

MAT 122 – 001  
Spring 2008  
Comprehensive Exam  
**Show all work.**

**For limits, show the details of L'Hôpital's rule.**  
**For differentiation problems, show the details of using the chain rule.**  
**For integration problems, show substitutions and all details.**

1. Find  $\lim_{x \rightarrow \infty} \frac{x}{\ln(1 + 2e^x)}$ .

2. Find  $\lim_{x \rightarrow \infty} x^3 e^{-x^2}$ .

3.  $y = x^{e^x}$ . Find  $y'$ .

4.  $y = e^{\cos x} + \cos(e^x)$ . Find  $y'$ .

5. Integrate  $\int \sqrt{x} \sin(1 + x^{3/2}) dx$ .

6. Integrate  $\int_0^{13} \frac{dx}{\sqrt[3]{(1 + 2x)^2}}$ .

7. Integrate  $\int \frac{\sec x \tan x}{1 + \sec x} dx$ .

8. Integrate  $\int e^x \sqrt{1 + e^x} dx$ .

9. Integrate  $\int \frac{\cos(\ln x)}{x} dx$ .

10. Set up a definite integral to find the area between the curves  $y = 5x - x^2$  and  $y = x$ . You need not do the integration.

11. Set up a definite integral to find the volume generated by revolving the region bounded by  $y^2 = x$  and  $x = 2y$  about the  $y$ -axis. You need not do the integration.

12. Set up a definite integral to find the volume generated by revolving the region bounded by  $y = x(x-1)^2$  and  $y = 0$  about the  $y$ -axis.