

AP Precalculus FRQ

Type 2: Modeling a Non-Periodic Context

(Calculator active)

On the initial day of sales ($t = 0$) for a new video game, there were 40 thousand units of the game sold that day. Ninety-one days later ($t = 91$), there were 76 thousand units of the game sold that day.

The number of units of the video game sold on a given day can be modeled by the function G given by

$$G(t) = a + b \ln(t + 1),$$

where $G(t)$ is the number of units sold, in thousands, on day t since the initial day of sales.

- (A) (i) Use the given data to write two equations that can be used to find the values for constants a and b in the expression for $G(t)$.
- (ii) Find the values for a and b as decimal approximations.
- (B) (i) Use the given data to find the average rate of change of the number of units of the video game sold, in thousands per day, from $t = 0$ to $t = 91$ days. Express your answer as a decimal approximation. Show the computations that lead to your answer.
- (ii) Use the average rate of change found in (i) to estimate the number of units of the video game sold, in thousands, on day $t = 50$. Show the work that leads to your answer.
- (iii) Let A_t represent the estimate of the number of units of the video game sold, in thousands, using the average rate of change found in (i). For A_{50} , found in (ii), it can be shown that $A_{50} < G(50)$. Explain why, in general, $A_t < G(t)$ for all t , where $0 < t < 91$.
- (C) The makers of the video game reported that daily sales of the video game decreased each day after $t = 91$. Explain why the error in the model G increases after $t = 91$.