Q 3.1

$$E[\theta] = [(X^T X)^{-1} X^T y)]$$

~~X~~ are considered fixed.

$$= (X^T X)^{-1} X^T \cdot E[y]$$

$$= (X^T X)^{-1} X^T \cdot E[X\theta^* + \varepsilon]$$

θ^* is considered fixed.

$$= (X^T X)^{-1} X^T \cdot (X\theta^* + \cancel{E[\varepsilon]}^{\,0})$$

$$= (X^T X)^{-1} X^T \cdot X\theta^*$$

$$= \theta^*$$