Assignment 1

Ex2.31

```
m1 = [
    1,5,4;
    2,3,6;
    1,1,1
];

m2 = [
     1, 2, 3, 4;
     5, 6, 7, 8;
     9,10,11,12;
    13,14,15,16
];

d = Determinant(m1);
disp(d)
d = Determinant(m2);
disp(d)


function D = Determinant(A)
%Determinant returns the determinant of the square matrix A
    %Check input is square
    [m,n] = size(A);
    if m ~= n
        D = 'The matrix must be square.';
    end
    %If A is 2x2, simply calculate the determinant
    if m == 2
        D = A(1,1)*A(2,2) - A(1,2)*A(2,1);
    %Otherwise for nxn matrices,
    %recursively find the determinants
    %of each minor, multiplied by the
    %corresponding element of the top row
    %of A. Flip between adding and subtracting
    %each one.
    else
        for i = 1:m
            B = A;      %minor of A
            B(1,:) = [];%clear top row
            B(:,i) = [];%and ith column
            if i == 1
                D = (A(1,i)*Determinant(B));
            else
                D = D + (A(1,i)*((-1)^(i-1))*Determinant(B));
            end
        end
    end
end
```

Ex3.2

$f(x) = x - 2e^{-x}$

a) Bisection Method

$$a = 0, b = 1$$
$$x_1 = \frac{a+b}{2} = 0.5$$
$$f(a) = f(0) = 0 - 2e^0 = -2$$
$$f(0.5) = 0.5 - 2e^{-0.5} = -0.71$$
$$-2 * -0.71 = positive$$

$$a = 0.5, b = 1$$
$$x_2 = 0.75$$
$$f(0.75) = 0.75 - 2e^{-0.75} = -0.19$$
$$-0.71 * -0.19 = positive$$

$$a = 0.75, b = 1$$
$$x_3 = 0.875$$
$$f(0.875) = 0.875 - 2e^{-0.875} = 0.04$$

b) Secant Method

$$x_{i+1} = x_i - \frac{f(x_i)(x_{i-1} - x_i)}{f(x_{i-1}) - f(x_i)}$$

$$x_1 = 0, x_2 = 1$$
$$f(0) = -2, f(1) = 0.26$$
$$x_3 = 1 - \frac{0.26(0-1)}{-2-0.26} = 0.88$$
$$f(0.88) = 0.05$$
$$x_4 = 0.88 - \frac{0.05(1-0.88)}{0.26-0.05} = 0.85$$
$$f(0.85) = -0.005$$
$$x_5 = 0.85 - \frac{-0.005(0.88-0.85)}{0.05+0.005} = 0.85$$

c) Newton's Method

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)}$$

$$f'(x) = -2(\frac{d}{dx}e^{-x}) + \frac{d}{dx}x$$
$$f'(x) = -2(e^{-x})(\frac{d}{dx} - x) + 1$$
$$f'(x) = 2e^{-x} + 1$$

$$x_1 = 1$$
$$x_2 = 1 - \frac{0.26}{1.74} = 0.85$$
$$x_3 = 0.85 - \frac{-0.005}{1.85} = 0.85$$
$$x_4 = 0.85$$

Ex4.24

```
m1 = [
    -1, 2,  1;
    2,  2, -4;
    0.2,1,0.5
];

m2 = [
     -1,-2,1,2;
     1,1,-4,-2;
     1,-2,-4,-2;
     2,-4,1,-2
];

i = Inverse(m1);
disp(i)
%disp(inv(m1));
i = Inverse(m2);
disp(i)
%disp(inv(m2));

function Ainv = Inverse(A)
%Inverse uses GaussJordan method to find the inverse of A

    [m,n] = size(A);
    if m ~= n
        Ainv = 'The matrix must be square.';
        return
    end

    Ainv = eye(m); %identity matrix to be transformed into inverse

    for j = 1:m
        temp = 1/A(j,j);
        for k = 1:m
            A(j,k) = temp * A(j,k);        %run through row j and divide by A(j,j) so
diagonal becomes ones
            Ainv(j,k) = temp * Ainv(j,k);  %all operations done to A are also done to Ainv
        end
        for L = 1:m
            if L ~= j                      %for all elements in column j NOT on the diagonal:
                temp = -A(L,j);            %subtract A(L,j)A(j,k) from A(L,k) so that
eventually
                for k = 1:m                %non diagonal becomes zeros
                    A(L,k) = A(L,k) + temp * A(j,k);
                    Ainv(L,k) = Ainv(L,k) + temp * Ainv(j,k);   %again, execute ops on both
A and Ainv
                end
            end
        end
```

```
    end
end
```