Lab experiment 5

Integration: Indefinite, definite and Area between the curves

MATLAB Syntax used:

`int(f,v)`	uses the symbolic object v as the variable of integration, rather than the variable determined by symvar
`rsums(f, [a, b])`	rsums(f, a, b) and rsums(f, [a, b]) approximates the integral for *x* from a to b.
`fill(X,Y,C)`	fill(X,Y,C) creates filled polygons from the data in X and Y with vertex color specified by C.
`char(X)`	converts array X of nonnegative integer codes into a character array.

A. Integration

i) Inbuilt MATLAB function:

```
syms x
f=input('enter the function f(x):');
a=input('enter lower limit of x ');
b=input('enter the upper limit of x');
n=input('number of intervals');
z=int(f,a,b) % direct evaluation
```

ii) As a sum of rectangles by using rsums command :

→**Initialization:**

```
value = 0;
dx = (b-a)/n;
```

→ **sum of the function values at all the right points**

```
for k=1:n
    c = a+k*dx;
    d=subs(f,x,c);
    value = value + d;
end
```

→ **value of the sum* length of the sub interval is the approx. value of the integral**

```
ivalue = dx*value
ezplot(f,[a b])
```

→ **Taking mid point function values**

```
rsums(f, a, b)
```

Problems:

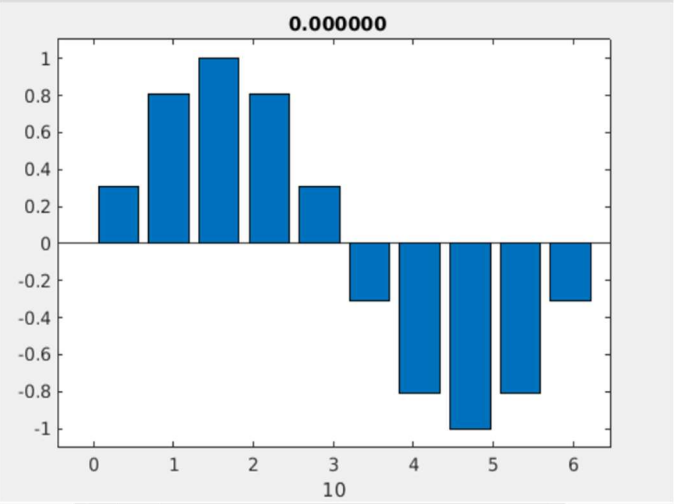
1) Sin(x) in [0, 2 pi]
2) Cos(x) in [-pi/2, pi/2]
3) e^x+tan(x)
4) x^2+4x^3 in [-2,4]
5) x/(x^2)+1 in [-1,6]

1)CODE:

```
syms x
f=input('enter the function f(x):');
a=input('enter lower limit of x ');
b=input('enter the upper limit of x');
n=input('number of intervals');
z=int(f,a,b)
value = 0;
dx = (b-a)/n;
for k=1:n
    c = a+k*dx;
    d=subs(f,x,c);
    value = value + d;
end
ivalue = dx*value
ezplot(f,[a b])
rsums(f, a, b)
```

OUTPUT:

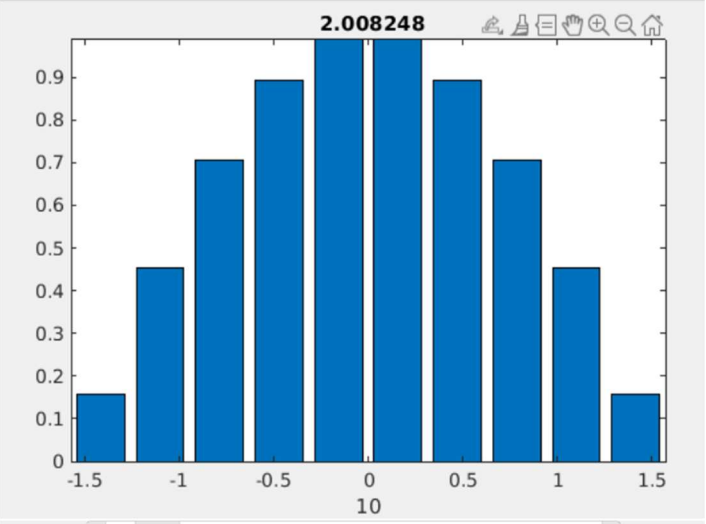
```
enter the function f(x):
sin(x)
enter lower limit of x
0
enter the upper limit of x
2*pi
number of intervals
10


z =


0


ivalue =


0
```



2)CODE:

```
syms x
f=input('enter the function f(x):');
a=input('enter lower limit of x ');
b=input('enter the upper limit of x');
n=input('number of intervals');
z=int(f,a,b)
value = 0;
dx = (b-a)/n;
for k=1:n
    c = a+k*dx;
    d=subs(f,x,c);
    value = value + d;
end
```

```
ivalue = dx*value
ezplot(f,[a b])
rsums(f, a, b)
```



OUTPUT:

```
enter the function f(x):
cos(x)
enter lower limit of x
-pi/2
enter the upper limit of x
pi/2
number of intervals
10


z =


2


ivalue =

(pi*(2*cos(pi/15) + 2*cos((2*pi)/15) + 2*cos((4*pi)/15) + 2*cos((7*pi)/15) +
2*cos(pi/30) + 2*cos((7*pi)/30) + 2*cos((11*pi)/30) + 2*cos((13*pi)/30) + (2^(1/2)*(5
- 5^(1/2))^(1/2))/2 + 3^(1/2) + 5^(1/2) + (2^(1/2)*(5^(1/2) + 5)^(1/2))/2 + 2))/30
```

3)CODE:

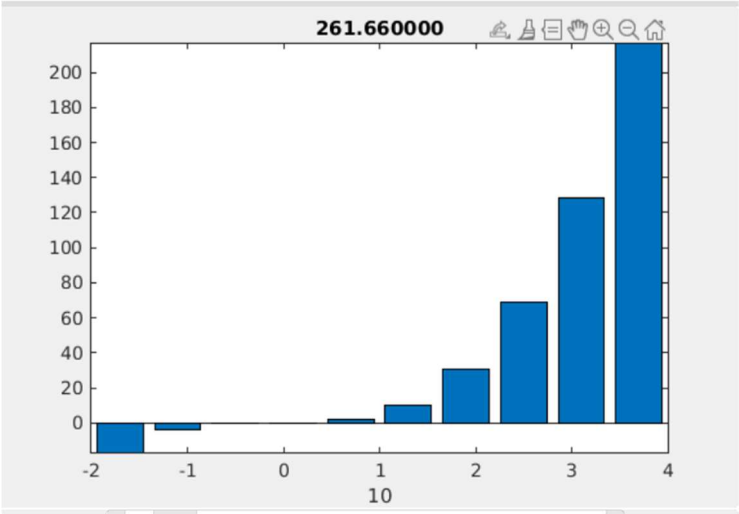
```
syms x
f=input('enter the function f(x):');
z=int(f)
```

OUTPUT:

```
enter the function f(x):
exp(x)+tan(x)


z =


log(tan(x)^2 + 1)/2 + exp(x)
```

4)CODE:

```
syms x
f=input('enter the function f(x):');
a=input('enter lower limit of x ');
b=input('enter the upper limit of x');
n=input('number of intervals');
z=int(f,a,b)
value = 0;
dx = (b-a)/n;
for k=1:n
    c = a+k*dx;
    d=subs(f,x,c);
    value = value + d;
end
ivalue = dx*value
ezplot(f,[a b])
rsums(f, a, b)
```



OUTPUT:

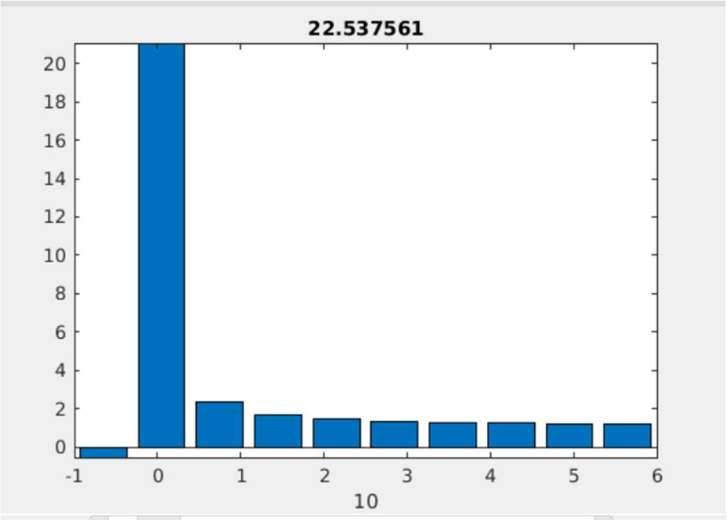
```
enter the function f(x):
x^2+4*x^3
enter lower limit of x
-2
enter the upper limit of x
4
number of intervals
10


z =


264



ivalue =


8967/25
```

5)CODE:

```
syms x
f=input('enter the function f(x):');
a=input('enter lower limit of x ');
b=input('enter the upper limit of x');
n=input('number of intervals');
z=int(f,a,b)
value = 0;
dx = (b-a)/n;
for k=1:n
    c = a+k*dx;
    d=subs(f,x,c);
    value = value + d;
end
ivalue = dx*value
```

```
ezplot(f,[a b])
rsums(f, a, b)
```

OUTPUT:




```
enter the function f(x):
x/(x^2)+1
enter lower limit of x
-1
enter the upper limit of x
6
number of intervals
10

z =

NaN


ivalue =

10694648027/1255082400
```

B. Area between the curves:

i) Initialization:

```
syms x y
y1=input('ENTER THE Y1 REGION VALUE');
y2=input('ENTER THE Y2 REGION VALUE');
figure (1)
axes;
ezplot(y1);
hold on
ezplot(y2);
hold on
```

ii) Solving for points of intersection:

```
t=solve(y1-y2); %(Y1-Y2=0)
poi=double(t)
x1 = linspace(poi(1),poi(2));
yy1 =subs(y1,x,x1);
yy2 = subs(y2,x,x1);
```

iii) Creating a polygon:

```
xx = [x1,fliplr(x1)];
yy = [yy1,fliplr(yy2)];
fill(xx,yy,'g')
grid on
evaluating the area
f=int(y1-y2,t(1),t(2))
```

Problems:

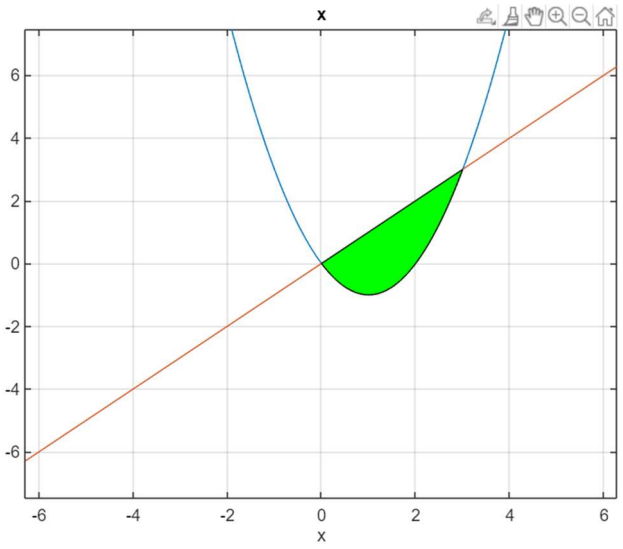
6) Find the area of the regions enclosed by the curves, $y = x^2 - 2x, y = x$
7) Find the area of the regions enclosed by the curves $y = -x^2 + 4x, y = x^2$
8) Find the area of the regions enclosed by the curves $y = 7 - 2x^2, y = x^2 + 4$

6) CODE:

```
syms x y
y1=input('ENTER THE Y1 REGION VALUE');
y2=input('ENTER THE Y2 REGION VALUE');
figure (1)
axes;
ezplot(y1);
hold on
ezplot(y2);
hold on

t=solve(y1-y2); %(Y1-Y2=0)
poi=double(t)
x1 = linspace(poi(1),poi(2));
yy1 =subs(y1,x,x1);
yy2 = subs(y2,x,x1);

xx = [x1,fliplr(x1)];
yy = [yy1,fliplr(yy2)];
fill(xx,yy,'g')
grid on
f=int(y1-y2,t(1),t(2))
```

OUTPUT:

```
ENTER THE Y1 REGION VALUE
(x^2)-2*x
ENTER THE Y2 REGION VALUE
x

poi =

     0
     3


f =

-9/2
```

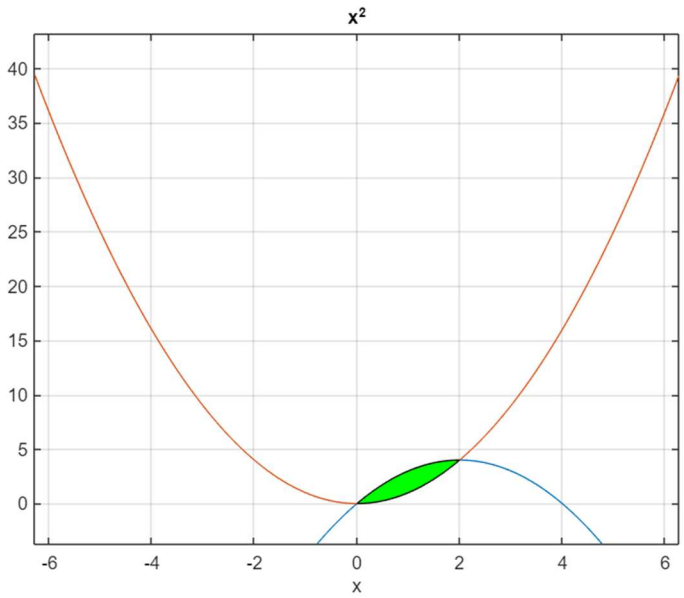


7) CODE:

```
syms x y
y1=input('ENTER THE Y1 REGION VALUE');
y2=input('ENTER THE Y2 REGION VALUE');
figure (1)
axes;
ezplot(y1);
hold on
ezplot(y2);
hold on

t=solve(y1-y2); %(Y1-Y2=0)
poi=double(t)
x1 = linspace(poi(1),poi(2));
yy1 =subs(y1,x,x1);
yy2 = subs(y2,x,x1);

xx = [x1,fliplr(x1)];
yy = [yy1,fliplr(yy2)];
fill(xx,yy,'g')
grid on
f=int(y1-y2,t(1),t(2))
```

OUTPUT:

```
ENTER THE Y1 REGION VALUE
-(x^2)+(4*x)
ENTER THE Y2 REGION VALUE
x^2

poi =

     0
     2


f =

8/3
```



8) CODE:

```
syms x y
y1=input('ENTER THE Y1 REGION VALUE');
y2=input('ENTER THE Y2 REGION VALUE');
figure (1)
axes;
ezplot(y1);
hold on
ezplot(y2);
hold on

t=solve(y1-y2); %(Y1-Y2=0)
poi=double(t)
x1 = linspace(poi(1),poi(2));
yy1 =subs(y1,x,x1);
yy2 = subs(y2,x,x1);

xx = [x1,fliplr(x1)];
yy = [yy1,fliplr(yy2)];
fill(xx,yy,'g')
grid on
f=int(y1-y2,t(1),t(2))
```

OUTPUT:

```
ENTER THE Y1 REGION VALUE
7-(2*(x^2))
ENTER THE Y2 REGION VALUE
x^2+4

poi =

    -1
     1


f =

4
```