

Math 157 - Quiz 9

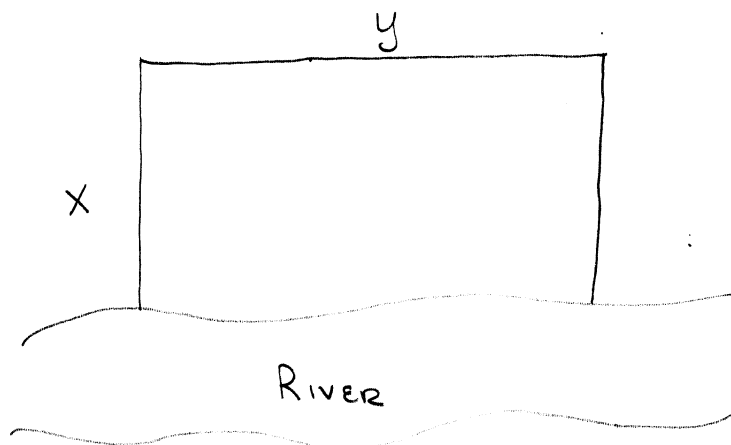
November 6, 2013

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (5 points) A dairy farmer plans to enclose a rectangular pasture adjacent to a river. To provide enough grass for the herd, the pasture must contain 245,000 square meters. No fencing is required along the river. What dimensions will use the least amount of fencing?



$$\text{Minimize } P = 2x + y$$

$$\text{s.t. } xy = 245,000$$

$$y = \frac{245,000}{x}$$

$$P(x) = 2x + \frac{245,000}{x}, \quad x > 0$$

DIMENSIONS ARE
350 m by 700 m

$$P'(x) = 2 - \frac{245,000}{x^2} = 0$$

$$\Rightarrow 2x^2 = 245,000$$

$$x^2 = 122,500$$

$$x = 350$$

$$y = \frac{245,000}{350} = 700$$

$$P''(x) = \frac{490,000}{x^3}$$

$$P''(350) > 0 \Rightarrow x = 350 \text{ gives a MIN.}$$

2. (2.5 points) The side of a square measures 6 inches, with a possible error of $\pm \frac{1}{16}$ inch. Use differentials to estimate the propagated error in computing the area of the square.

$$A = s^2$$

$$dA = 2s ds$$

$$\Delta A \approx 2s \Delta s$$

$$\Delta A \approx 2(6)\left(\frac{1}{16}\right) = \frac{12}{16} = \frac{3}{4}$$

$$\Delta A \approx \frac{3}{4} \text{ in}^2$$

3. (2.5 points) The revenue for a company selling x units of a product is

$$R = 900x - 0.1x^2.$$

Use differentials to estimate the change in revenue as the sales increase from 3000 units to 3050 units.

$$dR = (900 - 0.2x) dx$$

$$\Delta R \approx (900 - 0.2x) \Delta x$$

$$\Delta R \approx (900 - 0.2(3000))(50) \\ = \boxed{15000}$$

THE EXACT CHANGE IS

$$R(3050) - R(3000) = 14750$$