Problem 4: What's Going on at 0?

Consider the function

$$f(x) = \begin{cases} x \ln(x), & x > 0 \\ 0, & x = 0 \\ e^x - 1, & x < 0 \end{cases}$$

1. Is f continuous at $x = 0$?

2. Is f differentiable at $x = 0$?

As always, show your work, fully explain and justify your answer. A solution mainly obtained by computers or calculators, or answers without proper justification will not be accepted.