

7. [9 points] Consider the family of functions

$$f(x) = ax^2e^{-bx}$$

where  $a$  and  $b$  are positive constants. Note that

$$f'(x) = ax(2 - bx)e^{-bx}.$$

a. [4 points] Find the exact values of  $a$  and  $b$  so that  $f(x)$  has a critical point at  $(4, e^{-2})$ .

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

b. [5 points] Using your values of  $a$  and  $b$  from the previous part, find and classify the local extrema of  $f(x)$ . Use calculus to find and justify your answers, and be sure to show enough evidence that you have found them all. For each answer blank, write NONE if appropriate.

**Answer:** Local max(es) at  $x =$  \_\_\_\_\_ Local min(s) at  $x =$  \_\_\_\_\_