Problem 1:

Find a function $f \in C^2(\mathbb{R})$ with $f \notin C^3(\mathbb{R})$.

Problem 2:

(a) Use the differential quotient to determine the derivative of

$$f : \mathbb{R} \longrightarrow \mathbb{R}, \quad x \longmapsto x^n, \quad n \in \mathbb{N}$$

(b) Consider the functions $f, g : \mathbb{R} \longrightarrow \mathbb{R}$

With f differentiable in x_0 and $f(x_0) = 0$ and

g continuous in $x_0 = 0$.

Show that $f \cdot g$ is differentiable in x_0.

Problem 3:

Show that the function $f : \left[-\frac{\pi}{2}, \frac{\pi}{2}\right] \longrightarrow \mathbb{R}$ given by

$$f(x) = x^2 e^{\sin(x)}$$

has 3 extrema.