CHA		
2	Topic: 4.3	Rates of Change in Applied Contexts Other Than Motion

Learning Objective CHA-3.C: Interpret rates of change in applied contexts.

Example 1: From the 2010 AP Calculus Exam AB/BC 1

There is no snow on Janet's driveway when snow begins to fall at midnight. From midnight to 9 A.M., snow accumulates on the driveway at a rate modeled by $f(t) = 7te^{\cos t}$ cubic feet per hour, where t is measured in hours since midnight. Janet starts removing snow at 6 A.M. $(t = 6)$.

The rate $g(t)$, in cubic feet per hour, at which Janet removed snow from the driveway at time t hours after midnight is modeled by $g(t) = \begin{cases} 0 & \text{for } 0 \le t < 6 \\ 125 & \text{for } 6 \le t < 7 \\ 108 & \text{for } 7 \le t \le 9. \end{cases}$

a. Find the rate of change of the volume of snow on the driveway at 8 A.M.

Scoring Guidelines from 2010

1 : answer

Example 2: A penguin population on an island is modeled by a differentiable function P of time t, where $P(t)$ represents the number of penguins and t is measured in years, for $0 \le t \le 40$. There are 100,000 penguins on the island at time $t = 0$. The birth rate for the penguins on the island is modeled by $B(t) = 1000e^{0.06t}$ penguins per year and the death rate for the penguins on the island is modeled by $D(t) = 250e^{0.1t}$ penguins per year

a. What is the rate of change of the penguin population on the island at $t = 0$?

Example 3: From the 2017 AP Calculus Exam AB/BC

When a certain grocery store open, it has 50 pounds of bananas on a display table. Customers remove bananas from the display table at a rate modeled by $f(t) = 10 + (0.8t)\sin\left(\frac{t^3}{100}\right)$ for $0 < t \le 12$ where $f(t)$ is measured in pounds per hour and t is the number of hours after the store opened. After the store has been open for three hours, store employees add bananas to the display table at a rate modeled by $g(t) = 3 + 2.4\ln(t^2 + 2t)$ for $3 < t \le 12$, where $g(t)$ is measured in pounds per hour and t is the number of hours after the store opened.

a. Find $f'(7)$. Using correct units, explain the meaning of $f'(7)$ in the context of the problem.

Scoring Guidelines from 2017

2 : { 1 : value; 1 : meaning }

1 : answer

b. Is the number of pounds of bananas on the display table increasing or decreasing at time $t = 5$? Give a reason for your answer.

Scoring Guidelines from 2017

2 : { 1 : considers f; 1 : answer with

1 : answer

Storing on your ti-84

- **To store any number, enter in the number or use your ANS, then** STO **button (below LN button) then the variable button X,T, θ, n.**

- **To store functions, hit the** $y =$ **button and type the functions into y_1 and y_2**
  - **You can access these by using** VARS **, arrow to the right and choose functions**