MAT126 Fall 2009
Practice Midterm II
The actual midterm will consist of six problems
Problem 1 If the function $g(x)$ is given by

$$g(x) = \int_{2x}^{x^2} t \ln t \, dt,$$

compute the derivative $g'(x)$

a) by using the Fundamental Theorem of Calculus to differentiate the integral

b) by using the Evaluation Theorem to first evaluate $g(x)$ explicitly, and then differentiating.
Problem 2  Evaluate the following definite integral:

1. \( \int_{0}^{2} x^2 \sqrt{4 - x^2} \, dx \)

2. \( \int_{1}^{e^\pi} \frac{\cos(\ln x) \sin^2(\ln x)}{x} \, dx \)

3. \( \int_{\frac{1}{\pi}}^{\frac{2}{\pi}} \frac{\sin(1/x)}{x^2} \, dx \)
Problem 3 Evaluate the following indefinite integral using integration by parts:

1. \[ \int \arcsin(x) \, dx \]

2. \[ \int \sqrt{x} \ln^2(x) \, dx \]
Problem 4 Evaluate
\[ \lim_{n \to \infty} \int_0^{2\pi} x \sin(nx) \, dx \]
Problem 5  Decompose a rational function into partial fractions

\[
\frac{x^3 - 6x}{x^2 + 4x + 4}
\]

Problem 6  Evaluate the integral

\[
\int_0^1 \frac{x + 1}{x^2 + 9} \, dx
\]
Problem 7 Can the midpoint approximation to the integral

\[ \int_{1}^{2} \frac{1}{x^2} \]

with \( n = 100 \) be equal to

- \( \frac{1}{7} \).
- \( \frac{1}{5} \).

To get a full credit you need to justify your answer.