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?