

CALCULUS 1510 - MIDTERM OCT. 2005

- [12] 1. Evaluate the limit or show that it does not exist.
- [4] (a) $\lim_{x \rightarrow 2} \frac{\sqrt{x+2} - 2}{x-2}$ [4] (b) $\lim_{x \rightarrow \infty} (x - \sqrt{1+x^2})$ [4] (c) $\lim_{x \rightarrow 2} \frac{x-2}{|x-2|}$
- [7] 2. Let $f(x) = 3x^2 + x$. Find $f'(2)$ using **ONLY** the definition of the derivative.
- [13] 3. Compute the following derivatives. Do **NOT** simplify your answer after differentiating.
- [4] (a) $f'(x)$ if $f(x) = \sin(\sqrt{1+x^2})$ [4] (b) $g''(x)$ if $g(x) = \frac{x}{1-x}$ [5] (c) $h'(x)$ if $h(x) = x^{(x-1)}$.
- [8] 4. Let $f(x) = e^{\cos x}$
- [4] (a) Find $f''(0)$. [4] (b) Find the equation of the tangent line of the curve $f(x) = e^{\cos x}$ at the point when $x = \frac{\pi}{2}$.
- [10] 5. The equation $y^5 - y \cos x = 0$ defines y as a function on x .
- [6] (a) Evaluate $\frac{dy}{dx}$ at the point $(0,1)$.
- [4] (b) Find an equation of the tangent line to the curve $y^5 - y \cos x = 0$ at the point $(0,1)$.
- [4] 6. [bonus] Suppose $f(x)$ and $g(x)$ are continuous at $x = a$. Show that the function $f(x)g(x)$ is also continuous at $x = a$.

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- [11] 1. Evaluate the limit or explain why it does not exist.
- (a) $\lim_{x \rightarrow 2} \frac{\sqrt{x} - \sqrt{2}}{2x^2 - 8}$ (b) $\lim_{x \rightarrow 0} \frac{(x^2 - 1) \sin^2(\pi x)}{x^2}$ (c) $\lim_{x \rightarrow 0} \frac{(2+x)^3 - 8}{x}$
- [16] 2. Find $f'(x)$ for each of the following functions. Do **NOT** simplify your answers.
- (a) $f(x) = x(\ln x)^2$ (b) $f(x) = \frac{\tan x - e^{-x}}{e^{3x}}$ (c) $f(x) = x^3 + 2^{\cot x}$
- [3] 3. Express the function below in terms of the Heaviside function, h . Do **NOT** simplify your answer. No justification is required.
- $$f(x) = \begin{cases} 0 & x < -1 \\ x-2 & -1 < x < 3 \\ x-4 & 3 < x < 5 \\ 0 & x > 5 \end{cases}$$
- [6] 4. Use the definition of a derivative to find the value of $f'(1)$ if $f(x) = \frac{2}{\sqrt{2-x}}$
- [3] 5. Determine whether the function F is continuous at $x = 3$. Justify your answer using limits.
- $$F(x) = \begin{cases} 1-x^2 & x < 3 \\ -8 & x = 3 \\ 2-3x & x > 3 \end{cases}$$
- [6] 6. Find an equation of the normal line to the curve $ye^{xy} = 2$ at the point with coordinates $(\ln 2, 1)$.