

## Math 234 Review

### Chapter 5: Maxima and Minima

1. Find all critical points of the following functions. Apply the second derivative test to the critical points you find.

(a)  $2x^2 + 6xy + 5y^2 + 6x + 10y + 5$

(b)  $x^2 + 3xy + 2y^2 - x - 2$

(c)  $3x^2 + 2x^3 + 2y^2 + y^4$

(d)  $xy(3x + 3y + 1)$

(e)  $x^4 + y^4 - 4xy$

2. Find all critical points of the function

$$f(x, y, z) = x^2 + (x - y)^2 + (y - z)^2 + (z - 1)^2.$$

3. Find the volume of the largest rectangular box with edges parallel to the axes that can be inscribed in the the surface

$$x^4 + y^4 + z^4 = 1.$$

4. Find all points on the surface

$$x^2 + 4y^2 + 9z^2 = 36$$

that are closest to the origin.

5.\* A thin cylindrical drinking cup has a disk-shaped base and is of constant density 1 per unit area. The cup has total mass fixed to be  $S$ . Find the largest possible capacity of the cup.

### Chapter 6: Integrals

1. Compute the following double integrals.

(a)  $\iint_D \sin(x^2) dA$ , where  $D = \{(x, y) : 0 \leq y \leq 1, y \leq x \leq 1\}$

(b)  $\iint_D \frac{y}{1+x^2} dA$ , where  $D = \{(x, y) : 0 \leq y \leq 1, y^2 \leq x \leq 1\}$

(c)  $\iint_D xe^y dA$ , where  $D = \{(x, y) : 0 \leq y \leq 1, \sqrt{y} \leq x \leq y\}$

(d)  $\iint_D \sqrt{4-x^2-y^2} dA$ , where  $D = \{(x, y) : x^2 + y^2 \leq 2\}$

2. Find the volume of the following regions by computing a double integral.

(a) the region in the first octant bounded by  $y^2 = 4 - x$ ,  $y^2 = x$  and  $z = y$ .

(b) the region in the first octant bounded by  $z^2 = x^2 + y^2$  and  $z = x^2 + y^2$ .

3. Check out the last homework assignment for triple integrals.