## Problems

**Problem 4.1.**     (1 point)

Prove that there does not exist a weak derivative for the function

$$u(x) = \begin{cases} x & \text{if } 0 < x \leq 1 \\ 2 & \text{if } 1 \leq x < 2 \end{cases}.$$

(**Hint:** *Write the definition of weak derivative and use a sequence of test functions $\{\varphi_m\}$ that have value 1 at $x = 1$ and approach zero as $m \to \infty$ for all other points $x \in (0, 2)$, $x \neq 1$. )*

**Problem 4.2.**     (1 point)

Give some counterexample showing that Friedrichs' inequality does not hold for functions that do not have zero trace on the boundary.

(**Hint:** *It is enough to work in dimension 1 and use continuous functions, where the notion of trace coincides with values on the boundary.)*