INSTRUCTIONS

- Read each question carefully, and answer each question completely.
- Show all of your work. No credit will be given for unsupported answers.
- Write your solutions clearly and legibly. No credit will be given for illegible solutions.

1. (10 points) Express \( \frac{1+i}{3-4i} \) in the form \( a+bi \), where \( a \) and \( b \) are real numbers.
2. (10 points) What are the poles of \( f(x) = \frac{x^7}{x^2(x^2 + 4)(x^2 - 9)} \)? What is the multiplicity of each pole?

3. (10 points) Calculate \( T_5 \) for \( \int_1^6 \sin(x^2) \, dx \).
4. (10 points) Find the area of intersection between the circles $r = \sin \theta$ and $r = \sqrt{3} \cos \theta$. 
5. (10 points) Evaluate $\int_0^\infty e^{-x} \cos(2x) \, dx$. There must be no imaginary numbers in your answer.

*Hint:* You may use the formulas

$$\lim_{x \to \infty} e^{-x} \sin(2x) = 0 \quad \text{and} \quad \lim_{x \to \infty} e^{-x} \cos(2x) = 0.$$
6. (10 points) Evaluate $\int \frac{x^2}{x^2 - 4} \, dx$. 
BONUS QUESTION (5 EXTRA CREDIT POINTS):

Show that
\[ \lim_{n \to \infty} \sqrt[n]{n!} = \infty. \]

Hint: Verify that \( n! \geq (n/2)^{n/2} \) by observing that half the factors of \( n! \) are greater than or equal to \( n/2 \).

SURVEY QUESTION (5 EXTRA CREDIT POINTS):

To be determined.