Practice BC Exam 2020 – 2

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Question 1 (25 minutes)

For a function $f(x)$ it is known that $f(0)=7$, $f''(x)$ is continuous, and $f''(x)<0$ for $0 \le x \le 6$. Select values of the first and second derivatives of $f(x)$ are given in the table below.

x	0	1	2	3	4	5	6
$f'(x)$	*5*	*4*	*3*	*1*	*-1*	*-1.5*	*-3*
$f''(x)$	*-3*	*-2*	*-5*	*-2*	*-1*	*-3*	*-6*

(a) Using Euler's method and two steps of equal size, estimate $f(6)$ from the value of $f(0)$.

(b) Use the table of values and a trapezoidal sum using three equal subintervals to estimate $f(6)$.

(c) Explain why $f(x)$ must take a relative maximum on the interval $(0,6)$.

(d) Let $g(x)=f(3x)$. Write the second-degree Taylor polynomial for $g(x)$ centered at $x=0$.

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Question 2 (15 minutes)

The rate of cars entering a parking lot, measured in cars per hour, is modeled by the function $f(t) = 50\left(\sqrt{t} + 2\cos\left(\frac{1}{7}t^2\right)\right)$, where $0 \le t \le 8$ is the time, in hours, after 12 noon ($t = 0$ is noon). At $t = 0$ the parking lot is empty.

(a) Compute $f'(3)$ and provide the appropriate units. Interpret the meaning of the answer in the context of the problem.

(b) How many cars enter the parking lot from noon to 8 pm? Give your answer to the nearest car.

(c) How many cars are in the lot when the rate at which cars are entering is at a minimum for $0 \le t \le 8$? Give your answer to nearest car.

(d) The parking lot uses a dynamic pricing system, charging $10 - t$ dollars to enter before 5 pm, and $5 to enter after 5 pm. To the nearest dollar, how much money is collected from $t = 0$ to $t = 8$?