MT-A142-09  Exam Three  Fall 2003

You may keep this page of questions. Turn in your answers with all of your work on the yellow paper and blue paper. You are NOT allowed to use calculators, Mathcad or Maple on questions #1 – 5. Work these questions on the yellow paper. After you have finished these first five questions, turn in the first part of the exam and receive blue paper to use for the two calculator questions.

(1) 10 Points. State the Fundamental Theorem of Calculus.

(2) 20 Points. Evaluate the following definite integrals and antiderivatives.

(a) $\int_0^1 x^2(x^3 + 4) \, dx$  
(b) $\int 2 \sin(3t) \, dt$  
(c) $\int \frac{1}{\sqrt{1 - z^2}} \, dz$  
(d) $\int_0^1 \frac{1}{1 + x^2} \, dx$

(3) 12 Points. Use the following table of values for $f'(x)$ to approximate $f(3), f(6)$ and $f(9)$. Assume that $f'$ is continuous.

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f'(x)$</td>
<td>4</td>
<td>8</td>
<td>2</td>
<td>-6</td>
</tr>
</tbody>
</table>

(4) 16 Points. Find an equation for a quartic polynomial whose graph is symmetric about the $y$-axis if the polynomial has a $y$-intercept of 3 and has local minima at $(-2, -5)$ and $(2, -5)$.

(5) 12 Points. Suppose that $f(0) = -3$ and that $f'(x) \leq e^{2x}$ for all $x$ in $[-10, 10]$. Use the Racetrack Principle to find an upperbound for $f(\ln 5)$. 
For these two questions, but NOT for the first five questions, you may use your calculator or the computer. Turn in your work on the first five questions and receive blue paper before getting out your calculator or using the computer.

(6) 12 Points. For the integral \( \int_{4}^{7} \sqrt{1 + x \sin^2 x} \, dx \), use your calculator or the computer to calculate the Riemann sum for the partition \( \{4.000, 4.800, 5.500, 7.000 \} \) augmented by the values \( \{4.500, 5.000, 6.800 \} \). Find the value for this Riemann sum to the nearest thousandth.

(7) 18 Points. A metal storage bin with an open top is to be made by cutting equal squares from the four corners of a rectangular sheet of galvanized iron and turning up the sides. The rectangular sheet of iron is 12.0 feet wide by 16.0 feet long. What size squares should be cut from the corners to maximize the volume of the bin? Assume that it is possible to measure and cut these squares to the nearest thousandth of a foot.