CS/MATH 3414 Exam 1

(please fill in the following information)

Name:

ID:

1. (2 points) Consider the equation $x^2 + ax + b = 0$ with roots p and q. In floating point arithmetic, how should p and q be determined in order to minimize cancellation error?

2. (2 points) Describe a method for computing $e^x - \sin x - \cos x$ when x is small.

3. (3+1=4 points) What does the following functional iteration compute?

$$x_{n+1} = \frac{2e\,x_n}{x_n^2 + e}$$

State also whether it is globally convergent or locally convergent.

4. (4 points) Calculate an approximate value for $4^{3/4}$ using one step of the secant method with $x_0 = 3$ and $x_1 = 2$.

5. (1+2+1+1=5 points) Write down the Newton interpolating polynomial for the data f(-1) = -11, f(0) = -1, f(1) = 1, f(3) = 29. Give an estimate of the error when computing f(2) using this polynomial. Are there any quadratic polynomials that fit f at the given points? Are there any quintic (degree 5) polynomials that fit f at the given points?

6. (2 points) Determine the interpolating polynomial in Newton form to the data f(0) = 1, f(1) = 0, f'(0) = 0, f'(1) = 0.

7. (3+3=6 points) The values of a function f are given at three points x_0 , x_1 , and x_2 . If a quadratic interpolating polynomial is used to estimate $f'(x_0)$, what formula will result? What is the error term?