Exam

Name___________________________________

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Find all the critical values of \( y = x^3 - x^2 - x + 2 \).

2) Find all the critical values of \( f(x) = x^4 - 8x^2 + 3 \).

3) If \( f(x) = 2x^3 + 3x^2 - 36x + 1 \), determine the intervals on which \( f \) is increasing and the intervals on which \( f \) is decreasing.

4) If \( f(x) = \frac{x^4}{4} - \frac{2x^3}{3} \), determine the intervals on which \( f \) is increasing and the intervals on which \( f \) is decreasing.

5) Let \( f(x) = \frac{x^4}{4} + \frac{x^3}{3} - x^2 \). Determine the intervals on which \( f \) is

(a) Determine the intervals on which \( f \) is increasing.
(b) Determine the intervals on which \( f \) is decreasing.
(c) Based on your answers to parts (a) and (b), find the values of \( x \) for which \( f \) has relative maxima.
(d) Based on your answers to parts (a) and (b), find the values of \( x \) for which \( f \) has relative minima.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

6) The function \( y = x^3 + 15x^2 - 33x \) has a relative maximum when \( x = \)

A) 11 \hspace{1cm} B) 1 \hspace{1cm} C) -1 \hspace{1cm} D) 0 \hspace{1cm} E) -11

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

7) Find all the critical values of \( f(x) = x^8 - 2x^4 \).

8) Determine the intervals on which the function is increasing and on which it is decreasing. Also determine the points of relative maxima and relative minima.

\( f(x) = 16x^5 - 5x \)

9) Let \( f(x) = 3x^5 - 10x^4 + 7x \). Determine the intervals on which \( f \) is (a) concave up and (b) concave down.

(c) Find the \( x \)-values of all inflection points.

10) Let \( f(x) = x^5 + 5x^3 \). Determine the intervals of which \( f \) is (a) concave up and (b) concave down. (c) Find the \( x \)-values of all inflection points.

11) If \( y = x^4 + 4x^3 - 18x^2 - 3x + 4 \), find the \( x \)-values of all inflection points.
12) Let \( y = x^3 - 3x^2 - 9x + 10 \).
   (a) Determine \( y' \) and \( y'' \).
   (b) Determine intervals on which the function is increasing; determine intervals on which the function is decreasing.
   (c) Determine the coordinates of all relative maximum and relative minimum points.
   (d) Determine intervals on which the function is concave up; determine intervals on which the function is concave down.
   (e) Determine the coordinates of all inflection points.
   (f) With the aid of the information obtained in parts (a)–(e), give a reasonable sketch of the curve.

13) If \( y = 3x^4 - 6x^2 \), use the second-derivative test to find all values of \( x \) for which (a) relative maxima occur (b) relative minima occur.

14) If \( y = x^3 + 4x^2 - 3x + 4 \), use the second-derivative test to find all values of \( x \) for which (a) relative maxima occur (b) relative minima occur.

15) Use the second derivative test to find the points of relative maxima and relative minima for the function \( y = \frac{x^4}{2} - 2x^3 + 5 \).

16) Find the absolute extrema for \( y = x^3 + x^2 - 3x + 7 \) on the interval \([0, 3]\) and where they occur.