Math 105: Winter 2013  
Exam 1: February 8  

Correct answers accompanied by incorrect or incomplete work will not receive full credit.

1. (4 points each) The graph of $f(x)$ is given. Evaluate the following (assume the tickmarks occur at 1, 2, etc).

(a) $\lim_{x \to 0^-} f(x)$

(b) $\lim_{x \to 0^+} f(x)$

(c) $\lim_{x \to 0} f(x)$

(d) $f(0)$

(e) $\lim_{x \to -2} f(x)$

(f) $f(-2)$
2. (6 points) The graph below is a graph of \( f(x) \). Estimate \( f'(−3) \).

![Graph of f(x)](image)

3. (6 points) Let \( g(x) = \tan x \). Use secant line(s) to numerically estimate \( g'(\pi/3) \). (Make sure your calculator is in RADIANT mode.)

4. (6 points) Let \( h(x) = 3x^2 + \frac{6}{x^3} - 4\sqrt{x^3} + 7x^{-2} + 14 \). Calculate \( h'(4) \).

5. (4 points) Let \( U(t) \) be the number of people unemployed in a country \( t \) months after the election of a new president. What does the statement \( U'(20) = -10,000 \) mean in this context? Include units in your answer.
6. (5 points each) The graph below is a graph of \( f(x) \).

Let \( F(x) \) be an antiderivative of \( f(x) \).

(a) For what value(s) of \( x \) (if any) does \( F \) have a local maximum? Explain your answer.

(b) For what value(s) of \( x \) (if any) does \( F \) have a local minimum? Explain your answer.

(c) For what value(s) of \( x \) (if any) does \( F \) have an inflection point? Explain your answer.
7. (5 points each) Suppose \( g'(w) = \sqrt{w} - 3 \). JUSTIFY your answer to each of the following questions WITHOUT GRAPHING \( g' \).

(a) What is the natural domain of \( g'(w) \)?

(b) Is \(-3\) in the range of \( g'(w) \)?

(c) Is \( g \) concave up at \( w = 4 \)?

(d) \( g \) has a stationary point at \( w = 9 \). On \( g \), is \( w = 9 \) a local maximum, local minimum, or neither?

8. (5 points) Let \( h(x) = 3x^2 + \frac{6}{x^3} - 4\sqrt{x^3} + 7x^{-2} + 14 \). Find an antiderivative of \( h \).
9. (6 points) Sketch the graph of a continuous function $g(x)$ over the interval $[-1, 5]$ that has the following properties:

- $g(2) = 1$
- $g'(x) > 0$ on the interval $[-1, 3)$, $g'(3)$ does not exist, and $g'(x) > 0$ on the interval $(3, 5]$.
- $g''(x) < 0$ on the interval $[-1, 3)$, $g''(x) = 0$ on the interval $[3, 5]$.

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\[
\begin{array}{|c|c|c|c|c|}
\hline
-4 & -2 & 0 & 2 & 4 \\
\hline
-1 & 1 & 2 & 3 & 4 \\
\hline
\end{array}
\]
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10. (5 points) Let $f(x) = \frac{3}{x + 2}$. Fill in all of the empty spaces in following equation.

\[
f'(7) = \lim_{x \to 7} \frac{f(x) - f(7)}{x - 7}
\]

\[
= \lim \frac{f(7) - f(7)}{x - 7} \quad (f \text{ should NOT appear in this line})
\]

11. (3 points) How many inches of snow do you think Lewiston will get this weekend?