Midterm Exam #2-Math 022-F ‘07
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The exam is 50 minutes long. No calculators or notes are permitted. Show your work. You do not need to simplify your answers.

Trigonometric Identities

\[
\sin^2 x + \cos^2 x = 1
\]

\[
1 + \tan^2 x = \sec^2 x
\]

\[
\sin(A + B) = \sin A \cos B + \cos A \sin B
\]

\[
\cos(A + B) = \cos A \cos B - \sin A \sin B
\]

\[
\sin(2A) = 2 \sin A \cos B
\]

\[
\cos(2A) = \cos^2 A - \sin^2 A
\]

\[
\cos^2 A = \frac{1}{2}(1 + \cos 2A)
\]

\[
\sin^2 A = \frac{1}{2}(1 - \cos 2A)
\]

\[
\sin A \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]
\]

\[
\cos A \cos B = \frac{1}{2} [\cos(A - B) + \cos(A + B)]
\]

\[
\sin A \cos B = \frac{1}{2} [\sin(A + B) + \sin(A - B)]
\]

\[
\int \sin^n x \, dx = -\frac{1}{n} \cos x \sin^{n-1} x + \frac{n-1}{n} \int \sin^{n-2} x \, dx
\]

\[
\int \cos^n x \, dx = \frac{1}{n} \sin x \cos^{n-1} x + \frac{n-1}{n} \int \cos^{n-2} x \, dx
\]
For problems #1-#2, evaluate the integral.

Problem #1

\[ \int_{1}^{e} t \ln t \, dt \]
Problem #2

\[ \int_{1}^{3/2} \frac{dx}{\sqrt{2x - x^2}} \]
Problem #3

Find the partial fractions decomposition of the following rational function. You do not need to integrate.

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

Does the following integral converge or diverge? If it converges, find its value.

\[ \int_{e}^{\infty} \frac{1}{x(\ln x)^3} \, dx \]