**Differentiation**

**Chapter one**

1-Real number

If a and b are two real no. then one of the following is true

Some properties of R

1-if a>b then –a<-b

2- if a>b then

3-if a<b ,b<c then a<c

4-if a<b then a+c<b+ c then a<c real no.

5-if a<b ,c<d then a+c < b+d

6-if a<b ,c any +ve real no. then a.c <b.c

7-if a<b ,c any -ve real no. then a.c >b.c

8-if 0<a<b , 0<c<d then a.c <b.d

9-if a<b<0 , c<d<0 then a.c >b.d

**2-Intervals**

An interval is asset of real no.s x having one of the following forms

1. Open interval (a,b) all real no.s x a<x<b
2. closed interval [a,b] all real no.s x axb
3. half open from the left or half closed from the right (a,b] , all real no.s x a<x<b
4. half open from the right or half closed from the left [a,b), all real no.s x ax<b

Note:

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Ex: find the set of all the following inequalities:

1st case : x>0

Sol. set 1st case=(0,

2st case : x<0

Sol. set 2st case=

2-(x+3)(x+4)>0

Sol:

1st case: (x+3)>0 ʌ (x+4)>0

 x>-3 ʌ x>-4

sol. Set 1st case =(-3,∞)

2st case: (x+3)<0 ʌ (x+4)<0

 X<-3 ʌ x<-4

sol. Set 2st case =(-∞,-4)

sol. set=(-3, ∞) U (-∞,-4)=R/[-4,-3]

H.W: find the set of all the following inequalities:

1. 2+3x<5x+8

2- 4<3x-2

3 -

4-

1. **Absolute value**

The absolute value of real no. x denoted by is define as follows:

Properties of absolute value

1-

2-

3-

4-

Ex: find the set of all the following:

 1-

 Sol:

 Or

Sol. Set:=(,)=R/(, 2)

H.W: find the set of all the following:

 1-

2-

3-

4-

5-

6-

 Theorem:

Let a,b be two no.s then

1-

2-

3-

4-

 5-

 6-

 7-

Proof:

1-

2-

3-

4-

5-

 6-

7-

 **Chapter two**

1-Relation:

Let a,b so every set subset of A is represent relation from A to B.

 2-Functions and its Algebra:

A function from aset A to set B is arule that assigns each element to only element in B satisfy

3-The domain:

The set D is called the domain of f is the set of all x first component occurring in the ordered pairs of f , denoted by dom (f)

Dom (f)=

4-The codomain:

The codomain is for all element in two set B .and denoted by such that

5-Range:

Is the set of second component which assigne by element of first component and denoted by

6-Kind of function

 The function divided into kind

 1-Algebraic function

i) polynomial function

ii) Regular function

iii) Radical function

EX: find the domain of the functions:

1.

H.W: find the domain of the functions:

1- 2- 3- 4-

2-Non-Algebraic function

 1-trigonometric function

1. Exponential function
2. Logarithmic function2
3. Absolute function
4. Identity function

7-Some operations on functions:

 1-

2-

3-

4-

Ex: find ,and its domain

Sol:

 =

 =

H.W: ,and its domain of the following functions:

1-

2-

3-

5-composition of function

 If f and g are function such that the range of g is a subset of domain of f then there is a function fog define as follow:

In general

Ex: find

Sol:

1. X-1

 X

1. X-1

 X

H.W: of the following functions:

 1-

 2-

 3-

5-

**Chapter three**

1. **Limits**

The limits of f(x) as x approaches a is the no. L if given any there exists such that for all x, 0<implies

Theorem:

1-if f(x)=c c constant ,then

1-if and ,then :

1. such that K is constant
2. ,M

 V)

VI) such that K is constant

 VII)

 VIII)

 IX)

**Limits of polynomials** is any polynomial function

 **Limits of quotient of poly**

If f(x) and g(x) are polynomials ,then

 **,**

Ex: find the limit ,if it exist

*1- ,*

1. *,*

H.W:

1- 2 - 3-

4- 5- 6-

 7- 8- 9-

**One -sided limits(right-hand limits and left-hand limits)**

Def 1: the limits of the fun. f(x) as x approaches a from the right equals L if given any such that for all x,

Implies denoted by

Def 2: the limits of the fun. f(x) as x approaches a from the left equals L if given any such that for all x,

Implies denoted by

Note

A function f(x) has a limit at appoint a iff the right –hand and left- hand limits at exist and are equal

 and

Ex: find the limit of the function

as 1.

sol: 1.

 2.

 3. a/

 b/

H.w: find the limit of the function

If 1.

If 1.

3-

**Limits at infinity (limits as )**

Def 1: the limits of the fun. f(x) as x approaches infinity is the no. L if given any such that for all x,

Implies

Def 2: the limits of the fun. f(x) as x approaches negative infinity is the no. L if given any such that for all x,

Implies

Theorem: if f(x) =k for any no. k

 1 - such that k is constant

1. if and ,then :
2.
3. ,M
4.
5.
6.

Ex: find the limits of:

1.

2.

H.W: Ex: find the limits of:

1-

 2-

 3-

**Infinite limits**

Def 1: the limits of the fun. f(x) as x approaches a , such that is the infinity if given any such that for all x, S.T

 , implies f(x)>M

Def 2: the limits of the fun. f(x) as x approaches a , such that is the -infinity if given any such that for all x, s.t , implies f(x)<M

Ex: find the limits

1-

2.

3-

3-

H.W: Ex: find the limits

1- 2-

 2-**continuity**

Def1: the fun. y=f(x) is continuous at x=c iff all three of the follow statements are true:

1. (c) is exists (
2. is exists (f has a limit as x)
3. (the limit equals the fun. value)

Ex: is f cont. at x=0

Sol:

1-f(0)=1 is exist

2-

 is cont.

Def2: discontinuity at appoint

Is a fun. F is not cont. at a point c, we say that f is discontinuous at c and call c appoint of discontinuity of f.

Ex: is f cont. at x=-1

Sol:

1- f(-1)=1 is exist

2-

 is not cont. at x=-1

H.w:

1- is f cont. at x=2

2- is f cont. at x=0

3-1- is f cont. at x=-3

4- is f cont. at x=2

5- is f cont. at x=-1

 **Chapter 4**

**The derivative of a function**

the derivative of afun. is the fun. whose value at is defined by the eq.

 whenever the limit exist

 Ex: find the definition of derivative to find the derivative of the fun.

 Sol:

 = 2x

 H.W: find the definition of derivative to find the derivative of the functions:

1- 2- 3-

4- 5- 6-

Some rules of derivative

1. If , where c is constant then (x)=0
2. Power rule for positive integer (power of x) if n is positive integer then
3. The sum rule

 4-the constant multiple rule

 (x)

 5-the product rule

6-Positive integer power of adiff. fun. if u is adiff. Fun.n is power of u then

7-The quotient rule

8-negative integer power of adiff. fun. if u is adiff.

 Ex: find the derivative of the function:

1.
2.
3.
4.
5.

1.

**Derivative of trigonometric function**

1-if

2-if

3-if

4-if

5-if

6-if

7-if

8-if

Note:
1-

2-

 4-

 5-

 6-

Ex: find the derivative of the function:

1.
2.

3-

**4-**

5-

H.W: find the derivative of the function:

**1- 2-**

3- 4-