Instructions:

- Closed book: No notes, no books, no calculators.
- Exam time 50 minutes, do all of the problems.
- You must justify your answers for full credit.
- Write your answers in the space below each problem.
- If you need more space, use reverse side or scratch pages. Indicate clearly where to find your answers.
1. (6 points) Find each of the following limits.

a) \[ \lim_{x \to -\infty} \frac{x(3x - 4) + 2}{5x^2 - 10} \]

b) \[ \lim_{x \to -3} \frac{x^2 - 9}{x^2 + 2x - 3} \]

c) \[ \lim_{x \to 1} \frac{1}{x + 1} - \frac{1}{2} \cdot \frac{1}{x - 1} \]
2. (6 points) Differentiate each function.

a) \( f(x) = (2x^3)^4 \)

b) \( f(x) = \frac{1}{x} + x^2 e^x \)

c) \( f(x) = \ln \left( \arctan \sqrt{\frac{x}{4}} \right) \)
3. (5 points) Find the equation of the line tangent to the curve

\[
\sin(4x + y) = 2x - 2y
\]

at the point \((\pi, \pi)\).

4. (5 points) Find the absolute minimum and absolute maximum of the function

\[
f(x) = x^3 - 3x^2 + 1 \quad \text{on the interval} \quad -\frac{1}{2} \leq x \leq 4.
\]
5. (3 points) Suppose that the point (2, 3) is on the graph of \( y = g(x) \), and that the equation of the line tangent to the graph of \( y = g(x) \) at this point is \( y = -2x + 7 \). If you wanted to find a solution to \( g(x) = 0 \) by Newton’s method and you used \( x_1 = 2 \) as your initial guess, what would \( x_2 \) be?

6. (4 points) Find the \( n \)th order Taylor polynomial of \( f(x) = e^{2x} \) at \( x = a \), where \( a \) is any real number. Write your answer using \( \sum \) notation.