Math 111-01, Fall 2022 Professor Rob Benedetto

**Practice Test B for Midterm Exam 1**

**Instructions**: This optional exam is for practice, to give you an idea of what our in-class midterm exam will be like. I'd recommend that you try taking it in exam conditions: 50 minutes, closed-book.

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**1.** [32 Points] Evaluate each of the following limits. Please **justify** your answers. Be clear if the limit equals a value, $+\infty$ or $-\infty$, or Does Not Exist.

(**a**) $\lim_{x\to 0} \dfrac{x^2-4x}{x^2-3x-18} =$

(**b**) $\lim_{x\to -7} \dfrac{x^2+2x-35}{|x+7|} =$

(**c**) $\lim_{x\to -3} \dfrac{x^2+2x-3}{x^2-4x-12} =$

(**d**) $\lim_{x\to -6} \dfrac{\frac{x}{x+2} - \frac{x-3}{x}}{x+6} =$

(**e**) $\lim_{x\to 2} \dfrac{x+7}{x-2} =$

(**f**) $\lim_{x\to 3} \dfrac{g(x^2)-7}{(g(x))^2-1} =$ where $g(x) = x-2$

**2.** [12 Points] Use translation, etc. to graph the following two functions:

$$f(x) = 3 + \sin(2x) \qquad\qquad g(x) = 2 + \frac{1}{x-3}$$

**3.** [16 Points] Suppose that $f(x) = \sqrt{3-x+x^2}$. Compute $f'(x)$ using the **limit definition of the derivative**.

**4.** [14 Points] Suppose that $f(x) = x^3 + 7x^2 - 4x + 9$. Write the **equation of the tangent line** to the curve $y = f(x)$ when $x = -1$. **Use the limit definition of the derivative when computing the derivative.**

**5.** [10 Points] Suppose that $f$ and $g$ are functions, and

- $\lim_{x\to 7} f(x) = 4$
- $\lim_{x\to 7} g(x) = -2$
- $g(x)$ is continuous at $x = 7$.

Evaluate the following quantities and fully justify your answers. Do not just put down a value:

**(a)** $\lim_{x\to 7}(3f(x) - 5g(x)) =$

**(b)** $g(7) =$

(problems continue next page)

**6.** (16 Points) Consider the function defined by

$$f(x) = \begin{cases} 4 - x & \text{if } x < 0 \\ x^2 - 1 & \text{if } 0 \leq x \leq 3 \\ 8 & \text{if } x > 3 \end{cases}$$

**(a)** Carefully sketch the graph of $f(x)$.

**(b)** Compute $\lim_{x \to 0} f(x)$.

**(c)** Compute $\lim_{x \to 3} f(x)$.

**(d)** State the value(s) at which $f$ is discontinuous. Justify your answers using definitions or theorems discussed in class.