S.O.S. Mathematics CyberBoard

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3.3

Moderator: **helmut** [Moderator Control Panel]

Author **Message**

bribiescase

offline

Math Cadet

Joined: Tue, 31 Mar 2020 15:10
Posts: 6

Post subject: 3.3 **Posted:** Sun, 12 Apr 2020 16:38

Proven by contradiction

Assume the $\lim_{x \to x_0} f(x)$ = c exists.

By definition $\forall \varepsilon > 0 \exists \delta > 0\ such\ that\ |f(x) - L| < \varepsilon$ whenever $x \in D\ not\ incldu ing[tex]\{x_0\}$ and $|x - x_0| < \delta/2 \Rightarrow |f(x) - c| < \varepsilon$

Now for x,y $\in D$ not including $\{x_0\}\ such\ that |x - x_0| < \delta/2 < |y - y_0| < \delta/2$ $\Rightarrow |x - y| < \delta$

Consider,

$|f(x) - f(y)| < |f(x) - c| + |f(y) - c| < \varepsilon/2 + \varepsilon/2 = \varepsilon$
which contradicts the given hypothesis, therefore,
$\lim_{x \to x_0} f(x)$ does not exists

helmut

online

Site Admin

Joined: Sat, 26 Apr 2003 15:14
Posts: 2246
Location: El Paso TX (USA)

Post subject: Re: 3.3 **Posted:** Thu, 16 Apr 2020 16:45

There is one typo that needs to be fixed.

The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark. - Michelangelo Buonarroti

bribiescase

offline

Math Cadet

Joined: Tue, 31 Mar 2020 15:10
Posts: 6

Post subject: Re: 3.3 **Posted:** Fri, 17 Apr 2020 08:35

$|f(x)-f(y)|<|f(x)-c|+|f(y)-c|<\varepsilon/2+\varepsilon/2=\varepsilon$
which contradicts the given hypothesis, therefore,
$\lim_{x\to x_0} f(x)$ does not exists[/quote]

Is it this part that I need to show how it contradicts, to which I would have
$|f(x)-f(y)|\geq|f(x)-c|+|f(y)-c|\geq\varepsilon/2+\varepsilon/2=\varepsilon$?

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Abigail Chaidez

offline

Member

Joined: Tue, 31 Mar 2020 14:55
Posts: 12

Post subject: Re: 3.3 **Posted:** Fri, 17 Apr 2020 14:22

> **bribiescase wrote:**
>
> Now for x,y $\in D$ not including $\{x_0\}$ *such that*
> $|x-x_0|<\delta/2<|y-y_0|<\delta/2\Rightarrow|x-y|<\delta$

So I want to know if this is your hypothesis given because you state that your hypothesis given is being contradicted but you do not specify what is the hypothesis given before hand?

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violeta guzman

offline

Member

Joined: Tue, 31 Mar 2020 15:36
Posts: 12

Post subject: Re: 3.3 **Posted:** Fri, 17 Apr 2020 14:33

Is the hypothesis coming from the definition?
Reading through the proof that Estefany has already written, I think the hypothesis would be:

For every $\epsilon>0\ \exists$ a $\delta>0$ such that $|x-x_0|<\delta\Rightarrow|f(x)-f(y)|\geq\epsilon$

I think this is where your contradiction would come in.

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solivas11

offline

Member

Joined: Mon, 30 Mar 2020 21:12
Posts: 10

Post subject: Re: 3.3 **Posted:** Sat, 18 Apr 2020 18:55

> **violeta guzman wrote:**
>
> Is the hypothesis coming from the definition?
> Reading through the proof that Estefany has already written, I think the hypothesis would be:
>
> For every $\epsilon>0\ \exists$ a $\delta>0$ such that $|x-x_0|<\delta\Rightarrow|f(x)-f(y)|\geq\epsilon$
>
> I think this is where your contradiction would come in.

I concur with Violeta in showing that there is a limit at x_0 while simultaneously holding $|f(x) - f(y)| \geq \epsilon$ true would give the contradiction.

> **bribiescase wrote:**
>
> Proven by contradiction
>
> Assume the $\lim_{x \to x_0} f(x) = c$ exists.
>
> By definition
> $\forall \varepsilon > 0,\ \exists \delta > 0\ such\ that\ |f(x) - L| < \varepsilon\ whenever\ x \in D \setminus \{x_0\}$
> $and\ |x - x_0| < \delta/2 \Rightarrow |f(x) - c| < \varepsilon$
>
> Now for
> $x, y \in D \setminus \{x_0\}\ such\ that\ |x - x_0| < \delta/2\ and\ |y - x_0| < \delta/2 \Rightarrow |x - y| < \delta$
>
> Consider,
>
> $|f(x) - c| + |f(y) - c| < \varepsilon/2 + \varepsilon/2 = \varepsilon$
>
> $|(f(x) - c) + (c - f(y))| \leq |f(x) - c| + |c - f(y)| < \varepsilon$ Note: notice $|c - f(y)| = |f(y) - c|$
>
> $|f(x) - f(y)| < \varepsilon$
> which contradicts the given hypothesis, $|f(x) - f(y)| \geq \epsilon$, therefore,
> $\lim_{x \to x_0} f(x)$ does not exists

I just cleaned the above a bit.

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helmut — **Post subject:** Re: 3.3 — **Posted:** Sun, 19 Apr 2020 21:44

online

Site Admin

Joined: Sat, 26 Apr 2003 15:14
Posts: 2246
Location: El Paso TX (USA)

The exercise is stated incorrectly in the notes.

It has to be "$|x - x_0| < \delta$ and $|y - x_o| < \delta$" instead of just requiring "$|x - y| < \delta$". Sorry for that.

____
The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark. - Michelangelo Buonarroti

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helmut — **Post subject:** Re: 3.3 — **Posted:** Sun, 19 Apr 2020 21:48

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Credit to Estefany, Violet and Sergio for finding that mistake.

The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark. - Michelangelo Buonarroti

Joined: Sat, 26 Apr 2003 15:14
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helmut **Post subject:** Re: 3.3 **Posted:** Sun, 19 Apr 2020 21:50

online

Site Admin

Joined: Sat, 26 Apr 2003 15:14
Posts: 2246
Location: El Paso TX (USA)

The proof then looks something like that:

> **bribiescase &Sergio wrote:**
>
> Proven by contradiction
>
> Assume the $\lim_{x\to x_0} f(x) = c$ exists.
>
> By definition
> $\forall\varepsilon > 0,\ \exists\delta > 0\ such\ that\ |f(x) - L| < \varepsilon\ whenever\ x \in D \setminus \{x_0\}$
> $and\ |x - x_0| < \delta/2 \Rightarrow |f(x) - c| < \varepsilon$
>
> Now for $x, y \in D \setminus \{x_0\}\ such\ that\ |x - x_0| < \delta\ and\ |y - x_0| < \delta$
>
> Consider,
>
> $|f(x) - c| + |f(y) - c| < \varepsilon/2 + \varepsilon/2 = \varepsilon$
>
> $|(f(x) - c) + (c - f(y))| \le |f(x) - c| + |c - f(y)| < \varepsilon$ Note: notice $|c - f(y)| = |f(y) - c|$
>
> $|f(x) - f(y)| < \varepsilon$
> which contradicts the given hypothesis, $|f(x) - f(y)| \ge \epsilon$, therefore, $\lim_{x\to x_0} f(x)$ does not exists.

The greater danger for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark. - Michelangelo Buonarroti

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