MT-A132-05 Exam Three Fall 1999

You may keep this page of questions. Turn in all of your work on the colored paper and the graph paper. For this exam, NO CALCULATORS are permitted or needed. It is expected that on some problems, you will leave your answers in exact form as fractions, radicals, logarithmic expressions or exponential expressions (for examples, \( \frac{5}{7}, \sqrt{5}, \ln 13, e^2 \)) rather than finding decimal approximations for these.

(1) 10 Points. Find \( f'(x) \) and \( f''(x) \) if \( f(x) = e^{3x} \).

(2) 10 Points. Find \( \frac{du}{dx} \) implicitly if \( x^3 + xy^3 = 2y + 5 \).

(3) 30 Points. Find values for the following antiderivatives and definite integrals. (You are expected to use the Fundamental Theorem of Calculus, rather than the definition of the definite integral, to evaluate the definite integrals.)

\[
\begin{align*}
(a) \quad & \int (3x^4 + 7x + 5) \, dx \\
(b) \quad & \int \frac{x^3 + 5x + 8}{x^2} \, dx \\
(c) \quad & \int \frac{5t^2}{t^3 + 7} \, dt \\
(d) \quad & \int_1^4 (x^2 + 2x + 5) \, dx \\
(e) \quad & \int_0^2 e^{-0.5x} \, dx
\end{align*}
\]

(4) 10 Points. State the definition of the definite integral \( \int_a^b f(x) \, dx \).

(5) 10 Points. On the graph paper, sketch a graph of \( y = f(x) = x^3 - 3x^2 \). Find the coordinates for all intercepts, extrema, and points of inflection.

(6) 15 Points. A fence is to be built around a 1200-square-foot rectangular field. Three sides are to be made of wood costing $5.00 per foot while the fourth side is to be made of stone costing $25.00 per foot. Find the dimensions of the enclosure that minimize the total cost. Show your work!

(7) 15 Points. Sketch a graph of the region that is bounded by \( y = x + 2 \) and \( y = x^2 - 3x + 2 \). Then find the area of this region.