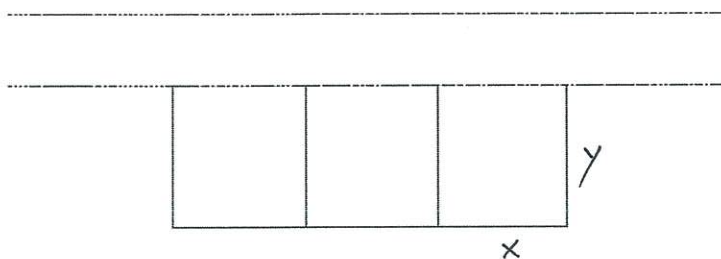


Name Solutions
Student I.D. _____

Math 1210-1
Quiz 7
March 25, 2016

Directions: You may ask and answer each others questions on this quiz. The goal is to understand what you're doing and express your thoughts clearly. Write your own solutions though, rather than just copying someone elses. Calculators are not allowed on this quiz. Show your work.

1) Farmer Joe wishes to test three new strains of table corn, as well as advertise his farming abilities. He will fence off three adjacent and congruent rectangular plots, one for each variety of corn, using the road as the "northern" (fenceless) border for each plot. The road edges are represented by the two dashed lines in the picture below, and the fencing is represented with solid line segments below the road.



Farmer Joe happens to have 600 linear feet of fencing available to construct his plots. What dimensions should he choose for each rectangular plot in order to maximize its area?

1a) Find the optimal dimensions using Calculus.

(8 points)

Maximize $A = xy$
subject to constraint $3x + 4y = 600$
 $\Rightarrow 4y = 600 - 3x$
 $y = 150 - \frac{3}{4}x$ } 2 pt

so $A = x(150 - \frac{3}{4}x) = 150x - \frac{3}{4}x^2$ 1 pt $0 \leq x \leq 200$ natural domain since $y \geq 0$
 $A'(x) = 150 - \frac{3}{2}x$ 1 pt

$0 = 150 - \frac{3}{2}x$ 1 pt
 $\frac{3}{2}x = 150$
 $x = 150 \cdot \frac{2}{3} = 100$ 1 pt

$x = 100$
 $y = 150 - 75 = 75$ 2 pts

1b) Explain why your answer gives you a MAXIMUM area, using concepts we've learned (use back of page if necessary). Precisely, use critical point analysis for a natural domain, INC/DEC, or concavity argument. Any of the following suffice:

(1) $A(x) = 150x - \frac{3}{4}x^2$
is a CD parabola
so there is one
critical pt & it
gives max value



(2) $0 \leq x \leq 200$ is
natural domain
 $A(0) = 0 = A(200)$
so $A(100) > 0$ is
the max value
(critical pt. analysis).

(3) sign A' (2 points)
+ + 0 - - -
INC 100 DEC
so $A(100) = \text{max}$

(4) sign $A''(x) = -\frac{3}{2}$
- - - - -
100
so $A(100) = \text{max.}$