SM223 – Calculus III with Optimization
Assoc. Prof. Nelson Uhan

Fall 2017

Exam 4 – Information and Review Problems

1 Information

- When: Wednesday 29 November, in class
- What: Lessons 28 - 35
- Calculators are allowed
- No other outside materials allowed
- Review in class on Monday 27 November
  - We will discuss some of the problems below, as well as any questions that you might have
- EI on Tuesday 28 November, 1900 – 2000, CH348 (or nearby)

2 Review Problems

Note: these problems together are not meant to represent the total length of the exam.

Problem 1. A package in the shape of a rectangular box can be mailed by the US Postal Service if the sum of its length and girth (twice the sum of its width and height) is at most 108 in. Find dimensions of the package with the largest volume that can be mailed using the Lagrange multiplier method.

Problem 2. Reverse the order of integration for each iterated integral.

a. $\int_{-1}^{1}\int_{2}^{3} e^{x^3+y}\,dy\,dx$

b. $\int_0^1\int_x^1 \cos(y^2)\,dy\,dx$

c. $\int_0^1\int_{\sqrt{y}}^1 \frac{ye^{x^2}}{x^3}\,dx\,dy$

Problem 3. Set up the following double and triple integrals as iterated integrals.

a. $\iint_D \frac{y}{1+x^2}\,dA$, where D is bounded by $y=\sqrt{x}$, $y=0$, and $x=4$.

b. $\iint_D \frac{1}{1+x^2}\,dA$, where D is the triangular region with vertices $(0,0)$, $(1,1)$, and $(0,1)$.

c. $\iint_D x\,dA$, where D is the region in the first quadrant that lies between the circles $x^2+y^2=1$ and $x^2+y^2=2$. Use polar coordinates.

d. $\iint_D (x^2+y^2)^{3/2}\,dA$, where D is the region in the first quadrant bounded by the lines $y=0$ and $y=\sqrt{3}x$ and the circle $x^2+y^2=9$. Use polar coordinates.

e. $\iiint_D xy\,dV$, where E is the solid that lies below that plane $z=x$ and above the triangular region with vertices $(0,0,0)$, $(2,0,0)$, and $(0,2,0)$.

f. $\iiint_D xy\,dV$, where E is bounded by the paraboloid $x=1-y^2-z^2$ and the plane $x=0$.

Problem 4. Set up an integral to find the volume of the solid above the paraboloid $z=x^2+y^2$ and below the half-cone $z=\sqrt{x^2+y^2}$.

Problem 5. Consider a lamina that occupies the region D bounded by the parabola $x = 1 - y^2$ and the coordinate axes in the first quadrant with density function $\rho(x, y) = y$.

a. Set up an integral to find the mass of the lamina.
b. Set up integrals to find the center of mass of the lamina.

Problem 6. Rewrite the iterated integral

$$\int_{-1}^{1} \int_{x^2}^{1} \int_{0}^{1-y} f(x, y, z)\, dz\, dy\, dx$$

using the following orders of integration:

a. $dz\, dx\, dy$
b. $dx\, dy\, dz$