**Lecture10.**

**Rolle’s Theorem. Lagrange’s theorem. Increasing and decreasing Functions. Fermat’s theorem. Cauchy’s Theorem.**

**Mean-value theorems**

1. **Rolle’s Theorem.**

**a)**If a function is continuous on the closed interval ,

**b)** has a derivative at every interior point of this interval,

**c)** and

then the argument *x* has at least one value , where  such that

 (1)

1. **Lagrange’s Theorem.**

**a)** If a function is continuous on the closed interval ,

**b)** has a derivative at every interior point of this interval, then

 (2)

where 

**Increasing and decreasing Functions.**

**Theorem.** Let J be an open interval, and let I be an interval consisting of all the points of J and possibly one or both of the endpoints of J. Suppose that f is continuous on I and differentiable on J.

1. If for all *x* in J, then *f* is increasing on I,
2. If for all x in J, then f is decreasing on I,
3. If for all x in J, then f is nondecreasing on I.
4. If for all x in J, then f is nonincreasing on I.
5. **Cauchy’s Theorem.**

**a)** If functions and are continuous on the closed interval ,

**b)** and for have a derivatives that do not vanish simultaneously, c) and then

 (3)

where 

1. **Fermat’s Theorem.** If f is defined on an open interval *(a,b)* and achieves a maximum (orminimum) value at the point *c* in *(a,b),* and if exists, then

( values of *x* where are called critical points of the function *f*).