

MATH 142

FINAL EXAM

May 6, 2002

NAME (please print legibly): _____

Your University ID Number: _____

Circle your Instructor's Name along with the Lecture Time:

Felea (2 o'clock) Knightly (9 o'clock) Kojcinovic (10 o'clock) Voloshina (2 o'clock)

- No calculators are allowed on this exam.
- Please show all your work. You may use back pages if necessary. You may not receive full credit for a correct answer if there is no work shown.
- Please put your simplified final answers in the spaces provided.

Part I		
QUESTION	VALUE	SCORE
1	30	
2	10	
3	10	
4	10	
5	10	
6	20	
7	10	
TOTAL	100	

Part II		
QUESTION	VALUE	SCORE
8	16	
9	16	
10	12	
11	10	
12	14	
13	14	
14	18	
TOTAL	100	

Part I

1. (30 pts) Let $f(x) = \frac{1}{6}x^3 - 2x + \frac{1}{2}$.

(a) Find the domain of f .

ANSWER: _____

(b) Find the intervals on which f is increasing and decreasing.

ANSWER: _____

(c) Find the local extrema of f .

ANSWER: _____

(d) Find the intervals on which f is concave up and concave down.

ANSWER: _____

(e) Sketch the graph of the curve $y = f(x)$.

2. (10 pts) Find the point on the curve $y = x + 3$ which is closest to the origin.

ANSWER: _____

3. (10 pts) An object moving along the x -axis passes through the origin at time $t = 0$. Assuming that the velocity of the object at time $t = 0$ is $v(0) = 3$ and that its acceleration at time t is given by $a(t) = t - 2$, find the position of the object $s(t)$ at time t .

ANSWER: _____

4. (10 pts) Find the Riemann sum corresponding to $n = 4$ for the integral

$$\int_{-1}^3 (1 + 2x) dx$$

using right hand endpoints as sample points.

ANSWER: _____

5. (10 pts) Differentiate the following functions.

(a) $\int_1^x \cos(t^2) dt$

ANSWER: _____

(b) $\int_x^0 \frac{e^t}{\cos^2 t + 4} dt$

ANSWER: _____

6. (20 pts) Evaluate the following indefinite integrals.

(a) $\int x^3 - e^x + \cos x dx$

ANSWER: _____

(b) $\int \frac{1}{x \ln x} dx$

ANSWER: _____

(c) $\int x e^x dx$

ANSWER: _____

(d) $\int \sin^2 x \cos^3 x dx$

ANSWER: _____

7. (10 pts) Find the volume of the solid obtained by rotating, about the y -axis, the region enclosed by the curves $y = \sqrt{x}$ and $y = x$.

ANSWER: _____

Part II

8. (16 pts) Evaluate the following indefinite integrals.

(a) $\int \ln(\cos x) \sin x \, dx$

ANSWER: _____

(b) $\int \frac{3x^2}{(x-2)(x+1)} \, dx$

ANSWER: _____

9. (16 pts) Evaluate the following indefinite integrals.

(a) $\int \frac{1}{x^2\sqrt{x^2+9}} dx$

ANSWER: _____

(b) $\int \frac{e^x}{e^{2x}-4} dx$

ANSWER: _____

10. (12 pts) Estimate

$$\int_1^5 x^2 + x dx$$

using the Trapezoidal Rule with $n = 4$.

ANSWER: _____

11. (10 pts) Find the average value of $f(x) = \arctan x$ over $[0, 1]$.

ANSWER: _____

12. (14 pts) Find the length of the curve $y = \frac{1}{2}(x^2 - \ln x)$, $1 \leq x \leq 3$.

ANSWER: _____

13. (14 pts) Find the area of the surface obtained by rotating, about the y -axis, the curve $x = \sqrt{y+2}$, $2 \leq y \leq 3$.

ANSWER: _____

14. (18 pts) Evaluate the following improper integrals

(a) $\int_1^{\infty} \frac{1}{(x+1)^4} dx$

ANSWER: _____

(b) $\int_{-\infty}^0 e^{-x} dx$

ANSWER: _____

(c) $\int_2^6 \frac{1}{\sqrt{x-2}} dx$

ANSWER: _____