

## Math 141 Exam 2 Spring 2020

Make sure you fill in your answers clearly on the scantron answer sheet provided. Fill in your name, student ID number, and exam version on the answer sheet. You may use this exam to work out the problems. You must hand in this exam as well as the scantron answer sheet. When you hand in your exam, be prepared to show your picture ID. No notes or formula sheets are allowed for this exam. Approved calculators such as TI-83 or TI-84 calculators are permitted for this exam, however TI-89 calculators and any CAS calculators are prohibited. No cell phones are permitted outside your bag at any time during the exam.

Name, and section: \_\_\_\_\_

ID#: \_\_\_\_\_

Exam version: B

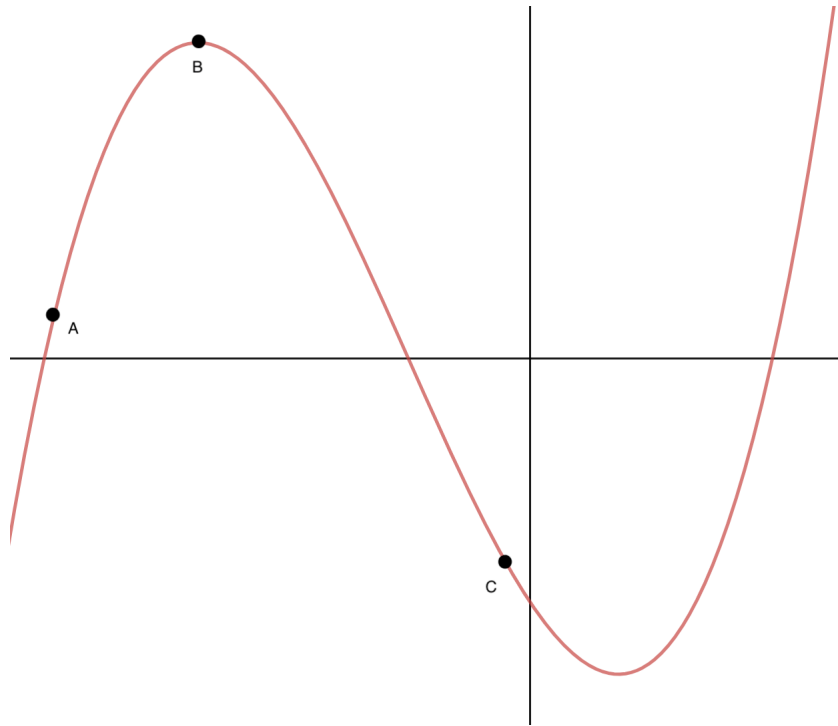


Figure 1: Use this graph to answer questions 1-3.

1. Which of the following are true at point  $A$ ?

- A.  $f(x)$  is positive,  $f'(x)$  is positive, and  $f''(x)$  is positive.
- B.  $f(x)$  is positive,  $f'(x)$  is negative, and  $f''(x)$  is positive.
- C.  $f(x)$  is positive,  $f'(x)$  is positive, and  $f''(x)$  is negative.
- D.  $f(x)$  is positive,  $f'(x)$  is negative, and  $f''(x)$  is negative.

2. Which of the following are true at point  $B$ ?

- A.  $f(x)$  is positive,  $f'(x)$  is zero, and  $f''(x)$  is negative.
- B.  $f(x)$  is zero,  $f'(x)$  is zero, and  $f''(x)$  is negative.
- C.  $f(x)$  is positive,  $f'(x)$  is zero, and  $f''(x)$  is positive.
- D.  $f(x)$  is positive,  $f'(x)$  is positive, and  $f''(x)$  is zero.

3. Which of the following are true at point  $C$ ?

- A.  $f(x)$  is negative,  $f'(x)$  is negative, and  $f''(x)$  is negative.
- B.  $f(x)$  is negative,  $f'(x)$  is positive, and  $f''(x)$  is positive.
- C.  $f(x)$  is negative,  $f'(x)$  is negative, and  $f''(x)$  is positive.
- D.  $f(x)$  is negative,  $f'(x)$  is positive, and  $f''(x)$  is negative.

4. If  $f(x) = \frac{2}{x+1}$ , find  $f^{(3)}(x)$ .

A.  $\frac{-4}{(x+1)^3}$

B.  $\frac{-12}{(x+1)^4}$

C.  $\frac{4}{(x+1)^3}$

D.  $\frac{12}{(x+1)^4}$

5. Find all critical values of  $f(x) = \sqrt{x^2 + 9}$ .

A.  $x = 0$ ,  $x = 3$ , and  $x = -3$

B.  $x = 0$  and  $x = 3$

C.  $x = 0$  and  $x = -3$

D.  $x = 0$  only

6. On which interval(s) is  $f(x) = -\frac{1}{12}x^4 + \frac{1}{2}x^3 - x^2$  concave down?

A.  $(1, 2)$

B.  $(-\infty, 1)$  and  $(2, \infty)$

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

D.  $f(x)$  is never concave down

7. Find all inflection points of  $f(x) = \frac{1}{2}x^4 - 3x^2$ .

A.  $x = 1$  only

B.  $x = -1$  only

C.  $x = -1$  and  $x = 1$

D.  $x = 0$ ,  $x = -1$ , and  $x = 1$

8. Find the horizontal asymptote of  $f(x) = \frac{5x^4 + 2x + 8}{9x^2 - 3x - 6}$ , if it exists.
- A.  $y = 0$
  - B.  $y = \frac{5}{9}$
  - C.  $y = 2$
  - D.  $f$  does not have a horizontal asymptote.
9. If  $f(3) = -10$ ,  $f'(3) = 0$ , and  $f''(3) = -10$ , then
- A. there is a relative maximum at  $x = 3$
  - B. there is a relative minimum at  $x = 3$
  - C. there is an inflection point at  $x = 3$
  - D.  $f(3)$  is the absolute minimum value
10. Which of the following is true?
- A. If  $c$  is a critical value for  $f$ , then  $f'(c) = 0$ .
  - B. If  $f'(c) = 0$ , then  $(c, f(c))$  is either a relative minimum point or a relative maximum point.
  - C. If  $f''(c) = 0$ , then  $(c, f(c))$  is an inflection point.
  - D. None of the above
11. What is the absolute minimum value of  $f(x) = x^4 - 2x^2$  on  $[-2, 2]$ ?
- A. 1
  - B.  $-1$
  - C. 8
  - D.  $-8$
12. Find the absolute maximum and minimum values of  $f(x) = \frac{4x}{x^2 + 1}$  on the interval  $[-3, 0]$ .
- A. The absolute minimum value is  $-\frac{6}{5}$ , and the absolute maximum value is 2.
  - B. The absolute minimum value is  $-2$ , and the absolute maximum value is  $\frac{6}{5}$ .
  - C. The absolute minimum value is  $-2$ , and the absolute maximum value is 0.
  - D. There is no absolute minimum value, but the absolute maximum value is 0.

13. If the revenue function is  $R(x) = 25x - 0.25x^2$  and the cost function is  $C(x) = 5x + 3$ , which of the following is the profit function?

- A.  $P(x) = -0.25x^2 + 20x - 3$
- B.  $P(x) = -0.25x^2 + 20x + 3$
- C.  $P(x) = -0.25x^2 - 20x + 3$
- D.  $P(x) = 0.25x^2 - 20x + 3$

**Use the function  $P(x)$  from problem 13 to answer questions 14-16.**

14. Find the profit from producing and selling 10 items.

- A. \$228
- B. \$222
- C. \$178
- D. \$172

15. Find the marginal profit from producing and selling 10 items.

- A. -\$15
- B. \$15
- C. -\$25
- D. \$25

16. Which of the following would be used to approximate the profit from producing and selling the first 52 items?

- A.  $P'(52)$
- B.  $2 \cdot P'(50)$
- C.  $P(50) + 2 \cdot P'(50)$
- D.  $P(50) + P(2)$

17. The product of two positive numbers is 9. What is the minimum possible value of their sum?
- A.  $-6$
  - B.  $6$
  - C.  $3$
  - D. There is no minimum value
18. You are constructing a fence that must enclose a rectangular area of  $104 \text{ ft}^2$ . The front of the fence must be made of ash wood, which costs  $\$9$  per foot. The other sides of the fence will be made of plywood, which costs  $\$4$  per foot. What are the dimensions of the fence which will minimize your cost?
- A.  $2 \text{ feet} \times 52 \text{ feet}$
  - B.  $4 \text{ feet} \times 26 \text{ feet}$
  - C.  $7 \text{ feet} \times 15 \text{ feet}$
  - D.  $8 \text{ feet} \times 13 \text{ feet}$
19. Suppose that for a given function  $f$ , both  $f'$  and  $f''$  exist everywhere on the interval  $(-\infty, \infty)$  and that  $f$  has exactly one critical value, which is at  $x = 5$ . If  $f'(5) = 0$  and  $f''(5) = -10$ , which of the following are necessarily true?
- A.  $f$  has an absolute minimum at  $x = 5$ .
  - B.  $f$  has an absolute maximum at  $x = 5$ .
  - C.  $f$  has an inflection point at  $x = 5$ .
  - D. None of the above.
20. Your business determines that in order to sell  $x$  items, the price per item should be given by  $p = 180 - 0.75x$ . The cost of producing  $x$  items is given by  $C(x) = 4000 + 0.75x^2$ . What price per item should be charged in order to maximize the profit?
- A.  $\$60$
  - B.  $\$135$
  - C.  $\$1400$
  - D. None of the above.