

Student's Name: \_\_\_\_\_

Student's ID Number: \_\_\_\_\_

**MA 16010 Sections:**

9:50-10:50am Section 0002

11:00am-noon Section 0001

**Instructions:**

1. **Do NOT turn the page until told to do so.**
2. Fill in your name and student ID in the space provided above.
3. On the scantron, fill in your name, section number, student ID. Leave the test/quiz number blank. Sign your name.
4. There are 12 problems and a total of 7 pages (including this cover page). The maximum possible score for this exam is 100, and each problem is worth the same points.
5. You can use the available space below a question or at the back of each page for your work. Turn in **BOTH** the scantron and the exam when you leave. Note: **you will be graded ONLY based on your scantron answer sheet.**
6. Only a one-line display scientific calculator is allowed. **NO** other electronic devices are allowed. No books or notes are allowed.
7. You will have 60 minutes to complete the exam.
8. **Keep your eyes on your own exam please. Try to cover your bubbled-in scantron answers.**
9. **Good luck!**

MA 16010 - Exam 3

1. Find the open interval where  $f(x) = \frac{1}{2}x^4 + 2x^3$  is concave downward.

- A.  $(-2, 0)$
- B.  $(-\infty, -3)$
- C.  $(-2, \infty)$
- D.  $(-3, 0)$
- E.  $(-3, -2)$

2. Find the inflection point of  $y = x^3 + 3x^2$ .

- A.  $(-2, 4)$
- B.  $(-2, 0)$
- C.  $(0, 0)$
- D.  $(-1, 0)$
- E.  $(-1, 2)$

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3.  $\lim_{x \rightarrow \infty} f(x) = \infty$  is true for which of the following functions?

A.  $f(x) = \frac{2x^3 + x^2 - 2}{-3x^3 + 7}$

B.  $f(x) = \frac{2}{x} + 3$

C.  $f(x) = \frac{x + 9}{x^2 + x + 6}$

D.  $f(x) = \frac{x - x^2}{-x + 5}$

E.  $f(x) = \frac{x^3 + x^2 - 2}{-x + 5}$

4. Choose the correct statement regarding the asymptotes of  $f(x)$ .

$$f(x) = \frac{x^2 - 2x + 6}{x + 1}$$

A. Horizontal Asymptote:  $y = -1$ ; Vertical Asymptote:  $x = 1$ ; Slant Asymptote: None

B. Horizontal Asymptote:  $y = 0$ ; Vertical Asymptote:  $x = -1$ ; Slant Asymptote: None

C. Horizontal Asymptote: None; Vertical Asymptote:  $x = -1$ ; Slant Asymptote: None

D. Horizontal Asymptote:  $y = -1$ ; Vertical Asymptote:  $x = 1$ ;  
Slant Asymptote:  $y = x - 3$

E. Horizontal Asymptote: None; Vertical Asymptote:  $x = -1$ ;  
Slant Asymptote:  $y = x - 3$

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5. A manufacturer has determined that the total cost  $C$  of operating a factory is

$$C(x) = 1.5x^2 + 45x + 15000$$

where  $x$  is the number of units produced. Which of the following statements is true regarding the **average cost**?

- A. The minimum average cost is 195
- B. The maximum average cost is 195
- C. The minimum average cost is 345
- D. The maximum average cost is 345
- E. The minimum average cost is 300

6.  $f(x)$  is a polynomial and

$$f'(2) = 0, \quad f'(5) = 0$$

$$f''(3) = 0, \quad f''(x) < 0 \quad \text{on} \quad (-\infty, 3) \quad \text{and} \quad f''(x) > 0 \quad \text{on} \quad (3, \infty)$$

Which of the following statements are true?

- I.  $(2, f(2))$  is an inflection point of  $f(x)$ .
- II.  $(3, f(3))$  is an inflection point of  $f(x)$ .
- III.  $f(x)$  has a relative maximum at  $x = 2$ .
- IV.  $f(x)$  has a relative minimum at  $x = 5$ .

- A. Only I and III are true.
- B. Only I and IV are true.
- C. Only II and III are true.
- D. Only I, II and IV are true.
- E. Only II, III and IV are true.

7.  $\int \frac{\sin x - 2 \cos x}{4} dx =$

- A.  $\frac{2 \sin x + \cos x}{4} + C$
- B.  $\frac{2 \sin x - \cos x}{4} + C$
- C.  $\frac{-\sin x + 2 \cos x}{4} + C$
- D.  $\frac{-2 \sin x - \cos x}{4} + C$
- E.  $\frac{-2 \sin x + 2 \cos x}{4} + C$

8. An evergreen nursery usually sells a certain shrub after 5 years of growth and shaping. The growth rate during those 5 years is approximated by

$$\frac{dh}{dt} = 1.4t + 8,$$

where  $t$  is the time in years and  $h$  is the height in centimeters. The seedlings are 14 centimeters tall when planted. How tall are the shrubs when they are sold?

- A. 29 cm
- B. 36 cm
- C. 57.5 cm
- D. 71.5 cm
- E. 92.5 cm

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9. A company's marketing department has determined that if their product is sold at the price of  $p$  dollars per unit, they can sell  $q = 2800 - 200p$  units. Each unit costs \$ 10 to make. What is the **maximum profit** that the company can make?

- A. 600 dollars
- B. 800 dollars
- C. 980 dollars
- D. 1000 dollars
- E. 1200 dollars

10. A particle is moving on a straight line with an initial velocity of 10 ft/sec and an acceleration of

$$a(t) = \sqrt{t} + 2,$$

where  $t$  is time in seconds and  $a(t)$  is in ft/sec<sup>2</sup>. What is its velocity after 9 seconds?

- A. 90 ft/sec
- B. 140 ft/sec
- C. 46 ft/sec
- D. 135 ft/sec
- E. 24 ft/sec

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11. A rectangular plot of farmland will be bounded on one side by a river and on the other three sides by a single-strand electric fence. With 160 m of wire at your disposal, what is the **largest area** you can enclose?

- A.  $1600 \text{ m}^2$
- B.  $3200 \text{ m}^2$
- C.  $6400 \text{ m}^2$
- D.  $4800 \text{ m}^2$
- E.  $4000 \text{ m}^2$

12. A rectangular box with square base and top is to be constructed using sturdy metal. The volume is to be  $16 \text{ m}^3$ . The material used for the sides costs \$4 per square meter, and the material used for the top and bottom costs \$1 per square meter. What is the **least amount of money** that can be spent to construct the box?

- A. \$30
- B. \$55
- C. \$96
- D. \$136
- E. \$160