

Name: _____

VIP ID: _____

- Write your name and your VIP ID in the space provided above.
- The test has five (5) pages, including this one.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, or notes may be used on this test.
- An approved calculator may be used on this test.

Page	Max. points	Your points
2	25	
3	25	
4	25	
5	25	
Total	100	

Problem 1 (15 pts). The function $f(x) = x^4 - 5x^3 + 11x$ has a critical point at $x = 1$. Identify what kind of critical point it is.

- ☐ $f(x)$ has a local minimum at $x = 1$.
- ☐ $f(x)$ has a local maximum at $x = 1$.
- ☐ $x = 1$ is neither maximum, minimum, nor inflection point of $f(x)$.
- ☐ $f(x)$ has an inflection point at $x = 1$.

Problem 2 (10 pts). The function $y = f(x)$ is shown below. How many inflection points does this function have on the interval shown?

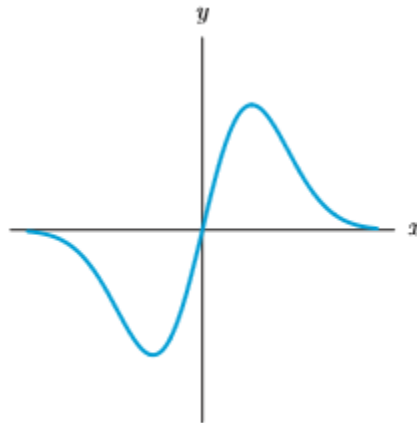


Figure 4.5

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3

Problem 3 (10 pts). Concerning the graph of the function below, which of the following statements is true?

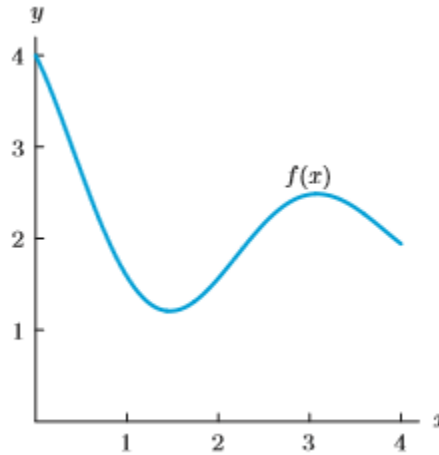


Figure 4.1

- ☐ The derivative is zero only at one value of x , where it is a local minimum.
- ☐ The derivative is zero at two values of x , both being local maxima.
- ☐ The derivative is zero at two values of x , one is a local maximum, while the other is a local minimum.
- ☐ The derivative is zero at two values of x , one is a local maximum on the interval, while the other is neither a local maximum nor a minimum.
- ☐ The derivative is zero at two values of x , one is a local minimum on the interval, while the other is neither a local maximum nor a minimum.

Problem 4 (15 pts). Find all local maxima, minima and inflection points of the function $f(x) = 2x^3 + 3x^2 - 180x + 9$.

Problem 5 (10 pts). If the graph below is that of $f'(x)$, which of the following statements is true concerning the function $f(x)$?

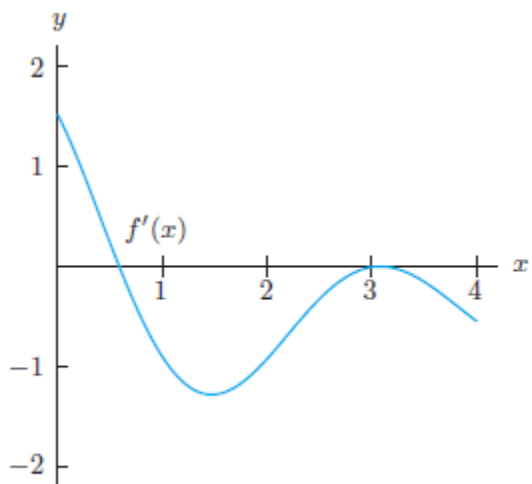


Figure 4.2

- ☐ The derivative is zero only at one value of x , where it is a local minimum.
- ☐ The derivative is zero at two values of x , both being local maxima.
- ☐ The derivative is zero at two values of x , one is a local maximum, while the other is a local minimum.
- ☐ The derivative is zero at two values of x , one is a local maximum on the interval, while the other is neither a local maximum nor a minimum.
- ☐ The derivative is zero at two values of x , one is a local minimum on the interval, while the other is neither a local maximum nor a minimum.

Problem 6 (15 pts). Find the global maximum and the global minimum of the function $f(x) = 2x^3 - 9x^2$ over the interval $-1 \leq x \leq 6$.

Problem 7 (10 pts). Find the value of constants a and b so that the minimum of the parabola $f(x) = ax^2 - bx + 3$ is at $(1, -1)$.

Problem 8 (15 pts). Find the quantity that maximizes profit if the total revenue and total cost (in dollars) are given (resp.) by

$$\begin{aligned} R(q) &= 5q - 0.003q^2, \\ C(q) &= 300 + 1.1q, \end{aligned}$$

where q is quantity and $0 \leq q \leq 1000$ units.