1). Overview:

In this lab, I programmed a riemann-sum to estimate the area under the curve for a certain function under the interval [0,5]. The interval was divided into slices with thickness dx. The value dx was determined by how many slices were defined under the specific interval. The smaller dx is, the more of an accurate value the program would output for area. A graph for the function was also implemented into the program, along with the number of slices under the curve to show a more visual presentation of what's going on.

2). Procedure:

Values were compared to observe whether there is a match. Based on the observation. The values from each of the programs were approximately similar only with a small margin of error. This is only due to the fact that different sums were used to observe, leading to different approximations but with a small margin of error.

3). programming/graphing:

Part 1:

```
 A = [sqrt(2);1;exp(pi)];
B = [3;5;7];
D = 0;
for i = [1 2 3]
    D = A(i)*B(i)+D;
end
disp(D)
```

Part 2:

```
A = [sqrt(2); 1;exp(pi)];
B = [3;5;7];
D = 0;
for i = [1, 2,3];
    D = A(i)*B(i)+ D;
end
disp(D)
```

Part 3:

```
n = 200;
dx = 5/(n);
x = [dx:dx:5];
y = fx(x);
Q1 = 0;
Q2 = 0;
for i = [1, n]
   Q1 = y(i)*dx + Q1;
end
for i = [2, n]
   Q2 = y(i-1)*(dx) + Q2;
end
disp(Q1)
disp(Q2)
trapo(y,n);
Q3 = (Q1 + Q2)/2
xlabel("x axis")
ylabel("y axis")
title("area under the curve")
plot(x,y)
hold on;
bar (x-(dx/2),y)
```

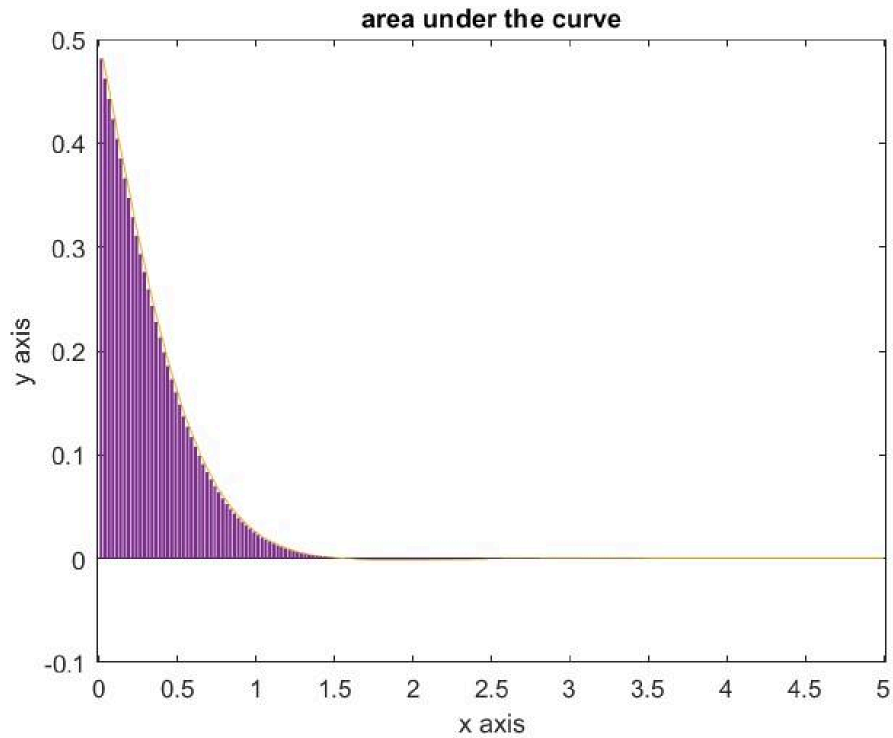
Part 4:

```
n = 200;
dx = (5)/(n -1);
x = 0: dx: 5;
y = fx(x);
A = [ones(n-1, 1);0];
B = [ones(n,1)];
Q1 = y* A *dx;
Q2 = y*B *dx;
err = NaN*B;
for i = [1:1:n]
   err(i) = per_error(i);
end
plot([1:1:n],err' )
```

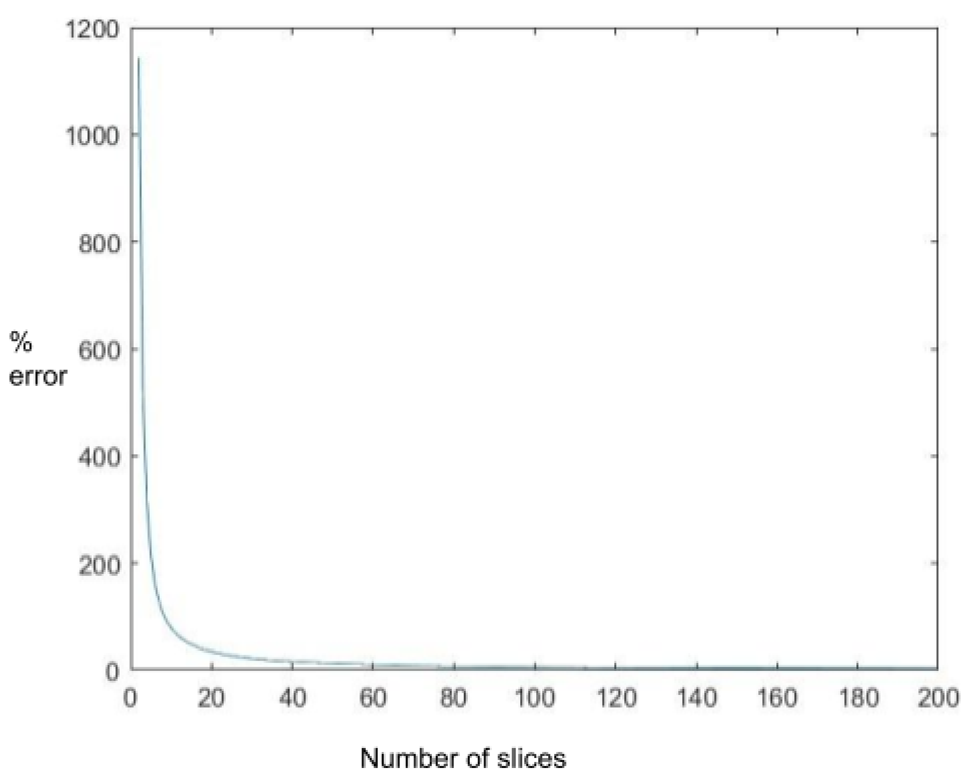
Part 5:

```
n = 200;
dx = (5)/(n -1);
x = 0: dx: 5;
y = fx(x);

A = [ones(n-1, 1);0];
B = [ones(n,1)];

Q3 = (dx/2)*(y(1)+y(n))+ y*A*dx;
```

graphs:



area under the curve
0.5
0.4
0.3
0.2
0.1
0
-0.1
y axis
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
x axis



1200
1000
800
600
400
200
0
%
error
0
20
40
60
80
100
120
140
160
180
200
Number of slices

4). conclusion:

The results show that the area under the curve can be approximated through a sum of n slices. It also shows that by decreasing the thickness of each slice, the approximation becomes more accurate to the actual area under the curve.