

9. [9 points] A Math 115 coordinator is trying to create functions with certain properties in order to test students' understanding of various calculus concepts.

a. [5 points] He wants a function  $f(x)$  of the form

$$f(x) = \begin{cases} ax^2 + ax + be^x & \text{for } x < 0 \\ a + 2\cos(x) & \text{for } x \geq 0 \end{cases}$$

where  $a$  and  $b$  are constants.

Find all value(s) of  $a$  and  $b$  for which  $f(x)$  be differentiable at  $x = 0$ . Show enough work to justify your answer.

**Answer:**  $a =$  \_\_\_\_\_,  $b =$  \_\_\_\_\_

b. [4 points] The coordinator also wants a function  $g(x) = cx - e^x$ , where  $c$  is a constant, so that  $g(x)$  has at least one critical point. What condition(s) on  $c$  will make this true?

Find the  $x$ -values of all critical points in this case. Your answer may be in terms of  $c$ .

**Answer:** Critical points at  $x =$  \_\_\_\_\_ when  $c$  satisfies \_\_\_\_\_.