

5. [9 points] A function $u(x)$ and its first and second derivatives are given by the formulas

$$u(x) = 2x^2 - \ln|x|, \quad u'(x) = \frac{(2x-1)(2x+1)}{x}, \quad \text{and} \quad u''(x) = \frac{1}{x^2} + 4.$$

Note that $u(x)$ is defined for all real numbers except $x = 0$.

- a. [2 points] List the x -coordinates of all critical points of $u(x)$. (*No justification required.*)

Answer: Critical points at $x =$ _____

- b. [4 points] Use the **first derivative test** to find the x -coordinates of all local minima and local maxima of $u(x)$. If there are none of a particular type, write NONE. Be sure you show enough evidence to support your conclusions.

Hint: Remember that $u(x)$ is undefined at $x = 0$.

Answer: Local min(s) at $x =$ _____ and Local max(es) at $x =$ _____

- c. [3 points] Note that $u''(x)$ is positive wherever it is defined.

i. How could you use this fact to verify your answer to part **b.**? Briefly explain.

ii. What does this fact tell you about the number of inflection points of $u(x)$? Briefly explain.