Math 130 Day 38

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

Practice

1. Today we will finish our discussion of l'Hopital's rule and begin a discussion of antiderivatives. Review Chapter 4.7 and skip to Chapter 4.9 on antiderivatives. Pay particular attention to pages 320–323. We will concentrate on this material on Wednesday.

2. Here are some limits of the harder type we discussed today. If you can do these you are in good shape: Page 308ff #55, 57, 61, 65, and 67.

- **a)** These were suggested last time: Try page 307 #15, 19, 22(Ans: 4/7), 23, 31, 33.
- **b)** Now try page 307 #37, 41, and 49. Try $\lim_{x\to\infty} x^2 e^{-x}$, $\lim_{x\to\infty} x\tan(\frac{1}{x})$ $\lim_{x\to 0^+} x^2 \ln x$. Answers: 0, 1, 0.

3. Close reading: Review the basic differentiation rules and the corresponding integration rules on Page 296 and 297. (Omit the ones with the cotangent, cosecant and $\sec^{-1} x$ functions.) Now try page 301: Review from reading #3–9 odd. Basic Skills: #11–21 odd.

Math 130, Day 38. Hand in Friday. Name: ______________________

WeBWorK Set Day38. Due Thursday.

1. Determine whether each limit is indeterminate and if so, give its form (e.g., $\frac{0}{0}, \frac{\infty}{\infty}, 1^\infty$, etc.). Then evaluate the limit. Show your work. Indicate the method (HP, LH, etc) where appropriate. Several techniques may be used. Your choice!

a) $\displaystyle\lim_{x\to 4^+} \frac{x-4}{\sqrt{x}-2}$

b) $\displaystyle\lim_{t\to 0^+} \frac{t^2-2}{t^2+2t}$

c) Work out on scrap first. $\displaystyle\lim_{x\to -\infty} \frac{\sqrt{16x^2+1}}{2x}$. What's simpler: HP or LH?

d) $\displaystyle\lim_{x\to 0} \frac{\sin 5x}{\arcsin x}$

e) $\lim_{x\to\infty} \left(1 - \frac{2}{x}\right)^x$

f) $\lim_{x\to 0} \frac{\sin x - x}{x^3}$

g) $\lim_{x\to 0^+} x \ln x^2$

h) $\lim_{x\to\infty} (1+x^2)^{1/x}$

2. Carefully determine whether the following functions have VA's at $x = 1$ by calculating appropriate limits.

a) $f(x) = \dfrac{6^x - 6}{x^3 - 1}$

b) $g(x) = \dfrac{x^2 - 2x + 1}{x^2 - x}$

3. Bonus: Calculus Jeopardy. Completing this question will prepare you for Friday's class. (You should also look at Chapter 4.9.) These questions ask you to 'reverse' the process of differentiation. This reverse process is called **antidifferentiation** and is a major focus of Calculus II.

Example. If $f'(x) = 4x^3$, what was the original function $f(x)$?

Answer: $f(x) = x^4$, because $D_x(x^4) = 4x^3$.

Instead of writing `If` $f'(x) = 4x^3$`, what was the original function` $f(x)$`?` we use the notation: $\int 4x^3\, dx$. So we would write

$$\int 4x^3\, dx = x^4.$$

Or we might write

$$\int \frac{1}{1+x^2}\, dx = \arctan x \quad \text{because} \quad D_x(\arctan x) = \frac{1}{1+x^2}.$$

Try the following. **Check your answers by taking the derivative.** Remember, each question is giving you the derivative and asking you to find the 'original' function.

a) $\int \cos x\, dx =$

b) $\int 11x^{10}x\, dx =$

c) $\int -6x^{-7}x\, dx =$

d) $\int x^{-1}\, dx =$

Extra Credit

This is a busy time of the term. These are extra practice on graphing with asymptotes, if you need it. To receive credit, you must do the corresponding problem on WeBWorK Set Day38XC. DUE: Friday.

1. Do a complete graph of $y = f(x) = \dfrac{2x^3 - x^2 + \frac{1}{3}}{x^3}$. Include all asymptotes. Show your work.

2. Do a complete graph of $y = f(x) = \dfrac{x-1}{\sqrt{x^2 - 2x + 2}}$. Include all asymptotes. Show your work.