Score: ___ / 150 Name: ______________________ Instructor: ______________________

Final Exam Part I (Calculator Section) MA1161 Spring 2006

Show sufficient work to justify all answers.

1. Let $T(t)$ be the temperature (in $°F$) in Dallas t hours after midnight June 2, 2005. The table shows values of this function recorded every two hours.

t	0	2	4	6	8	10	12	14
T	73	73	70	69	72	81	88	91

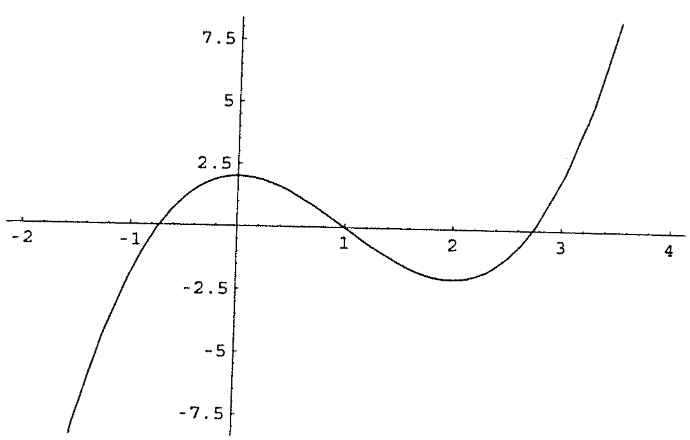
   (a) What is the meaning of $T'(10)$?

   $T'(10)$ means ____ [4]

   (b) Estimate the value of $T'(10)$. **Include units**

   $T'(10) =$ ______________________ [4]

2. The graph of $f(x)$ is shown below. Sketch a possible graph of $f'(x)$ on the same set of axes.



[5]

3. A ball is thrown straight down from the top of a building. Use the height function $h(t) = -16t^2 - 22t + 220$ ft. to answer the following:

(a) What is the average velocity of the ball during the first 3 seconds? **Include units**

Average Velocity = ______________________ [5]

(b) Find the exact instantaneous velocity of the ball at $t = 3$ seconds. **Include units**

Instantaneous Velocity = ______________________ [5]

(c) What is the acceleration of the ball at $t = 3$ seconds? **Include units**

Acceleration = ______________________ [5]

4. Suppose we have an implicit function $x^2y + 4y^2 = 3$

(a) Find $\frac{dy}{dx}$

$\frac{dy}{dx} =$ ____________________ [6]

(b) Find the slope of the line tangent to the curve at the point $(1, -1)$

Slope = ____________________ [3]

(c) Find the equation of the tangent line at $(1, -1)$

$f(x) =$ ____________________ [3]

5. Use the table to answer the following questions

x	-1	0	1	2	3
$f(x)$	3	3	1	0	1
$g(x)$	1	2	2.5	3	4
$f'(x)$	-3	-2	-1.5	-1	1
$g'(x)$	2	3	2	2.5	3

(a) Find $\frac{d}{dx}(\frac{f(x)}{g(x)})$ at $x = -1$.

$\frac{d}{dx}\frac{f(x)}{g(x)} =$ ______________________________ [5]

(b) Find $\frac{d}{dx}(f(g(x))$ at $x = 0$.

$\frac{d}{dx}(f(g(x)) =$ ______________________________ [5]

6. Solve the initial value problem $\frac{dP}{dt} = -5e^{-t}$ when $P(0) = 8$.

answer: ______________________________ [4]

7. Consider the function $f(x) = x^3 e^{-3x}$, defined over the interval $-1 \leq x \leq 2$.

(a) Find any critical points and classify each as a local maximum, local minimum or neither. Use the 1st or 2nd derivative test to verify your solutions.

Local Min: ____________________ [4]

Local Max: ____________________ [4]

(b) Identify the global minimum and global maximum, if they exist.

Global Min: ____________________ [2]

Global Max: ____________________ [2]

(c) Give the best possible bounds for the function.

Bounds: ____________________ [2]

8. You want to make a cylindrical can, capped at both ends, using 75 square inches of aluminum. What dimensions will maximize the volume of the can? Show your work to verify the solution is a maximum. **Include units**

Dimensions = ____________________ [6]

9. A raindrop is a perfect sphere. When the radius is 0.2 mm, the radius is increasing at .001 mm/second. At what rate is the volume of the raindrop changing at that moment? **Include units**

Rate = ______________________ [6]

10. A car going 60 ft./sec brakes to a stop in 8 seconds. Its velocity is recorded every 2 seconds and is given in the following table

t seconds	0	2	4	6	8
$v(t)$ ft./sec	60	38	20	8	0

(a) Find the LHS (left-hand sum) and the RHS (right-hand sum) of the distance traveled by the car during the 8 seconds (using $\Delta t = 2$). **Include units**

LHS = ______________________ [4]

RHS = ______________________ [4]

(b) Give your best estimate of the distance traveled by the car during the 8 seconds. **Include units**

Estimate = ______________________ [3]

11. Given $\int_{-2}^{0} f(x)dx = 4$ and $f(x)$ is an odd function, find:

(a) $\int_0^2 f(x)dx$

$\int_0^2 f(x)dx =$ ____________________ [4]

(b) The average value of $f(x)$ on $[0, 2]$.

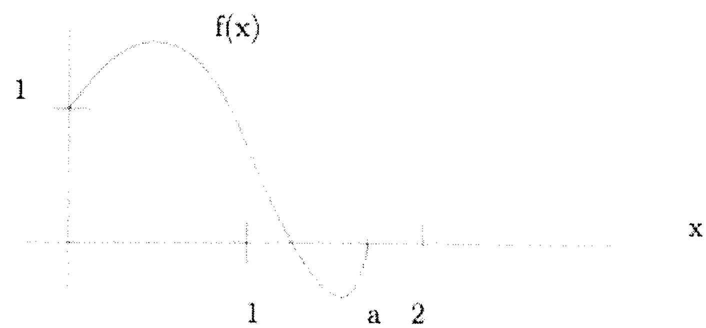
Average Value = ____________________ [4]

(c) $\int_{-2}^{2} f(x)dx$

$\int_{-2}^{2} f(x)dx =$ ____________________ [4]

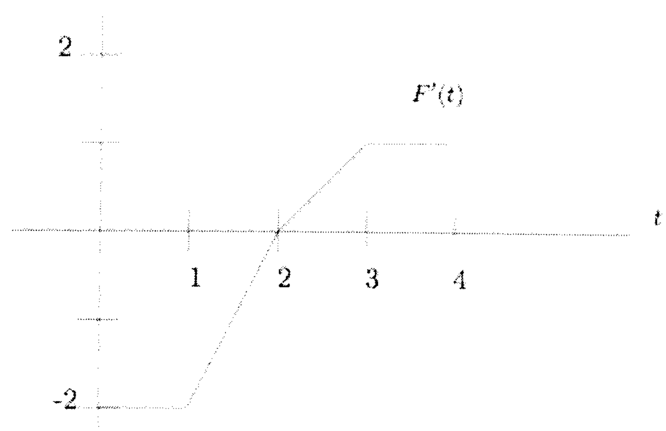
12. Using the figure below, list from least to greatest,

(a) The area bounded by $f(x)$ and the x-axis between $x = 0$ and $x = a$.
(b) The average value of $f(x)$ on $0 \leq x \leq a$.
(c) $\int_0^a f(x)dx$



Least to Greatest: ______________________ [3]

13. The figure below shows $F'(t)$. If $F(0) = 1$, use the Fundamental Theorem of Calculus to find $F(3)$.



$F(3) =$ ______________________ [5]

Score: ___ Name: ________________________ Instructor: ________________________

Final Exam Part II (Non-Calculator Section) MA1161 Spring 2006

Show sufficient work to justify all answers.

1. Find the derivatives of the following functions (Without simplifying the answer):

   (a) $s(t) = \frac{1}{t} + \pi t$

   $s'(t) =$ ________________________ [4]

   (b) $v = x^2 \arctan\sqrt{x}$

   $v' =$ ________________________ [4]

   (c) $f(x) = \ln(e^{3x})$

   $f'(x) =$ ________________________ [4]

   (d) $g(x) = \frac{\cos x}{x^3+1}$

   $g'(x) =$ ________________________ [4]

2. Evaluate each of the following:

(a) $\int \cos x \; dx$

$\int \cos x \; dx =$ ______________________ [4]

(b) $\int_0^2 (2x^2 + 3x)dx$

$\int_0^2 (2x^2 + 3x)dx =$ ______________________ [6]

(c) $\int_1^e (\frac{1}{y})dy$

$\int_1^e (\frac{1}{y})dy =$ ______________________ [6]

(d) $\frac{d}{dx} \int_0^x \sin \sqrt{t} \; dt$

$\frac{d}{dx} \int_0^x \sin \sqrt{t} \; dt =$ ______________________ [6]