

6. [5 points] Consider the differentiable function  $Z$  defined by

$$Z(v) = \begin{cases} \frac{e^{v-1} - v}{(v-1)^2} & \text{if } v \neq 1 \\ \frac{1}{2} & \text{if } v = 1. \end{cases}$$

Use the limit definition of the derivative to write an explicit expression for  $Z'(1)$ .

*Your answer should not involve the letter  $Z$ . Do not attempt to evaluate or simplify the limit.*

Please write your final answer in the answer box provided below.

**Answer:**  $Z'(1) =$

7. [6 points] Consider the family of functions

$$g(x) = 16r^3 \ln(|x|) + \frac{1}{3}k^3x^3$$

where  $r$  and  $k$  are nonzero constants. Note that

$$g'(x) = \frac{1}{x}(k^3x^3 + 16r^3) \quad \text{and} \quad g''(x) = \frac{1}{x^2}(2k^3x^3 - 16r^3).$$

Find values of  $r$  and  $k$  so that  $g(x)$  has an inflection point at  $(1, 9)$ . Be sure to justify that  $(1, 9)$  is in fact an inflection point of  $g(x)$  for your choice of  $r$  and  $k$ .

**Answer:**  $r =$  \_\_\_\_\_ and  $k =$  \_\_\_\_\_