b.

$$E[\hat{\beta}] = E\left[\sum_{i=1}^{n} w_i y_i\right] = \sum_{i=1}^{n} w_i E[y_i]$$

$$= \sum_{i=1}^{n} w_i \times (x_i \beta)$$

$$= \sum_{i=1}^{n} \left(\frac{x_i}{\sum_{j=1}^{n} x_j^2}\right) x_i \beta$$

$$= \beta \sum_{i=1}^{n} \left(\frac{x_i^2}{\sum_{j=1}^{n} x_j^2}\right) = \beta$$

c. $$Var[\hat{\beta}] = Var\left[\sum_{i=1}^{n} w_i y_i\right]$$

$$= \sum_{i=1}^{n} w_i^2 Var[y_i]$$

$$= \sum_{i=1}^{n} w_i^2 \sigma^2$$

$$= \sigma^2 \times \sum_{i=1}^{n} \left(\left(\frac{x_i^2}{\sum_{j=1}^{n} x_j^2}\right)^2\right)$$

$$\sigma^2 \times \frac{\sum_{i=1}^{n} x_i^2}{\left(\sum_{j=1}^{n} x_j^2\right)^2}$$

$$\frac{\sigma^2}{\sum_{j=1}^{n} x_j^2}$$