1. (15 points) Consider the equation $x^2 - 3 = 0$. Take the starting interval $[1, 2]$. Do 3 iterations of the bisection method. How many iterations would it take to reduce the interval to length less than $1.e - 6$ (justify your answer).

2. (15 points) Consider the equation $x^2 - 3 = 0$. If $x_0 = 2$, use Newton’s root finding method to find $x_1$ and $x_2$. If you’re in the region of quadratic convergence, how many iterations do you expect to need to get the root within $1.e - 6$? Justify your answer.
3. (15 points) Consider the equation \( x^2 - 3 = 0 \). Let \( x_0 = 0, x_1 = 2 \). Find \( x_2 \) and \( x_3 \) by the secant method.

4. (10 points) Set up the Vandermonde matrix system to find a cubic polynomial which goes through the points \( (x_i, y_i), (-1, 1), (0, -1), (1, 1), (2, 1) \).
5. (15 points) Use the Lagrange formulation to find the parabola determined by \( p(-1) = 1, p(1) = -1, p(2) = 2 \).

6. (15 points) Use the Newton divided difference formulation to find the parabola determined by \( p(-1) = 1, p(1) = -1, p(2) = 2 \).
7. (15 points) Use Taylor expansions to show that

\[
\frac{f(x + h) - f(x - h)}{2h} = f'(x) + O(h^2)
\]

and state what assumptions must be made to derive this formula.