

NAME:

Math 106 - Exam 2 - March 7, 2008

Instructions: Show all of your work and circle your final answers. Your work should flow logically and be easy to follow. Cross out any work that you do not want considered. Calculators are allowed, but notes and books are not.

Problem	Max	Score
1	10	
2	10	
3	20	
4	10	
5	10	
TOTAL	60	

1. (10 points) Evaluate $\int \frac{dx}{\sqrt{16+x^2}}$.

2. (10 points) Evaluate $\int xe^{3x} dx$.

3. (20 points) Let $f(x) = \sqrt{x}$.

(a) Find $P_2(x)$, the degree-2 Taylor polynomial for $f(x)$ centered at $x = 4$.

(b) Use your polynomial to approximate $\sqrt{6}$.

(c) What does Taylor's Theorem imply about the maximum approximation error committed by $P_2(x)$ on the interval $[4, 6]$?

4. (10 points) A certain company sells light bulbs. Let X be the length of time, in days, that it takes for a randomly chosen light bulb to burn out. The probability density function of X is

$$f(x) = \begin{cases} \frac{k}{(x+1)^3} & \text{if } x \geq 0, \\ 0 & \text{if } x < 0, \end{cases}$$

for some positive constant k . Find the value of k that makes $f(x)$ a probability density function.

5. (10 points) Use a comparison to determine whether $\int_1^{\infty} \frac{1}{\sqrt{x} + x^4} dx$ converges or diverges.

Potentially Useful Integral Formulæ

1. $\int \sec(x) dx = \ln |\sec x + \tan x| + C.$

2. $\int \sin^n(x) dx = -\frac{\sin^{n-1}(x)\cos(x)}{n} + \frac{n-1}{n} \int \sin^{n-2}(x)dx, \text{ for } n \neq 0.$

3. $\int \cos^n(x) dx = \frac{\cos^{n-1}(x)\sin(x)}{n} + \frac{n-1}{n} \int \cos^{n-2}(x)dx, \text{ for } n \neq 0.$

4. $\int \sec^n(x) dx = \frac{\sec^{n-2}(x)\tan(x)}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2}(x)dx, \text{ for } n \neq 1.$