$Y = X_1^2 + W$ $\qquad$ X_1 & W are independent

& $\mathbb{E}(W) = 0$

$$\mathbb{E}(Y|X_1) = \mathbb{E}(X_1^2 + W | X_1) \overset{\text{sum}}{=} \mathbb{E}(X_1^2|X_1) + \mathbb{E}(W|X_1)$$

take out what is known/given

drop what is independent

$$= X_1^2 + \mathbb{E}(W) = X_1^2$$

BLP of Y given X_1 $\qquad$ $\beta_0^* + \beta_1^* X_1$

$$\beta_0^* = \underline{\mathbb{E}(Y)} - \beta_1^* \mathbb{E}(X_1)^{= -1}, \qquad \beta_1^* = \frac{\mathrm{Cov}(X_1, Y)}{\mathrm{Var}(X_1)_{= 1}}$$

$\mathbb{E}(Y) = \mathbb{E}(\mathbb{E}(Y|X_1))$

$= \mathbb{E}(X_1^2) = (-1)^2 + 1$

$= 2$

need distribution of X_1

$X_1 \sim N(-1, 1)$ as example

For $X \sim N(\mu, \sigma^2)$ $\quad$ σ^2: $\mathrm{Var}(X)$

$\mathbb{E}(X) = \mu$

$\mathbb{E}(X^2) = \mu^2 + \sigma^2$

$\mathbb{E}(X^3) = \mu^3 + 3\mu\sigma^2$

$$\mathrm{Cov}(X_1, Y) = \mathbb{E}(X_1 Y) - \underbrace{\mathbb{E}(X_1)}_{=-1}\underbrace{\mathbb{E}(Y)}_{=2}$$

So $\mathbb{E}(X_1 Y) = \mathbb{E}(\mathbb{E}(X_1 Y | X_1))$

$= \mathbb{E}(X_1 \mathbb{E}(Y|X_1))$

$= \mathbb{E}(X_1 \cdot X_1^2)$

$= \mathbb{E}(X_1^3) = \ldots$

You can now complete the calculations.