

# Suggested Homework for Lecture 6

## Math 116

(1) For each of the following functions, determine the interval(s) on which  $f(x)$  is increasing or decreasing.

(1a)  $f(x) = x^3 - 12x$

(1b)  $f(x) = x^4 - 4x$

(1c)  $f(x) = x^3 - 6x + 1$

(1d)  $f(x) = -x^2 + x + 13$

(2) For each of the following functions, find the critical points and identify each as a local maximum, minimum, or neither.

(2a)  $f(x) = x^3 + 1$

(2b)  $f(x) = x^2 + 2x + 3$

(2c)  $f(x) = x^3 - 3x + 2$

(2d)  $f(x) = x^4 - 2x^2$

(3) In the following problems, the graph of  $f'(x)$  is shown (next page). For each graph, determine where  $f(x)$  is increasing and decreasing; identify the critical points of  $f(x)$  and classify each as a local maximum, local minimum, or neither.

(3a) Figure 1

(3b) Figure 2

(3c) Figure 3

(4) In the following problems, find the absolute minimum and maximum values of the given function  $f(x)$  on the indicated interval.

(4a)  $f(x) = x^2 + 6x + 7, [-4, 0]$

(4b)  $f(x) = x^3 + x, [-1, 1]$

(4c)  $f(x) = 3x^4 - 4x^3 + 12, [-1, 2]$

(4d)  $f(x) = 2x^3 - 3x^2 - 36x + 5, [0, 5]$

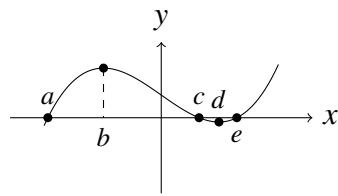


Figure 1:

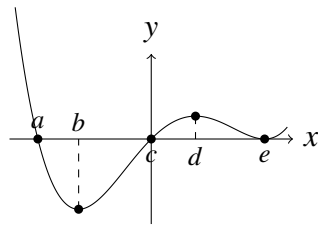


Figure 2:

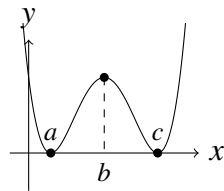


Figure 3:

# Answers to Suggested Homework for Lecture 6

## Math 116

**(1a)** Increasing on  $(-\infty, -2)$  and  $(2, \infty)$ ; decreasing on  $(-2, 2)$

**(1b)** Increasing on  $(1, \infty)$ ; decreasing on  $(-\infty, 1)$

**(1c)** Increasing on  $(-\infty, -\sqrt{2})$  and  $(\sqrt{2}, \infty)$ ; decreasing on  $(-\sqrt{2}, \sqrt{2})$

**(1d)** Increasing on  $(-\infty, \frac{1}{2})$ ; decreasing on  $(\frac{1}{2}, \infty)$

**(2a)**  $x = 0$ , neither

**(2b)**  $x = -1$ , local minimum

**(2c)**  $x = -1$ , local maximum,  $x = 1$ , local minimum

**(2d)**  $x = -1$ , local minimum,  $x = 0$ , local maximum,  $x = 1$ , local minimum

**(3a)** Increasing on  $(a, c)$  and  $(e, \infty)$ , decreasing on  $(-\infty, a)$  and  $(c, e)$ . The critical points are  $x = a, c$ , and  $e$ , where  $x = a$  and  $x = e$  are local minima,  $x = c$  is a local maximum.

**(3b)** Increasing on  $(-\infty, a)$ ,  $(c, e)$  and  $(e, \infty)$ . Decreasing on  $(a, c)$ . Critical points are  $x = a, x = c$ , and  $x = e$ , with  $x = a$  a local maximum,  $x = c$  a local minimum, and  $x = e$  neither.

**(3c)** Increasing on  $(-\infty, a)$ ,  $(a, c)$ , and  $(c, \infty)$ . Decreasing nowhere. Critical points are  $x = a$  and  $x = c$ , and both are neither a local max nor a local min.

**(4a)** Absolute maximum 7 at  $x = 0$ , absolute minimum -2 at  $x = -3$ .

**(4b)** Absolute maximum 2 at  $x = 1$ , absolute minimum -2 at  $x = -1$ .

**(4c)** Absolute maximum 28 at  $x = 2$ , absolute minimum 11 at  $x = 1$ .

**(4d)** Absolute maximum 5 at  $x = 0$ , absolute minimum -76 at  $x = 3$ .