**Homework 05**

Mech307

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1)

With 100000 many small intervals, the a value must be a = 2.0265 for the Integral to be 200.

2)

Ix(first) = 8396.8000

Ix(second) = 8396.8000

3)



Integral between 0 and 10 = 203.4347

With 10000 many small intervals, the b value must be b = 0.77939 for the Integral to be 80.

4)



Integral between 0 and 100 = 20880.5556

5)

The area is 157.0796 cm.

6)

Area of the intersection region = 5.6072.

Codes:

Pr1:

clc

clear all

close all

a = 0;

N = 100000;

b = 2.02;

I = 197.2366;

while(I<199.9999)

x = linspace(a,b,N+1);

h = x(2) - x(1);

y = 100\*(1-exp(-0.1\*x).\*cos(4\*x+pi).\*sin(x+4));

I = (h/3) \* (y(1) + 4\*sum(y(2:2:end-1)) + 2\*sum(y(3:2:end-2)) + y(end));

b = b+0.00001;

end

fprintf("With %d many small intervals, the a value must be a = %4.4f for the Integral to be 200.",N,b);

Pr2:

clc

clear all

close all

a1 = 0;

b1 = 16;

N = 100000;

x11 = linspace(a1,b1,N+1);

h11 = x11(2) - x11(1);

y11 = x11.^2.\*(16 - x11.^2/16);

I11 = (h11/3) \* (y11(1) + 4\*sum(y11(2:2:end-1)) + 2\*sum(y11(3:2:end-2)) + y11(end));

x12 = linspace(a1,b1/2,N+1);

h12 = x12(2) - x12(1);

y12 = x12.^2.\*(16 - x12 - 8);

I12 = (h12/3) \* (y12(1) + 4\*sum(y12(2:2:end-1)) + 2\*sum(y12(3:2:end-2)) + y12(end));

Ix1 = I11 - I12;

fprintf("Ix(first) = %.4f\n",Ix1);

a2 = 0;

b2 = 8;

x21 = linspace(a2,b2,N+1);

h21 = x21(2) - x21(1);

y21 = x21.^2.\*(x21 + 8 - x21.^2/16);

I21 = (h21/3) \* (y21(1) + 4\*sum(y21(2:2:end-1)) + 2\*sum(y21(3:2:end-2)) + y21(end));

x22 = linspace(b2,b2\*2,N+1);

h22 = x22(2) - x22(1);

y22 = x22.^2.\*(16 - x22.^2/16);

I22 = (h22/3) \* (y22(1) + 4\*sum(y22(2:2:end-1)) + 2\*sum(y22(3:2:end-2)) + y22(end));

Ix2 = I21 + I22;

fprintf("Ix(second) = %.4f",Ix2);

Pr3:

clc

clear all

close all

a = 0;

b = 10;

N = 10001;

x = linspace(a,b,N);

h = x(2) - x(1);

y = 20 + 10\*sin(2\*x).\*exp(-0.1\*x)./sqrt(1+3\*x);

yp = zeros(1,N);

yp(1) = (-y(3) + 4\*y(2) - 3\*y(1)) / (2\*h);

yp(N) = -(-y(N-2) + 4\*y(N-1) - 3\*y(N)) / (2\*h);

for i = 2:1:N-1

yp(i) = (y(i+1) - y(i-1)) / (2\*h);

end

subplot(2,1,1), plot(x,y,'r-','linewidth',1);

grid on

xlabel('x'), ylabel('y');

subplot(2,1,2), plot(x,yp,'m-','linewidth',1);

grid on

xlabel('x'), ylabel('dy/dx');

I = (h/3) \* (y(1) + 4\*sum(y(2:2:end-1)) + 2\*sum(y(3:2:end-2)) + y(end));

fprintf("Integral between 0 and 10 = %.4f\n",I);

c = 0;

I80 = 0;

while(I80<79.9999)

x = linspace(a,c,N+1);

h = x(2) - x(1);

y = 100\*(1-exp(-0.1\*x).\*cos(4\*x+pi).\*sin(x+4));

I80 = (h/3) \* (y(1) + 4\*sum(y(2:2:end-1)) + 2\*sum(y(3:2:end-2)) + y(end));

c = c+0.00001;

end

fprintf("With %d many small intervals, the b value must be b = %.5f for the Integral to be 80.",N-1,c);

Pr4:

clc

clear all

close all

N = 11001;

X = [0 10 20 30 40 50 60 70 80 90 100]';

Y = [200 205 213 220 225 226 221 211 198 183 170]';

C = [X.^0 X X.^2 X.^3 X.^4];

u = (C'\*C)\(C'\*Y);

A = u(1);

B = u(2);

D = u(3);

E = u(4);

F = u(5);

xx = linspace(X(1), X(end), N);

yy = A + B\*xx+ D\*xx.^2+ E\*xx.^3+ F\*xx.^4;

h = xx(2) - xx(1);

yp = zeros(1,N);

yp(1) = (-yy(3) + 4\*yy(2) - 3\*yy(1)) / (2\*h);

yp(N) = -(-yy(N-2) + 4\*yy(N-1) - 3\*yy(N)) / (2\*h);

for i = 2:1:N-1

yp(i) = (yy(i+1) - yy(i-1)) / (2\*h);

end

subplot(2,1,1), plot(xx,yy,'r-','linewidth',1);

grid on

xlabel('x'), ylabel('y');

subplot(2,1,2), plot(xx,yp,'m-','linewidth',1);

grid on

xlabel('x'), ylabel('dy/dx');

I = (h/3) \* (yy(1) + 4\*sum(yy(2:2:end-1)) + 2\*sum(yy(3:2:end-2)) + yy(end));

fprintf("Integral between 0 and 100 = %.4f\n",I);

Pr5:

clc

clear all

close all

a = 10;

b = 5;

N = 100000;

x = linspace(-a,a,N+1);

h = x(2) - x(1);

y = sqrt(b.^2\*(1-x.^2/a^2));

I = (h/3) \* (y(1) + 4\*sum(y(2:2:end-1)) + 2\*sum(y(3:2:end-2)) + y(end));

Area = 2\*abs(I);

fprintf("The area is %.4f cm.",Area);

Pr6:

clc

clear all

close all

xTemp = 0:0.00001:2;

y1 = sqrt(25-(xTemp-3).^2);

y2 = 3\*(xTemp-1).^2+2;

I = find((y1-y2)<=0.00003 & (y1-y2)>-0.00001);

a = xTemp(I(1));

b = xTemp(I(2));

N = 100000;

x = linspace(a,b,N+1);

h = x(2) - x(1);

I1 = (h/3) \* (y1(1) + 4\*sum(y1(2:2:end-1)) + 2\*sum(y1(3:2:end-2)) + y1(end));

I2 = (h/3) \* (y2(1) + 4\*sum(y2(2:2:end-1)) + 2\*sum(y2(3:2:end-2)) + y2(end));

Area = I1 - I2;

fprintf("Area of the intersection region = %.4f\n",Area);