Calculus AB

Name:_____

Optimization Day 2 (D2 #2)

$x = 24 \quad y = 8$

1) Find two positive numbers whose product is 192, and the sum of the first plus three times the second is a minimum.

$xy = 192$

$y = \frac{192}{x}$

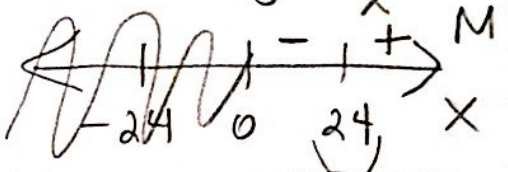
$M = x + 3y$

$M = x + 3\left(\frac{192}{x}\right)$

$M = x + \frac{576}{x} \rightarrow 576x^{-1}$

$M' = 1 - 576x^{-2}$

$0 = 1 - \frac{576}{x^2} = \frac{x^2 - 576}{x^2} = 0$



(D2 #3)

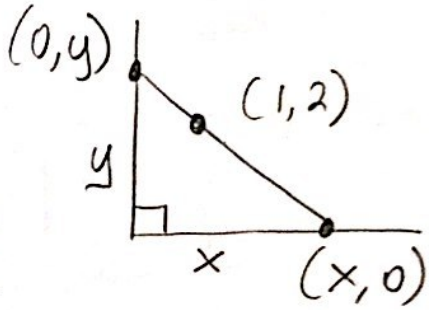
2) A right triangle is formed in the 1st quadrant by the x- and y- axes and a line through (1,2).

a) Write the length of L of the hypotenuse as a function of x.

b) Find the vertices of the triangle such that its area is a minimum.

$x^2 - 576 = 0$

$x = \pm 24$



$A = \frac{1}{2}xy$

$A = \frac{1}{2}x\left(\frac{-2x}{1-x}\right)$

$A = \frac{-x^2}{1-x} = \frac{x^2}{x-1}$

$\frac{dA}{dx} = \frac{(x-1)(2x) - (x^2)(1)}{(x-1)^2}$

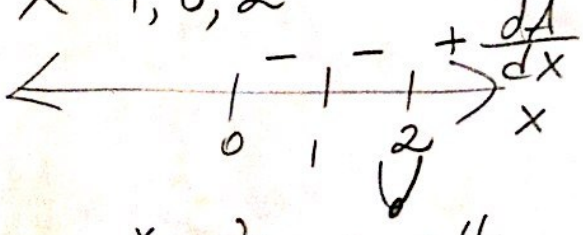
$\frac{dA}{dx} = \frac{2x^2 - 2x - x^2}{(x-1)^2}$

$\frac{dA}{dx} = \frac{x^2 - 2x}{(x-1)^2} = 0$

$x^2 - 2x = 0$

$x(x-2) = 0$

$x = 1, 0, 2$



$x = 2 \quad y = 4$

$m = \frac{2-y}{1-0} = \frac{2-0}{1-x}$

$2 - y = \frac{2}{1-x}$

$-2 \qquad -2$

$\frac{-y}{-1} = \frac{\frac{2}{1-x} - 2}{-1}$

$y = \frac{-2}{1-x} + 2\frac{(1-x)}{(1-x)}$

$y = \frac{-2 + 2 - 2x}{1-x}$

$y = \frac{-2x}{1-x}$

(2,0)
(0,4)

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