MIDTERM 2

Math 103
10/22/2014

Name: _____

ID: _____

"My signature below certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this"

Signature: _____

Read all of the following information before starting the exam:

- Check your exam to make sure all **??** pages are present.
- You may use writing implements and a single handwritten sheet of 8.5"x11" paper.
- NO CALCULATORS.
- Show all work, clearly and in order, if you want to get full credit. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- Good luck!

1	8		7	8	
2	8		8	8	
3	8		9	8	
4	8		10	8	
5	8		11	10	
6	8		12	10	
Total	100				

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_____ **1.** What is $\frac{d}{dx}e^{\tan^{-1}x}|_{x=\sqrt{3}}$?

a. $1/4$
b. $\frac{e^{\pi}}{2}$
c. $e^{\pi/3}$
d. $\frac{e^{\pi/3}}{2}$
e. $\frac{e^{\pi/3}}{4}$
f. 1
g. $\frac{e^{\pi/4}}{3}$
h. $\frac{e^{\pi/4}}{2}$

_____ **2.** What values should a and b have so that

$$f(x) = \begin{cases} ax + b & \text{if } x < 1 \\ \ln x & \text{if } x \geq 1 \end{cases}$$

is differentiable everywhere.

a. $a = 0, b = -1$
b. $a = 0, b = 0$
c. $a = 0, b = 1$
d. $a = 1, b = -1$
e. $a = 1, b = 0$
f. $a = 1, b = 1$
g. $a = e, b = -1$
h. $a = e, b = 1$

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_____ **3.** If $f(x) = \frac{x}{\sin x}$, what is $f'(\pi/6)$?

a. $\frac{2\sqrt{3}}{3} - \frac{\pi}{9}$
b. $\frac{2\sqrt{3}}{3} + \frac{\pi}{9}$
c. $\frac{\pi}{9} - \frac{2\sqrt{3}}{3}$
d. $\frac{\sqrt{3}}{16} - \frac{3\pi}{16}$
e. $\frac{\sqrt{3}}{16} + \frac{3\pi}{16}$
f. $\frac{3\pi}{16} - \frac{\sqrt{3}}{16}$
g. $2 - \frac{\pi\sqrt{3}}{3}$
h. $\frac{\pi\sqrt{3}}{3} - 2$

_____ **4.** The chart below gives the functions f, f', g, and g' at several values. What is $\frac{d}{dx} f(xg(x)) \mid_{x=1}$?

x	1	2	3	4
f(x)	1	2	3	4
f'(x)	2	1	3	1
g(x)	2	1	3	1
g'(x)	4	3	2	1

a. 1
b. 2
c. 3
d. 4
e. 6
f. 8
g. 9
h. 12

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_____ **5.** Find $\frac{d}{dx}(x\cos|x|)\,|_{x=0}$. (Remember this means the derivative of $x\cos|x|$ at the point $x=0$.)

a. $-\pi$
b. -2
c. -1
d. 0
e. 1
f. 2
g. π
h. DNE

_____ **6.** The graph of $y = ax^3 - 2ax^2 - x + 1$ is a curve such that the tangent line at $x = 2$ has slope 11. What is a?

a. -2
b. -1
c. 0
d. 1
e. 2
f. 3
g. 4
h. There is no such value a

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_____ **7.** What is the slope of the tangent line to the curve $x^2y^3 - y^2 = 4x - 4$ at $(1, 1)$?

a. 0
b. 1/4
c. 1/3
d. 1/2
e. 2/3
f. 1
g. 2
h. 3

_____ **8.** What is the derivative of $\frac{\sqrt{e^x(x^2+4)}}{(x-1)^2(x+1)^3}$ at $x = 0$?

a. -2
b. -1
c. -1/2
d. -1/4
e. 2
f. 1
g. 1/2
h. 1/4

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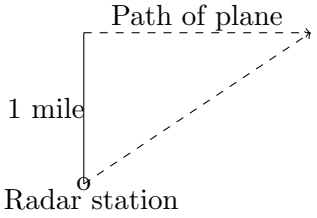
_____ **9.** Which of the following values is closest to $\sqrt[3]{124}$? (It may help to remember that $\sqrt[3]{125} = 5$.)

a. 5
b. $5 - 1/125$
c. $5 - 1/75$
d. $5 - 1/25$
e. $5 + 1/125$
f. $5 + 1/75$
g. $5 + 1/25$
h. 4

_____ **10.** A plane is flying horizontally at an altitude of 1 mile and a speed of 300 miles per hour. At one point in its trip, the plane passes directly over a radar station. Soon after, the distance from the plane to the radar station is 2 miles; at this moment, what is the rate at which the distance from the plane to the radar station is increasing?

a. $\frac{150}{\sqrt{3}}$mph
b. 150mph
c. $150\sqrt{3}$mph
d. $30\sqrt{3}$mph
e. $\frac{30}{\sqrt{3}}$mph
f. $\frac{300}{\sqrt{3}}$mph
g. $300\sqrt{3}$mph
h. 200mph



11. Consider the function $g(x) = x^5 + 2x^3 + 1$. What is $\frac{d}{dx}g^{-1}(x)|_{x=4}$? (That is, the derivative of $g^{-1}(x)$ at $x = 4$. It is helpful to notice that $g(1) = 4$.)

12. $L(x)$ is a new function with the property that $\frac{d}{dx}L(x) = \ln(\ln(x))$. What is $\frac{d}{dx}L(e^{e^x})$?