Hour Exam 2

Math 3

November 10, 2008

Name:____

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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 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 this cover page.

Non-multliple choice questions:

Problem	Points	Score
1	15	
2	10	
3	15	
Total	40	

MULTIPLE-CHOICE

1. The slope of the tangent line to the curve $y^3 + x^2 y + x = 11$ through the point $(1, 2)$ is:

(a) $2/3$

(b) 1

(c) -2

(d) $-5/13$

(e) None of the above.

2. For the function $f(x) = x^2 - 2\ln x$, which item lists the intervals where the function is increasing?

(a) $(0, 1)$

(b) $(1, \infty)$

(c) $(-1, 0) \cup (1, \infty)$

(d) $(-\infty, 2)$

(e) $(0, \infty)$

3. In the interval $[-2, 3]$, the value of the function $f(x) = x^3 - 3x - 1$ at its absolute maximum is:

(a) -3

(b) 1

(c) 17

(d) 29

(e) None of the above.

4. The derivative of $f(x) = x^{2\sin x}$ is

(a) $2\,x^{2\sin x}\left(\cos x \ln x + \dfrac{\sin x}{x}\right)$

(b) $(2\sin x)\,x^{2\sin x - 1}$

(c) $2\,x^{2\sin x}\cos x$

(d) $x^{2\cos x}$

(e) None of the above.

5. Suppose that we apply Newton's method to approximate the root of the equation $3x^2 - e^x = 0$. If we start at $x_0 = 1$, then, after one iteration of the method, x_1 is:

(a) 1

(b) $\dfrac{3}{6-e}$

(c) $3-e$

(d) $-\dfrac{3}{3-e}$

(e) None of the above.

6. Consider the function $f(x) = |x-1|+1$ on the interval $[0,2]$. Using the Mean Value Theorem we can conclude:

(a) $f'(c) = 0$ for some c in the interval $(0,2)$.

(b) $f'(c) = 2$ for some c in the interval $(0,2)$.

(c) The function has a zero in the interval $[0,2]$.

(d) The Mean Value Theorem does not apply because this function is not continuous in $[0,2]$.

(e) The Mean Value Theorem does not apply because this function is not differentiable in $(0,2)$.

7. The solution to the initial value problem

$$\frac{dy}{dx} = -y \sin x, \quad y(0) = 2e$$

is:

(a) $y = 2e - 1 + \cos x$.

(b) $y = 2e^{1+\sin x}$.

(c) $y = 2e^{\cos x}$.

(d) $y = e^{\sin x} \cos x$.

(e) None of the above.

8. If you apply Euler's Method to the differential equation $y' = x^2 + y^2$ starting at the point $(0, 1)$ with a step size of 1, then the estimate to $y(2)$ you obtain is:

(a) 1

(b) 2

(c) 5

(d) 7

(e) None of the above.

9. A suitable linearization approximates the value of $\sqrt{83}$ as:

(a) 9

(b) 83/9

(c) 19/2

(d) $9 + \sqrt{2}$

(e) None of the above.

10. A ball is thrown up vertically and it reaches the highest point exactly 2 seconds after it was thrown. What was the initial velocity of the ball?

(a) 4.9 meters/second.

(b) 2 meters/second.

(c) 98 meters/second.

(d) 19.6 meters/second.

(e) None of the above.

NON-MULTIPLE-CHOICE. SHOW ALL YOUR WORK.

1. Assume that the position of a particle moving along the x-axis is given as a function of time by $x(t) = t^3 - 3t + 5$.

(a) (5 pts) For what values of t is the particle at rest?

(b) (5 pts) When is the particle moving to the left?

(c) (5 pts) When is the particle speeding up?

2a. (5 pts) Find

$$\int \frac{12x^7 + 4x^5 + 5}{x^2}\, dx$$

2b. (5 pts) Solve the differential equation

$$y' = \frac{12x^7 + 4x^5 + 5}{x^2}$$

subject to the condition that $y(1) = 2$.

3. A radioactive substance decays at a rate proportional to the amount present. Suppose that we measure time in days, that we begin (at day 0) with 30 grams, and that after 40 days we have 25 grams. Let $y(t)$ be the amount of the substance present at time t.

(a) (5 pts) Find an equation for $y(t)$. (Your answer may involve natural logs.)

(b) (5 pts) What is the half-life of the substance? (Your answer may involve natural logs.)

(c) (5 pts) What is $\lim_{t\to\infty} y(t)$?