MAC2241
Suggested problems on Chapter 4 material (applications of derivatives)

Idris Mercer

April 13, 2018

1. Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = 5 - 4x - x^2$$

2. Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

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

3. Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = 5 + 12x - x^3$$

4. Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = \frac{x}{x^2 + 4}$$

5. Find the intervals on which the function is increasing, decreasing, concave up, or concave down.

$$f(x) = x^{4/3} - x^{1/3}$$

6. Find all the critical points of the function.

$$f(x) = 4x^4 - 16x^2 + 17$$

7. Find all the critical points of the function.

$$f(x) = 3x^4 + 12x$$

8. Find all the critical points of the function.

$$f(x) = \frac{x+1}{x^2+3}$$

9. Find all the critical points of the function.

$$f(x) = (x^2 - 25)^{1/3}$$

10. Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = x^4 - 4x^3 + 4x^2$$

11. Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = 2x + 3x^{2/3}$$

12. Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = \frac{x^2}{x^4+16}$$

13. Find all the relative extrema of the function, and classify each of them as a minimum or a maximum.

$$f(x) = \ln(2 + x^2)$$

14. Draw a graph of the function. Label all the critical points, inflection points, and asymptotes.

$$f(x) = \frac{x-3}{4-x}$$

15. Draw a graph of the function. Label all the critical points, inflection points, and asymptotes.

$$f(x) = \frac{x}{x^2-4}$$

16. Find the absolute maximum and absolute minimum of the function

$$f(x) = (x^2 + x)^{2/3}$$

on the interval $[-2, 3]$.

17. Find the absolute maximum and absolute minimum of the function

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

on the interval $(-1, 5]$.

18. Find the absolute maximum and absolute minimum of the function

$$f(x) = \frac{\ln x}{x}$$

on the interval $[1, e^2]$.

19. Find a number in the closed interval $[\frac{1}{2}, \frac{3}{2}]$ such that the sum of the number and its reciprocal is
a. as small as possible
b. as large as possible.

20. How should two nonnegative numbers be chosen so that their sum is 1 and the sum of their squares is
a. as large as possible
b. as small as possible?

21. A rectangular field is to be bounded by a fence on three sides and by a straight stream on the fourth side. Find the dimensions of the field with maximum area that can be enclosed using 1000 ft of fence.

22. A rectangular plot of land is to be fenced in using two kinds of fencing. Two opposite sides will use heavy-duty fencing selling for \$3 a foot, while the remaining two sides will use standard fencing selling for \$2 a foot. What are the dimensions of the rectangular plot of greatest area that can be fenced in for a cost of \$6000?