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$$1) \quad a) \quad y = \frac{1}{1 + e^{-t}} \leadsto \frac{1}{y} = 1 + e^{-t} \leadsto \ln\left(\frac{1}{y} - 1\right) = -t$$

$$\begin{bmatrix} n & \sum x_i \\ \sum x_i & \sum x_i^2 \end{bmatrix} \begin{bmatrix} -\beta_0 \\ -\beta_1 \end{bmatrix} = \begin{bmatrix} \sum \left(\ln\left(\frac{1}{y_i} - 1\right)\right) \\ \sum \left(\ln\left(\frac{1}{y_i} - 1\right) \cdot x_i\right) \end{bmatrix}$$

$$b) \quad \ln\left(\frac{1}{y} - 1\right) = -(-2) - (0,2) \cdot (20)$$

$$\ln\left(\frac{1}{y} - 1\right) = 2 - 4$$

$$\frac{1}{y} - 1 = e^{-2}$$

$$\frac{1}{y} = e^{-2} + 1$$

$$y = \frac{1}{e^{-2} + 1}$$

$$y \approx 0,88$$

2)

a)

$$\begin{bmatrix} 1 & a_1 & a_1^2 \\ 1 & a_2 & a_2^2 \\ 1 & a_3 & a_3^2 \\ 1 & a_4 & a_4^2 \\ 1 & a_5 & a_5^2 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 4 \\ 1 & 3,5 & 12,25 \\ 1 & 4 & 16 \\ 1 & 5,1 & 26,01 \\ 1 & 7 & 49 \end{bmatrix}$$

$$b) q_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} \cdot \frac{1}{\sqrt{1^2+1^2+1^2+1^2+1^2}} = \frac{1}{\sqrt{5}} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \frac{\sqrt{5}}{5} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \end{bmatrix}$$

$$q_2 = \begin{bmatrix} 2 \\ 3,5 \\ 4 \\ 5,1 \\ 7 \end{bmatrix} - \left(\left(2 \cdot \frac{\sqrt{5}}{5} \right) + \left(3,5 \cdot \frac{\sqrt{5}}{5} \right) + \left(4 \cdot \frac{\sqrt{5}}{5} \right) + \left(5,1 \cdot \frac{\sqrt{5}}{5} \right) + \left(7 \cdot \frac{\sqrt{5}}{5} \right) \right) \cdot \begin{bmatrix} \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \end{bmatrix} \div \|x_2 - (x_2 \cdot q_1) q_1\|$$

$$q_2 = \begin{bmatrix} 2 \\ 3,5 \\ 4 \\ 5,1 \\ 7 \end{bmatrix} - 26,1 \cdot \frac{\sqrt{5}}{5} \cdot \begin{bmatrix} \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \\ \sqrt{5}/5 \end{bmatrix} = \frac{26,1}{5} \cdot \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} 2 - 26,1/5 \\ 3,5 - 26,1/5 \\ 4 - 26,1/5 \\ 5,1 - 26,1/5 \\ 7 - 26,1/5 \end{bmatrix} = \begin{bmatrix} -3,22 \\ -1,72 \\ -1,22 \\ -0,12 \\ 1,78 \end{bmatrix}$$

$$\div \|x_2 - (x_2 \cdot q_1) q_1\|$$

$$\begin{aligned} & \sqrt{(-3,22)^2 + (-1,72)^2 + (-1,22)^2} \\ & \sqrt{(-0,12)^2 + (1,78)^2} \\ & 4,2424 \end{aligned}$$

$$q_2 = \begin{bmatrix} -0,759 \\ -0,405 \\ -0,288 \\ -0,028 \\ 0,420 \end{bmatrix}$$

$$2) \text{ c) } \begin{matrix} \begin{bmatrix} 2,24 & 9,66 & 47,97 \\ 0 & 3,73 & 34,05 \\ 0 & 0 & 6,27 \end{bmatrix} & \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \end{bmatrix} & = & \begin{bmatrix} 8,14 \\ 2,78 \\ -0,42 \end{bmatrix} \\ \mathcal{R} & \beta & & Q'y \end{matrix}$$

$$\therefore 6,27 \beta_2 = -0,42 \Rightarrow \beta_2 \approx -0,07$$