# Math 3 Midterm Exam #2

## February 19, 2015

# Instructor (circle one): Smedinghoff, Sadykov, Andrews Moore Hall Filene

PRINT NAME: \_\_\_\_\_

*Instructions*: This is a closed book, closed notes exam. Use of calculators is not permitted. You must justify all of your answers to receive credit. A correct answer with no justification will receive minimal credit.

You have **two hours** to work on this exam.

Circle your instructor's name above.

The Honor Principle requires that you neither give nor receive any aid on this exam.

 1-6.
 /30

 7.
 /5

 8.
 /25

 9.
 /5

 10.
 /10

 11.
 /5

 12.
 /5

 13.
 /5

 14.
 /10

**Total:** \_\_\_\_\_ /100

#### 1. (5 points) What is

 $\int_0^{\sqrt{\pi}} x \sin(x^2) dx?$ 

- (a) 0
- (b) 1
- (c)  $\sqrt{\pi}$
- (d)  $\pi$
- (e)  $\pi^2$

2. (5 points) What is

$$\int_{-1}^{1} x(x+1)^6 dx?$$

(a) 0  
(b) 
$$\frac{24}{7}$$
  
(c)  $\frac{48}{7}$   
(d)  $\frac{72}{7}$   
(e)  $\frac{96}{7}$ 

# 3. (5 points) Let $F(x) = \frac{x}{x^2+1}$ . What is $\int_{-1}^{1} F'(x) dx$ ?

- (a) 0
- (b) 2
- (c) -1
- (d) 1
- (e) -2

4. (5 points) Evaluate the integral

$$\int_{1}^{9} \frac{3x-2}{\sqrt{x}} dx.$$

- (a) 64
- (b) 40
- (c) 68
- (d) 44
- (e) -68

## 5. (5 points) Find the limit:

$$\lim_{x \to \infty} \frac{x-2}{x^2+1}$$

- (a) 1
- (b) 0
- (c) -2
- (d)  $\infty$
- (e)  $-\infty$

6. (5 points) Find the limit:

$$\lim_{x \to \infty} \frac{\sqrt{9x^6 - x}}{x^3 + 1}$$

- (a) 9
- (b) 3
- (c)  $\infty$
- (d) 0
- (e) 4

#### 7. (5 points) Estimate

$$\int_1^9 \frac{1}{x^2 + 3} dx$$

by dividing the interval [1,9] into 4 equal subintervals and using left Riemann sums. You do not need to simplify your answer.

8. Consider the function

$$f(x) = 16\left(1 - \frac{2}{x} - \frac{8}{x^2}\right).$$

(Hint: although you can write f(x) as a single fraction, and that helps you to do certain things, if you want to take the derivative of f(x) it's easier to leave f(x) in the above form.)

(a) (5 points) Find the x and y-intercepts of f.

(b) (5 points) Find the critical point(s) of f, and classify each critical point as a local maximum, a local minimum, or neither. Determine the intervals on which f is increasing/decreasing.

(c) (5 points) Find the inflection point(s) of f. Determine the intervals on which f is concave up/down.

(d) (5 points) Find the horizontal and vertical asymptote(s) of f (f has no slanted asymptotes).

(e) (5 points) Accurately graph the function f(x) on the axes provided. Label all points and asymptotes found in the previous parts of the question.



9. (5 points) Find the absolute maximum and minimum of  $f(x) = x^3 - 3x^2 + 3x$  on [0,3].

10. (10 points) If the product of two positive numbers x and y is 16, what is the smallest value that  $x^2 + y$  can be?

11. (5 points) Define  $f(x) = \int_{x^2}^0 \frac{\sin t}{t} dt$ . Then what is f'(x)?

12. (5 points) Find the most general antiderivative of the function:

$$f(x) = 2\sqrt{x} + 6\cos x$$

13. (5 points) Find the most general antiderivative of the function:

$$f(x) = x\sqrt{x^2 + 5} + x^{-1/2}$$

14. (10 points) Find f if  $f''(x) = 20x^3 + 6$ , and f(1) = 0, f'(1) = 8.