Math 152 – Sample Exam 1 – Spring 2016 – Louis Gross

It would be best if you try to take this Sample Exam as if you were sitting in class, using only a calculator. For the actual in-class exam, there will be blank sheets of paper handed out for you to give the answers but it will be important for you to SHOW YOUR WORK even if you are certain your answer is correct. Note that this Sample Exam is approximately the same length as the actual exam will be.

1. Compute each of the following limits, if they exist. If they don't exist, state so.

(a) $\lim_{y\to\infty}\frac{4-y}{2y+3}$ (b) $\lim_{x\to 3}\frac{4x+2}{x+1}$ (c) $\lim_{h\to 0}\frac{h^2-2h}{3h^2+h}$

(d) $\lim_{x\to\infty}\frac{5x^2}{2x^2+3x-1}$ (e) $\lim_{x\to 2}\frac{x^3-8}{x-2}$ (f) $\lim_{x\to 2}\frac{x-2}{x^3-8}$ (g) $\lim_{x\to -1}(8x^2+\frac{x-1}{x+1})$

2. For a variety of soybean, it has been experimentally determined that an equation describing the photosynthetic rate per leaf surface area, measured in μmol CO_2 m^{-2} s^{-1} at light level I is $P(I)=\frac{3I}{.1I+25}-3$

Find an equation for the horizontal asympotote for P(I) and state what this represents biologically.

3. Sketch the graphs of 3 different functions which are not continuos at x=2 and give the equations of the functions you are graphing.

4. For each of the following functions, state where the function is continuous

(a) $f(x)=\begin{cases} x+1 \text{ for } x\le -1 \\ x^2 \text{ for } -1<x\le 1 \\ x \text{ for } x>1 \end{cases}$ (b) $g(x)=\begin{cases} x^2 \text{ for } x\le 0 \\ \frac{1}{x^2} \text{ for } 0<x<\frac{1}{2} \\ x-1 \text{ for } x\ge\frac{1}{2} \end{cases}$

5. Researchers have developed a piecewise function that can be used to estimate the body weight (in grams) of a male broiler chicken during the first 56 days of life according to

$$W(t)=\begin{cases} 48+3.64t+.6363t^2+.00963t^3 \text{ for } 1\le t\le 28 \\ -1004+65.8t \text{ for } 28<t\le 56 \end{cases}$$

where t is the age of the chicken (in days).

(a) Determine the weight of a male broiler that is 25 days old.

(b) Is W(t) a continuous function?

(c) Comment on why the researchers would use two different functions to estimate the weight of a chicken at various ages.

6. Suppose that as a squirrel grows from birth (at age 0) its weight increases according to $B(t) = 30\ 2^t\sqrt{t}$ where B(t) is its weight at age t months measured in grams.What is the average rate of change of body weight for squrirrels as the grow from age 1 month to age 4 months?

7. The below table gives a drug concentration in the blood stream following an injection,

t(hrs)	0	1	2	3	4	5
D(t) mg/ml	200	150	112	84	63	47

Estimate the rate of change of the drug concentration at times 1 and 4, stating the units of this rate of change and stating what method you chose to estimate this.

8. In a study on weight loss in mice it was found that the change in body weight of mice over a day could be estimated by a particular function $f(c)$ of the caloric intake c of the mouse that day, where c is measured in calories and f is measured in grams.
(a) Interpret the statement that f(200)=3 in terms of diet and weight
(b) Interpret the statement $f'(120) = 0$ in terms of diet and weight.
(c) What are the units of $f'(c)$?

9. Suppose that the metabolic rate M, measured as g O_2 consumed per minute for a mouse during a day varies over the the day due to temperature changes according to
$M(t) = -2t^2 + 50t + 10$
where t is time of the day in hours after midnight.
(a) What is the average rate of change of metabolic rate over the full day and what are the units of this?
(b) Estimate the rate of change of M at t=6

10. Draw a graph of a function f(x) which is continuous at x=a for some a, but for which $\lim_{x\to a^+} f'(x)$ and $\lim_{x\to a^-} f'(x)$ have different values.