

PRINT Your Name: \_\_\_\_\_

There are 8 problems on 4 pages. The exam is worth 50 points. SHOW your work.

**CIRCLE** your answer. **NO CALCULATORS!**

Neither your exam, nor your score, will not be available until class on Monday.

1. (7 points) Let  $f(x, y) = 2x^2y^3 - x^3y^5$ ,  $x = r \cos \theta$ , and  $y = r \sin \theta$ . Find  $\left. \frac{\partial f}{\partial \theta} \right|_{r=2, \theta=\pi/4}$ .

2. (6 points) Let  $f(x, y) = \frac{xy + y^3}{x^2 + y^2}$ .

(a) Calculate the limit of  $f(x, y)$  as  $(x, y) \rightarrow (0, 0)$  along  $y = x$ .

(b) Calculate the limit of  $f(x, y)$  as  $(x, y) \rightarrow (0, 0)$  along  $y = 2x$ .

(c) What is  $\lim_{(x, y) \rightarrow (0, 0)} f(x, y)$ ?

3. (6 points) Identify all local extreme points and all saddle points of  $f(x, y) = xy^2 - 6x^2 - 3y^2$ .

4. (6 points) A boy's toy boat slips from his grasp at the edge of a straight river. The stream carries it along at 6 feet per second. A cross wind blows it toward the opposite bank at 5 feet per second. If the boy runs along the shore at 3 feet per second following his boat, how fast is the boat moving away from him 3 seconds after the boat slipped from his grasp.

5. (7 points) Compute  $\int_1^3 \int_{-y}^{2y} xe^{y^3} dx dy$ .

6. (6 points) Compute  $\int_0^4 \int_{\sqrt{x}}^2 \sin(y^3) dy dx$ .

7. (6 points) Find the volume of the solid in the first octant which is bounded by  $x^2 = 4y$  and  $5y + 9z = 45$ .

8. (6 points) Find the volume of the solid in the first octant which is bounded by  $x^2 + y^2 = 4$  and  $x + y - z = 0$ .