9. [10 points] The continuous function $w(x)$ is defined piecewise for all real numbers by the rule

$$w(x) = \begin{cases} -x^2 + 3x + 1 & x < -1 \\ 3x^{1/3} & -1 \leq x \leq 1 \\ -x^2 + 3x + 1 & x > 1. \end{cases}$$

a. [5 points] Find the x-coordinates of all critical points of $w(x)$. If there are none, write NONE. Show your work.

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

b. [3 points] Let $L(x)$ be the linear approximation of the function $w(x)$ at the point $x = \frac{1}{2}$. Find a formula for $L(x)$. Your answer should not include the letter w, but you do not need to simplify.

Answer: $L(x) =$ _____

c. [2 points] Does $L(x)$ give an overestimate or underestimate for $w(x)$ near $x = \frac{1}{2}$? Circle your answer below, and show work to justify your answer.

UNDERESTIMATE OVERESTIMATE

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