미적분학 및 연습 I (MATH161) 제 1 차시험 (2011 년 1 학기)

학과: 학번: 이름:

1. (15 점) Let $f(x)$ be defined on an interval $I = (-1,\ 1)$ and suppose that $f(c) \neq 0$ at some $c \in I$ where f is continuous. Use the 'ϵ-δ argument' to show that there is an interval $(c-\delta,\ c+\delta) \subset I$ about c such that $f(x)f(c) > 0$ for every $x \in (c-\delta,\ c+\delta)$.

2. (15 점) Let $f(x) = \cos x$ and $g(x) = \sin x$ on $I = (-\infty,\ \infty)$. Prove that the zeros of f and g separate each other on I; that is, prove that between two consecutive zeros of $\cos x$ there is exactly one zero of $\sin x$ and conversely.

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3. (14점) Let $f(x) = \int_0^x \sin(\pi t^2/2)dt$. At what values of x does this function have local maximum values? On what intervals is the function concave up?

4. (14점) Suppose that $0 < c < \pi/2$. For what values of c is the area of the region enclosed by the curves $y = \cos x$, $y = \cos(x - c)$, and $x = 0$ equal to the area of the region enclosed by the curves $y = \cos(x - c)$, $x = \pi$, and $y = 0$?

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5. (14점) Suppose that f''' is continuous and $f'(c) = f''(c) = 0$, but $f'''(c) > 0$. Does f have a local maximum or minimum at c? Does f have a point of inflection at c?

6. (14점) Let S be the solid generated by revolving the region bounded by $y = 1 - 3x^2$ and $y = -2$ about the y-axis. Let V be the volume of the solid generated by revolving S about the x-axis. Find V.

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7. (14점) Use Newton's method with the initial value $x_0 = 1$ to find the absolute minimum value of the function $f(x) = \frac{1}{4}x^4 + x^2 - 4x$ correct to two decimal places.