MATH 1060 — SAMPLE EXAM
FALL 2014

NAME: _______________________________________________________

1. Do not open this exam until you are told to begin.
2. This exam has pages including this cover. There are problems.
3. Write your name on the top of EVERY sheet of the exam!
4. Do not separate the pages of the exam.
5. Please read the instructions for each individual exercise carefully. One of the skills being tested on this exam is your ability to interpret questions, so I will not answer questions about exam problems during the exam.
6. Show an appropriate amount of work for each problem so that I can see not only the answer but also how you obtained it. Whenever possible, present your final answer to each problem in a complete sentence using appropriate notation.
7. You are not allowed to use methods that have not yet been covered in class.
8. Turn off all cell phones.

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POINTS</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
1. Let \( f(x) \) be a function defined on \([0, 6]\). The values of \( f(x) \) are given by the following graph.

(a) (7 pts) Find \( h'(5) \) if \( h(x) = \frac{5}{x} + \sqrt{x}f(x) - \pi^2 \).

(b) (3 pts) Sketch \( f'(x) \).
2. Consider the function \( f(x) = \frac{4x^3 - 4}{\sqrt{x^6 - 1}} \).

(a) (3 pts) Find the domain of \( f \). Use interval notation to describe the domain.

(b) (8 pts) Find any vertical asymptotes the graph of \( f \) may have. Be sure to provide calculus-based work that supports your findings.

(c) (9 pts) Find any horizontal asymptotes the graph of \( f \) may have. Be sure to provide calculus-based work that supports your findings.
3. (12 pts) Use the limit definition of the derivative to find the derivative of \( f(x) = \frac{2x - 1}{x + 3} \).
4. (12 pts) The per capita income is defined to be the gross domestic product (GDP) divided by the total population. The GDP of Smalltown in 2008 was 6000 dollars and the total population was 100. At that time the population was increasing by about 12 people per year and the GDP was increasing by about 2000 dollars per year. At that time, what was the rate of change of the per capita income in Smalltown? Be sure to justify your answer.
Name: 

5. (12 pts) Let \( f(x) = \frac{4e^x}{1 + e^x} \). Find all \( x \)-values where \( f(x) \) has a slope of 1.
6. Let $f(x) = 2 \cos x - 1$.

(a) (10 pts) Give an equation of the tangent line to $f(x)$ at $x = \frac{2\pi}{3}$.

(b) (4 pts) Graph $f(x)$ and the tangent line found in part (a). Be sure to label the graph appropriately.
7. Let \( f(x) = \begin{cases} \frac{2x^2 - 11x + 5}{x-5} & \text{if } x \neq 5 \\ 10 & \text{if } x = 5 \end{cases} \). Use \( f(x) \) in parts (a)-(d).

(a) (5 pts) Compute \( \lim_{x \to 5} f(x) \).

(b) (5 pts) For the limit computed in part (a), illustrate the definition of a limit by finding a \( \delta \) value that corresponds to \( \epsilon = \frac{1}{2} \). Provide a graph that illustrates the definition for this \( \epsilon \) and your \( \delta \). (Be sure to appropriately label your graph.)
(c) (5 pts) Prove the limit computed in part (a) using the \( \epsilon \)-\( \delta \) definition.

(d) (5 pts) Is \( f(x) \) continuous at \( x = 5 \)? Be sure to give an argument to support your conclusion.