Question

Test

Consider the linear model $y = Xb + e$, with y $(n \times 1)$, X $(n \times k)$, b $(k \times 1)$, and e $(n \times 1)$. For given y, X and b, $e = y - Xb$. Find an expression without parentheses for the sum of squared residuals $e'e$.

Answer

$$\begin{aligned} e'e &= (y - Xb)'(y - Xb) \\ &= (y' - (Xb)')(y - Xb) = (y' - b'X')(y - Xb) \\ &= y'y \boxed{- y'Xb - b'X'y} + b'X'Xb \\ &= y'y \boxed{- 2y'Xb} + b'X'Xb \end{aligned}$$

$b'X'y$ returns a scalar, so $b'X'y = y'Xb$.