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 700 feet per second. Find the two angles at which we can fire the cannon to hit the target. Give numerical answers accurate to two decimal places.

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40 pts.

Problem 2.

A particle moves in the plane with the position vector

$$\mathbf{R}(t) = \frac{t^2}{2}\mathbf{i} + \frac{t^3}{3}\mathbf{j}.$$

Find the curvature κ, the tangential component of acceleration A_T, and the normal componet of acceleration A_N at $t = 1$.

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40 pts.

Problem 3. Consider the function $f(x, y) = x + y^2 + x^2y^3$. Find the partial derivatives $f_x, f_y, f_{xx}, f_{xy}, f_{yx}$ and f_{yy}.

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40 pts.

Problem 4.

A rectangle is measured to have a width of $x = 5$ feet and height of $y = 2$ feet. The maximum possible error in these measurements is ± 0.2 feet. Use increments to estimate the maximum error in the calculated area of the rectangle. What is the maximum percentage error in the area?

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40 pts.

Problem 5.

Let $z = f(x, y) = x^2y + xy^3$, where $x = t^3$ and $y = 1 + 2t$. 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.

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40 pts.

Problem 6.

Consider the function

$$f(x, y) = x^2y^3 - x.$$

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?

EXAM

Exam 1

Math 2350, Fall 2007

Oct. 17, 2007

- 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!