

# Aero 320: Numerical Methods

## Lab Assignment 7

Fall 2013

### Problem 1

#### Convergence in root-finding: Newton's method and Halley's method

The equation for Generalized Halley's method is given by

$$x_{n+1} = x_n + (k + 1) \frac{\left(\frac{1}{f(x_n)}\right)^{(k)}}{\left(\frac{1}{f(x_n)}\right)^{(k+1)}}$$

- (a) Show that for  $k = 0$ , the equation represents *Newton's method*. Next, for  $k = 1$ , prove that the equation represents *quadratic Halley's method*.
- (b) Consider solving the nonlinear equation  $f(x) = x^3 + 4x^2 - 10 = 0$ , as discussed in class, using *Newton's method*. Write a program to compute the order  $\alpha$ , and the asymptotic error constant  $\lambda$ , for this case.
- (c) Repeat part (b) for *quadratic Halley's method*.