$$Y_0 = f(x_0) + \varepsilon_0 \qquad (3.21)$$

$$\hat{\tilde{f}}(x_0) = x_0^T \hat{\tilde{\beta}}$$

$$E(Y_0 - \hat{f}(x_0))^2 = E\left((Y_0 - E(Y_0)) - (\tilde{f}(x_0) - E(Y_0))\right)^2$$

$$= E(Y_0 - E(Y_0))^2 - 2E\left((Y_0 - E(Y_0))(\tilde{f}(x_0) - E(Y_0))\right) + E(\hat{f}(x_0) - E(Y_0))^2$$

$$= \sigma^2 - \cancel{2E(Y_0)\tilde{f}(x_0)} + \cancel{2E(Y_0)E(Y_0)} + \cancel{2E(Y_0)\tilde{f}(x_0)} - \cancel{2E(Y_0)E(Y_0)} + E(\hat{f}(x_0) - f(x_0))^2$$

$$= \sigma^2 + E\left(x_0^T \hat{\beta} - f(x_0)\right)^2$$

$$= \sigma^2 + MSE\left(\hat{f}(x_0)\right) \qquad (3.22)$$