

King Fahd University of Petroleum and Minerals
 Department of Mathematical Sciences
Math 102, Sections 18, 20, 23
Final Examination
Semester II, 2005–2006(052)
June 04, 2006
Time: 07:00 p.m. – 10:00 p.m.

Name: _____ Section #: _____

ID #: _____ Serial #: _____

Sec. #	Instructor	Location
18, 20, 23	Dr. Abdul Rahim Khan	Building 54 (Exhibition Center)

Instructions:

1. Do not use programmable calculators. Use of ordinary calculator is allowed.
2. Show all your work. Less credit will be given for answer not supported by proper work.
3. Clearly indicate the theorem or result you use.
4. This exam consists of 13 pages.
5. Do not forget to write your NAME, ID#, Section # and Serial # in the space provided above.

Question #	Grade/Points
1	_____/18
2	_____/18
3	_____/18
4	_____/18
5	_____/18
6	_____/20
Total:	_____/110

1. (a) Use rectangle method to find area under the curve $y = x^3$ over the interval $[2, 6]$. (9 points)

- (b) Use mean value theorem for integrals to evaluate $\int \sqrt{x} \, dx$ over the interval $[0, 9]$. (9 points)

2. (a) For an odd function f , $\int_{-a}^a f(x)dx = 0$. Use this fact and a suitable substitution to evaluate $\int_0^\pi \sin^8 x \cos^5 x dx$. (9 points)

- (b) Find the area of the region bounded by the graphs of the equations $x = y^2$ and $2y^2 = x + 4$. (9 points)

3. (a) The region bounded by the curves:

$$x + y = 3 \quad \text{and} \quad y = 3 - x^2$$

is rotated about the line $x = 2$. Find volume of the solid of revolution by cylindrical shell method. (9 points)

(b) Evaluate: $\int \frac{dx}{x^2\sqrt{x^2-25}}$.

(9 points)

4. (a) Evaluate: $\int \frac{x^3 + x^2 + x + 2}{(x^2 + 1)(x^2 + 2)} dx.$

(9 points)

(b) Find sum of the series:

$$\sum_{n=1}^{\infty} \left[\frac{1}{4n^2 - 1} + \frac{1}{n^4} - \frac{1}{4^n} \right].$$

(9 points)

5. (a) Check whether the series converges or diverges:

$$\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{1 + n^2} .$$

(9 points)

- (b) Determine whether the series is absolutely convergent or conditionally convergent:

$$\sum_{k=1}^{\infty} (-1)^{k-1} \frac{k}{k^2 + 5}.$$

(9 points)

6. (a) Find radius of convergence and interval of convergence of the power series:

$$\sum_{n=0}^{\infty} \frac{(x+7)^n}{(2n+1)}.$$

(10 points)

- (b) Let $f(x) = \frac{1}{1-3x}$ where $|x| < 1$. Find a power series representation for $f(x)$ and $f'(x)$. (5 points)

- (c) Use power series to approximate $\int_0^{1/2} \frac{\ln(1+x)}{x}$ to 3 decimal-place accuracy. (5 points)