Math 180 Practice Exam 1

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Name _____

1) Sketch a function that satisfies the following properties.

- $f(-3) = -2$
- $\lim_{x \to -\infty} f(x) = \infty$
- $\lim_{x \to 3^-} f(x) = -\infty$
- $\lim_{x \to 3^+} f(x) = \infty$
- $\lim_{x \to \infty} f(x) = -1$

2) **a)** Use the limit definition of the derivative to compute the the derivative of the function:

$$f(x) = \sqrt{5x + 1}$$

b) Use differentiation rules to check your answer.

3) Find the following limits.

- $\lim_{x \to 0^+} x \ln(x)$

- $\lim_{x \to 0} \frac{\sin(x)}{x}$

- $\lim_{x \to \infty} \frac{e^x}{x^2}$

- $\lim_{x \to 0} \frac{\tan(x)}{x}$

- If n is a positive, odd natural number, find $\lim_{x \to 0} \frac{\sin(x)}{x^n}$.

4) Define a function given by $f(x) = \int_0^x g(t)dt$ on the interval $[0, 6]$ where

$$g(t) = \begin{cases} t & \text{if } 0 \leq t \leq 3 \\ -t + 6 & \text{if } 3 < t \leq 6 \end{cases}$$

- In order to get some intuition, graph $g(t)$
- Using this graph, find $f(3)$.
- What is $f'(x)$?

5) Find $\lim_{x \to 0} x^2 \cdot \cos(\frac{1}{x})$. Name any theorems used.

6) Compute the following integrals.

- $\int (x^2+1)^4 dx$

- $\int_0^3 \frac{x^7-x^3}{x^2} dx$