FALL SEMESTER 2019-20

COURSE: MAT1011(CFE)-ELA

SLOT: L31+L32

ASSESSMENT 1: CONTINUITY, DIFFRENTIABILITY AND MEAN VALUE THEOREMS

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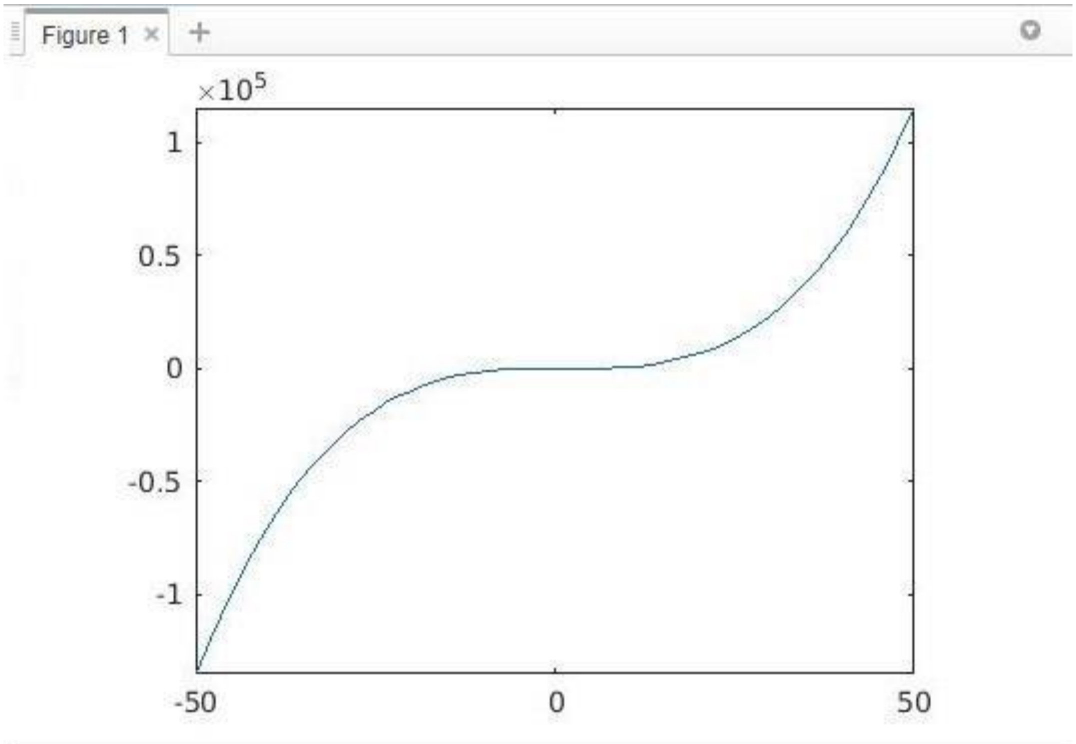
Exercise 1: Develop a MATLAB programme to verify the continuity of each of the following functions f(x) at the indicated points a.

CODE:

```
Untitled.m
clear
clc
syms x
f=input('enter f(x)=')
fplot(f,[-50,50])
a=input('enter the point a:')
r=limit(f,x,a,'right')
l=limit(f,x,a,'left')
d=subs(f,x,a)
if l==d & r==d
    disp(['the given function is continuous at point',num2s
else
    disp('f is not continuous at the given point')
end
```

(a)f(x)=x^3-4*x^2+5x-6 at a=3

FUNCTION GRAPH:



INPUT AND OUTPUT:

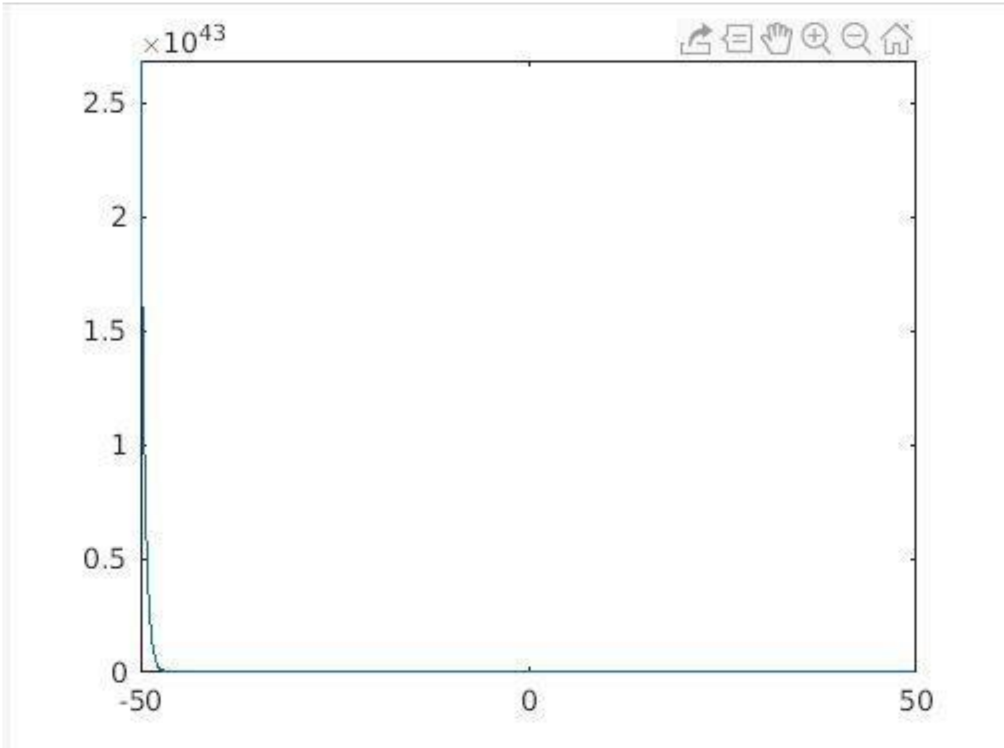
COMMAND WINDOW

```
enter f(x)=
x^3-4*x^2+5*x-6

f =

x^3 - 4*x^2 + 5*x - 6

enter the point a:
3

a =

     3


r =

0
```

```
r =

0


l =

0


d =

0

the given function is continuous at3
>>
```

(b) f(x)=e^-2x at a =7 Ans.

FUNCTION GRAPH:



INPUT AND OUTPUT:

```
enter f(x)=
exp(-2*x)

f =

exp(-2*x)

enter the point a:
7

a =

     7


r =
```

```
r =

exp(-14)


l =

exp(-14)


d =

exp(-14)

the given function is continuous at7
>>
```

Exercise 2:

Develop a matlab programme to verify the differentiability of each of the following functions f(x) at the given point a . Also identify the critical points wherever possible.

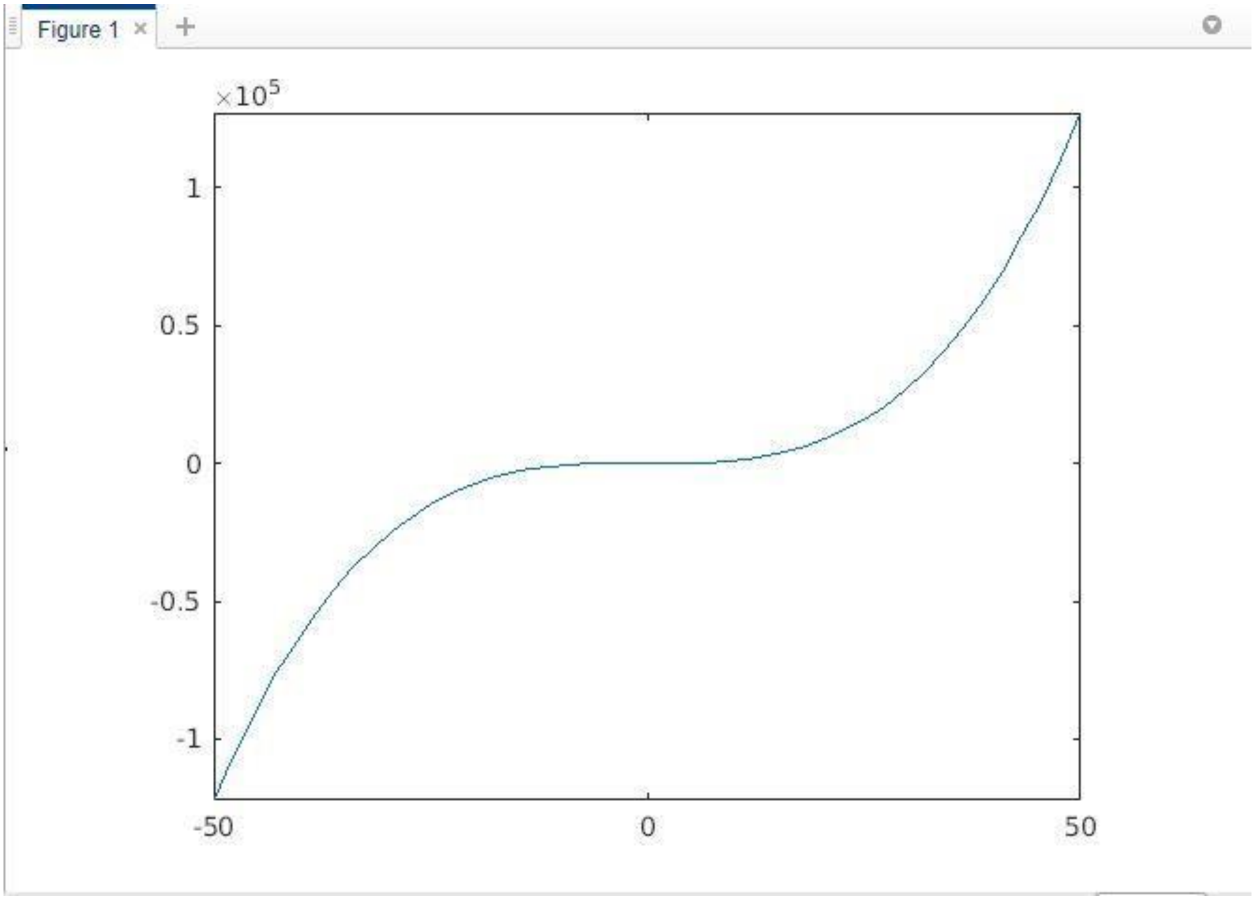
CODE:

```
clc
clear
syms x
f=input('enter the function f(x)')
fplot(f,[-50,50])
a=input('enter the point to be chekced')
d=subs(f,x,a)
A=(f-d)/(x-a)
L=limit(f,x,a,'left')
R=limit(f,x,a,'right')
if L==R
    disp(['f is diffrentiable in the given point ',num2str(a)])
else
    disp('the given function f is not diffrentiable in the given point')
end
disp('the critical points are')
c=solve(diff(f,x),x)
```

(a) f(x)=(x-2)(x^2+3*x) at

a=pi/2 Ans.

FUNCTION GRAPH:



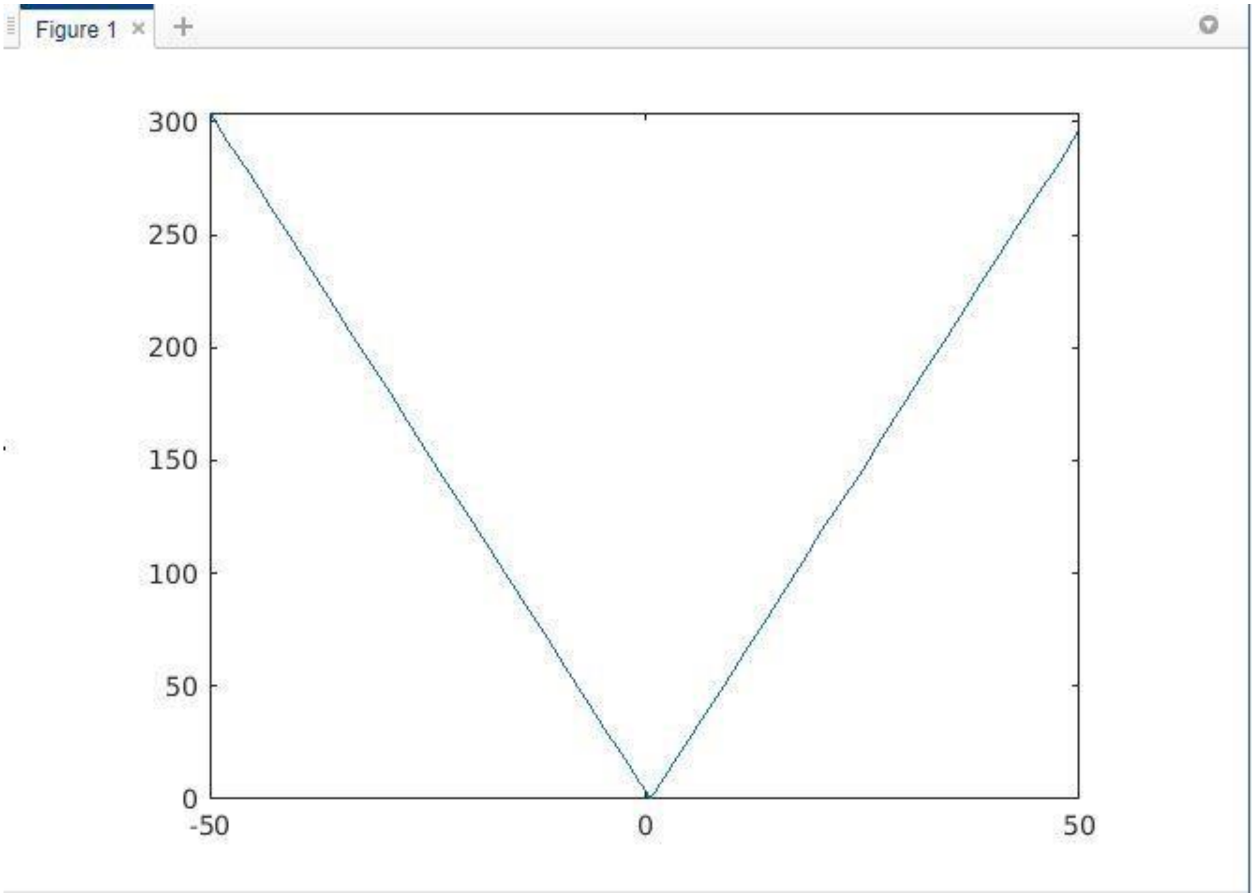
INPUT AND OUTPUT:

```
enter the function f(x)
(x-2)*(x^2+3*x)

f =

(x^2 + 3*x)*(x - 2)

enter the point to be chekced
pi/2

a =

    1.5708


d =

(pi/2 - 2)*((3*pi)/2 + pi^2/4)
```

```
((x^2 + 3*x)*(x - 2) - (pi/2 - 2)*((3*pi)/2 + pi^2/4))/(x - pi/2)


L =

(pi/2 - 2)*((3*pi)/2 + pi^2/4)


R =

(pi/2 - 2)*((3*pi)/2 + pi^2/4)

f is diffrentiable in the given point 1.5708
the critical points are

c =

 - 19^(1/2)/3 - 1/3
   19^(1/2)/3 - 1/3
```

(b) f(x)=2*|3x-2| at a=2/3 Ans.

FUNCTION GRAPH:



INPUT AND OUTPUT:

COMMAND WINDOW

```
enter the function f(x)
2*abs(3*x-2)


f =


2*abs(3*x - 2)


enter the point to be chekced
2/3


a =


    0.6667



d =


0
```

```
A =

(2*abs(3*x - 2))/(x - 2/3)


L =

0


R =

0

f is diffrentiable in the given point 0.66667
the critical points are

c =

2/3
```

Exercise 3:

Let f(t) be continuous on closed interval [a,b] and differentiable on open interval (a,b).Write a matlab code to verify and to find the constant of Rolle’s theorem for f(x)=x^2(2-x) on [0,2] Ans.

CODE:

Untitled1.m × MVT.m × rolles.m × +

```
clear
clc
syms x
f=input('enter the function f(x):')
I=input('enter the interval [A,B] for the fuction:')
f1=subs(f,x,I(1))
f2=subs(f,x,I(2))
if f1==f2
    c=solve(diff(f,x),x)
    c=vpa(c(imag(c)==0),4)
    q=find(c>I(1)&c<I(2))
    r=vpa(c(q),4)
    c=r
    disp("the constant c satisfying Rolle's theorem is",char(c))
else
    disp("the function does not satisfy Rolle's theorem because f(A) is not equal to f(B)")
end
```

INPUT AND OUTPUT:

COMMAND WINDOW

```
enter the function f(x):
(x^2)*(2-x)

f =

-x^2*(x - 2)

enter the interval [A,B] for the fuction:
[0,2]

I =

     0     2


f1 =

0
```

```
f2 =

0


c =

   0
 4/3


c =

     0
 1.333


q =

     2
```

```
r =

1.333


c =

1.333

    "the constant c satisfying Rolle's theorem is"    "1.333"

>>
```

Exercise 4:

Find the constant of the mean value theorem for each of f(x)=x+1/x-1 on [-2,-1] Ans.

CODE:

Untitled1.m | MVT.m | Figure 1

```
clear
clc
syms x
f=input('enter the function f(x):')
I=input('enter the interval:')
f1=subs(f,x,I(1))
f2=subs(f,x,I(2))
L=I(2)-I(1)
P=(f2-f1)/L
c=solve(diff(f,x)-P,x)
c=vpa(c(imag(c)==0),4)
q=find(c>I(1)&c<I(2))
r=vpa(c(q),5)
disp(['the constant(s) that satisfies mean value theorem is/are',char(r)])
```

INPUT AND OUTPUT:

```
enter the function f(x):
(x+1)/(x-1)

f =

(x + 1)/(x - 1)

enter the interval:
[-2,-1]

I =

    -2    -1


f1 =

1/3
```

```
f2 =

0


L =

     1


P =

-1/3


c =

 1 - 6^(1/2)
 6^(1/2) + 1
```

```
 1 - 6^(1/2)
 6^(1/2) + 1


c =

 -1.449
  3.449


q =

     1


r =

-1.4495

the constant(s) that satisfies mean value theorem is/are-1.4495
>>
```