

Name: _____
ID number: _____
Recitation Time: _____

Math 251

Optimization

Activity 8 - Part I

This **activity comes in TWO PARTS** (the second of which is only released in recitation) and is worth 2 % of course credit and graded out of “10” points (5 points for completion, 5 points for correctness on a randomly chosen subset of the exercises). See tentative calendar on the syllabus for due dates. Late activities are accepted up to a day late with a 50 % penalty.

Whenever a box is provided, put your final answer for that part of the exercise in the box.

- (1) A rancher is going to use 500 ft of fencing to make 5 adjacent rectangular cattle pens by fencing off a large rectangle and then 4 internal segments across (parallel to two sides of the larger external rectangle). Find the dimensions of the larger external rectangle (all 5 pens together) that maximize the area.

- (2) A window is going to be built in the shape of semicircle atop a rectangle (this type of window is called a *Norman Window*). 24 ft of wood is going to be used to frame just the perimeter of the window. Find the dimensions (radius of the semicircle and height of the rectangle) that produce a window that lets the most light into the structure.



- (3) Jackson, a dog, can swim at a speed of 3 ft per second and run at a speed of 4 ft per second. Jackson is on the bank of a 100-ft wide river (flowing at a negligible speed) and on the bank on other side of the river, 200 ft downstream is Jackson's owner Gabriella. Jackson will swim across the river to the other bank and then run to the Gabriella. Determine the minimum amount of time it will take Jackson to get to Gabriella.

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- (4) After a person eats a meal, the difference between person's measured metabolic rate and their resting metabolic rate (kJ/hr) can be approximated by

$$M(t) = -10.28 + 175.9te^{-t/3},$$

where t is hours after the meal. Determine the time (hours after eating) at which the person's measured metabolic rate (minus their resting rate) is greatest.