

MATH 311H: Homework 11

Due: Monday, November 27 at 5 pm. Note that you have two weeks to do this assignment, because of the midterm and the holiday break.

1. Upcoming office hours are Monday November 13 and Thursday November 16 10-11 in LSH 102D and Monday November 20 10-11 in LSH 102D and also 3-4 on Zoom at Meeting ID 570 840 4797 with passcode cycle.
2. A reminder that Midterm 2 is on Tuesday November 21 (on which day the university runs on a Thursday schedule). It covers Sections 3.3-4 and 4.1-5, which is to say through nearly the end of lecture on Monday November 13. Test protocols are the same as last time; a sample midterm is posted.
3. Do problems 4.4.2*, 4.4.5, 4.4.6, 4.5.2*, and 5.2.5 in Abbott. In 5.2.5, note that “twice-differentiable at 0” means that the derivative function exists on a neighborhood of 0 and is itself differentiable at 0.
4. Prove that*
 - (a) There is some $x \in (0, \frac{\pi}{2})$ for which $x = \cos(x)$.
 - (b) There is some $x \in (0, 1)$ with the property that $xe^x = 2$.

Remark: You can assume that $\cos x$, e^x are continuous functions on \mathbb{R} .

5. Prove that a polynomial function $p(x)$ of odd degree has at least one real root, that is, there is at least one $r \in \mathbb{R}$ such that $p(r) = 0$.
6. Calculate the derivatives of the following functions using the definition of the derivative.
 - $f(x) = \frac{3x+4}{2x-1}$ at $x = 1$.
 - $g(x) = x^2 \cos x$ at $x = 0$.
 - $h(x) = \frac{1}{x}$ at any $c \neq 0$.