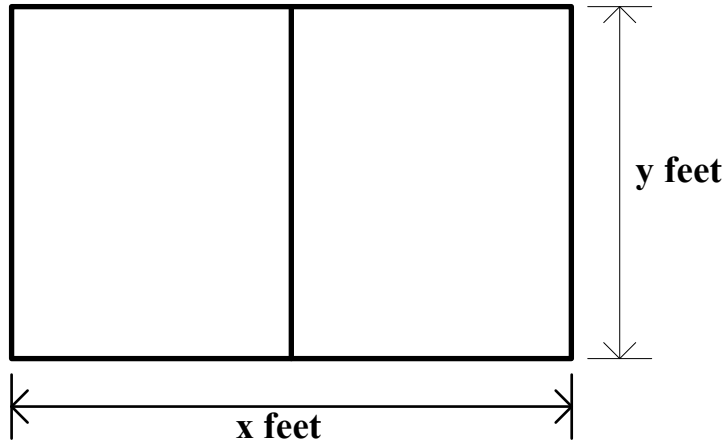# Calculus   Worksheet #7   Unit 1   Selected Solutions

2. A farmer wishes to fence in a rectangular plot of land and to divide it into two equal areas using a piece of fencing that connects the midpoint of two opposite sides. Please see the diagram. If the total enclosed area must be 2400 square feet, then what dimensions will use the least amount of fencing?

Let F represent the amount of fencing needed.

$$F = 2x + 3y$$

Since the total enclosed area is 2400 square feet,

$$xy = 2400 \longrightarrow y = \frac{2400}{x}$$

Therefore, $F = f(x) = 2x + \dfrac{7200}{x}$

$$f(x) = 2x + 7200x^{-1}$$

$$f'(x) = 2 - 7200x^{-2}$$

$$f'(x) = 2 - \frac{7200}{x^2}$$

$$2 - \frac{7200}{x^2} = 0$$

$$2x^2 - 7200 = 0$$

$$x^2 = 3600$$

$$x = 60 \text{ or } x = \cancel{-60}$$

$$y = 40$$

x	F
50	244
60	240
70	242.86

← minimum

The amount of fencing needed is a minimum if the enclosed region is 60 feet long and 40 feet wide.