Final Exam Information

Math 126

The exam will emphasize topics that we studied after the last midterm exam. These topics are:

- Partial derivatives, tangent planes, directional derivatives, gradient, max/min values (Sections 14.1, 14.3, 14.4, 14.6, 14.7)
- Double integrals, iterated integrals, and applications (Sections 15.1, 15.2, 15.5)

Of course, to do well on these topics you also have to know previous topics, especially derivatives, integrals, and 3D geometry. Calculus is inherently cumulative! The exam will also specifically cover the following topics from earlier in the course. (The sections below refer to the Stewart text.)

- Areas and volumes; average value (Sections 6.1, 6.2, 6.3, 6.5)
- Integration by parts, improper integrals (Sections 7.1, 7.8)
- Arc length; applications of integrals to physics, economics, and biology (Sections 8.1, 8.3, 8.4)
- Differential equations, direction fields, separable equations, models for population growth, linear differential equations (Sections 9.1, 8.2, 9.3, 9.4, 9.5)
- Taylor series, ratio test and convergence intervals, geometric series and applications (see the Moodle files on Taylor series and geometric series from a different text)
- 3D coordinates, vectors, dot product, equations of lines and planes in space (Sections 12.1, 12.2, 12.3, 12.5)

The best way to study for the exam is to practice problems! Some review problems appear on the next page; solutions will be posted separately. Also try some of the following problems from the chapter review sections in the Stewart text:

- Chapter 6 review: #1-16, 19-22
- Chapter 7 review: #1, 3, 4, 6, 9, 41-47
- Chapter 8 review: #1, 2, 7, 11, 12, 13, 17, 18
- Chapter 9 review: #1-3, 5, 7, 9, 11, 12, 15
- Chapter 11 review: #45, 46
- Chapter 12 review: #1, 2, 4a-c, 5, 15-18, 21, 23, 28-30
- Chapter 14 review: #3, 7, 8, 13-22, 25-27 (tangent plane only), 33, 45-47, 51-55
- Chapter 15 review: #3-6, 13, 15, 29, 30

Calculators will *not* be permitted on the exam, but the exam problems will be written to emphasize concepts and to avoid tedious arithmetic. Furthermore, the formulas on the next page will be provided on the final exam (as on Exam 2).

Formulas for Final Exam

$$L = \int_a^b \sqrt{1 + [f'(x)]^2}\, dx$$

$$M_y = \int_a^b x(f(x) - g(x))\, dx \qquad M_x = \int_a^b \frac{1}{2}\left[(f(x))^2 - (g(x))^2\right] dx$$

$$C = \int_0^X [p(x) - P]\, dx \qquad S = \int_0^X [P - p_S(x)]\, dx$$

$$F = \frac{A}{\int_0^T c(t)\, dt} \qquad P(t) = \frac{M}{1 + Ae^{-kt}} \text{ where } A = \frac{M - P_0}{P_0}$$

$$M_y = \iint_D x\rho(x,y)\ dA \qquad M_x = \iint_D y\rho(x,y)\ dA \qquad m = \iint_D \rho(x,y)\ dA$$

Practice Problems

1. Approximate the function $f(x) = \sqrt{x}$ by a Taylor polynomial of degree 2 at $a = 4$. Use the approximation to estimate $\sqrt{4.1}$.

2. Find the angle between the vectors $\langle 2, 4, 2\rangle$ and $\langle 3, -1, 5\rangle$.

3. Find an equation of the tangent plane to the surface given by $z = e^x \cos(y) + x + 2$ at the point $(0, 0, 3)$. ss

4. Find the maximum rate of change of the function $f(x, y) = x^2y + \sqrt{xy}$ at the point $(2, 2)$. In which direction does it occur?

5. Find the volume below the surface $z = 2x^2 + y^2 - 2xy$ and above the region $R = [0, 2] \times [0, 1]$.

6. Evaluate the indefinite integral: $\int x^2 \sin(2x)\, dx$

7. The triangular region bounded by the y-axis, the line $y = x$, and the line $y = 1$ is revolved around the x-axis. Find the volume of the resulting solid.

8. Evaluate $\iint_R 3x\, dA$, where R is the region in the xy-plane determined by $0 \le y \le x \le 1$.