MTH 32 LECTURE NOTES (Ojakian)

Topic 1: Reviewing Calculus I

OUTLINE
References:
Calc 1 Book - *2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 3.3, 3.6*
Calc 2 Book - *1.1, 1.3, 1.5*

1. Limits and Continuity

2. The Derivative and Differentiating (especially: The Chain Rule)

3. The Integral

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1. Limits

   PROBLEM 1. *What is a limit?*

   PROBLEM 2. *Evaluate the following limits*
   (AND - experiment using the Excel worksheet and DESMOS):

   (a) $\lim_{x \to 3} x^2$

   (b) $\lim_{u \to -1} f(u)$, where $f(u) = \begin{cases} u^5 & \text{if } u > -1 \\ u+1 & \text{if } u \leq -1. \end{cases}$

   (c) $\lim_{x \to 0} h(x)$, where $h(x) = \begin{cases} 1 + \sqrt{x} & \text{if } x \geq 0 \\ 1/x & \text{if } x < 0. \end{cases}$

   PROBLEM 3. *For the last problem, if the limit is not defined, try to make it defined by making a small change to the function.*

2. Continuity

   PROBLEM 4. *What is continuity?*

   PROBLEM 5. *Discuss the continuity of the functions in the previous problems.*

3. The Derivative

PROBLEM 6. *What does the following mean:* **the *derivative* of** $f(x)$ **at** a*?*

PROBLEM 7. *Use DESMOS.*

(a) *Graph* $f(x) = x^2$ *and its derivative, seeing how this makes sense.*

(b) *Graph* $f(x) = \cos(x)$ *and its derivative, seeing how this makes sense.*

PROBLEM 8. *Differentiate each function (remember the chain rule!).*

(a) $x^{-3} + \cos(x)$

(b) $u^{-3} \cos(u)$

(c) $\cos(y^{-3})$

4. Limits at Infinity

PROBLEM 9. *What is a limit as we "go to infinity"?*

PROBLEM 10. *Evaluate the following limits*
*(**AND - experiment using the Excel worksheet and DESMOS**):*

(a) $\lim_{x \to \infty} 1/x$

(b) $\lim_{n \to \infty} n^2$

(c) $\lim_{x \to \infty} \cos(x)$

5. The Integral - Basic Theory

PROBLEM 11. *What is the integral?*

PROBLEM 12. *Recall summation notation, and do the following.*

(a) *From* WORK BOOK *do Section 1: Exercises 1 - 3, 5 - 7.*

(b) *What is the difference between the* **definite integral** *and the* **indefinite integral***?*

PROBLEM 13. *From the* WORK BOOK*, do section 1, exercises 14b, 16a, 20*

6. Extra Practice Problems

PROBLEM 14. *Differentiat the following functions.*

(a) $\sin(3x) + \cos(2 + x^7)$

(b) $\sqrt{x^2 + \sin(1 + 3x^5)}$

(c) $x^7 \sqrt{x}$

(d) $7x^{-4}\sqrt{x + 100}$

PROBLEM 15.

From the WORK BOOK *do as many problems as you can in section 1 (don't worry too much about the tricky ones!).*