1. (10) Evaluate the indefinite integral $\int \frac{3x-4}{x^2-3x+2}\,\mathrm{d}x$.

2. (15) Find a **nonzero** number b such that $\int_0^b \ln(x)\,\mathrm{d}x = 0$.

3. (25)

(i) Find the solution $y(x)$ of the differential equation $(1+x^4)\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{x^3}{y^2}$ that satisfies $y(0) = 2$.

(ii) Find the general solution of the differential equation $y' + y = \cos(e^x)$.

4. (15)

(i) Verify that $\sinh x$ is a solution to the differential equation $y'' - y = 0$.

(ii) Solve the initial value problem $y'' - 5y' = 0$, where $y(0) = 3$ and $y'(0) = 10$.

(iii) Find the general solution of the differential equation $y'' + 2y' + 10y = 0$.

5. (10) Determine if the sequence $\left\{ \dfrac{n \cos n}{n^2 + 1} \right\}_{n=1}^{\infty}$ converges, and if it does, find its limit.

6. (10)

(i) Starting with $n = 1$, find the general term of the sequence

$$\frac{3}{2^2 - 1^2}, \quad \frac{4}{3^2 - 2^2}, \quad \frac{5}{4^2 - 3^2}, \ldots .$$

(ii) Determine whether the sequence above converges, and if so, find its limit.

7. (15)

(i) Show that the sequence $\left\{ \dfrac{n!}{12^n} \right\}_{n=1}^{\infty}$ is eventually monotone.

(ii) Show that the sequence $\{\ln(n)\}_{n=1}^{\infty}$ is eventually monotone.

(iii) Give an example of a divergent monotone sequence.

Name: _____

Section: _____

University of Colorado

Mathematics 2300: Second Midterm Exam

March 5, 2008

No calculators, formula sheets, notes or books are allowed.
Justify your answers. Correct answers with no justification may not receive full credit.

Problem	Points	Score
1	10	
2	15	
3	25	
4	15	
5	10	
6	10	
7	15	
Total	100	