```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% NAME: abraham reines
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% DATE: Mar 21, 2022
%
% PROGRAM: Problem27b.m
% PURPOSE:  Use bisection to find the zeros with ten decimal places accuracy.
 What are they?
% CREDIT: Adapted from an example written by Dr. Lucus

% JMU PLEDGE
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%


close all
clear
clc

f = @(x) exp(x); a = 0; b = 2; er = exp(2) - 1;

fprintf('Part (a)----------------------------------------------------\n')
fprintf('%-10s%-20s%-20s%-20s\n', 'n', 'h', 'Error', 'Error Ratio')
n = 10;
err = [];
while n < 1000
    ret = left(f, a, b, n);
    err = [err abs(ret - er)];
    fprintf('%-10d%-20.8f%-20.8f', n, (b - a)/n, err(end))
    if n > 10
        fprintf('%-20.4f\n', err(end-1)/err(end))
    else
        fprintf('%-20s\n', '-')
    end
    n = n * 2;
end
disp('The error is equivalent to h.')

fprintf('\nPart (b)----------------------------------------------------\n')
fprintf('%-10s%-20s%-20s%-20s\n', 'n', 'h', 'Error', 'Error Ratio')
i = 10;
err = [];
while i < 1000
    ret = mid(f, a, b, i);
    err = [err abs(ret - er)];
    fprintf('%-10d%-20.8f%-20.8f', i, (b - a)/i, err(end))
    if i > 10
        fprintf('%-20.4f\n', err(end-1)/err(end))
    else
        fprintf('%-20s\n', '-')
    end
    i = i * 2;
end
```

```
disp('The error is equivalent to h^2.')

function ret = left(f, a, b, n)
h = (b - a)/n;
i = 1:n;
x = a + (i - 1)*h;
ret = sum(f(x)*h);
end

function ret = mid(f, a, b, n)
h = (b - a)/n;
i = 1:n;
x = a + (i - 1/2)*h;
ret = sum(f(x)*h);
end
```

```
Part (a)----------------------------------------------------
n         h                   Error               Error Ratio
10        0.20000000          0.61762294          -
20        0.10000000          0.31412948          1.9661
40        0.05000000          0.15839540          1.9832
80        0.02500000          0.07953044          1.9916
160       0.01250000          0.03984841          1.9958
320       0.00625000          0.01994500          1.9979
640       0.00312500          0.00997770          1.9990
The error is equivalent to h.

Part (b)----------------------------------------------------
n         h                   Error               Error Ratio
10        0.20000000          0.01063602          -
20        0.10000000          0.00266133          3.9965
40        0.05000000          0.00066548          3.9991
80        0.02500000          0.00016638          3.9998
160       0.01250000          0.00004160          3.9999
320       0.00625000          0.00001040          4.0000
640       0.00312500          0.00000260          4.0000
The error is equivalent to h^2.
```

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