

# MTH 4422 Midterm Study Guide

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**Instructions.** Answer the following questions thoroughly.

1. Explain the idea behind Newton's Method for solving the equation  $f(x) = 0$ , using the Taylor's Series approach.
2. Explain the idea behind Newton's Method for solving the equation  $f(x) = 0$ , using the Geometric approach.
3. Explain how and why the Bisection Algorithm (for solving  $f(x) = 0$ ) works.
4. Explain how and why the Fixed Point Algorithm (for solving  $f(p) = p$ ) works.
5. Explain how LaGrange Polynomials are constructed to approximate the function whose data points include  $(x_0, f(x_0)), (x_1, f(x_1)), \dots, (x_n, f(x_n))$ , and explain why this works.
6. Describe the Trapezoidal Method for integration, and explain why it works.
7. Describe Simpson's Method for approximating  $\int_a^b f(x) dx$ , and explain why it works.
8. Given the data points  $(-1, -2), (1, 2), (2, 7)$ , compute the LaGrange Polynomial that agrees with the data points.  
We have 3 data points, so we should have a polynomial of degree 2.
9. Given the data points  $(-2, -46), (-1, -14), (0, -4), (1, 2), (2, 22)$  compute the LaGrange Polynomial that agrees with the data points.
10. With reference to the preceding exercise, we had 5 data points and yet the LaGrange Polynomial was only of degree 3. (We would expect that the LaGrange Polynomial that fits all **five** data points would have degree 4.) How can we explain this?