1 a.

$N = 3$ $(0,6), (1,0)$ and $(0,0)$

$(x_1, y_1), (x_2, y_2)\ (x_3, y_3)$

used from slide 14:

$$\hat{B}_1 = \frac{\sum_{n=1}^{N}(x_n-\bar{x})(y_n-\bar{y})}{\sum_{n=1}^{N}(x_n-\bar{x})^2} = \frac{Sxy}{Sxx} \qquad \hat{B}_0 = \frac{1}{N}\left(\sum_{n=1}^{N} y_n - \hat{B}_1 \sum_{n=1}^{N} x_n\right)$$

where $\bar{x} = \frac{1}{N}\sum_{n=1}^{N} x_n$ and similarly for the y-variable

Computing in R for $Sxy, Sxx, \hat{B}_0, \hat{B}_1$

$c(\hat{B}_0, \hat{B}_1) = (3, -3)$

$\hat{B}_0 = 3$

$\hat{B}_1 = -3$

b. The least-squares minimization problem uses the sum of the squares, not the abs value. The paramators would be incorrect because of the changes in signs. The above prob. had the denominator or sxx, squared making it pos. but the above remained the same sign. Using the abs. value thus would change the signs of $\hat{B}_0, \hat{B}_1$

3

(x_n, y_n), $n=1, \dots N$ ordered pairs

$y_n, n=1, \dots, N$

$\hat{y}_n = \hat{B}_0 + \hat{B}_1 x_n$ for $n=1, \dots, N$

$$\sum_{n=1}^{N} y_n = \sum_{n=1}^{N} \hat{y}_n$$

Always true,

$$\hat{y}_n = \hat{B}_0 + \hat{B}_1 x_n + \hat{\varepsilon}_n$$

$$\sum_{n=1}^{N} y_n = \sum_{n=1}^{N} (\hat{B}_0 + \hat{B}_1 x_n) + \sum_{n=1}^{N} \hat{\varepsilon}_n$$

$$= \sum_{n=1}^{N} \hat{y}_n + \cancel{\sum_{n=1}^{N} \hat{\varepsilon}_n}^{\to 0}$$

$$\sum_{n=1}^{N} y_n = \sum_{n=1}^{N} \hat{y}_n$$