Name: _____

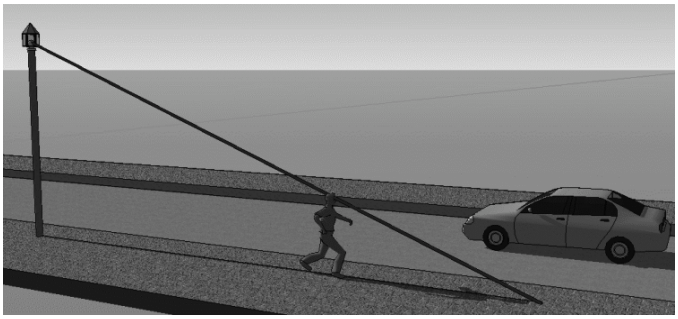
4-digit code: _____

- Write your name and the last 4 digits of your SSN in the space provided above.
- This booklet has six (6) pages, including this one.
- You have fifty (50) minutes to complete the exams.
- Pages 2–4 correspond to test #4. Pages 4–6 correspond to test #3.
- **There are four problems in page 2: two are on *related rates*, and two on *optimization* (not necessarily in that order!). Chose one of each: do the problem on related rates on page 3, and the problem on optimization of page 4.**
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books or notes may be used on this test. You may use a calculator, if you want.

Page	**Max. points**	**Your points**
3	50	
4	50|25	
5	50	
6	25	
Total	100|100	

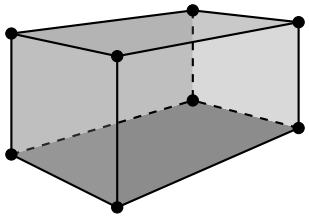
Problem 1 (50 pts). A farmer wants to fence an area of 13.5 million square feet in a rectangular field and then divide it in half with a fence parallel to one of the sides of the rectangle. What should the lengths of the sides of the rectangular field be so as to minimize the cost of the fence?

Problem 2 (50 pts). A street light is mounted at the top of a 15-ft-tall pole. A man 6 ft tall walks away from the pole with a speed of 7 ft/s along a straight path. How fast is the tip of his shadow moving when he is 30 ft from the pole? (leave the answer as a fraction)



Problem 3 (50 pts). At noon, ship A is 70 km west of ship B. Ship A is sailing south at 40 km/h and ship B is sailing north at 20 km/h. How fast is the distance between the ships changing at 4:00 PM? (leave the answer as a fraction)

Problem 4 (50 pts). A box with square base and open top must have a volume of $4,000$ cm^3. Find the dimensions of the box that minimize the amount of material used.



Related Rates

Optimization

Note: The relevant part related to optimization of this problem will count as 25% of your exam # 3.

Problem 5 (25 pts)**.** Find the equation of the tangent lines to the curve $y = (\ln x)/x^2$ at the points $(1, 0)$ and $(e, 1/e^2)$.

$y =$ $y =$

Problem 6 (25 pts)**.** Find the critical values of the function $h(x) = \dfrac{x-3}{x^2+2}$. You **do not** have to indicate whether they are local maxima, local minima, or neither.

Problem 7 (25 pts)**.** Compute the following limits:

[10 pts] $\lim_{x\to\infty} \dfrac{1-x-x^2}{5x^2-9} =$ $\boxed{}$

[15 pts] $\lim_{x\to\infty} \left(1-\dfrac{4}{x}\right)^{3x} =$ $\boxed{}$