

Hour Exam 1

Math 3

Oct. 24, 2007

Name: _____

Instructor (circle):

Lahr (8:45) Pomerance (11:15) Treneer (12:30)

Instructions: You are not allowed to use calculators, books, or notes of any kind. All your answers to the multiple choice questions must be marked on the Scantron form provided, and your responses to the remaining questions must be written in this exam booklet. Take a moment now to print your name and section clearly on your Scantron form, and on pages 1 and 2 of your exam booklet. With regard to the multiple choice questions, you may write on the exam, but you will only receive credit for what you write on the Scantron form. At the end of the exam you must turn in both your Scantron form, and your exam booklet. There are 10 multiple choice problems each worth 6 points, and there are 3 additional problems totaling 40 points. Check to see that you have 8 pages of questions plus cover and scoring pages.

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Problem	Points	Score
1 – 10 (MC)	60	
11	15	
12	10	
13	15	
Total	100	

1. The number $\sin \pi + \ln 1 + e^0$ can be simplified to
 - (a) 0
 - (b) $\sqrt{2}$
 - (c) -1
 - (d) 2
 - (e) none of the above

2. What symmetry does the graph of $y = x^2 - 6x + 10$ have?
 - (a) It is an even function and so is symmetric about the y -axis.
 - (b) It is an odd function and so is symmetric about the origin.
 - (c) It is symmetric about the line $y = 3$.
 - (d) It is symmetric about the line $x = 3$.
 - (e) It has no symmetry.

3. Consider the function $f(x) = 3x^2 - 4x + 1$. The equation of the tangent line to the graph of $f(x)$ at $(0, 1)$ is

- (a) $y = 6x - 4$
- (b) $y = 6x + 1$
- (c) $y = 2x + 1$
- (d) $y = -4x + 1$
- (e) none of the above

4. The limit

$$\lim_{x \rightarrow 7} \frac{x - 7}{|x - 7|}$$

is

- (a) 1
- (b) -1
- (c) 0
- (d) does not exist, but the function tends to ∞
- (e) does not exist

5. Which of the following describes the behavior of the function

$$f(x) = \begin{cases} 3(x-2)^2 - 5 & x \neq 2, \\ 0 & x = 2 \end{cases}$$

at $x = 2$?

- (a) $\lim_{x \rightarrow 2} f(x)$ does not exist.
- (b) $\lim_{x \rightarrow 2} f(x)$ exists but f is not continuous at $x = 2$.
- (c) f is continuous but not differentiable at $x = 2$.
- (d) f is differentiable but not continuous at $x = 2$.
- (e) None of the above.

6. Suppose $f(x)$ is a continuous function with domain the closed interval $[-1, 3]$. Suppose too that $f(-1) = 2$ and $f(3) = -2$.

- (a) There must be some number c with $-1 < c < 3$ with $f(c) = 3$.
- (b) There must be some number c with $-1 < c < 3$ where f is not differentiable.
- (c) There must be some number c with $-1 < c < 3$ with $f(c) = e$.
- (d) There must be some number c with $-1 < c < 3$ with $f(c) = 1/\pi$.
- (e) The given information is not enough to conclude any of the above.

7. The slope of the tangent line to $f(x) = (x^3 - x + 1)^{11}(2x^2 + x - 3)^7$ at $x = 1$ is

- (a) $(33x^2 - 11)(x^3 - x + 1)^{10}(28x + 7)(2x^2 + x - 3)^6$
- (b) 0
- (c) does not exist
- (d) 22
- (e) none of the above

8. The limit

$$\lim_{x \rightarrow \infty} \frac{3x^3 - 4x^2 + 5}{7x^5 + 9x^4 - 3x}$$

is

- (a) 0
- (b) $-\frac{5}{3}$
- (c) $\frac{3}{7}$
- (d) does not exist, but the function tends to ∞
- (e) does not exist

9. The inverse of the function $y = \frac{1+e^x}{1-e^x}$ is

- (a) $y = \frac{x-1}{x+1}$
- (b) $y = \frac{x-1}{e(x+1)}$
- (c) $y = \ln\left(\frac{x+1}{x-1}\right)$
- (d) $y = \ln\left(\frac{x-1}{x+1}\right)$
- (e) The function has no inverse

10. The derivative of

$$f(x) = x \sin \sqrt{x}$$

is

- (a) $\sin \sqrt{x} + x \cos \sqrt{x}$
- (b) $\frac{1}{2}x \cos\left(\frac{1}{\sqrt{x}}\right)$
- (c) $\sin \sqrt{x} + \frac{1}{2}\sqrt{x} \cos \sqrt{x}$
- (d) $\sin \sqrt{x} + x \cos \sqrt{x} + \frac{1}{2}x \sin\left(\frac{1}{\sqrt{x}}\right)$
- (e) none of the above

NON-MULTIPLE CHOICE. PLEASE SHOW ALL YOUR WORK.
You do not need to use the limit definition of the derivative for any of these problems. You may use the differentiation rules.

11. A falling stone travels $4.9t^2$ meters in t seconds (ignoring air resistance) and it continues to fall for 12 seconds.

(a) What is the stone's average speed over the first 10 seconds?

(b) What is the stone's instantaneous speed at the 10-second mark?

(c) What is the stone's instantaneous acceleration at the 7-second mark?

12. Consider the following table of experimental data points.

x	y
2	-2
3	2
4	2
6	10

(a) For each of the two lines

$$L_1(x) = 2x - 6 \quad \text{and} \quad L_2(x) = 3x - 8,$$

compute the sum of the squared errors in comparison with the experimental data.

(b) Which line gives the better fit to the data?

13. Consider the function

$$f(x) = \frac{x^2 + 5x + 4}{x^2 - 16}.$$

- (a) What is the domain of f ?
- (b) For each point c not in the domain of f , does f have a continuous extension to $x = c$? If so, what value should be assigned to f at c ?
- (c) Describe all vertical asymptotes that occur in the graph of f .