Sudoku Puzzle – Mini Exam #3
Logs and Exponentials, Analysis of Graphs, Applications of Derivatives, Integration
A Puzzle by David Pleacher

Solve the 29 multiple-choice problems below.
The choices are integers from 1 to 9 inclusive.
Place the answer in the corresponding cell (labeled A, B, C, … Y, Z, a, b,c).
Then solve the resulting SUDOKU puzzle.

The rules of Sudoku are simple.
Enter digits from 1 to 9 into the blank spaces.
Every row must contain one of each digit.
So must every column, and so must every 3x3 square.
Each Sudoku has a unique solution that can be reached logically without guessing.

______ A. If $f(x) = x + \frac{1}{x}$ Then the set of values for which f increases is:

(6) $(-\infty, \infty)$
(7) $(-\infty, -1) \bigcup (1, \infty)$
(8) $[-1, 1]$
(9) $(-\infty, 0) \bigcup (0, \infty)$

______ B. The Mean Value Theorem guarantees the existence of a special point on the graph of $y = \sqrt{x}$ between (0, 0) and (4, 2). What are the coordinates of the point?

(1) (1, 1) (2) (2, 1) (3) $\left(2, \sqrt{2}\right)$

(4) $\left(\frac{1}{2}, \frac{\sqrt{2}}{2}\right)$ (5) None of the Above

______ C. Evaluate: $\int_0^8 \frac{dx}{\sqrt{1+x}} =$

(5) 1 (6) $\frac{3}{2}$ (7) 2 (8) 4 (9) 6

______ D. For what value of k will $y = x + \frac{k}{x}$ have a relative maximum at x = -2?

(1) -4 (2) 4 (3) -2 (4) 2 (5) None of these

______ E. When the area in square units of an expanding circle is increasing twice as fast as its radius in linear units, the radius is

(5) $\frac{1}{4\pi}$ (6) $\frac{1}{\pi}$ (7) $\frac{1}{4}$ (8) 1 (9) π

______ F. The graph of $y = 5x^4 - x^5$ has a point of inflection at

(3) $(0,0)$ only (4) $(3,162)$ only (5) $(4,256)$ only

(6) $(0,0)$ and $(3,162)$ (7) $(0,0)$ and $(4,256)$

______ G. Find the point on the upper half of the ellipse $4x^2 + 9y^2 = 36$ that is nearest to the point $(1,0)$.

(1) $\left(\frac{9}{5}, \frac{8}{5}\right)$ (2) $\left(\frac{8}{5}, \frac{9}{5}\right)$ (3) $(0,0)$

(4) $(-1,2)$ (5) $(0,2)$ (6) $(3,0)$

______ H. $\lim_{h \to 0} \frac{1}{h} \ln\left(\frac{2+h}{2}\right) =$

(5) nonexistant (6) e^2 (7) 1 (8) 0 (9) $\frac{1}{2}$

______ I. If $\log_a (2)^a = \frac{a}{4}$ then $a =$

(2) 2 (3) 4 (4) 8 (5) 16 (6) 32

______ J. If $y = e^{nx}$ then $\frac{d^n y}{dx^n} =$

(5) $n!e^x$ (6) $n^n e^{nx}$ (7) $n!e^{nx}$

(8) ne^{nx} (9) $n^n e^x$

______ K. If $f(x) = (e)^{\frac{1}{x}}$, then $f'(x) =$

(5) $\frac{(e)^{\frac{1}{x}}}{x^2}$ (6) $-(e)^{\frac{1}{x}}$ (7) $\frac{(e)^{\frac{1}{x}}}{x}$ (8) $-\frac{(e)^{\frac{1}{x}}}{x^2}$ (9) $\frac{1}{x}(e)^{\left(\frac{1}{x}-1\right)}$

______ L. If $y=\ln\left(x^2+y^2\right)$, then the value of $\frac{dy}{dx}$ at the point $(1,0)$ is:

(1) 0 (2) 1 (3) 2 (4) $\frac{1}{2}$ (5) undefined

______ M. The set pf all points $\left(e^t,t\right)$, where t is a real number, is the graph of $y=$

(1) $\frac{1}{e^x}$ (2) $\ln(x)$ (3) $(e)^{\frac{1}{x}}$ (4) $x(e)^{\frac{1}{x}}$ (5) $\frac{1}{\ln x}$

______ N. $\frac{d}{dx}\left(\ln e^{2x}\right)=$

(1) 1 (2) $2x$ (3) 2 (4) $\frac{1}{e^{2x}}$ (5) $\frac{2}{e^{2x}}$

______ O. If $\sin x=e^y$ and $0<x<\pi$, what is $\frac{dy}{dx}$ in terms of x?

(1) $-\tan x$ (2) $-\cot x$ (3) $\tan x$ (4) $\csc x$ (5) $\cot x$

______ P. The slope of the line tangent to the graph of $y=\ln\left(x^2\right)$ at $x=e^2$ is

(5) $\frac{1}{e^4}$ (6) $\frac{4}{e^4}$ (7) $\frac{1}{e^2}$ (8) $\frac{2}{e^2}$ (9) $\frac{4}{e^2}$

______ Q. If $f(x)=e^x$, which of the following lines is an asymptote to the graph of f.

(5) $y=x$ (6) $y=-x$ (7) $y=1$ (8) $x=0$ (9) $y=0$

______ R. Determine the 100^{th} derivative of xe^x.

(5) e^x (6) xe^x+e^x (7) xe^x+100e^x (8) xe^x+101e^x

______ S. Simplify $e^{-3\ln(1/x)}$

(3) e^x (4) $\frac{1}{x^3}$ (5) x^3 (8) $-3x$ (9) $\frac{-3}{x}$

______ T. An open rectangular box is made from a square piece of metal (each side of length 12 inches) by cutting out square corners and folding up the sides. What size corners should be cut to maximize the volume of the box?

(2) 1" x 1" (3) 2" x 2" (4) 4" x 4" (5) 6" x 6"

______ U. $\int_0^1 \frac{x^2\,dx}{x^2+1} =$

(1) $\frac{4+\pi}{4}$ (2) $\frac{4-\pi}{4}$ (3) 0 (4) $\ln 2$ (5) $\frac{1}{2}\ln 2$

______ V. Find the average value of the function $f(x) = x^2$ over the interval [1, 4].

(3) 3 (4) 5 (5) 7 (6) 9 (7) 11

______ W. If $\frac{dy}{dx} = \frac{4\sin x - 3}{\cos y}$, and $x = 0$ when $y = \pi$, Express $\sin(y)$ in terms of x.

(1) $4\cos x + 3x - 4$ (2) $-4\cos x - 3x + 4$

(3) $-4\cos x - 3x$ (4) $4\cos x + 3x$

______ X. $\int \frac{dx}{\sin^2 x} =$

(1) $-\tan x + C$ (2) $\tan x + C$ (3) $\cot x + C$ (4) $-\cot x + C$

(5) None of the above

______ Y. If $f(x) = \begin{cases} 8 - x^2 & \text{for } -2 \le x \le 2 \\ x^2 & \text{elsewhere} \end{cases}$

Then $\int_{-1}^{3} f(x)\,dx$ is a number between

(6) 0 and 8 (7) 8 and 16 (8) 16 and 24 (9) 24 and 32

______ Z. $\int_{-1}^{2} \frac{|x|}{x}\,dx =$

(5) -3 (6) 1 (7) 2 (8) 3 (9) Nonexistant

______ a. $\int_0^1 \sqrt{x^2 - 2x + 1}\,dx =$

(1) $\frac{1}{2}$ (2) $-\frac{1}{2}$ (3) -1 (4) 1 (5) None of these

______ b. If $\int_1^3 f(x)\,dx = 6$ and $\int_2^4 f(x)\,dx = 2$ and $\int_2^3 f(x)\,dx = 1$

Then $\int_1^4 f(x)\,dx =$

(1) 1 (2) 2 (3) 3 (4) 7 (5) 9

______ c. What is the average value of $3t^3 - t^2$ over the interval $-1 \le t \le 2$?

(4) 16 (5) $\frac{33}{4}$ (6) 8 (7) $\frac{7}{2}$ (8) $\frac{11}{4}$

	A		B			C		D
				E	F			G
		H		I				
J	K			L			M	
N		O		P				Q
		R	S					T
						U	V	
W				X	Y	Z		
a		b						c

Here is a blank SUDOKU board for you to use:

Solution to the Sudoku With Logs and Exponentials, Analysis of Graphs, Applications of Derivatives, Integration

A = 7
B = 1
C = 8
D = 2

E = 6
F = 4
G = 1
H = 9

I = 5
J = 6
K = 8
L = 3

M = 2
N = 3
O = 5
P = 8

Q = 9
R = 7
S = 5
T = 3

U = 2
V = 5
W = 2
X = 4

Y = 9
Z = 6
a = 1
b =4

c = 8

5	7	6	1	9	3	8	4	2
8	3	2	7	6	4	5	9	1
4	1	9	8	5	2	3	7	6
6	8	1	9	3	7	4	2	5
3	2	5	4	8	1	7	6	9
9	4	7	5	2	6	1	8	3
7	9	3	6	1	8	2	5	4
2	5	8	3	4	9	6	1	7
1	6	4	2	7	5	9	3	8