1-e^{-|\tau|}\right)$$

$$= \frac{6}{9}e^{-|\tau|} = \frac{2}{3}e^{-|\tau|}$$