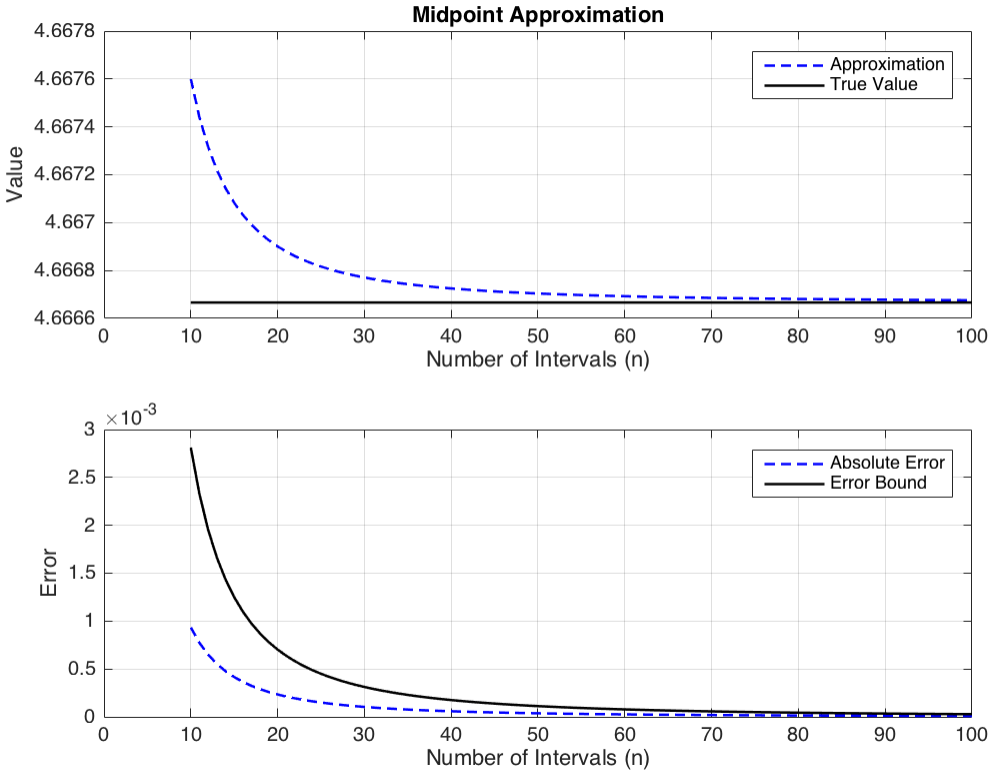
ESC103: Lab 1

```
%Clean up our workspace
clear; clc; close all;
```

Exercise 1

```
%Set up the vector of n values
n_vec = 10:100;

%Pre-allocate a vector of approximations
midpoint_approx_vec = zeros(1, length(n_vec));

%Values computed by hand
true_int = 14/3;
K = 1/4;

%Evaluate the midpoint approximation for n = [10,..,100]
for i = 1:length(n_vec)
    n = n_vec(i);

    dx = 3/n;
    xbar = (dx/2):dx:(3-(dx/2));
    f_at_xbar = sqrt(xbar+1);

    midpoint_approx_vec(i) = dx*sum(f_at_xbar);
end

%Compute error and error bounds
error_vec = abs(true_int - midpoint_approx_vec);
errorbound_vec = (3^3*K)./(24*n_vec.^2);

%Plot!
figure
%Subplot 1: Approximation
subplot(2,1,1)
plot(n_vec, midpoint_approx_vec, '--b', 'Linewidth', 1.25)
hold on
plot(n_vec, true_int*ones(1,length(n_vec)), '-k', 'Linewidth', 1.25)
legend('Approximation', 'True Value')
title('Midpoint Approximation')
xlabel('Number of Intervals (n)')
ylabel('Value')
xlim([0 100])
grid on

%Subplot 2: Error & Error Bounds
subplot(2,1,2)
plot(n_vec, error_vec, '--b', 'Linewidth', 1.25)
hold on
plot(n_vec, errorbound_vec, '-k', 'Linewidth', 1.25)
legend('Absolute Error', 'Error Bound')
```

```
xlabel('Number of Intervals (n)')
ylabel('Error')
xlim([0 100])
grid on
```



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