

INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write **your full name** on every piece of paper that will be uploaded to gradescope. Do all problems. **Start each problem on a new page.** Box your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. **Justify your answers, show all work. Only use techniques from sections 1.1-1.6.**

1. (12pts) Short answer. No justification required.

(a) Graph $f(x) = -\sqrt{|x|}$

(b) Is $f(x) = -\sqrt{|x|}$ even, odd, or neither?

(c) Let $g(x) = x^2 - 1$ and $h(x) = x^{-1/2}$ what is the domain of $h \circ g$?

(d) Evaluate:

$$\lim_{x \rightarrow 6} \frac{\sin(2x - 12)}{2x - 12}$$

2. (32pts) Evaluate the following limits. Justify all work.

(a)

$$\lim_{h \rightarrow 0} \frac{(x+h)^{-1} - x^{-1}}{h}$$

(b)

$$\lim_{x \rightarrow 4} \frac{\sqrt{x} - 2}{x - 4}$$

(c)

$$\lim_{x \rightarrow 0} \frac{\sin^2(3x)}{9x^2 \cos(x)}$$

(d)

$$\lim_{x \rightarrow 3} \frac{2x - 6}{|x - 3|}$$

3. (32pts) Justify all work.

(a) Evaluate

$$\lim_{x \rightarrow \infty} \frac{\pi x^2 + 7x + 1340}{13x^2 + x}$$

(b) Evaluate

$$\lim_{x \rightarrow -\infty} x^3 - x^5$$

(c) Use Squeeze Theorem to evaluate:

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

(d) Find all asymptotes of $f(x) = \frac{3x-3}{x^2-3x+2} + \pi$. Justify with limits.

4. (24pts) Justify all work.

(a) Complete the statement: A function f is continuous at a number a if...

(b) State the intermediate value theorem.

(c) Find a, b so that the following function is continuous

$$f(x) = \begin{cases} 3x^2 + 2 & \text{if } 0 \leq x \leq 1 \\ ax + b & \text{if } 1 < x \leq 2 \\ ax^3 + 5 & \text{if } 2 < x \leq 3 \end{cases}$$

(d) Prove $x^5 - 3x = 4 - x^2$ is solvable.