 Final Exam Section 1,2,3,4,9,10,11,12,13,16 (circle one)
12-20-02 Math 1850 Name ______________________

Only nongraphing calculators are allowed. Answer questions 1 to 14 AND EITHER question 15 OR 16 not both. The exam is 2 hours and 200 points are possible. The value of each question is indicated in the left margin.

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Problem	Points	Score
1*	15	
2*	18	
3	12	
4	10	
5*	10	
6	10	
7	10	
8*	21	
9	10	
10*	12	
11	14	
12	18	
13	14	
14	14	
15†	12	
16†	12	
TOTAL	200	

* Common Assessment Questions †Either 15 or 16

(15) 1. Evaluate the limit, if it exists.

(a) $\lim_{x \to 5} \frac{x^2 - 25}{x^2 - 3x - 10}$

(b) $\lim_{t \to -3} \frac{2t}{(t+3)^2}$

(c) $\lim_{x \to 8-} \frac{|x-8|}{x-8}$

(18) 2. Differentiate the function.

(a) $f(x) = \frac{x^3 + 4x^2}{x^4 + 11}$

(b) $g(x) = x \tan 5x$

(c) $g(x) = \sin(x^3) + \sin^2 x$

3. Find $f'(x)$ from first principles, that is directly from *the definition of a derivative* $(\lim_{h\to 0}(f(x+h) - f(x))/h)$ when

$$f(x) = \sqrt{x-1}.$$

(12)

(10) 4. If $f(x) = \sqrt{x}$ and $g(x) = \sin x$, find the functions $f \circ g$, $g \circ f$ and $g \circ g$ and their domains.

(10) 5. Find an equation for the tangent line to the curve $y = x\sqrt{x+2}$ at (2,4).

(10) 6. Find dy/dx by implicit differentiation. $y^3 - 5x^2y = -32$.

7. A rock, thrown vertically from 2 m above the surface of the moon with an initial velocity of 16 m/sec, reaches a height of $s = 2 + 16t - 0.8t^2$ m in t seconds.

(10) (a) Find the velocity of the rock after t seconds.

(b) How high does the rock go?

8. Evaluate the integral.

(21) (a) $\int \frac{4x^6 + 3\sqrt{x}}{2x^3}\,dx$

(b) $\int \frac{4x^2}{\sqrt{9 + x^3}}\,dx$

(c) $\int_{\pi/12}^{\pi/9} \sec^2 3\theta \, d\theta$

(10) 9. Find the *derivative* the function $g(x) = \int_1^{\sqrt{x}} \frac{1}{\sqrt{1+t^4}} \, dt$.

(12) 10. Find the absolute maximum and minimum of $f(x) = 3x^4 + 2x^3$, on the closed interval $-1 \leq x \leq 1$.

11. Gravel is being dumped from a conveyor belt at a rate of 2 m^3/min onto a dock. It forms a pile in the shape of a cone whose base diameter and height are always equal. How fast is the height of the pile increasing when the pile is 3 m high? (The volume of a cone of height h and base *radius* r is $\frac{\pi}{3}r^2h$.)

(14)

12. Find the area of the region enclosed by the curve $y = 4 - x^2$ and the x-axis,

(14)

(18) 13. Let $f(x) = x^4 + x^3$

(a) Find the intervals of increase or decrease.

(b) Find the local maximum and minimum values.

(c) Find the intervals of concavity and the inflection points.

(d) Use the information from parts (a), (b) and (c) to sketch the graph

14. Find two positive numbers x and y so that $x + 4y = 1000$ and xy is as large as possible.

(14)

Instructions: Do EITHER question 15 or 16 but not both. If you attempt both then indicate which is to be graded.

15. Use Newton's method and initial approximation $x_1 = 1$ to find x_3, the third approximation of the root of the equation and $x^3 + x - 1 = 0$.

(12)

16. A particle moving along a line has velocity $v(t) = t^2 - t$ (in meters per second) Find (a) the displacement and (b) the distance traveled by the particle $0 \leq t \leq 3$.

(12)