Math 122 (Section 3)  Test 1  September 29, 2006

Name ________________________________

Seat # ________________________________

- Do not open this test booklet until told to do so.
- Turn off all cell phones.
- For multiple-choice questions, precisely one answer is correct. Circle this correct answer.
- For all other questions, you must show sufficient work to justify your answer.
- You are not allowed to borrow another student's calculator during the test.
- Show your Student ID when you turn in your test.

#1 (8 points) __________________________
#2 (8 points) __________________________
#3 (20 points) _________________________
#4 (8 points) __________________________
#5 (8 points) __________________________
#6 (8 points) __________________________
#7 (10 points) _________________________
#8 (5 points) __________________________
#9 (5 points) __________________________
#10 (5 points) _________________________
#11 (5 points) _________________________
#12 (10 points) _________________________

Total (100 points) ____________________
1. (8 points) The Wicked Witch of the West was 63 inches tall when Dorothy emptied a bucket of water upon her. The water caused the witch to melt so that her height decreased by 8% per second. Which of the following formulas gives the witch’s height in inches $t$ seconds after she was hit with the water?

(a) $h(t) = 63e^{0.08t}$
(b) $h(t) = 63(0.08)^t$
(c) $h(t) = 63(-0.08)^t$
(d) $h(t) = 63 - (0.08)^t$
(e) $h(t) = 63e^{0.92t}$
(f) $h(t) = 63(0.92)^t$
(g) $h(t) = 63(1.08)^t$

2. (8 points) Suppose that $200$ is invested in an account which earns interest at 8.5% compounded continuously. How many years does it take for the balance in this account to reach $800$? Your answer should be rounded off correctly to one place after the decimal point.
3. (20 points) A company manufactures and sells footballs. The cost and revenue functions are each linear and are given in the table below where \( q \) represents the number of footballs, and cost and revenue are given in dollars.

<table>
<thead>
<tr>
<th>( q )</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C(q) )</td>
<td>684</td>
<td>794</td>
<td>904</td>
<td>1014</td>
<td>1124</td>
<td>1234</td>
</tr>
<tr>
<td>( R(q) )</td>
<td>0</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>800</td>
<td>1000</td>
</tr>
</tbody>
</table>

(a) Give a formula for the cost function \( C(q) \).

(b) Give a formula for the revenue function \( R(q) \).

(c) If this company produces and sells 250 footballs, do they earn a profit or suffer a loss? What is the dollar amount of that profit (or loss)?

(d) What is the exact number of footballs which this company must produce and sell in order to break even? (i.e., to have a profit of $0)?
4. (8 points) Given that $5e^t - 2 = 3e^t + 6$, find the exact value of $t$.

5. (8 points) Suppose that $f(x) = \ln (90 + 5^x)$. Approximate the value of $f'(4)$. Your answer should be rounded off correctly to one place after the decimal point.
6. (8 points) It has been raining heavily since midnight. Suppose that \( f(t) \) represents the total number of inches of rain which have fallen in the \( t \) hours since midnight. Suppose that \( f'(4) = 2 \). Which of the following sentences must be true?

(a) From midnight to 2 a.m. it rained a total of 4 inches.
(b) From midnight to 4 a.m. it rained a total of 2 inches.
(c) From midnight to 2 a.m. it was raining at an average rate of 4 inches per hour.
(d) From midnight to 4 a.m. it was raining at an average rate of 2 inches per hour.
(e) At 2 a.m. it was raining at a rate of 4 inches per hour.
(f) At 4 a.m. it was raining at a rate of 2 inches per hour.

7. (10 points) Suppose that the population of killer bees in Texas \( t \) months from today is modeled by the function \( B(t) = 9500(1.08)^t \).

(a) How many killer bees are predicted to be in Texas 2 years from now?

(b) On average, how quickly is the Texas killer bee population predicted to increase over the next two years?
In the next 3 problems, a table of values is given for a function. Circle **linear** if the function could be linear, circle **exponential** if the function could be exponential, and circle **neither** if it is impossible for the function to be either linear or exponential. You do not need to find formulas for any of the functions.

8. (5 points)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

9. (5 points)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

10. (5 points)

<table>
<thead>
<tr>
<th>$x$</th>
<th>$h(x)$</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>4</td>
<td>5.4</td>
</tr>
</tbody>
</table>
11. (5 points) The graph of $f(x)$ is shown below.

Circle the graph of $f'(x)$, given that it is one of the 6 choices below.
12. (10 points) Technicium-99m is the most widely used radioisotope in diagnostic nuclear medicine. It has a half-life of six hours. If a person is injected with Technicium-99m, how long does it take until there is only 4% of the substance remaining in the person’s body? Give your answer to the nearest hour.