

4. [12 points] Consider the continuous, piecewise-defined function $r(x)$ given as follows:

$$r(x) = \begin{cases} -x^2 - 2x & \text{if } x < 0 \\ xe^{-x} & \text{if } x \geq 0 \end{cases}.$$

For each part below, you must use calculus to find and justify your answers. Make sure your final conclusions are clear, and that you show enough evidence to justify those conclusions.

It may be helpful to note that $e \approx 2.72$ and/or that $\frac{1}{e} \approx 0.37$.

- a. [4 points] Find all critical points of $r(x)$. Show all your work.

Answer: Critical point(s) at $x =$ _____

- b. [4 points] Find the x -coordinates of all global minimum(s) and global maximum(s) of $r(x)$ **on the interval** $[-2, 1]$. If there are none of a particular type, write NONE.

Answer: Global max(es) at $x =$ _____

Answer: Global min(s) at $x =$ _____

- c. [4 points] Find the x -coordinates of all global minimum(s) and global maximum(s) of $r(x)$ **on the interval** $(-\infty, \infty)$. If there are none of a particular type, write NONE.

Answer: Global max(es) at $x =$ _____

Answer: Global min(s) at $x =$ _____