

# MATH 141

## EXAM II

November 18, 1999

No calculators allowed on this exam. Please show all your work.

I. In questions 1–5, circle the appropriate letter.

1. (5 pts) Let  $f(x) = (x + 1)^2(x + 2)$ . Find  $f'(0)$ .

(A) 6 (B) 9 (C) 4 (D) 12 (E) 8 (F) 16 (G) 5 (H) 20

2. (5 pts) Let  $f(x) = \frac{x^3}{(x + 2)^2}$ . Find  $f'(-1)$ .

(A) 8 (B) 5 (C) 10 (D) 4 (E) 20 (F) 9 (G) 12 (H) 16

3. (5 pts) Find the slope of the tangent line to the curve  $2x^3 + 2y^3 - 9xy = 0$  at the point  $(1, 2)$ .

(A) 3 (B) 9 (C)  $9/2$  (D)  $1/3$  (E)  $4/5$  (F)  $18/5$  (G) 7 (H)  $-18/5$

4. (5 pts) Let  $f(x) = x \sin x$ . Find  $f''(0)$ .

(A)  $\sqrt{2}$  (B)  $\sqrt{2}/2$  (C) 2 (D)  $-\sqrt{3}$  (E)  $-\sqrt{2}$  (F) -2 (G)  $\sqrt{3}$  (H)  $-\sqrt{2}/2$

5. (5 pts) If  $f(x) = \ln((x^2 + 1)^5)$ , then  $f'(2) =$  \_\_\_\_\_

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4 (F) 5 (G) 6 (H) 7

II. Find the derivatives of the following functions.

6. (5 pts)  $f(x) = x \ln x$  \_\_\_\_\_

7. (5 pts)  $f(x) = \frac{x^2 + 1}{x}$  \_\_\_\_\_

8. (5 pts)  $f(x) = \cos(x^3)$  \_\_\_\_\_

9. (5 pts)  $f(x) = \cos^3(x)$  \_\_\_\_\_

III. Find the derivatives of the following functions.

10. (5 pts)  $f(x) = 3^x$  \_\_\_\_\_

11. (5 pts)  $f(x) = x^{\sin x}$  \_\_\_\_\_

12. (5 pts)  $f(x) = \ln(\sin(e^x))$  \_\_\_\_\_

13. (5 pts)  $f(x) = \sin^{-1}(2x)$  (e.e.  $\arcsin(2x)$ ) \_\_\_\_\_

14. (12 pts) A ball is thrown straight up with an initial velocity of 48 ft/sec from the top of a building 160 ft high. Its height above the ground  $s(t)$ , at time  $t$  (in seconds) is given by

$$s(t) = -16t^2 + 48t + 160 .$$

(a) What is the maximum height of the ball?

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

(b) What is the velocity of the ball when it hits the ground?

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

15. (11 pts) A cylindrical water tank has a radius of 12 inches. If water flows into the tank at a rate of 2 cubic inches per second, how fast is the water level in the tank rising?

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

16. (12 pts) A light is on the ground 40 meters from a building. A man 2 meters tall walks from the light toward the building at  $3/2$  meters/sec.

(a) Find the height of his shadow as a function of the elapsed time since he leaves the light.

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

(b) Find the rate of change of the length of his shadow when he is 20 meters from the building.

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