Question 1: Logistic/Cross-Entropy

[4 marks]

Consider the combination of the logistic activation function,

$$y = \sigma(z) = \frac{1}{1 + e^{-z}} \quad , \quad z \in \mathbb{R} \, , \tag{1}$$

with the cross-entropy loss function,

$$L(y, t) = -t \ln y - (1 - t) \ln(1 - y) \quad , \quad t \in \{0, 1\} \, . \tag{2}$$

Derive the simplest expression you can for $\frac{\partial L}{\partial z}$. Make sure your proof is organized, and explain your steps.

Submitting Mathematical Derivations

You will submit your solution as a PDF to Kritik. In preparing your solution, you may:

- typeset your answer in a word-processing application, like Word or LaTeX,
- handwrite your answer on a tablet computer, or
- handwrite your answer on paper, and take a photo or scan.

No matter which option you choose, it is your responsibility to ensure the PDF you submit is of sufficient quality that others can reasonably understand your work.