Student name: _____

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MATH 10A (Butler)

Midterm 2, 5 March 2007

This test is closed book and closed notes, with the exception that you are allowed one $8\frac{1}{2}'' \times 11''$ page of handwritten notes. You may use any shortcuts for derivatives unless explicitly stated otherwise. No calculator is allowed for this test. For full credit show all of your work (legibly!), unless otherwise specified. You do not need to simplify your answers any more than the question requires.

1. (8 points) Find the tangent line to the curve $g(x) = \ln(x^2 + 1)$ at $x = -1$.

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2. (a) (2 points) Complete the following definition of the derivative for $f(x)$:

$$f'(x) = \lim_{h \to 0} \text{———————————}$$

(b) (6 points) Using the definition for the derivative given above, find $f'(x)$ for $f(x) = 4x^2 - 3x$. [Remember to show all of your work!!]

3. Let $f(t) = te^{-t}$.

(a) (4 points) When is $f(t)$ increasing?

(b) (4 points) When is $f(t)$ concave down?

4. (MULTIPLE CHOICE QUESTIONS, 3 points each). Write your answer in the space provided. There is no partial credit for incorrect answers.

_____ If $f(2) = 7$ and $f'(2) = -3$ and $f''(x) < 0$ for all x then
(a) $f(1) < 10$.
(b) $f(1) = 10$.
(c) $f(1) > 10$.
(d) there is not enough information to say anything about $f(1)$.

_____ If $f(\omega) = e^3\pi^{100}$ then $f'(\omega)$ is
(a) $e^3\pi^{100}$.
(b) $3e^2\pi^{100}$.
(c) $100e^3\pi^{99}$.
(d) $300e^2\pi^{99}$.
(e) $e^3\pi^{100} + 100e^3\pi^{99}$.
(f) $3e^2\pi^{100} + 100e^3\pi^{99}$.
(g) none of the above.

_____ If $f(r) = \cosh(2r)$ then $f^{(101)}(0)$ (i.e., the 101st derivative evaluated at 0) is
(a) -2^{101}
(b) 0
(c) 1
(d) 2^{101}
(e) none of the above.

5. Find the derivatives of the following functions (hint: it *might* be possible to simplify the function before taking the derivative):

(a) (5 points) $f(x) = \cos^2(x^2) + \tan^2(x^2) + \sin^2(x^2)$

(b) (4 points) $f(x) = \dfrac{y^4 - 2y^2 + 1019y + 3}{y}$

6. (8 points) Find an expression for $\dfrac{dy}{dx}$ (i.e., $\dfrac{dy}{dx}$ = something involving y and/or x) given that

$$x + y = \arctan(y).$$