Name: ———————————————————————   ————— / 20

There are 20 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. **[12 points]** Compute the derivatives of the following functions. Simplify your answers.

   a. $f(r) = (1 - r^3)\sec(r)$

   b. $f(x) = \dfrac{\cos(x)}{1 - e^{ax}}$, where a is a constant real number.

   c. $f(t) = \sqrt{1 + t^2 e^t}$.

   d. $f(x) = \tan\left(x^2 - e^{\sin(x)}\right)$

2. [4 points] The length of a day in a certain city is given by

$$L(t) = 12 + 8\sin\left(2\pi\frac{t-80}{365}\right).$$

where L is measured in hours and t is measured in days, with $t = 0$ representing January 1.

    a. Compute $L'(t)$.

    b. Suppose you have computed $L'(220) \approx -0.1$. Interpret what this means in precise language that your parents could nevertheless understand. Your answer must include units for full credit.

3. [4 points] Determine all times t such that the graph of $y = \sin(3x) - 3x$ has a horizontal tangent.