

Math 130, Day 4. Hand In Next Time. Name: _____

Remember: Do WeBWorK Set Day 04. Start now!

1. (6pts) These limits are straightforward. Note which limit rules you apply. **Make sure to write out the question**, not just the answer. State which limit law(s) you apply at each step (as we did in class and as in Example 2, p. 70.

a) Page 76 #22

b) Page 76 #24

c) Page 76 #30

2. (6pts) For these next problems, you cannot immediately apply a limit law since the form is indeterminate: $\frac{0}{0}$. Carry out appropriate algebraic simplification and then evaluate the limit. Write out the question and **be sure to use proper notation** (limit symbols, equal signs). You will need to simplify before evaluating the limit.

a) Page 77 #40

b) Page 77 #46. Review the algebra in the answer to Day 2, #6 (b) on today's handout.

3. (3pts) **Average Velocity Review.** Remember that m_{sec} is the same as average velocity. For example, if we the position of an object is given by $f(x)$ and we want the average velocity on the general interval $[a, x]$, then we use the difference quotient

$$m_{\text{sec}} = \text{Ave Velocity} = \frac{f(x) - f(a)}{x - a}.$$

Let $f(x) = x^2 + 5x + 1$ represent the position of an object. Determine the average velocity on the general interval $[2, x]$ by simplifying the difference quotient above by using $a = 2$. If necessary, review the online Answers to the Day 2 problems.

4. (4pts) Tammy has been asked to determine the instantaneous velocity at time $x = 4$ of an object that has position $f(x) = x^2 - 7x$. She knows that instantaneous velocity at $x = 4$ is a limit of average velocity as $x \rightarrow 4$:

$$\text{Inst Vel} = \lim_{x \rightarrow 4} \text{Ave Velocity} = \lim_{x \rightarrow 4} \frac{f(x) - f(4)}{x - 4}.$$

- a) Why can't Tammy just plug $x = 4$ into this expression?
- b) Help Tammy determine the instantaneous velocity at $x = 4$ by using some algebra as in the previous problem and then evaluating the limit. Use proper notation (limit symbols, equal signs).
5. (3pts) Prove that you are an average/instantaneous velocity pro. Let $s(t) = \frac{2}{t}$ represent the position of an object at time t . Find the instantaneous velocity at $t = 8$ as a limit of average velocity using the process in the previous problem. Use proper notation (limit symbols, equal signs). Review the algebra in the answer to Day 2, #6 (b) on today's handout.

6. (4pts) Mark each of these as best described: As a polynomial (P); As rational (R); Neither (N)?

a) $\sqrt{x^2 + 12x + 100}$

b) $\frac{2x^{10} - 4x}{x^2 + 3x + 1}$

c) $\frac{x}{x^{1/2} + 1}$

d) $2x^5 - 3x^{2/3} + 1$

e) $\frac{9}{6x^2 + 2}$

f) $\sin(x^2 + 3x + 1)$

g) $x^2 - 6x + 1$

h) $\sqrt{2}$

7. Remember how functions work. Let $f(x) = x^2 + 5x + 1$. To evaluate $f(2+h) - f(2)$ we simply substitute $2+h$ for x :

$$f(2+h) - f(2) = (2+h)^2 + 5(2+h) + 1 - (4 + 10 + 1) = (4 + 4h + h^2) + (10 + 5h) + 1 - (15) = h^2 + 9h.$$

Be careful to square properly and to multiply through by constants as needed.

a) (3pts) Let $f(x) = x^2 - 3x$. Evaluate $\lim_{h \rightarrow 0} \frac{f(3+h) - f(3)}{h}$. This really simplifies. Be sure to use proper notation (limit symbols, equal signs). Evaluate the limit only after you have simplified.

b) **Optional Bonus.** Let $f(x) = \sqrt{x}$. Evaluate $\lim_{h \rightarrow 0} \frac{f(4+h) - f(4)}{h}$. You will need to use conjugates. You can read about conjugates in today's online Class Notes for Day 04.