Hour Exam #1

Math 3

Oct. 21, 2009

Name:____

Instructor (circle):

Lahr (sec 1, 8:45)   Pomerance (sec 2, 11:15)   Yang (sec 3, 11:15)

Instructions: You are not allowed to use calculators, books, or notes of any kind. All of your answers must be marked on the Scantron form provided or entered on the test, depending on the problem. Take a moment now to print your name and section clearly on your Scantron form, and on page 1 of your exam booklet. You may write on the exam, but you will only receive credit on Scantron (multiple choice) problems 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 12 multiple choice problems each worth 6 points and 2 long-answer written problems worth 14 points each. Check to see that you have 8 pages of questions plus the cover page for a total of 9 pages.

Non-multiple choice questions:

Problem	Points	Score
13	14	
14	14	
Total	28	

1. For the function $f(x) = \dfrac{x-1}{x^2} = x^{-1} - x^{-2}$, its domain is

(a) $(-\infty, 1) \cup (1, \infty)$

(b) $(-\infty, 0) \cup (0, \infty)$

(c) $(-\infty, \infty)$

(d) $(0, \infty)$

(e) none of the above

2. For the same function $f(x)$ as in problem 1, its horizontal and vertical asymptotes are

(a) $y = 0,\ x = 0$

(b) $y = 1,\ x = 1$

(c) $y = 1,\ x = 0$

(d) $y = 0,\ x = 1$

(e) No choice above gives the complete and correct list of horizontal and vertical asymptotes.

3. A weight that is suspended by a spring of length 1 meter bobs up and down with its height above the floor at time t seconds given by the formula $h(t) = 2 + \frac{1}{\pi}\sin(\pi t)$. Note that the function $h(t)$ has the derivative $h'(t) = \cos(\pi t)$. At $t = 1/2$ seconds the object is

(a) moving its fastest upward.

(b) moving its fastest downward.

(c) at its highest point.

(d) at its lowest point.

(e) None of the above.

4. For the same situation as problem 3, but at time $t = 1$ second, the object is

(a) moving its fastest upward.

(b) moving its fastest downward.

(c) at its highest point.

(d) at its lowest point.

(e) None of the above.

5. The function $f(x) = \cos(x) + \sin(x) + 1$ is:

(a) even.

(b) odd.

(c) neither even nor odd.

(d) both even and odd.

6. Let $f(x) = \ln(2x - 1)$ and $g(x) = e^{2x}$. Then $g(f(x))$ is [note that the answer may have been simplified using rules of exponentials and logarithms]

(a) $4x - 2$

(b) $\ln(4x^2 - 8x + 1)$

(c) $\ln(2e^{2x} - 1)$

(d) $4x^2 - 4x + 1$

(e) None of the above.

7. Solve for x, expressing your answer in terms of the natural logarithm function:

$$8^{x+2} = 5^{-x}.$$

Note that the answer may have been simplified using rules of logarithms.

(a) $x = -\frac{1}{2} \ln\left(\frac{5}{8}\right)$

(b) $x = \frac{2\ln(3)}{\ln(5)}$

(c) $x = \frac{-2\ln(8)}{\ln(40)}$

(d) $x = \frac{\ln(8)}{\ln(20)}$

(e) $x = \frac{\ln(64)}{\ln(40)}$

8. Find $f'(x)$ when $f(x) = 3x^2 - 5x + \sqrt{3}$. It is

(a) $6x - 5$

(b) $6x - 5 + \frac{1}{2\sqrt{3}}$

(c) 6

(d) $6x - 5 + \frac{3}{2\sqrt{3}}$

(e) none of the above

9. Consider the function

$$f(x) = \begin{cases} -x+1, & \text{if } x \leq 1 \\ x^2, & \text{if } x > 1. \end{cases}$$

Which of the following statements is true.

(a) $f(x)$ is continuous wherever it is defined.

(b) $f(x)$ is discontinuous at $x = 1$ but has a removable discontinuity there.

(c) $f(x)$ is discontinuous at $x = 1$ and the discontinuity there is not removable.

(d) $f(x)$ is continuous at $x = 1$ and $\lim_{x\to 1} f(x)$ does not exist.

(e) none of these.

10. For the limit $\lim_{x\to 2} \frac{x^2 - 3x + 2}{x^2 - 4}$, which statement is correct?

(a) The limit is 0.

(b) The limit does not exist.

(c) The limit is 4.

(d) The limit is 1/4.

(e) None of the above.

11. Find the derivative of the function: $f(x) = \sin(3x+1) + \cos(2x-3)$.

(a) $f'(x) = \cos(3x+1) + \sin(2x-3)$

(b) $f'(x) = \cos(3x+1) + 3\sin(2x-3)$

(c) $f'(x) = 3\cos(3x+1) + 2\sin(2x-3)$

(d) $f'(x) = 3\sin(3x+1) - 2\cos(2x-3)$

(e) none of the above

12. Find $f'(x)$ if $f(x) = \tan\left(\frac{x+1}{x-1}\right)$. It is

(a) $f'(x) = \tan(x+1) - \tan(x-1)$

(b) $f'(x) = -\frac{x+1}{x-1}\sec\left(\frac{x+1}{x-1}\right)$

(c) $f'(x) = -\frac{2}{(x-1)^2}\sec^2\left(\frac{x+1}{x-1}\right)$

(d) $f'(x) = \frac{x+1}{x-1}\sec^2\left(\frac{x+1}{x-1}\right)$

(e) none of the above

13. The function $f(x) = \sqrt{x}$ has the derivative $f'(x) = \dfrac{1}{2\sqrt{x}}$. Find the equation of the tangent line to the graph of $y = f(x)$ at the point $(4, 2)$. [Show all of your work, explaining the steps you take.]

14. Carefully work out the derivative of $f(x) = 2x^2 - 3x$ using the formula $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$.

[Note: You must use the limit definition of the derivative. Do not use the power rule!]