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QUIZ 5

MATH 200, SECTION 9

February 26, 2021

Directions: Closed book, closed notes, no calculators.

By submitting this quiz you affirm that you agree with this statement: *On my honor, I have neither given nor received unauthorized aid on this assignment, and I pledge that I am in compliance with the VCU Honor System.*

1. (20 points) Use the limit definition $f'(x) = \lim_{w \to x} \frac{f(w) - f(x)}{w - x}$ to find the derivative of $f(x) = \sqrt{x-1}$.

   Please present your work in a linear, organized fashion. Show all steps.

$$f'(x) = \lim_{w \to x} \frac{f(w) - f(x)}{w - x} = \lim_{w \to x} \frac{\sqrt{w-1} - \sqrt{x-1}}{w - x}$$

$$= \lim_{w \to x} \frac{\sqrt{w-1} - \sqrt{x-1}}{w - x} \cdot \frac{\sqrt{w-1} + \sqrt{x-1}}{\sqrt{w-1} + \sqrt{x-1}}$$

$$= \lim_{w \to x} \frac{\sqrt{w-1}^2 + \sqrt{w-1}\sqrt{x-1} - \sqrt{x-1}\sqrt{w-1} - \sqrt{x-1}^2}{(w-x)\left(\sqrt{w-1} + \sqrt{x-1}\right)}$$

$$= \lim_{w \to x} \frac{(w-1) - (x-1)}{(w-x)\left(\sqrt{w-1} + \sqrt{x-1}\right)}$$

$$= \lim_{w \to x} \frac{w - x}{(w-x)\left(\sqrt{w-1} + \sqrt{x-1}\right)}$$

$$= \lim_{w \to x} \frac{1}{\sqrt{w-1} + \sqrt{x-1}}$$

$$= \frac{1}{\sqrt{x-1} + \sqrt{x-1}} = \frac{1}{2\sqrt{x-1}}$$

Answer $\boxed{f'(x) = \frac{1}{2\sqrt{x-1}}}$