MA 16500
EXAM 3 INSTRUCTIONS
VERSION 01
NOVEMBER 6, 2012

Your name ____________________ Your TA's name ____________________

Student ID # _______________ Section # and recitation time __________

1. You must use a #2 pencil on the scantron sheet (answer sheet).

2. Check that the cover of your question booklet is GREEN and that it has VERSION 01 on the top. Write 01 in the TEST/QUIZ NUMBER boxes and blacken in the appropriate spaces below.

3. On the scantron sheet, fill in your TA's name (NOT the lecturer's name) and the course number.

4. Fill in your NAME and PURDUE ID NUMBER, and blacken in the appropriate spaces.

5. Fill in the four-digit SECTION NUMBER.

6. Sign the scantron sheet.

7. Blacken your choice of the correct answer in the spaces provided for each of the questions 1–12. Do all your work on the question sheets. Show your work on the question sheets. Although no partial credit will be given, any disputes about grades or grading will be settled by examining your written work on the question sheets.

8. There are 12 questions, each worth 8 points. The maximum possible score is

$8 \times 12 + 4$ (for taking the exam) $= 100$ points.

9. NO calculators, electronic device, books, or papers are allowed. Use the back of the test pages for scrap paper.

10. After you finish the exam, turn in BOTH the scantron sheets and the exam booklets.

11. If you finish the exam before 8:55, you may leave the room after turning in the scantron sheets and the exam booklets. If you don't finish before 8:55, you should REMAIN SEATED until your TA comes and collects your scantron sheets and exam booklets.

Questions

1. Find the absolute maximum and absolute minimum values of the function

$$f(x) = 2\cos x + \sin 2x$$

on the closed interval $[0, \pi/2]$.

A. absolute maximum $= 2$, absolute minimum $= 0$

B. absolute maximum $= \sqrt{2} + 1$, absolute minimum $= 0$

C. absolute maximum $= \sqrt{2} + 1$, absolute minimum $= -1$

D. absolute maximum $= \frac{3\sqrt{3}}{2}$, absolute minimum $= 0$ (correct)

E. absolute maximum $= \frac{3\sqrt{3}}{2}$, absolute minimum $= -1$

2. We have two functions $f(x)$ and $g(x)$ such that

(i) both f and g are continuous on $[1, 5]$,

(ii) both f and g are differentiable on $(1, 5)$.

Suppose that $f(1) = 3, g(1) = 0, f(5) = 15$, and that $f'(x) - g'(x)$ is always equal to 2 on the interval $(1, 5)$.

Find $g(5)$.

A. 4 (correct)

B. 6

C. 8

D. 9

E. 11

3. Consider the function $y = f(x) = x^8(x-1)^7$ on the interval $(-\infty, \infty)$. Then

(a) the local maximum, and
(b) the local minimum

of the function are attained when

A. (a) $x = 1$ (b) $x = 0$
B. (a) $x = 0$ (b) $x = 1$
C. (a) $x = 1$ (b) $x = \frac{8}{15}$
D. (a) $x = 0, 1$ (b) $x = \frac{8}{15}$
E. (a) $x = 0$ (b) $x = \frac{8}{15}$ (correct)

4. We have a function $y = f(x)$ such that its first derivative is given by the following formula

$$f'(x) = (x+2)^3(x-3)^4.$$

Find the x-coordinates of all the inflection points of the graph of the function $y = f(x)$.

A. $\{-2, \frac{1}{7}, 3\}$

B. $\{\frac{1}{7}, 3\}$ (correct)

C. $\{-2, 3\}$

D. $\{-2, \frac{1}{7}\}$

E. We can not determine the x-coordinates of all the inflection points, because we do not know the formula for the original function $f(x)$.

5. Compute the following limits:

(a) $\lim_{x\to 0} \frac{\sin x - x}{x^3}$

(b) $\lim_{x\to 0} \frac{\sin x}{x+1}$

A. (a) $\frac{1}{3}$ (b) 1

B. (a) ∞ (b) 0

C. (a) ∞ (b) 1

D. (a) $-\frac{1}{6}$ (b) 0 (correct)

E. (a) $-\frac{1}{6}$ (b) 1

6. Compute the following limits:

(a) $\lim_{x \to \frac{\pi}{2}} (2x - \pi) \sec x$.

(b) $\lim_{x \to 1} \left(\frac{1}{x-1} - \frac{1}{\ln x} \right)$

A. (a) 0 (b) 0

B. (a) ∞ (b) 0

C. (a) 2 (b) 2

D. (a) -2 (b) $\frac{1}{2}$

E. (a) -2 (b) $-\frac{1}{2}$ (correct)

7. Compute the limit

$$\lim_{x \to 0^+} (1 - 4x)^{\frac{2}{x}}$$

A. 0

B. e

C. e^{-8} (correct)

D. e^8

E. 1

8. Which of the following is the graph of the function

$$y = f(x) = \frac{x}{x^2 - 36}.$$

A.

B.

C. (correct)

D.

E.

9. Which of the following is the graph of the function

$$y = f(x) = (x^2 + 2x)e^{-x}.$$

A.

B.

C.

D. (correct)

E.

10. Find the area of the largest rectangle that can be inscribed in a right triangle with two legs of length 4 cm and 6 cm, if the two sides of the rectangle lie along the legs.

A. 4

B. $4\sqrt{2}$

C. 6 (correct)

D. 8

E. $4\sqrt{5}$

11. A cylindrical can without a top is made to contain 8 cm^3 of liquid. Find the radius of the can that minimizes the cost of the metal to make the can.

A. $2\sqrt[3]{\pi}$ cm

B. $\frac{8}{\pi}$ cm

C. 4 cm

D. $\frac{4}{\sqrt{\pi}}$ cm

E. $\frac{2}{\sqrt[3]{\pi}}$ cm (correct)

12. Find the equation of the line through the point (2, 5) that cuts off the least area from the first quadrant.

A. $y = -\frac{5}{2}x + 10$ (correct)

B. $y = -2x + 9$

C. $y = -x + 7$

D. $y = -\frac{1}{2}x + 6$

E. $y = -\frac{2}{5}x + \frac{29}{5}$