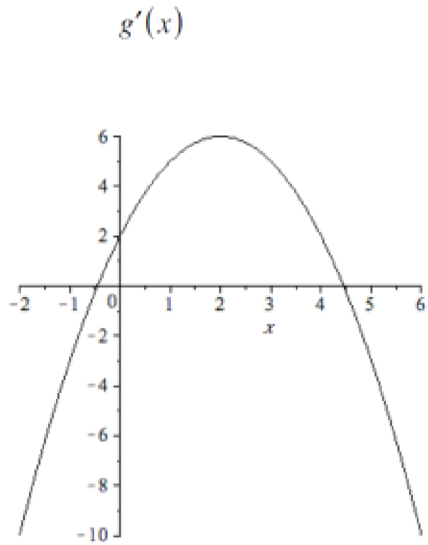
M124
Fall 2023

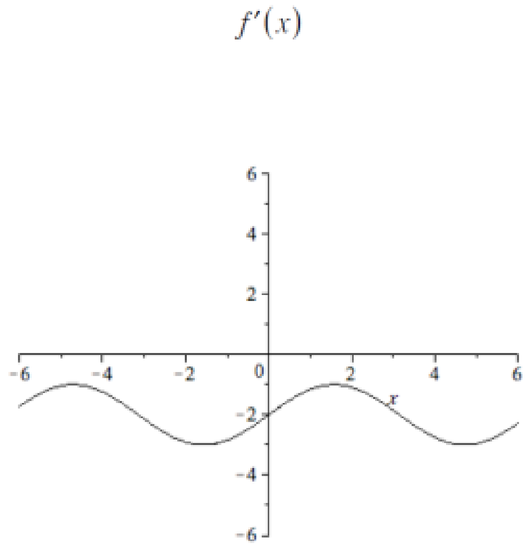
Quiz 3

Name:__________

No calculators or notes allowed. Please show all your work (an answer with no justification will may not get credit).

1. Below are the graphs of the **derivatives** of two functions, f and g.





For each statement, write **True** if the statement must be true, write **False** if the statement must be false. If there is not enough information (if the statement might be true and might be false), write **NED**.

Also include a short reason for each.

(a) $g''(x)$ is a decreasing function.

(b) $f(x)$ is a decreasing function.

(c) $g(x)$ is increasing on the interval $[-2, 2]$.

(d) The largest value of $f(x)$ on $[-2, 2]$ is $f(-2)$.

(e) $g(x)$ is always concave down.

2. Find k so that the following function is continuous:

$$f(x) = \begin{cases} kx & \text{if } 0 \leq x < 2 \\ 3x^2 & \text{if } x \geq 2. \end{cases}$$

If you get stuck, for partial credit state the definition of continuity of f at $x = a$.

3. If $f(3) = -1$ and $f'(3) = 2$, then estimate the value of $f(3.1)$ using the tangent line approximation to f at $x = 3$.

4. A can of soda has been in a refrigerator for several days; the refrigerator has been set to 4°C. Upon removal, the soda is placed on a kitchen table where the temperature is a constant 22° C. One hour later, the temperature of the soda is 10°.

   If $F(t) = a \cdot b^t + c$ is the temperature (in Celsius) at time t (in hours), find the (exact) values of a, b, c.

5. (a) Write the expression in logarithmic form: $100^{1/2} = 10$.

   (b) Write the expression in exponential form: $\log_{10}(1/100) = -2$

6. Solve each equation, and leave your answer in exact form:

   (a) $4 - \ln(3 - x) = 0$

   (b) $4 \cdot 3^{2x+1} = 8$

7. Suppose that the population at time t (in days) is modeled by the function $P(t) = Ae^{kt}$. If the initial population is 6 and the doubling time is 5 days, then find exact values of A and k: