MA 16100 **Exam 3 Form A** **Fall 2013**

Mark TEST 01 on your scantron sheet

Name_____

10-digit PUID_____

RECITATION Section Number and time_____

Recitation Instructor_____

Lecturer_____

Mark TEST 01 on your scantron sheet

Instructions:

1. Fill in all the information requested above and on the scantron sheet. On the scantron sheet also fill in the little circles for your name, section number and PUID. Remember, your section number is a 4 digit number beginning with a zero.
2. This booklet contains 14 problems, each worth 7 points (except problems 13 and 14 are worth 8 points each). The maximum score is 100 points. The test booklet has 8 pages, including this one.
3. For each problem mark your answer on the scantron sheet and also circle it in this booklet.
4. Work only on the pages of this booklet.
5. No Books, notes, calculators nor any electronic device may be used on this test.
6. At the end turn in your exam and scantron sheet to your recitation instructor.

Mark TEST 01 on your scantron sheet

1. The half life of Calculium-311, an imaginary but highly radioactive substance is 60 hrs. Given an initial amount of 40 grams of Calculium, how long will it take until 35 grams decay (in hours)?

   A. $\ln(35)$

   B. $60\ln(35)$

   C. $\dfrac{\ln(35)}{\ln(30)}$

   D. 180

   E. 300

2. A 5 foot person walks at 40 feet per minute on a level path toward a vertical wall. A light on the ground directly behind the person casts a shadow of the person on the wall. The light is 100 feet from the wall. How fast is the person's shadow on the wall changing in length (in feet per minute) when the person is 25 feet from the wall?

   A. $-\dfrac{32}{9}$

   B. -32

   C. $-\dfrac{8}{9}$

   D. $-\dfrac{125}{14}$

   E. $-\dfrac{125}{28}$

3. A complicated chemical reaction in a test tube converts substance A to substance B. Their amounts, denoted a and b (in grams) satisfy

$$a^{-3} + b^{-3} - a^{-1}b^{-2} = 1.$$

When $a = 1$, the amount of A is decreasing at a rate of 0.3 grams/min. At what rate is the amount of B increasing at that moment?

A. 0.1

B. 0.2

C. -0.2

D. 0.6

E. 1.

4. By linear approximation the value of $(8.2)^{2/3}$ is approximately

A. $4\frac{1}{3}$

B. $4\frac{1}{15}$

C. 4

D. $3\frac{5}{16}$

E. None of the above

5. On the interval $[-2, 2]$ the function $f(x) = \dfrac{x^2}{1+x^2}$ has

   A. an absolute maximum at $x = 0$.

   B. an absolute minimum at $x = 1$.

   C. an absolute minimum at $x = -1$.

   D. an absolute maximum at $x = 2$.

   E. no absolute maximum.

6. The Mean Value Theorem guarantees that if f is differentiable for all x and $f(8) = 4$, $f(-6) = -3$, then we can find a number c such that

   A. $f'(c) = 4$ with $-6 < c < 8$

   B. $f'(c) = \dfrac{1}{2}$ with $-3 < c < 4$

   C. $f'(c) = \dfrac{1}{2}$ with $-6 < c < 8$

   D. $f'(c) = \dfrac{1}{4}$ with $-6 < c < 8$

   E. $f'(c) = 0$.

7. If $f(x) = \dfrac{(x-1)^2}{x+1}$, then $f'(x) = \dfrac{x^2+2x-3}{(x+1)^2}$ and $f''(x) = \dfrac{7-2x}{(x+1)^3}$. Find where f is decreasing.

A. $(-\infty, -3) \cup (1, \infty)$

B. $(-\infty, -1) \cup (-1, \infty)$

C. $(-3, \infty)$

D. $(-3, -1) \cup (-1, 1)$

E. $(-3, 1)$

8. An inflection point for the function

$$f(x) = \sin(x) - \cos(x)$$

is:

A. $(\pi/2, 1)$

B. $(3\pi/2, -1)$

C. $(\pi/4, 0)$

D. $(\pi, 1)$

E. $(0, -1)$

9. Evaluate the following limit:

$$\lim_{x\to\infty}\left(1+\frac{1}{(2x)}\right)^{3x}$$

A. 1

B. $e^{3/2}$

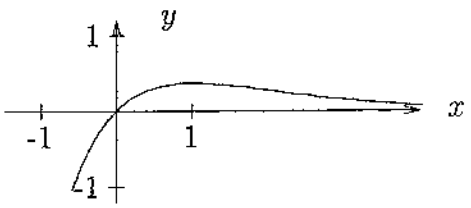
C. e^{3}

D. $e^{2/3}$

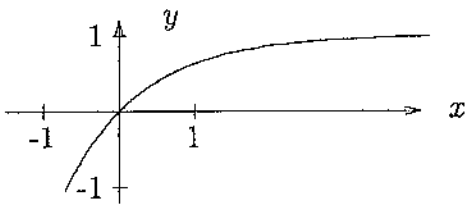
E. e^{6}

10. Which of the following graphs looks most like the graph of $y = xe^{-x}$?

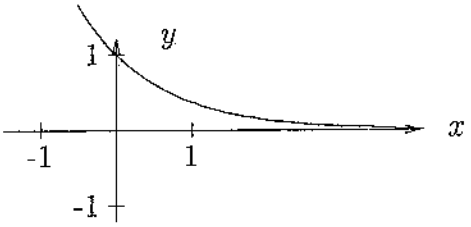
A.



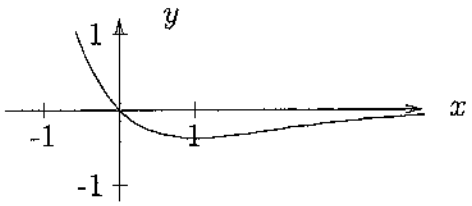
B.



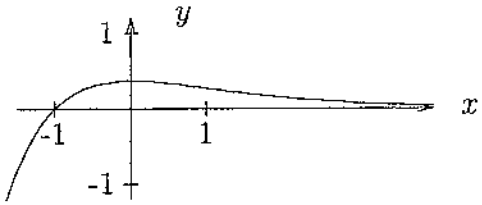
C.



D.



E.



11. Find the point on the line $y = 2x + 3$ that is closest to the origin.

A. $\left(-\frac{6}{5}, \frac{5}{3}\right)$

B. $\left(-\frac{6}{5}, \frac{9}{5}\right)$

C. $\left(-\frac{6}{5}, \frac{3}{5}\right)$

D. $\left(-\frac{3}{5}, \frac{5}{3}\right)$

E. $\left(-\frac{3}{5}, \frac{9}{5}\right)$

12. Two bicycles are traveling along perpendicular roads. Bicycle A is traveling due east at 4 mi/hr, and bicyle B is traveling due north at 6 mi/hr. At noon, when bicycle A reaches the intersection, bicycle B is 9 mi away and moving toward the same intersection. If t is the number of hours after noon, the bicycles are closest together when t is

A. 0

B. $\frac{27}{26}$

C. $\frac{9}{5}$

D. $\frac{3}{2}$

E. $\frac{14}{13}$

13. Let $f(x) = 2x^3 - 3x^2$. f has

A. 1 local max and 2 points of inflection

B. 1 local max and 1 point of inflection

C. 1 local min and 2 points of inflection

D. 1 local min and 1 point of inflection

E. 1 local min, 1 local max and 1point of inflection

14. $\lim_{x \to 0} \dfrac{\sin x - x}{\tan x - x} =$

A. $-\dfrac{1}{2}$

B. -1

C. 0

D. $\dfrac{1}{2}$

E. 1