Calculus I, Exam 2: Week 9 Version

Fall 2016

- **You may not collaborate on this exam; do not work with others.**
- This exam is open notes, open book. This exam is untimed, but unless I hear otherwise, I expect you to finish by Wednesday, Friday November 9, 2016.
- When you are done with the exam, give it to me or put it under my door. Please don't put it my mailbox.
- To receive full credit on most of these problems you must show your work clearly. You can check your work with a computer, but you need to make your calculational methods clear.

1. Let $f(10) = 5$, $g(10) = 3$, $f(4) = 2$, $g(4) = 10$, $f'(10) = \frac{1}{3}$, $g'(10) = 4$, $f'(4) = 7$, $g'(4) = -4$. If $h(x) = 2f(x)g(x)$, and $w(x) = f(g(x))$.

   (a) Find $h(10)$.

   (b) Find $h'(10)$.

   (c) Find $w(4)$.

   (d) Find $w'(4)$.

2. Find the derivative of the following functions:

   (a) $f(x) = 613 + (3x^4 - 5)^{69}$

   (b) $f(x) = \sin(\pi x^2)$

   (c) $f(x) = \frac{e^{2x}}{(1-x)^2}$

   (d) $f(x) = 3^x \cos(2x)$

   (e) $f(x) = \sqrt{3x + \cos(4x)}$

   (f) $f(x) = \frac{3}{x^2} + 7 + 2\ln(3x)$

   (g) $f(x) = e^{-5x^2}$

3. Find the local linearization of $f(x) = \ln(1 + 5x)$ at $x = 0$.

4. Let $g(x) = x^3 - 3x^2 + 17$.

   (a) Find and classify all critical points of $g(x)$. Determine x and y values exactly. Don't just estimate them from a graph.

   (b) For what values of x is $g(x)$ concave down? Solve for x exactly—don't just look at a graph and approximate the answer.