

# MATH 2250

## Final Exam I

December 14, 2005

**NAME (please print legibly):** \_\_\_\_\_

**Your University ID Number:** \_\_\_\_\_

Please complete all questions in the space provided. You may use the backs of the pages for extra space, or ask me for more paper if needed. Work carefully, and try to complete the problems you find easier before going back to the harder ones. Good luck!

QUESTION	VALUE	SCORE
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	20	
8	10	
9	10	
10	10	
11	10	
12	10	
13	10	
14	10	
<b>TOTAL</b>	<b>150</b>	

**1. (10 points)** If the function  $f(x)$  is given by

$$f(x) = \frac{7 + x^2}{8 - x^2}, \quad (1)$$

Please find the derivative  $f'(x)$ .

ANSWER: \_\_\_\_\_

**2. (10 points)** If the function  $f(x)$  is given by

$$f(x) = 7x + 24/x^2, \quad (2)$$

Please find the equation for the tangent line to the function at  $(2, 20)$ .

ANSWER: \_\_\_\_\_

**3. (10 points)** If the function  $f(x)$  is given by

$$f(x) = \cos x + 4 \tan x, \quad (3)$$

Please find the derivative of  $f(x)$ .

ANSWER: \_\_\_\_\_

**4. (10 points)** Use the definition of the derivative as a limit to find the derivative of the function

$$f(x) = 3x^2 + 2x \quad (4)$$

ANSWER: \_\_\_\_\_

**5. (10 points)** Suppose that  $f'(x) = 2f(x) + 3x$ . If  $f(3) = 4$ , use tangent-line approximation to estimate the value of  $f(3.1)$ .

ANSWER: \_\_\_\_\_

**6. (10 points)** The function

$$f(x) = \frac{x^2 - 25}{x^2 - 16}. \quad (5)$$

Find all **horizontal and vertical** asymptotes of this function.

ANSWER: \_\_\_\_\_

**7. (20 points)** This problem has two parts. Be sure that you answer both! The function  $f(x)$  is given by

$$f(x) = 2x^3 - 27x. \quad (6)$$

**Part A** Find the intervals on which  $f(x)$  is increasing and decreasing.

ANSWER: \_\_\_\_\_

**Part B** Find the local minima and maxima of  $f(x)$ .

ANSWER: \_\_\_\_\_

**8. (10 points)** The volume of a certain cone grows at a rate of  $20\text{ft}^3/\text{sec}$ . The **diameter** of the base of the cone and the height of the cone are always the same. How fast is the height of the cone growing when the base is 10ft in **diameter**?

**Hint:** The volume of a cone of **radius**  $r$  and height  $h$  is  $\frac{1}{3}\pi r^2 h$ .

ANSWER: \_\_\_\_\_

**9. (10 points)** Evaluate the definite integral

$$\int_{-1}^1 x^2 - 3x + 4 dx. \quad (7)$$

ANSWER: \_\_\_\_\_

**10. (10 points)** Evaluate the indefinite integral

$$\int 8xe^{4x^2} dx. \quad (8)$$

ANSWER: \_\_\_\_\_

**11. (10 points)** Use integration by parts to evaluate the integral

$$\int x^2 \ln x \, dx. \quad (9)$$

ANSWER: \_\_\_\_\_



**12. (10 points)** Find the integral

$$\int \frac{20}{(x-1)(x+1)} dx. \quad (10)$$

ANSWER: \_\_\_\_\_

**13. (10 points)** Solve the differential equation

$$y' = (x - 5)e^{-2y}, \quad (11)$$

with the initial condition  $y(0) = \frac{\ln 4}{2}$ .

ANSWER: \_\_\_\_\_

**14. (10 points)** Use your calculator and Simpson's rule to estimate the value of

$$\int_{-1}^1 e^{x^2} dx \quad (12)$$

using  $n = 4$ .

ANSWER: \_\_\_\_\_