Math 142 – Summer 2003
Exam # 2– Show All Work

1. (a) Evaluate: \( \lim_{x \to 0} \frac{x \sin 2x}{x \sin 3x} = \) __________

(b) Evaluate: \( \lim_{x \to \infty} \left[ \ln(8x^2 + 3x + 1) \right] \ln(2x^2 - 7x + 1) = \) __________

2. Evaluate: \( \int \frac{1}{\sqrt{x}(1 + x)} \, dx = \) ______________

3. Evaluate: \( \int \frac{\sqrt{x^2 - 9}}{x^2} \, dx = \) ______________
4. Express as a sum of partial fractions and \textit{solve for the constants}:

\[
\frac{3x^3 + 5x^2 + 14x + 8}{(x^2 + 4)^2} =
\]

5. \[
x \sec^2 x \, dx =
\]

6. Evaluate: \[
\ln(x^2 + 1) \, dx =
\]
\textbf{Hint}: Don’t use any kind of substitution.
7. Express as a sum of partial fractions and solve for the constants:

\[
\frac{3x^2 - 4x + 1}{(x - 2)^3} = \text{__________________________}
\]

8. (a). Evaluate:

\[
\int \frac{1}{4 + x^2} \, dx = \text{__________________________} \quad \text{(Show your work!)}
\]

**Hint:** \[
\int \frac{1}{4 + x^2} \, dx = \frac{1}{2} \tan^{-1} \frac{x}{2} + C
\]

(b). Express the improper integral below as a sum of two limits involving other integrals, but do not bother to evaluate the integral any further. (Just fill in the blanks.)

\[
\int_{1}^{3} \frac{1}{x - 2} \, dx = \lim_{t \to 1^-} \int_{t}^{3} \frac{1}{x - 2} \, dx + \lim_{t \to 1^+} \int_{t}^{3} \frac{1}{x - 2} \, dx.
\]
9. (a). Evaluate: \( \lim_{x \to 0} \left[ e^{2x} + x \right] \)

(b). Evaluate: \( \int \frac{x^3 + 3x}{x^2 + 1} \, dx = \)

10. Evaluate: \( \int \frac{x^2}{\left(4 - x^3\right)^2} \, dx = \)