

Midterm 1 – Math 203

Tuesday, February 12, 2018

This is a closed-book exam.

You are allowed one cheat sheet (8.5 inch by 11 inch 2-sided)

Non-graphing calculators allowed.

Justify your answers to obtain full credit (and partial credit, too).

You have 75 minutes.

This exam consists of 5 questions and a bonus.

Please verify that you have all pages.

Name: _____

ID#: _____

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1. (20 points) Evaluate the limits in (a) and (b) then follow the separate instructions for (c):

(a) $\lim_{x \rightarrow -1} \frac{x^2 - 5x - 6}{x + 1}$

(b) $\lim_{x \rightarrow \infty} \frac{x^3 + x^2 + 2}{7x^3 + x + 1}$

(c) Is the following function continuous at $x = 2$? At $x = 4$? Justify your answers using limits:

$$f(x) = \begin{cases} 3 - x & x < 2 \\ \frac{x}{2} + 1 & 2 \leq x < 4 \\ 3 & x \geq 4 \end{cases}$$

2. (15 points)

(a) Using the limit definition of a derivative, differentiate the following:

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

(b) Find the equation of the line tangent to $f(x)$ at $x = 1$

3. (15 points) Using differentiation rules (rules for derivatives), find the derivatives of the following functions:

(a) $4x^3 + 2\sqrt{x} + \frac{1}{x^2}$

(b) $x^9 - 2x^5 - x^3 + x - 1$

(c) $(3x^4 + 4x^2)^7$

4. (25 points) Let $f(x) = 2x^3 - 6x^2$

(a) Find the (open) intervals where f is increasing and where f is decreasing.

(b) Find all relative extrema (both x and y coordinates). Indicate whether it is a relative maximum or relative minimum.

(c) Find the (open) intervals where f is concave up and where f is concave down

(d) Find all inflection point(s) (both x and y coordinates)

(e) Using the information from parts (a)-(d), graph the function. Label all relative extrema and inflection point(s).

5. (*25 points*) Market research into parking fees indicates that if a parking pass is \$20 per day then you will have 100 cars parked per month. If the parking pass is \$25 then you will have 50 cars parked per month.

- (a) Assuming that the demand curve is linear, find the equation relating the price d to the number x of cars parked. Use this to find the equation for revenue.
- (b) Using your answer from above, find the number of cars parked that maximizes the revenue. (If you could not answer part (a), find the maximum revenue for the commodity whose demand function is given by $d(x) = 400 - \frac{2}{5}x$.)
- (c) Bonus: (*5 points*) Find the price of a parking pass that will maximize the revenue in part (b).

Final Score

	Score	Out of
Question 1		20
Question 2		15
Question 3		15
Question 4		25
Question 5		25
(Bonus)		(5)
Total		100