Discussion Problems for Math 180

Tuesday, March 31, 2015

Review

1. Write as a single logarithm: $2\ln(x) - \ln(y) + 1$

2. What is $\sin\left(\dfrac{\pi}{12}\right)$?

3. A water balloon dropped from the top of University Hall will[1], at time t, have a height of

$$h(t) = 102\text{m} - (5\text{m/s}^2)t^2.$$

   (a) How long will it take for the balloon to hit a roughly two meter-tall student on the head?

   (b) How fast will the balloon be moving upon impact?

This time

4. If $s(3) = 4$ and $s'(3) = -2$, estimate $s(2.85)$.

5. ~~Prove that the function $f(x) = 17x^6 - 15x^4 + 3x^2 - 5x$ has a critical point on the interval $[0, 1]$. (You will not be able to determine what this critical point is.)~~ *[The MVT hasn't been covered yet.]*

6. Evaluate the following limits:

   (a) [Briggs and Cochran, 4.7.16] $\displaystyle\lim_{x\to 0} \frac{e^x - 1}{x^2 + 3x}$

   (b) [Briggs and Cochran, 4.7.17] $\displaystyle\lim_{x\to e} \frac{\ln(x) - 1}{x - e}$

   (c) [Briggs and Cochran, 4.7.21] $\displaystyle\lim_{u\to\pi/4} \frac{\tan(u) - \cot(u)}{u - \pi/4}$

7. Rewrite as the limit of a fraction, and then evaluate the limit using l'Hôpital's rule.

   (a) [Briggs and Cochran, 4.7.45] $\displaystyle\lim_{x\to 0} x\csc x$

   (b) [Briggs and Cochran, 4.7.52] $\displaystyle\lim_{x\to\infty} x - \sqrt{x^2 + 1}$

   (c) [Briggs and Cochran, 4.7.53] $\displaystyle\lim_{\theta\to\frac{\pi}{2}^-} \tan\theta - \sec\theta$

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[1]This equation neglects the very significant effects of air resistance, but were going to roll with it for now.