ÇANKAYA UNIVERSITY
Department of Mathematics and Computer Science

MATH 155
Calculus for Engineering I

Practice Final Exam

January 16, 2007
09:00-11:00

- This exam is meant to suggest the kind, difficulty, and number of problems on the real exam. Note that topics covered in the course, but not included on this practice exam, still might appear on the real exam.
- **Repeat**: Topics covered in the course, but not included on this practice exam, still **might appear on the real exam**.
- Set aside 110 min. during which you can work on this exam without interruption. Refer to no books, notes, or calculators while working on the exam. This will give you a sense of your level of preparation for the real exam.

1. If y is defined as a function of x by the equation $e^x - e^y = x^2 + y^2$ then find the equation of the line tangent to the graph at the point $(0, 0)$.

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2. Calculate the following limits

a) $\lim_{x \to 1} \left(\frac{x}{\ln x} - \frac{1}{x \ln x} \right)$

b) $\lim_{x \to \infty} x^{\left(\frac{1}{\sqrt{x}}\right)}$

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3. Evaluate the integral

$$\int \cos(\ln x)\, dx$$

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4. Evaluate the integral

$$\int \sin^5(4x)\,dx$$

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5. Integrate the function

$$\int \frac{y^2}{(25-y^2)^{3/2}}dy$$

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6. Evaluate the integral by first performing long division on the integrand and then writing the proper fraction as a sum of partial fractions

$$\int \frac{3x^3 + 11x^2 - 2x - 4}{x^3 - x^2} dx$$

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7. Evaluate the improper integral or state that it is divergent

$$\int_{-\infty}^{0} \frac{dx}{(81+x)\sqrt{x}}$$

8. Determine whether the improper integral converges or diverges

$$\int_1^\infty \frac{e^x}{\sqrt{1+x^2}}dx$$

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9. Find the limit

$$\lim_{x \to 0} \frac{2^{-\sin x} - 1}{e^x - 1}$$

10. Find the derivative of y with respect to x

$$y = (\ln x)^{1/(\ln x)}$$

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11. A rectangle has its base on the x-axis and its upper two vertices on the parabola $y = 12 - x^2$. What is the largest area the rectangle can have, and what are its dimensions?

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12. Sketch the graph of $y = x^2 \ln x$ including a discussion of all the usual features. Be sure to calculate $\lim_{x \to 0^+} x^2 \ln x$.

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13. If $f''(x) = e^{x/2} - 1$ where $f'(0) = 1$ and $f(0) = 2$, then calculate $f(2)$.
