Practice Exam 2

Tuesday, March 10, 2015

Instructions

- *You have 40 minutes to complete this exam.*
- *Write on your own paper, not this exam.*
- *No calculators, phones, books, or collaboration.*
- *You may not use results not covered yet in class.*
- *Fully justify all answers.*
- *You do not need to simplify your answers unless the problem says otherwise.*

Problems (5 problems, front and back)

1. Calculate derivatives:

   (a) $x \ln(\cos(x))$

   (b) $\dfrac{x^2 - 2x + 3}{x - 7}$

   (c) $3\tan^2(x) + 4\cos^2(x)$

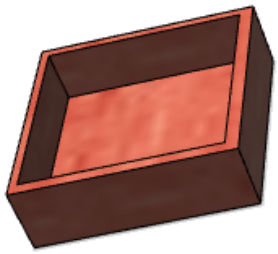
   (d) $\sqrt{5x} - \sqrt{3x}$

   (e) 4^x

2. Prove that
$$\frac{d}{dx}\tan^{-1}(x) = \frac{1}{1+x^2}$$
using implicit differentiation and your knowledge of trigonometry.

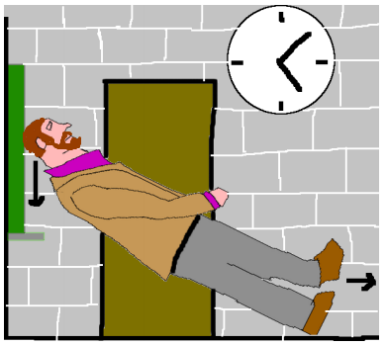
3. Sketch a graph of the function
$$f(x) = \frac{x}{x^2+3},$$
indicating any and all local extrema, inflection points, and/or asymptotes the function may have. *[Tip: for a problem like this, which will involve a great deal of arithmetic, as well as calculations that depend on previous calculations, it's a really good idea to check your work at each step before moving on. Otherwise you might mess something up near the beginning and end up doing a lot of useless work.]*

4. You want to construct an open-topped cardboard box with a square base, like so:



If the box needs to have a volume of four cubic meters, how many square meters of cardboard do you need to buy? (Don't worry about taking the thickness of the cardboard into account).

5. A five-foot-tall man leans against a wall to take a nap. After a while, his feet start sliding away from the wall at a rate of one inch per minute. His head remains against the wall, and his body remains rigid, like so:



How fast is his head sliding down the wall when its four feet above the ground?

Exam 1 will be held Wednesday, March 11 – that's tomorrow! – from 6 PM - 8 PM in Lecture Center A1.

Full solutions to this practice exam will be available at `http://math.uic.edu/~mclaury` this evening. And I have my usual office hours 3 PM - 4 PM today in the MSLC, located in SEO 430. The MSLC is open until 6 PM this evening and will open at 8 AM Wednesday morning.

Discussion classes are cancelled this Thursday.