

# Lecture 3

Tuesday 4<sup>th</sup> November, 2014

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# 1 Limits & Continuity

## 1.1 Continuity

If  $x \rightarrow a$  then  $f(x) \rightarrow L$ , we say that  $L$  is the limit of  $f(x)$  at  $x = a$ .

$$\lim_{x \rightarrow a} f(x) = L$$

We say that  $f(x)$  is continuous at  $x = a$ , iff

$$\lim_{x \rightarrow a} f(x) = L = f(a)$$

## 1.2 Continuity

If  $x \rightarrow a^+$  then  $f(x) \rightarrow L_2$ , and if  $x \rightarrow a^-$  then  $f(x) \rightarrow L_1$ .

We say that  $\exists \lim_{x \rightarrow a} f(x)$  iff  $L_1 = L_2$

## 1.3 Cauchy's Definition

Let  $f(x)$  be defined on an open interval about  $a$ , except possibly at  $a$  itself.

A number  $L$  is called the limit of  $f(x)$  at  $a$  if

$$\forall \epsilon > 0 \exists \delta > 0 : 0 < |x - a| < \delta \Rightarrow |f(x) - L| < \epsilon \quad (1)$$