Homework 9

Math 147, Fall 2017

This homework is due on Thursday, Oct. 26.

0. Read Sections 4.8 and 5.1. After reading these sections, you should be able to answer the following questions (which are *not* to be turned in).
   - The Mean-Value Theorem guarantees (under certain hypotheses) the existence of a number c with $a < c < b$ such that $f'(c) = \frac{f(b)-f(a)}{b-a}$. Does it tell you where in the interval (a, b) the number c is, or how many such c exist? Could there be two? Could there be infinitely many? (Consider a straight line.)
   - What does Rolle's Theorem say? How is it related to the Mean-Value Theorem?
1. Compute the derivative of $f(x) = x^2 + x^{\cos x} - (\ln x)^x$.
2. (a) Determine $\sin\left(\arccos \frac{3}{5}\right)$. *Hint:* Let $\theta = \arccos \frac{3}{5}$ be one angle of a right triangle.
   (b) Determine $\cos\left(\arcsin \frac{3}{5}\right)$.
3. Determine the value(s) of m and b that make the following function differentiable:
$$f(x) = \begin{cases} \arctan x & \text{if} \quad x < 1 \\ mx + b & \text{if} \quad x \geq 1 \end{cases}$$
4. (a) Determine the linear approximation of $f(x) = e^{2x}$ at $x = 0$.
   (b) Use the linear approximation you found to estimate $e^{-0.4}$.
5. Section 4.8 # 10, 16, 18, 38
6. Section 5.1 # 4, 26, 32, 38, 42, 48
7. (*Extra credit: 2 pts.) *Do the practice exam, and staple your solutions to your homework.*
8. (These problems are *not* to be turned in!) Section 4.7 # 18, 22; Section 4.8 # 1, 7, 11, 17, 25, 33, 37; Section 5.1 # 3, 9–12, 17, 25, 33, 35, 45, 46, 47, 53, 54

Reminder: The second exam is on Thursday–Friday, October 26–27. Please bring pencils and a 15-question scantron form. The topics for the exam are from Sections 4.2–4.8 and 5.1. The following questions may guide your studying for the exam:

- When should I use the product rule? chain rule? implicit differentiation? logarithmic differentiation? the formula for the derivative of an inverse function?
- What steps do I take when doing a related rates problem? doing implicit differentiation? logarithmic differentiation? finding global max/min?
- Can I use the power rule for computing the derivative of x^x? What about 5^x or x^5?
- How can I determine whether a piecewise function is continous and/or differentiable?
- How can I find the differential equation for a radioactive decay function or an exponential growth function?
- How do I compute acceleration? velocity? the instantaneous per-capita growth rate?
- What do the extreme-value and mean-value theorems say?