

## Math 331/631 Homework Assignment #1 Due Jan. 30

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1. Consider the MATLAB program “Sampleprogram.m” on the next page.
  - (a) Run the program in MATLAB by typing “Sampleprogram(1,2)” and explain what you get.
  - (b) Add comments to every line of the program explaining what it does.
  - (c) Adapt the program to find the only root of  $f(x) = x^3 + 17x - 3$ . You will have to find good initial guesses.
2. The four functions listed below have a fixed point at  $x = 1/2$ . Use the fixed-point iteration method to approximate it. Set the maximum number of iterations to  $N_0 = 25$  and the initial guess to  $x_0 = 1$ . Make a table of errors in the approximations for each function. For each function  $g(x)$ , find the maximum value of  $|g'(x)|$  for  $0 \leq x \leq 1$ . Explain the results in your table based on this.

$$g(x) = -\frac{3}{10} [10x^3 - 15x^4 + 6x^5] + \frac{13}{20}$$

$$g(x) = -\frac{4}{10} [10x^3 - 15x^4 + 6x^5] + \frac{14}{20}$$

$$g(x) = -\frac{5}{10} [10x^3 - 15x^4 + 6x^5] + \frac{15}{20}$$

$$g(x) = -\frac{6}{10} [10x^3 - 15x^4 + 6x^5] + \frac{16}{20}$$

3. problem 1 in 2.2

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function y=Sampleprogram(a,b)
tol = 1e-6; NO = 25;
FA = F(a);
FB = F(b);
if FA*FB > 0,
    disp(' ')
    disp(['f(',num2str(a),') and f(',num2str(b),') have the same sign.'])
    disp('Try a different interval.')
    disp(' ')
    return;
end
i = 1;
while i <= NO,
    p = a + (b-a)/2;
    FP = F(p);
    aa(i) = a; bb(i) = b;
    y(i) = p;
    if FP == 0 | (b-a)/2 < tol,
        x0 = p; break;
    end
    i = i + 1;
    if FA*FP > 0,
        a = p; FA = FP;
    else,
        b = p;
    end
end
x0 = a + (b-a)/2;
disp(' ')
disp(['The root is ',num2str(x0,11),' with a possible error of ',num2str((b-a)/2)])
disp(' ')
if i > NO,
    disp(['The Bisection method did not meet the'])
    disp(['tolerance ',num2str(tol),' after ',num2str(NO),' iterations']),
    disp(' ')
end
format long e,
disp(' n      a_n      p_n      b_n      F(p_n)      ')
disp('-----')
for kk=1:length(y)
    disp(sprintf(' %u      %11.8f      %11.8f      %11.8f      %11.8f      ', kk, aa(kk), y(kk), bb(kk), F(y(kk))))
end
disp(' ')
end%Sampleprogram
%-----
function Fun = F(x)
Fun = x.^3 + 4*x.^2 - 10;
end%function

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