Final Exam
Math 194
Spring 2007

Show your work. Write down your calculations, even if you use your calculator. There are 10 problems on 8 pages, including this page. Each numbered problem is worth 10 points.

<table>
<thead>
<tr>
<th>Question</th>
<th>Possible</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>
1. Find the domain of each function.

a) \( g(x) = \frac{x - 3}{x + 1} \)

1a. ________________________

b) \( f(x) = \frac{\sqrt{x + 3}}{x^2 + 2x - 8} \)

1b. ________________________

2. Let \( h(x) = 3x^2 - x + 6 \). Find the average rate of change of \( g(x) \) from \( x = 1 \) to \( x = 3 \).

2. ________________________
3. For each part give your answer as a function \( f(x) = mx + b \).

a) Find an equation of the linear function that has the values \( f(2) = 5 \) and \( f(-4) = 8 \).

\[ \text{3a. } \]

b) Find an equation of the linear function whose graph is the line containing the point \((2, -2)\) perpendicular to the line \( y = \frac{1}{4}x + 1 \).

\[ \text{3b. } \]
4. Consider the function whose graph is shown below.

![Graph of a function]

Give the approximate interval(s) upon which $f$ exhibits the property. Circle your answers.

a) $f$ is increasing.

b) $f$ is decreasing.

c) $f$ is concave up.

d) $f$ is concave down.
5. Write an equation for the exponential function whose graph contains \((0, \frac{1}{2})\) and \((2, 8)\).

6. Solve each equation for \(t\). Round to the nearest 0.001.

   a) \(5e^{3t} = 15e^t\).

   b) \(6 - \ln(2t + 4) = 9\).
7. A colony of bacteria is growing exponentially. Initially there are 1000 bacteria in the colony. After 4 hours, there are 5000 bacteria present. Assume that the growth is continuous.

a) Give an explicit formula \( A(t) \) that gives the population of the colony after \( t \) hours.

\[
7a. \quad \text{______________________________}
\]

b) What will the population be after 9 hours?

\[
7b. \quad \text{______________________________}
\]

c) After how many hours will the population be 100,000? Round your answer to the nearest tenth of an hour.

\[
7c. \quad \text{______________________________}
\]
8. Find an equation for the function whose graph is shown below.

9. Let \( h(x) = \frac{6}{\sqrt{2-x}} \). Find two functions, \( f(x) \) and \( g(x) \), such that \( h(x) = g(f(x)) = (g \circ f)(x) \) and neither \( f(x) \) nor \( g(x) \) is equal to \( x \).

\[
\begin{align*}
f(x) &= \quad \\
g(x) &= 
\end{align*}
\]
10. Find an equation for the polynomial whose graph is shown below.