Lecture Questions IV: 110.106 Calculus I (Bio & Soc Sci)

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Question 1

Determine the truth of the following two statements:

(1) In an optimization problem, the optimal value of a function happens only where the first derivative is 0 or is undefined.

(2) When evaluating limits, indeterminate expressions like 0^0, 1^∞, and $\infty - \infty$ are really just reworked forms of $\frac{0}{0}$ or $\frac{\infty}{\infty}$. Hence when they occur, we can use L'Hospital's Rule in their study. The same is true for the expressions $\frac{0}{\infty}$ and $\frac{\infty}{0}$.

A. Both are true.

B. (1) is true and (2) is false.

C. (1) is false and (2) is true.

D. Both are false.

Question 2

Let $F(x) = \int_2^{\ln x + \frac{1}{x}} \sqrt{\sin(4t^2) + e^{2t}}\, dt$. Then $F'(x)$ is...

A. $\dfrac{1}{2\sqrt{\sin(4t^2) + e^{2t}}} \left(8t\cos(4t^2) + 2e^{2t}\right) \Big|_2^{\ln x + \frac{1}{x}}$.

B. $\sqrt{\sin(4x^2) + e^{2x}} \left(\frac{1}{x} - \frac{1}{x^2}\right)$.

C. $\sqrt{\sin\left(4\left(\ln x + \frac{1}{x}\right)^2\right)\left(8\ln x + \frac{8}{x}\right)\left(\frac{1}{x} - \frac{1}{x^2}\right) + e^{2\left(\ln x + \frac{1}{x}\right)}\left(\frac{2}{x} - \frac{2}{x^2}\right)}$.

D. $\sqrt{\sin\left(4\left(\ln x + \frac{1}{x}\right)^2\right) + e^{2\left(\ln x + \frac{1}{x}\right)}}\left(\frac{1}{x} - \frac{1}{x^2}\right)$.

E. Who, the heck, knows?!?!.

Question 3

Evaluate $\lim_{x \to 0} \frac{1}{x^2} \int_0^x \sin t \, dt$. The limit ...

A. exists and is 0.

B. exists and is 1.

C. exists and is $\frac{1}{2}$.

D. is ∞.

E. does not exist (and is not ∞).