Good afternoon Happy Tuesday!

Agenda:
-Warm Up, Additional Practice and CW/HW
-Return Quizzes

-Notes finish continuity

-Answer homework questions and practice with continuity

-Infinite limits and limits at infinity next class. Squeeze theorem and 3 special cases.

$$g(x) = \begin{cases} 2-x^2 & x \le -1 \\ -x^3 & -1 < x < 1 \\ x^2 - 2 & x \ge 1 \end{cases}$$

$$\lim_{x \to -1^-} g(x) = 2-(-1)^2 = \textcircled{1}$$

$$\lim_{x \to -1^+} g(x) = -(-1)^3 = \textcircled{1}$$

$$\lim_{x \to -1} g(x) = 1$$

$g(1) = -1$; $\lim_{x \to 1^-} g(x) = -1$

$\lim_{x \to 1^+} g(x) = -1$ $\lim_{x \to 1} g(x) = \textcircled{-1}$

ⓐ $= \frac{1}{4}$

.9	.99	1	1.001	. . . .
	.250	.25	.2499	

$$\lim_{x\to 4} \sqrt{f(x)}$$

$$\sqrt{\lim_{x\to 4} f(x)} = \sqrt{16} = 4$$

$$x^2 = 16$$

$$\lim_{x\to 4} \overline{(f \circ g)(x)} \Rightarrow \overline{f(g(x))}$$

$$f\left(\lim_{x\to 4} g(x)\right) = f(-2) = 7$$

$$f(-2) \Rightarrow \lim_{x\to -2} f(x)$$

$$\lim_{x\to 4} (g(f(x))) \Rightarrow g\left(\lim_{x\to 4} f(x)\right)$$

$$\lim_{x\to 16} g(x) = g(16)$$

$$= 3$$

$$\lim_{x\to 0} e^{-x} \cdot \lim_{x\to 0} \cos(\pi x)$$

$$e^0 \cdot \cos(\pi \cdot 0) = \boxed{1}$$

$$\lim_{x\to 1} \ln\left(\frac{x}{e^x}\right) = \boxed{\ln\left(\frac{1}{e^1}\right)}$$

$$\ln(e^{-1}) = -1$$

$$f(g(x)) = f\left(\lim_{x \to 4} g(x)\right)$$

$$f \circ g$$

$$f(-2) =$$

$$\lim_{x \to -2} f(x) =$$

$$\lim_{x \to 1} \ln\left(\frac{1}{e^{x}}\right)$$

$$\ln e^{-1} = -1$$

Re-Cap:

- Continuous on the open interval (a,b)

- The existence of a Limit

Let f be a function and let c and L be real numbers. The limit of f(c) as x approaches c is L if and only if

$$\lim_{x \to c^-} f(x) = \lim_{x \to c^+} f(x)$$

Definition of Continuity on a closed interval. A function is continuous $[a,b]$; 1st f is continuous on (a,b)

$\lim_{x\to a^+} f(x)=f(a)$ and $\lim_{x\to b^-} f(x)=f(b)$

Properties of continuity:

If b is a real number and f and g are continuous at x=c, then the functions listed below are also continuous at c.

$b\cdot f$

$f \pm g$

$f \cdot g$

$\frac{f}{g}$ $g \neq 0$

- Poly:
- Rational
- Radical
- absolute value
- trig
- inverse trig
- exp
- Log

Continuity of a composite function

if g is continuous at c and f is continuous at g(c), then f(g(x)) is continuous at c.

$\sin(x^2)$

Test for continuity

① $\sec(x) = \frac{1}{\cos(x)} = 0$

$\frac{\pi}{2}$ & $\frac{3\pi}{2}$

$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \frac{3\pi}{2}\right), \ldots$

$\tan(x) = \frac{\sin(x)}{\cos(x)} =$

$$g(x) = \begin{cases} \sin\left(\frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$$

$\frac{1}{x} \to x \neq 0$

sine → everywhere continuous

$(-\infty, 0) \cup (0, \infty)$

Make a function continuous

$$f(x) = \begin{cases} 2, & x \leq -1 \\ ax+b, & -1 < x < 3 \\ -2, & x \geq 3 \end{cases}$$

$a = ?$
$b = ?$

$\lim_{x \to -1^-} f(x) = \lim_{x \to -1^+} f(x)$

$2 = ax + b$ @ $x = -1$

$2 = -a + b$

$\lim_{x \to 3^-} f(x) = \lim_{x \to 3^+} f(x)$

$ax + b = -2$
@ $x = 3$

$3a + b = -2$

$2 = -a + b$
$-(-2 = 3a + b)$

$4 = -4a$

$a = -1$

$2 = 1 + b$

$b = 1$

Make the function continuous

$$f(x) = \begin{cases} 2, & x \le -1 \\ ax+b, & -1 < x < 3 \\ -2, & x \ge 3 \end{cases}$$

2

$$\lim_{x \to -1^-} f(x) = \lim_{x \to -1^+} f(x)$$

$2 = ax + b$ @ $x = -1$

$2 = -a + b$

$$\lim_{x \to 3^-} f(x) = \lim_{x \to 3^+} f(x)$$

$ax + b = -2$

@ $x = 3$

$2 = -a + b$

$-(-2 = 3a + b)$

$4 = -4a$

$3a + b = -2$

$a = -1$

$b = 1$