1. p. 63 #38

2. Assume $X$ is compact subset of $\mathbb{R}^d$ and $\mu$ is a finite measure on $(X, \mathcal{B}_X)$. Let $a < b \in \mathbb{R}$ and $f : X \times [a, b] \to \mathbb{R}$ be $\mathcal{B}_X \times \mathcal{B}_{[a, b]}$-measurable and bounded. Assume also that $\frac{\partial f}{\partial t}(x, t)$ is jointly continuous. Prove that $F(t) = \int_X f(x, t) \, d\mu(x)$ is continuously differentiable on $[a, b]$ (usual convention at the endpoints) and $F'(t) = \int_X \frac{\partial f}{\partial t}(x, t) \, d\mu(x)$ for all $t \in [a, b]$.

3. p. 64 #44 (You can use Thm. 2.26 in the text but please study it make sure you understand why it is true.)

4. p. 68 #46
Note: In this question $\nu$ is not sigma-finite and so the construction we gave for the product measure does not apply. But on p. 64 the text uses Carathéodory Extension to define product measure in terms of the appropriate outer measure without the sigma-finite hypothesis, so you should use this construction to evaluate $\mu \times \nu(D)$. Make sure you evaluate all 3 expressions to show they are all distinct.