

Math 130 – Fall 2014 – Boyle –Exam 1

- NO CALCULATORS OR ELECTRONIC DEVICES ALLOWED.
- Where a calculator would be used, give your answer as an expression a calculator could evaluate.
- Use a separate answer sheet for each question.
- When you are asked to find a limit, possible correct answers include ∞ , $-\infty$ and DNE. (DNE = “does not exist”, including the case “is not defined”.)
- Give your pledge on page 1 only, covering the whole test.
- Draw a box around a final answer to a problem.

1. (13 points)

- (a) (4 pts) What is the domain of $y = \ln(5 - x)$?
- (b) (4 pts) Evaluate $\log_2(1/16)$.
- (c) (5 pts) Solve $\ln x + \ln 3x = -1$.

2. (14 points)

- (a) (5 pts) Solve $16^{2x+1} = 64^{x-2}$.
- (b) (9 pts) Suppose a population grows at an annual rate of 6% . Find the time it would take for the population to double.

3. (12 points)

- (a) (4 pts) What is $\sin(\pi/4)$?
- (b) (4 pts) Find all values of x between 0 and 2π for which $\tan x = 1$.
- (c) (4 pts) What are the amplitude and period of $h(x) = (-1/2) \sin(6\pi x)$?

4. (12 points) Find the following limits. (4 points each)

(a) $\lim_{x \rightarrow 2} f(x)$ with $f(x) = \begin{cases} 1 & \text{if } x \neq 2 \\ 5 & \text{if } x = 2 \end{cases}$

(b) $\lim_{x \rightarrow -2} \frac{x^2 - x - 6}{x + 2}$

(c) $\lim_{s \rightarrow \infty} E[1 - e^{-a(s-h)/E}]$.

(In part (c), the letters E, a, h represent fixed positive real numbers; the function was used in homework to model excitation of a nerve pathway.)

*** THERE ARE MORE QUESTIONS ON THE OTHER SIDE. ***

5. (12 points) Find the following limits. (4 points each.)

In part (b), assume $f'(5)$ exists.

$$(a) \lim_{x \rightarrow -2} \frac{|x + 2|}{x + 2}$$

$$(b) \lim_{x \rightarrow 5} \frac{(f(x) - f(5)) - (f'(5)(x - 5))}{x - 5}$$

$$(c) \lim_{x \rightarrow -\infty} \frac{3x^3 + 10x^2 - 1}{4x^2 + 5x + 2}$$

6. (12 points) Let position be measured in feet and let time be measured in seconds. Suppose the position of an object moving in a straight line is given by $s(t) = 5t^2 + 3t + 2$.

(a) (6 pts) What is the average velocity between $t = 0$ and $t = 2$?

(b) (6 pts) What is the instantaneous velocity at $t = 2$?

7. (15 points) (a) (5 pts) Find the derivative at $x = 4$ of the function

$$y = \frac{6}{\sqrt{x}}.$$

(b) (10 pts) Find an equation for the tangent line of the graph of

$$y = x^3 + \frac{1}{x} + 1$$

at the point $(1, 3)$.

8. (10 points) The radius of a blood vessel is 2 mm. A drug causes the radius to change to 1.8 mm. Find the approximate change in the area of a cross section of the vessel.

(Hint: use the differential, or equivalently the tangent line approximation. for the area function.)