MA161 **EXAM 3** **November 5, 1997**

Name: ______________________________

ID #: ______________________________

Recitation Instructor ______________ Time of Recitation ______________

Section #: ___________________________

Instructions:

1. Fill in your name, student ID number and division and section numbers on the mark–sense sheet. Also fill in the information requested above.
2. This booklet consists of 6 pages. There are 14 questions, each worth 7 points.
3. Mark your answers on the mark–sense sheet. Please show your working in this booklet.
4. No books, notes or calculators may be used.
5. When you are finished with the exam, hand this booklet and the mark–sense sheet, in person, to your instructor.

1. In a certain environment the rate of reproduction of a population of blue algae is proportional to the size of the population. It takes the population 4 hours to double in size. How long will it take for the population to triple in size?

   A. 6 hrs

   B. 12 hrs

   C. $\dfrac{\ln 4}{\ln 6}$ hrs

   D. $\ln 6$ hrs

   E. $\dfrac{4 \ln 3}{\ln 2}$ hrs.

2. Find the interval or intervals where the function

$$f(x) = \frac{1}{2}x^2 + \ln(x^4)$$

   is concave up.

   A. $(2,\ \infty)$

   B. $(-2, 2)$

   C. $(-\infty, -2)$ and $(2, \infty)$

   D. $(0, 2)$

   E. $(-\infty, \infty)$

3. The function $f(x) = 4x^2 - 2 - \dfrac{1}{x}$ has

   A. a relative minimum at $x = -\dfrac{1}{2}$

   B. a relative maximum at $x = -\dfrac{1}{2}$

   C. a relative minimum at $x = \dfrac{1}{\sqrt[3]{4}}$

   D. a relative maximum at $x = \dfrac{1}{\sqrt[3]{4}}$

   E. none of the above

4. A rectangular field is to have area 2,200 square meters. Fencing is required to enclose the field and divide it in half, as shown. Fencing for the perimeter costs \$2 per meter and fencing for dividing the field in half costs \$1.50 per meter. The minimum cost is

A. \$110

B. \$220

C. \$330

D. \$440

E. \$550

5. If $f(x) = x^2$ and $P = \{0, \frac{1}{2}, 1, 2\}$ then the lower sum $L_f(P)$ equals

A. $\frac{5}{8}$

B. $\frac{1}{8}$

C. $\frac{1}{2}$

D. $\frac{3}{8}$

E. none of the above

6. If $f'(x) = (x-1)(x-2)(x-3)$ then f has

A. relative minima at 1 and 3 and a relative maximum at 2.

B. a relative minimum at 1, and relative maxima at 2 and 3.

C. relative maxima at 1 and 3 and a relative minimum at 2.

D. relative maxima at -1 and -3 and a relative minimum at -2.

E. a relative maximum at -2, and relative minima at -1 and -3.

7. The maximum of x^3e^{-x} for $x > 0$ is

A. 0

B. 3

C. $27e^{-3}$

D. $\frac{1}{2}(\ln 2)^3$

E. $8e^{-2}$

8. The product of three positive numbers, two of which are known to be equal, is 64. What is the maximum and the minimum of the sum of the three numbers?

A. Min $= 12$, Max $= 66$

B. Min $= 8$, No Max

C. Min $= 12$, No Max

D. No Min, Max $= 66$

E. No Min, No Max

9. What values of a and b guarantee that $\int_0^{\pi} f(x)dx + \int_a^b f(x)dx = \int_{-3\pi}^{\pi} f(x)dx$?

A. $a = -3\pi,\ b = \pi$

B. $a = -3\pi,\ b = 0$

C. $a = 2\pi,\ b = -\pi$

D. $a = -2\pi,\ b = \pi$

E. $a = -4\pi,\ b = \pi$

10. If $f(x) = \begin{cases} 2x, & 0 \le x \le 2 \\ 4, & 2 \le x \le 4 \end{cases}$ then $\int_0^4 f(x)dx =$

A. 8

B. 16

C. 12

D. 6

E. none of the above

11. The inflection points of $f(x) = \dfrac{5}{x} - \dfrac{5}{x^3}$ are

A. $-1, 1$

B. $-1, \sqrt{6}$

C. $-\sqrt{6}, \sqrt{6}$

D. $-\sqrt{6}, \sqrt{3}$

E. $-\sqrt{3}, \sqrt{3}$

12. $\displaystyle\lim_{x\to\infty} \frac{3x^3 + 17x^2}{4x^3 - 18x^2} =$

A. ∞

B. $-\infty$

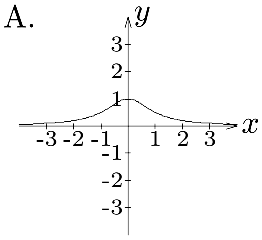
C. $-\dfrac{17}{18}$

D. $\dfrac{3}{4}$

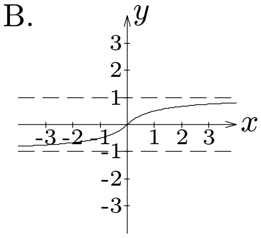
E. none of the above

13. Which of the sketches could be the graph of $f(x) = \dfrac{x}{x^2+1}$.

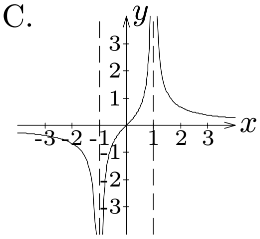
A.



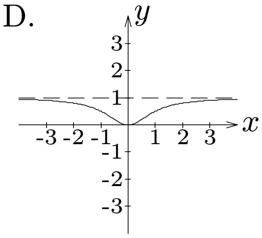
B.



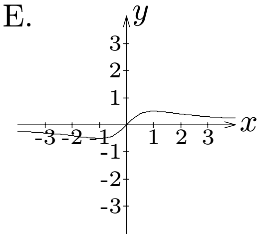
C.



D.



E.



14. $\displaystyle\lim_{x\to\infty} \frac{\sin(x^2)}{x} =$

A. 2

B. 0

C. ∞

D. 1

E. $-\infty$