MATH 201 Final Review 1.1 - 4.9

1. Be familiar with four ways to represent a function and with polynomial, rational, exponential, and logarithmic functions.

2. Know the transformations of functions (vertical and horizontal shifts, vertical and horizontal stretching, reflection.

3. Know how to find the inverse function of a one-to-one function and the definition of inverse function.

4. Know the limit laws and how to evaluate the limit of constant, polynomial, rational, and composite functions.

5. Know how to find the left-hand and right-hand limit and how to use the left-hand and right-hand limit to determine whether a limit exists.

6. Know the precise (formal) definition of a limit and how to use it to prove a limit.

Let f be a function defined on an open interval containing a, except maybe at a, and let L be a real number. Then

$$\lim_{x \to a} f(x) = L$$

means that for each $\epsilon > 0$ there exists a $\delta > 0$ such that $|f(x) - L| < \epsilon$ whenever $0 < |x - a| < \delta$.

7. Know the intermediate value theorem and how to apply it. Example:

Show that the polynomial function $f(x) = x^4 + x - 3$ has a zero in the interval $[1, 2]$.

8. Know the definition of continuity at a point and on an open interval.

9. Describe the intervals on which a function is continuous.

10. Know how to evaluate infinite limits and limits at infinity, and find horizontal and vertical asymptotes.

11. Know the limit definition of the derivative and how to use it, that is

$$f'(x) = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h}$$

12. Know how to find the instantaneous velocity, average velocity, and the slope of a tangent line at a point, as well as finding the equation of the tangent line at a point.

13. Know how to find the derivative of constant, polynomial, rational, exponential, logarithmic functions.

14. Know the sum/difference rule, power rule, product rule, quotient rule, and chain rule, and how to use them to find the derivative.

15. Know how to find higher order derivatives, for example,

(a) Given $y(x) = 8(x^2 - 1)^3$, find $y'''(x)$.

(b) Given $y(x) = x^2 \sin x$, find $y'''(x)$.

16. Know how to find derivatives of trigonometric functions and how to evaluate the limits like the following

$$\lim_{x \to 0} \frac{\sin 7x}{5x}$$

17. Know the definition of the chain rule and how to use it.

18. Know implicit differentiation, for example find $\frac{dy}{dx}$ given

$$xy = \cos(xy)$$

19. Know how to find the derivatives of logarithmic functions and how to use logarithms and implicit differentiation to simplify the differentiation of complicated functions,i.e. logarithmic differentiation.

20. Know how to solve related rates problems.

21. Know how to find the absolute max and absolute min over a closed interval, also be able to define critical numbers and find them.

22. Know the extreme value theorem.

23. Know the Mean Value Theorem and its application.

24. Know how to determine the intervals of increase and decrease.

25. Know to determine relative extrema using both the 1st derivative test and 2nd derivative test.

26. Know the indeterminate forms and how to find the limit using $L'Hopital's Rule$.

27. Be able to sketch a graph using all applicable concepts relating the behaviour of the function.

28. Know how to apply differentiation to finding applied maximum or minimum problems.

29. Know how to find an antiderivative of a function.

30. Review Exercises.
    (a) HW, Exams, Quizzes
    (b) Ch. 1. Review, 1 - 27
    (c) Ch. 2. Review, 1 - 46
    (d) Ch. 3. Review, 1 - 32, 34, 50 - 52, 54 - 59, 63 - 79, 81, 87, 91, 95, 100 - 102
    (e) Ch. 4. Review, 1 - 20, 45, 52, 59, 65 - 67, 68 - 73, 77