Upcoming Assignments & Opportunities:

· **Tomorrow**: TI-89 lesson in class - have your TI-89 with you in class every day from now on.
· **Tomorrow**: 5th or 6th-Retake Trig Quiz (bring lunch)
· **Sunday**: 6:00-8:00 pm. All guys on Kairos are REQUIRED to meet in room 109. We will get next week's HW completed so you don't have to catch up after retreat.

· **Next Week's Quiz Retake Options**: Mon (5th), Mon (2:55 pm), Fri (5th), Tues (7:20am) or Fri (7:20am) you may retake any quiz of your choice. Just show up and I'll have copies of all three types. Times are also posted on website assignment page.

· TRY, TRY, TRY to pass all three by next week Friday!

So start retaking on Monday - don’t procrastinate.

Today's Topics & Class Plan:

· Notes on Limits

What happens when x = 3 in the graph of \( f(x) = \frac{x^2-9}{x-3} \)?

\[ \text{Domain: } x \neq 3 \]

\[ (-\infty, 3) \cup (3, \infty) \]

What happens as x approaches 3 from the left side and from the right side in the graph of \( f(x) = \frac{x^2-9}{x-3} \)?

\[ \text{as } x \to 3^- \text{, } f(x) \to 6 \text{ agree} \]

\[ \text{as } x \to 3^+ \text{, } f(x) \to 6 \text{ agree} \]

Overall: \( \text{as } x \to 3 \text{, } f(x) \to 6 \)

When two folks walk toward x = 3 from opposite sides, does the road lead them close enough to 6 to shake hands? Mathematically, how close does the road get to 6?

☆ In calculus, we often don’t care what happens when x is exactly equal to a value, but does
the road get very close to the same LIMIT from both sides. If you reach "almost" the same point, then we agree that the LIMIT exists.

Graph the function \( f(x) = \frac{|x|}{x} \).

What is the left-hand limit as \( x \to 0^- \)?

What is the right-hand limit as \( x \to 0^+ \)?

Could the two "walkers" from opposite sides shake hands? (They have very tiny arms.)

So does an overall LIMIT exist when \( x = 0 \)?

\[
\lim_{x \to 0} f(x) \to d.n.e.
\]

Graph the piecewise function \( f(x) = \begin{cases} 
-5, & x = 1 \\
x^2 + 3, & x < 1 \\
3x + 1, & x > 1
\end{cases} \).

What is \( f(1) \)?

What is the left-hand limit as \( x \to 1^- \)?

What is the right-hand limit as \( x \to 1^+ \)?

Could the two "walkers" from opposite sides shake hands at \( x = 1 \)?

Does the (overall) LIMIT exist when \( x = 1 \)?

\[
\lim_{x \to 1} f(x) = 4
\]

**Definition of Limit:** \( L \) is a real number

If \( \lim_{x \to a^-} f(x) = L \) and \( \lim_{x \to a^+} f(x) = L \),
then we say the limit of \( f(x) \) as \( x \) approaches \( a \) is equal to \( L \)
or in symbols \( \lim_{x \to a} f(x) = L \).
Always remember that we do not care about what happens exactly at the x-value, simply whether the left-hand limit and the right-hand limit are equal so the two walkers get close enough to shake hands.

Exit Slip Task: Work with your partner to ...

Write another example of a non-continuous function, that still has an overall limit at its discontinuity.

*(Please use the same x value from both sides.)*

Write another example of a non-continuous function, that does NOT have an overall limit at its discontinuity.

*(Please use the same x value from both sides.)*