INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write (1) **your name**, (2) **1360/EXAM 1**, (3) **instructor's name** and (4) **SPRING 2011** on the front of your bluebook. Also make a scoring table with room for 5 problems and a total score. **Work all problems. Start each problem on a new page.** **Box** **your answers.** A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

— SHOW ALL WORK —

1. (30 pts) Determine if the integrals converge or diverge. Each part is worth 10 pts.

   (a) $\displaystyle\int_0^\infty \frac{e^x}{e^{2x}+1}\,dx$ (b) $\displaystyle\int_1^\infty \frac{x}{\sqrt{1+x^6}}\,dx$ (c) $\displaystyle\int_1^\infty e^{x^2}\,dx$

2. (16 pts) Find the antiderivative. Each part is worth 8 pts.

   (a) $\displaystyle\int \sqrt{1-4x^2}\,dx$ (b) $\displaystyle\int \frac{\cos(x)\sin(x)}{\sin^2(x)+3\sin(x)+2}\,dx$

3. (24 pts) Evaluate the given integrals. Each part is worth 8 pts.

   (a) $\displaystyle\int_1^2 xe^x\,dx$ (b) $\displaystyle\int_{-1}^1 \frac{e^x}{-1+e^x}\,dx$ (c) $\displaystyle\int_0^{\sqrt{3}} x\sqrt{x^2+1}\,dx$

4. (a) (9 pts) What is the area of one side of a thin metal plate that covers the region above the x-axis and below the curve $y = \ln(x)$, $e \le x \le e^2$.

   (b) (6 pts) Set-up but **do not solve** an integral (or integrals) to find the area of the region bounded by the curves $x^2 + y = 4$, $x + y = 2$ and the lines $x = -2$ and $x = 2$.

5. (15 pts) **Always True** or **False**: Do not justify your answer, just answer either *Always True* or *False*, each part is worth 3 points:

   (a) $\displaystyle\int \cos^2(x)\,dx = \frac{\cos^3(x)}{3} + C$

   (b) If $f(x)$ is continuous, then $\displaystyle\int_{-\infty}^{\infty} f(x)\,dx = \lim_{t\to\infty}\int_{-t}^{t} f(x)\,dx$

   (c) Given the integral $\displaystyle\int \sqrt{x^2-1}\,dx$, one possible trigonometric substitution to use to solve the integral is $x = \tan(\theta)$.

   (d) The partial fraction decomposition of $f(x) = \dfrac{1}{x^2(x^2+60)}$ is $\dfrac{1}{x^2(x^2+60)} = \dfrac{Ax+B}{x^2} + \dfrac{Cx+D}{x^2+60}$.

   (e) Suppose, for functions $f(x)$ and $m(x)$, we have that $f(x) \ge m(x) > 0$ for all $x > 106$ then if $\displaystyle\int_{106}^{\infty} m(x)$ diverges then so does $\displaystyle\int_{106}^{\infty} f(x)$.

FORMULAS ON THE OTHER SIDE.