Quiz #1 score____/30 **Name** Key

Calculus I

Fall 2009

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1. **Definition:** $\lim_{x\to c} f(x) = L$ iff $\forall \varepsilon>0\ \exists\ \delta>0$ s.t. $0<|x-c|<\delta \Rightarrow |f(x)-L|<\varepsilon$ ✓

5 pts.

$\forall \varepsilon>0\ \exists\ \delta>0$ s.t. $0<|x-2|<\delta \Rightarrow |(-3x+1)-(-5)|<\varepsilon$ ✓

20 pts.

2. **Prove:** $\lim_{x\to 2} -3x+1 = -5$ (with an ε,δ proof, supplying reasons for each step!)

$c=2,\ f(x)=-3x+1,\ L=-5$ ✓

Proof:

Let $\varepsilon>0$

choose $\delta = \varepsilon/3$

Let $0<|x-2|<\delta$ by hyp

so $x\neq 2$ and $|x-2|<\delta$ by alg

so $|x-2|<\varepsilon/3$ by sub

so $3|x-2|<\varepsilon$ by alg

so $|-3||x-2|<\varepsilon$ " "

so $|(-3)(x-2)|<\varepsilon$ " "

so $|-3x+6|<\varepsilon$ " "

so $|-3x+1+5|<\varepsilon$ " "

so $|(-3x+1)-(-5)|<\varepsilon$ " " ∎

✓

Scrap:

$|(-3x+1)-(-5)|<\varepsilon \Leftrightarrow$

$|-3x+1+5|<\varepsilon \Leftrightarrow$

$|-3x+6|<\varepsilon \Leftrightarrow$

$|(-3)(x-2)|<\varepsilon \Leftrightarrow$

$|-3||x-2|<\varepsilon \Leftrightarrow$

$3|x-2|<\varepsilon \Leftrightarrow$

$|x-2|<\varepsilon/3$ ✓

Excellent!! :)

$\left(-\frac{7}{2}, -\frac{1}{2}\right)$ $c=-3=-\frac{6}{2}$

3. Label the interval (a,b) on the x-axis where $a=-\frac{7}{2}$ and $b=-\frac{1}{2}$. Now label $c=-3$. Next, find the largest value of $\delta>0$ s.t. $\forall x,\ 0<|x-c|<\delta \Rightarrow a<x<b$. Finally, portray the region $0<|x-c|<\delta$ on the number line.

5 pts.

Find $\delta>0$ s.t. $\boxed{\text{the distance btwn } x \text{ \& } c \text{ (where } x\neq c) \text{ less than } \delta} \Rightarrow -\frac{7}{2}<x<-\frac{1}{2}$.

$0<|x-(-3)|<\delta$

$\boxed{x\neq -3}$ and $\boxed{-\frac{7}{2}=-3-\frac{1}{2}<x<-3+\frac{1}{2}=-\frac{5}{2}}$

$c-\delta<x<c+\delta$

$-3-\delta<x<-3+\delta$

Choose the smallest distance btwn c and the endpts a & b! ⇒

Answer:

$\delta =$ 1/2