One note: If $X$ and $Y$ are independent, then $E(X \mid Y = y) = E(X)$.

Why? If $X$ is discrete:

$$E(X \mid Y = y) = \sum_x (x) p_{X \mid Y}(x \mid y) = \sum_x (x) p_X(x) = E(X).$$

If $X$ is continuous:

$$E(X \mid Y = y) = \int_{-\infty}^{\infty} (x) f_{X \mid Y}(x \mid y) \, dx = \int_{-\infty}^{\infty} (x) f_X(x) \, dx = E(X).$$