

§2.1: Definition of a Derivative

“I WILL...

...define a derivative using the definition”

I. Definition

A. The derivative of a function allows you to find the _____ at a point.

1. The slope of a curve is DIFFERENT at every point whereas the slope of a line is the same.

B. Different ways of writing the derivative, it is known as “the derivative of y with respects to x ”

1. $f'(x)$: 1st Derivative of f

2. $\frac{dy}{dx}$: Derivative of y with respect to x

3. y' : 1st Derivative of y

4. $\frac{d}{dx}[f(x)]$: 1st Derivative of $f(x)$ with respect to x

II. Equation: _____ (Know it!)

III. Steps

A. Purpose of a Tangent Line

1. The line shares a point with the curve in question.

2. At the shared point, the derivative of the curve is equal to the slope of the line.

B. Finding the Derivative by the Limit Process

1. Apply the Difference Quotient the equation

2. Add the limit to each step as the goal is to determine the limit when _____; the difference is h .

It approaches at zero because the slope of the graph of f at $x = c$.

Ex 1: Use the limit process to find the derivative of $f(x) = 2x - 3$

Ex 2: Use the limit process to find the derivative of $f(x) = 2x^2 - 16x + 35$

Your Turn: Use the limit process to find the derivative of $f(x) = x^2 - 3$

Ex 3: Use the limit process to find the derivative of $f(x) = \sqrt{5x - 8}$

Your Turn: Use the limit process to find the derivative of $f(x) = \sqrt{x-1}$

IV. Using the Limit Process to find the Tangent Line

- A. Use the limit process to find the derivative
- B. Plug in x of the derivative to determine the slope
- C. Plug into Point-Slope form, _____ with the given x, y coordinates, and slope
- D. AP Hint: For free-response AP Questions, do not need to simplify point-slope form

Ex 4: Find the slope of the graph of $f(x) = x^2 - 8x + 9$ at the point $(3, -6)$ using the limit process. Then, find the equation of the tangent line.

Ex 5: Find the slope of the graph of $f(x) = \frac{3}{x}$ at the point $(3, 1)$ using the limit process. Then, find the equation of the tangent line.

Your Turn: Find the slope of the graph of $f(x) = x^2 + 2x + 1$ at the point $(-3, 4)$ using the limit process. Then, find the equation of the tangent line.

Ex 6: Given the function $y = \frac{1}{x}$ anchored at the point $(2, \frac{1}{2})$, find the slope of the secant line drawn through the point with x -coordinate $2 + h$. Use the expression to find the slope of the tangent to the graph of $y = \frac{1}{x}$ at the point $(2, \frac{1}{2})$.

AP 1) If $f(2) = 3$ and $f'(2) = -1$, find an equation of the tangent line when $x = 2$

(A) $y + 1 = 2(x - 2)$ (B) $y - 3 = 2(x + 1)$ (C) $y - 2 = 3(x + 1)$ (D) $y - 3 = -1(x - 2)$

Vocabulary	Connections and Process	Answer and Justifications