40 pts.

Problem 1. Suppose that we want to hit a target 11,000 feet away with a cannon that has a muzzle speed of 600 feet per second. Find the two angles at which we can fire the cannon to hit the target. Give numerical answers in degrees, accurate to two decimal places.

What is the time of flight if we fire the cannon at the smaller of the two angles? Give a numerical answer accurate to two decimal places.

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50 pts.

Problem 2. Consider the function

$$f(x, y) = e^{x^2 y}.$$

Find the partial derivatives f_x, f_y, f_{xx}, f_{xy}, f_{yx} and f_{yy}.

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40 pts.

Problem 3. A tank in the shape of a right circular cylinder is measured to have a radius of 10 feet and a height of 15 feet. If there is a maximum possible error of $\pm 1/24$ feet in these measurements, use increments to estimate the maximum possible error in the calculated volume of the tank and the maximum percentage error in the calculated volume.

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40 pts.

Problem 4. Let $z = f(x, y) = xy^2 + x^2 y$, where $x = 3t$ and $y = t^2$. Find dz/dt in the following two ways.

A. Express z explicitly as a function of t and differentiate.

B. Use the Chain Rule for partial derivatives, expressing your final answer as a function of t.

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40 pts.

Problem 5. Consider the function

$$f(x, y) = xy^2 + xy$$

A. Find the directional derivative of f at the point $P(1, 2)$ in the direction of the vector $-3\mathbf{i} + 4\mathbf{j}$.

B. In what direction should you go from P to get the greatest rate of change in f? What is this maximum rate of change?

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40 pts.

Problem 6. Find the critical points of the function

$$f(x, y) = \frac{1}{3}x^3 + \frac{1}{2}y^2 + xy + 6y + 1.$$

Classify each of the critical points as a relative maximum, relative minimum, or a saddle point.

EXAM

Exam 1

Math 2350–14, Fall 2008

Thursday, October 9, 2008

- 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 **250 points total**.

Good luck!