HOMEWORK 8 - MATH 151
DUE DATE: Monday, December 11
INSTRUCTOR: George Voutsadakis

Read each problem **very carefully** before starting to solve it. Four out of the ten problems will be chosen at random and graded. Each problem graded is worth 3 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Use the midpoint rule with $n = 5$ to approximate the integral $\int_0^1 \sin(x^2) dx$. Use your calculator only in the final step.

2. Use the form of the definition of the definite integral given in Theorem 4 of page 264 of your book to evaluate the integral $\int_1^4 (x^2 + 2x - 5) dx$.

3. Evaluate the following integrals by interpreting them as areas and then using familiar area formulas:

   (a) $\int_{-2}^2 \sqrt{4 - x^2} dx$
   (b) $\int_{-1}^3 (3 - 2x) dx$

4. Use property 8 on page 273 to estimate the value of the integrals:

   (a) $\int_0^2 \sqrt{x^3 + 1} dx$
   (b) $\int_{\pi/4}^{3\pi/4} \sin^2 x dx$

5. Evaluate the following integrals:

   $$(a) \int_1^8 \sqrt[3]{x^2} dx \quad (b) \int_{-2}^{-1} (4y^3 + \frac{2}{y^3}) dy \quad (c) \int_0^1 10^x dx \quad (d) \int_{1/2}^{\sqrt{3}/2} \frac{6}{\sqrt{1 - t^2}} dt$$

6. The acceleration function in meters per square seconds of a particle moving along a straight line is given by $a(t) = 2t + 3, 0 \le t \le 3$, and its initial velocity by $v(0) = -4$. Find the velocity of the particle at time t and the distance traveled by the particle from time $t = 0$ to time $t = 3$.

7. Water flows from the bottom of a storage tank at a rate of $r(t) = 200 - 4t$ liters per minute, where $0 \le t \le 50$. Find the amount of water that flows from the tank during the first 10 minutes.

8. Use Part 1 of the Fundamental Theorem of Calculus to find the derivative of the function:

   (a) $f(x) = \int_1^x \ln t \, dt$
   (b) $f(x) = \int_0^{x^2} \sqrt{1 + r^3} dr$
   (c) $f(x) = \int_{\sin x}^{\cos x} (1 + v^2)^{10} dv$

9. Find the average value of $f(x) = \frac{1}{x}$ in the interval $[1, 4]$ and the average value of $g(x) = \cos x$ in the interval $[0, \frac{\pi}{2}]$.

10. Evaluate the following integrals by the substitution method:

    $$(a) \int x(4 + x^2)^{10} dx \quad (b) \int \frac{\sin \sqrt{x}}{\sqrt{x}} dx \quad (c) \int e^{\sin \theta} \cos \theta \, d\theta$$