

Jenny's answers to Quiz 1
(Please return)

① $(AB)^{-1} = B^{-1}A^{-1}$ because (1 mark)

$(B^{-1}A^{-1})(AB) = B^{-1}IB = B^{-1}B = I$ and (2 marks)

$(AB)(B^{-1}A^{-1}) = AIA^{-1} = AA^{-1} = I$ (2 marks)

② $\frac{d}{d\beta_1} \log \prod_{i=1}^n \frac{1}{4\sqrt{2\pi}} e^{-\frac{1}{2 \cdot 16} (y_i - \beta_1 x_i)^2}$ (3 marks)

Constructing the log likelihood function with the correct

$\epsilon_i = y_i - \beta_1 x_i$
(3 marks)

$= \frac{d}{d\beta_1} \left[\log \left(\frac{1}{4\sqrt{2\pi}} \right)^n - \frac{1}{32} \sum_{i=1}^n (y_i - \beta_1 x_i)^2 \right]$

$= -\frac{1}{32} \sum_{i=1}^n \frac{d}{d\beta_1} (y_i - \beta_1 x_i)^2 = -\frac{1}{32} \sum_{i=1}^n 2(y_i - \beta_1 x_i)(-x_i)$

taking the derivative
(1 mark)

$= +\frac{1}{16} \sum_{i=1}^n x_i (y_i - \beta_1 x_i) \stackrel{\text{set}}{=} 0$

$\Rightarrow \sum_{i=1}^n x_i y_i = \beta_1 \sum_{i=1}^n x_i^2 \Rightarrow$

$$\beta_1 = \frac{\sum_{i=1}^n x_i y_i}{\sum_{i=1}^n x_i^2}$$

Final answer
(1 mark)