

40 pts. **Problem 1.** Find all of the critical points of the function

$$f(x, y) = x^3 + xy + \frac{1}{2}y^2$$

and classify them as local maxima, local minima or saddle points.

40 pts. **Problem 2.** Let R be the region in the xy -plane bounded by the line $y = 2x$ and the parabola $y = x^2$. Find the area of R . Find \bar{y} , the y -coordinate of the centroid of R .

40 pts. **Problem 3.** Express the repeating decimal

$$0.121212\overline{12} \dots$$

as a fraction.

40 pts. **Problem 4.** In each part, use the Ratio Test to determine if the series is convergent or divergent.

A.

$$\sum_{n=1}^{\infty} \frac{2^n}{n}.$$

B.

$$\sum_{n=1}^{\infty} \frac{2^n}{n!}.$$

40 pts. **Problem 5.** Find the first four terms in the Maclaurin Series of the function

$$f(x) = \sqrt{1+x}.$$

40 pts. **Problem 6.** Recall that the series for $\sin(x)$ is

$$\sin(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots$$

Use the first three terms of this series to estimate $\sin(1)$ (that would be sine of 1 radian). By estimating the error, show that your estimate is accurate to two decimal places.

EXAM

Exam 1

Math 3322, Fall 2006

October 9, 2006

- Write all of your answers on separate sheets of paper. You can keep the exam questions when you leave. You may leave when finished.
- You **must** show enough work to justify your answers. Unless otherwise instructed, give exact answers, not approximations (e.g., $\sqrt{2}$, not 1.414).
- This exam has 6 problems. There are **240 points total**.

Good luck!