

40 pts.

Problem 1.

Suppose that we want to hit a target 7000 feet away with a cannon that has a muzzle speed of 500 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.

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

Problem 2. Consider the function

$$f(x, y) = \sin(xy^2).$$

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

Problem 3. A tank in the shape of a right circular cylinder is measured to have a radius of 5 feet and a height of 10 feet. If there is a possible error of $\pm 1/12$ 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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Problem 4.

Let $z = f(x, y) = x^2y + xy$, where $x = t^2$ and $y = 5t$. 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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Problem 5. Consider the function

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

- A. Find the directional derivative of f at the point $P(2, 1)$ in the direction of the vector $-4\mathbf{i} - 3\mathbf{j}$.
 - 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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Problem 6. Find the critical points of the function

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

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

EXAM

Exam 1

Math 2350–05, Fall 2008

Wednesday, October 8, 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 **160 points total**.

Good luck!