Quiz 3 (100 points) Due in class 6/5/2018 Name:

NOTE: YOU MUST SHOW YOUR WORK TO RECEIVE FULL CREDIT. REMEMBER TO BOX YOUR FINAL ANSWER(S).

1. (15 pts) Let $g(x) = f(x) \cdot e^x$. Differentiate $g(x)$ and write $g'(x)$ in terms of $g(x)$, $f'(x)$, and e^x.

2. (15 pts) Let $h(x) = \frac{f(x)}{g(x)}$. Differentiate $h(x)$ using the product rule. (Hint: Write $\frac{1}{g(x)}$ as $[g(x)]^{-1}$.)

3. (10 pts) Let $h(x) = (x-5)(x-5)(x-4)(x-3)$. Differentiate $h(x)$ using the product rule. Which of the roots of $h(x)$ is also a root of $h'(x)$?

4. (10 pts) Identify the simple functions used in the composition of $h(x) = \ln\left(\sqrt{(x^3+5x+4)}\right)$

5. (8 pts) Differentiate $h(x) = 2^{\sqrt{x}}$.

6. (15 pts) Differentiate $h(t) = 2^{t^3} \cdot 2^{5t^2} \cdot 2^t$. (Hint: Use the chain rule.)

7. (15 pts) Using log rules to put $h(x) = \log_a |f(x)|$ in terms of $\ln |f(x)|$ and differentiate $h(x)$.
   (a) Raise a to the $h(x)$ and raise a to the $\log_a |f(x)|$. Set both quantities equal and simplify.

   (b) Take the natural log of both sides of your previous solution.

   (c) Solve for $h(x)$.

8. (12 pts) Let $h(t) = e^{10t}$.
   (a) Differentiate $h(t)$.

   (b) Differentiate your solution to part (a).

   (c) Differentiate your solution to part (b).

   (d) Based on parts (a), (b), and (c) let's create a rule for differentiating e^{ct}. If $\frac{d^n}{dx^n} f(x)$ means "take the derivative of $f(x)$ n times", then
   $$\frac{d^n}{dt^n} e^{ct} = c^? e^{ct}.$$
   What should the question mark be replaced with in the equation?