Math 124I - Winter 2003
Mid-Term Exam Number Two
February 20, 2003

Name: ________________________________  Section: ________________

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• Complete all questions.
• You may use a scientific (non-graphing) calculator during this examination. Other electronic devices are not allowed.
• You may use one hand-written 8.5 by 11 inch page of notes. You can use both sides of the note page.
• Show all work for full credit.
• You have 50 minutes to complete the exam.
1. Find $\frac{dy}{dx}$. You need not simplify your result.

(a) $y = \left(x^3 - 2x + \cos x\right)^8$

(b) $y = \frac{x^3 + 4}{x^2 - x + 1}$

(c) $y = \sec(x + e^x)$

(d) $y = x \sin 2x$
2. Find \( \frac{dy}{dx} \). You need not simplify your result.

(a) \( y = \ln \ln x \)

(b) \( x + \sin y = y + \cos x \).
3. Suppose \( f(x) = (3 - 5x)^{-2} \). Find \( f'''(0) \).

4. Find the equations of the tangent lines to the curve

\[
y = \frac{\cos x}{1 + e^x}
\]

at the point \( (0, \frac{1}{2}) \).
5. Suppose \( g(x) = \frac{xf(x)}{1+h(x)} \). Find \( g'(2) \) given that:

\[
\begin{align*}
  f(2) &= 1, \\
  f'(2) &= 0, \\
  h(2) &= -2, \\
  h'(2) &= 3.
\end{align*}
\]
6. Find a parabola with equation $y = ax^2 + bx$ whose tangent line at $(2, 14)$ is $y = 17x - 20$. 
7. Find the equation of the tangent line to \( y = (\ln x)^2 \) which passes through the origin.