

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

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

c.  $f(t) = \sqrt{1 + t^3 e^t}$ .

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

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

$$L(t) = 12 + 6 \sin\left(2\pi \frac{t-80}{365}\right).$$

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  $L'(245) \approx -0.1$ . 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  $y = 2x - \sin(2x)$  has a horizontal tangent.