Continuity and limit Math 280

Spring 2011

Continuity and limit

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Continuity and limit

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Continuity and limit

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Need precise definition of limit

Limits for $f : \mathbb{R} \to \mathbb{R}$

Continuity and limit

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Example: Evaluate $\lim_{x \to 0} \frac{\sin(x)}{x}$

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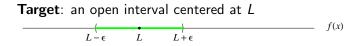
Continuity and limit

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Launch pad: an open interval centered at x_0 with x_0 taken out

$$x_0 - \delta$$
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Target: an open interval centered at
$$L$$

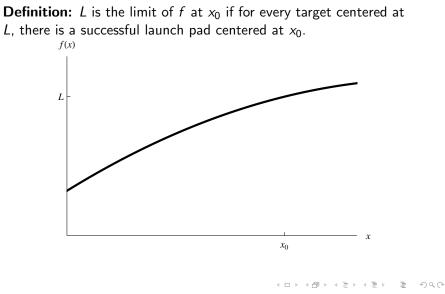
$$\underbrace{f(x)}_{L-\epsilon} \qquad f(x)$$

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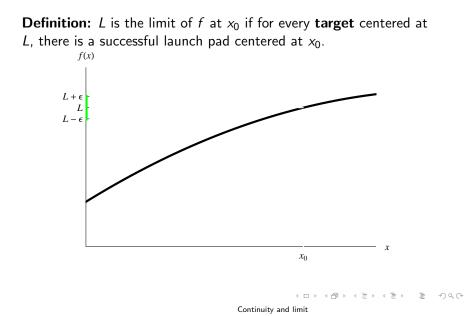
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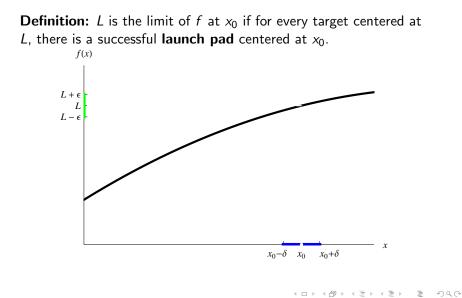
Successful launch pad: every input x in the launch pad has an output f(x) in the target

Continuity and limit

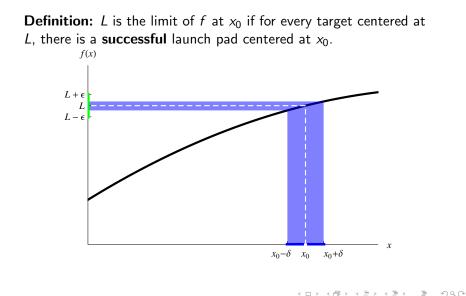


Continuity and limit





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Traditional phrasing of a precise definition

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Verbose

Traditional

Continuity and limit

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Traditional phrasing of a precise definition

Brief	Verbose	Traditional	
For each target			

For each target centered at L

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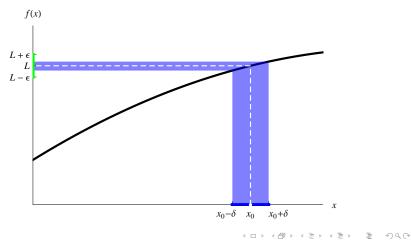
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A precise definition

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Continuity and limit

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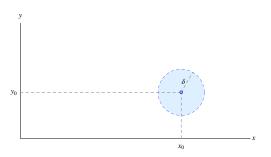
Definition: *L* is the limit of *f* at (x_0, y_0) if for every **target** centered at *L*, there is a successful launch pad centered at (x_0, y_0) . **Target**: an open interval centered at *L*

 $\begin{array}{c|c} & & \\ \hline \\ L-\epsilon & L & L+\epsilon \end{array} \qquad \qquad f(x,y)$

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$$L - \epsilon$$
 $L + \epsilon$ $f(x,y)$

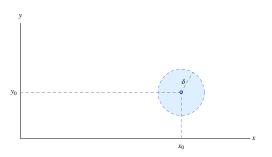
Launch pad: an open disk centered at (x_0, y_0) with (x_0, y_0) taken out



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$$L - \epsilon$$
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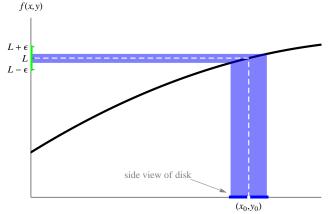
Launch pad: an open disk centered at (x_0, y_0) with (x_0, y_0) taken out



Successful launch pad: every input (x, y) in the launch pad has an output f(x, y) in the target

Continuity and limit

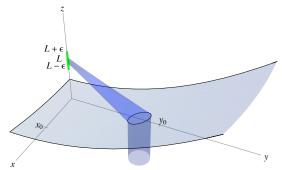
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