Honors Calculus Name _____

Discontinuity Limits: Lesson

Date _____

Evaluate each limit.

1) $\lim_{s\to 0} g(s)$, $g(s) = \begin{cases} 1 - \frac{s}{2}, & s \neq 0 \\ -2, & s = 0 \end{cases}$

$x = 0.0\ldots-1$

$x = -0.\ldots-1$

$\lim_{s\to 0}\left(1 - \frac{s}{2}\right) = 1 - \frac{0}{2} = 1$

$1 - \frac{1}{2}s$

2) $\lim_{s\to -1} -\frac{s+1}{s^2-1}$

$\lim_{s\to -1} \frac{s+1}{s^2-1} \Rightarrow \frac{-1+1}{+1-1} = \frac{0}{0}$

$\lim_{s\to -1} -\frac{s+1}{(s+1)(s-1)}$

$\lim_{s\to -1} -\frac{1}{s-1} = \frac{1}{-1-1} = -\frac{1}{2} \to \frac{1}{2}$

ex $x^2 - 81$

$(x-9)(x+9)$

Diff of Squares

3) $\lim_{s\to \frac{1}{4}} \frac{s - \frac{1}{4}}{\sqrt{s} - \frac{1}{2}} = \frac{0}{0}$!!

$\frac{(\sqrt{s} - 1/2)(\sqrt{s} + 1/2)}{\sqrt{s} - 1/2}$

$= \sqrt{s} + 1/2 \Rightarrow \lim_{s\to 1/4} \sqrt{s} + 1/2 = 1/2 + 1/2 = 1$

4) $\lim_{t\to -\frac{1}{2}} -\frac{2t^2 - 3t - 2}{2t+1} = -\frac{1}{2} - 2$

$\frac{(2t+1)(t-2)}{2t+1}$

$= t - 2$

Rationalizing the Numerator

5) $\lim_{x\to 1} \frac{\sqrt{x+15} - 4}{(x-1)} \cdot \frac{\sqrt{x+15} + 4}{\sqrt{x+15} + 4}$

$\frac{x+15-16}{(x-1)(\sqrt{x+15}+4)} = \frac{(x-1)}{(x-1)(\sqrt{x+15}+4)} = \left(\frac{1}{\sqrt{x+15}+4}\right)$

$= \lim_{x\to 1} \frac{1}{\sqrt{16}+4} = \frac{1}{4+4} = 1/8$

6) $\lim_{s\to -\frac{3}{2}} \frac{2s+3}{2s^2+9s+9}$

7) $\lim_{x \to -1} f(x)$, $f(x) = \begin{cases} x^2 + 6x + 10, & x \le -1 \\ -\frac{x}{2} - \frac{1}{2}, & x > -1 \end{cases}$

$\lim_{x \to -1^-} x^2 + 6x + 10 = 1 - 6 + 10 = 5$

$\lim_{x \to -1^+} -\frac{x}{2} - \frac{1}{2} = \frac{-1}{2} - \frac{1}{2} = -1$ → so, lim dne

8) $\lim_{x \to 0^+} f(x)$, $f(x) = \begin{cases} -x^2 + 4x - 5, & x \le 0 \\ x - 5, & x > 0 \end{cases}$

$\lim_{x \to 0^+} x - 5 = 0 - 5 = -5$

9) $\lim_{x \to -3^-} f(x)$, $f(x) = \begin{cases} -3, & x < -3 \\ -2x - 9, & x \ge -3 \end{cases}$

10) $\lim_{x \to -2^-} \frac{5|x+2|}{x+2}$ → $x + 2 < 0$

$x < -2$

(abs val is positive)

$\frac{5|x+2|}{x+2} =$

abs val pos. $x > -2$: $\frac{5(x+2)}{x+2}$, $x > -2$

abs val neg $x < -2$: $\frac{5(-1)(x+2)}{x+2}$, $x < -2$

$\begin{cases} 5, & x > -2 \\ -5, & x < -2 \end{cases}$

11) $\lim_{x \to 3} \frac{4|x-3|}{x-3}$

12) $\lim_{x \to 2^-} f(x)$, $f(x) = \begin{cases} 2x - 6, & x < 2 \\ -x^2 + 4x - 3, & x \ge 2 \end{cases}$

13) $\lim_{x \to -1} -\frac{3}{x^2 - 1}$ → $\frac{-3}{(x+1)(x-1)}$

$\frac{-3}{(1^-)^2 - 1} = \frac{-3}{1^- - 1}$

$0.99 - 1$

$\frac{-3}{0^-}$ (neg) $= +\infty$

14) $\lim_{x \to 3} \frac{x-3}{x^2 - 5x + 6} = \frac{x-3}{(x-3)(x-2)} = \frac{1}{x-2}$

$\lim_{x \to 3} \frac{1}{x-2} = \frac{1}{3-2} = 1$

15) $\lim_{x \to 2} -\frac{1}{x^2 - 4}$ dne

$\lim_{x \to 2^-} \frac{-1}{x^2-4} = \frac{-1}{(2^-)^2 - 4} = \frac{-1}{4^- - 4} = \frac{-1}{0^-} = +\infty$

$\lim_{x \to 2^+} \frac{-1}{x^2-4} = \frac{-1}{(2^+)^2 - 4} = \frac{-1}{4^+ - 4} = \frac{-1}{0^+}$ (neg) $= -\infty$

16) $\lim_{x \to 1^-} \frac{x+3}{x^2 - 2x + 1} = \frac{1^- + 3}{1^- - 2^- + 1} = \frac{4^-}{-1+1} = \frac{4^-}{0}$

$= 0.999 - 1.999$

≈ -1

∞

If 2 functions, $f(x)$ (orrginal) and $g(x)$ (simplified version), agree (which means $f(x) = g(x)$) everywhere except at point c, where $f(x)$ is undefined,

then $\lim_{x \to c} f(x) = \lim_{x \to c} g(x)$.

$f(c)$ is undef.

unable to solve by plugging in.

limit after you cancel terms