

Learning Objective CHA-3.A: Interpret the meaning of a derivative in context.

In Units 2 and 3, we have extensively studied the procedure for FINDING a derivative. Now, in Unit 4, we will turn our attention to WHAT the derivative MEANS in the context of a problem.

Example 1: From the 2001 AP Calculus Exam AB/BC 2

The temperature, in degrees Celsius ($^{\circ}\text{C}$), of the water in a pond is a differentiable function W of time t . The table to the right shows the water temperature as recorded every 3 days over a 15-day period.

a. Use the data from the table to find an approximation for $W'(12)$. Show the computations that lead to your answer. Indicate units of measure.

t (days)	$W(t)$ ($^{\circ}\text{C}$)
0	20
3	31
6	28
9	24
12	22
15	21

Scoring Guidelines from 2001

2: { 1: difference quotient
1: answer (with units)

What if we were asked to interpret the meaning of the approximated derivative value, we found in Example 1? Interpreting the meaning of a derivative in the context of a problem will certainly be a question you will encounter on the AP Exam. The acronym N.U.T. can help you properly answer these types of questions.

b. Interpret the meaning of the derivative from part (a) in the context of the problem.

Guidelines for Interpreting the Meaning of a Derivative in Context.

When interpreting the meaning of a derivative, use the following acronym:

N. Noun/Number (Subject of the problem and the numerical value.)

U. Units (Label with the appropriate units.)

T. Time (Include the time \underline{AT} which the derivative (change) was computed.)

**Example 2:** From the 2013 AP Calculus Exam AB 1

On a certain workday, the rate, in tons per hour, at which unprocessed gravel arrives at a gravel processing plant is modeled by $G(t) = 90 + 45 \cos\left(\frac{t^2}{18}\right)$, where t is measured in hours and $0 \leq t \leq 8$. At the beginning of the workday ($t = 0$), the plant has 500 tons of unprocessed gravel. During the hours of operation $0 \leq t \leq 8$, the plant processed gravel at a constant rate of 100 tons per hour.

a. Find $G'(5)$. Using correct units, interpret your answer in the context of the problem.

Scoring Guidelines from 2013

2: { 1: $G'(5)$
1: interpretation with units

Example 3: From the 2007 AP Calculus Exam – Form B AB 3

The wind chill is the temperature, in degrees Fahrenheit ($^{\circ}\text{F}$), a human feels based on the air temperature, in degrees Fahrenheit, and the wind velocity v , in miles per hour (mph). If the air temperature is 32°F , then the wind chill is given by $W(v) = 55.6 - 22.1v^{0.16}$ and is valid for $5 \leq v \leq 60$.

a. Find $W'(20)$. Using correct units, explain the meaning of $W'(20)$ in terms of the wind chill.

Scoring Guidelines from 2007

2: { 1: value
1: explanation
1: answer