AP Precalc

Free Response Question #2

FRQ #2 Notes

Write your questions and thoughts here!

CALCULATOR ACTIVE – IN CONTEXT

Units 1 and 2

Part A: You will need to come up with possible equations based off a situation, table or other possible scenario and you'll need to find values for those parameters.

Ex 1: The Algebro Fan Club started in 2005. In 2007 (t = 2), there were 43 members of the club. In 2020, (t = 15) there were 148 members of the club. The number of members of the Fan Club can be modeled by the function *B* given by $B(t) = a \cdot b^t + 12$, where $B(t)$ is the number of members during year *t*, and *t* is the number of years since 2005.

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 $B(t)$.

ii.Find the values for a, and b as decimal approximations.

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*just find the parameters, not the equations.

Part B: All about AROC (average rate of change). CALCULATE it, APPLY/INTERPRET it and REASON about it.

B) i. Use the given data to find the average rate of chang of Fan Club members per year, from *t = 2,* to *t = 15.* Express your answer as a decimal approximation. Show the computations that led to your answer.

ii. Use the average rate of change found in (i) to estimate the numbers of Fan Club Members for *t = 8,* years. Show the computations that lead to your answer.

iii. Consider the values that result from using the average rate of change found in (i) to estimate the number of fans for times *t = p* years, where *2 < p < 15.* Are these estimates less than or greater than the number of fans predicated by the model *B* at time *t = p* years. Explain your reasoning. Your explanation should include characteristics of the average rate of change and reference the graph of *B.*

Write your questions and thoughts here!

Part C: Focus is on where the model may have limitations. Could be domain and range or some other time the model breaks down.

C. For which *t*-value, $t = 9$ years or $t = 24$ years, should the Booster Club have more confidence in when using the model *B?* Give a reason for your answer in the context of the problem.

Ex 2. Mr. Bean started up his own TikTok channel all about traveling! Things started slowly as after 10 days ($t = 10$) he only had 16 followers. Things did pick up though and after 28 days ($t = 28$) he had 87 followers. The number of followers that Mr. Bean has for his channel can be modeled by the piecewise function *F* given by:

$$F(t) = \begin{cases} 6 + a\log x & for\ 1 \leq t \leq 14 \\ .5(x-b)^2 + 15 & for\ t > 14 \end{cases}$$

Where *F(t)* is the number of followers of Mr. Bean's channel *t* days since he started the channel.

(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 *F(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 in the number of followers of Mr. Bean's TikTok channel per day, from $t = 16$ to $t = 29$.

(ii) Interpret the meaning of your answer from (i) in the context of the problem.

(iii) Consider the values that result from using the average rate of change found in (i) to estimate the number of followers of Mr. Bean's TikTok channel for times $t = p$ days, where $16 < p < 28$. Are these estimates less than or greater than the number of followers predicted by the model *F* for times $t = p$ days? Explain your reasoning. Your explanation should include characteristics of the average rate of change and a reference to the graph of *F*.

(C) The model *F* is valid for $0 \leq t \leq 30$ days. Explain how the range of values of the function *F* should be limited by the context of the problem.

Free Response Question #2

AP Precalculus

FRQ #2 Practice

Instructions: Answer each FRQ.

1)

t	0	9	45
Number of People	14	59	104

The table gives the number of people in the audience at Mr. Brust's Ted Talk. When he starts at 7 PM ($t = 0$), there are 14 people in the audience. Nine minutes later ($t = 9$), there were 59 people in the audience. Forty-five minutes later ($t = 45$), there were 105 people in the audience.

The number of people in the audience can be modeled by the quadratic function *P* given by $P(t) = at^2 + bt + c$ where *P(t)* is the number of people in the audience *t* minutes after the Ted Talk started.

(A) (i) Use the given data to write three equations that can be used to find the values for constants *a, b,* and *c* as decimal approximations.

(ii) Find the values of *a, b,* and *c* as decimal approximations.

(B) (i) Use the given data to find the average rate of change in the number of people in the audience from $t = 9$ to $t = 45$ minutes. 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 people in the audience at time $t = 30$ minutes. Show the computations that lead to your answer.

(iii) The average rate of change found in (i) can be used to estimate the number of people in the audience for times $t = d$ minutes, where $9 < d < 45$. Are these estimates less than or greater than the people in the audience predicted by *P* at time $t = d$ minutes. Explain your reasoning. Your explanation should include characteristics of the average rate of change and a reference to the graph of *P.*

(C) The model *P* is an appropriate model to make predictions about the number of people in the audience if the predicted number of people in the audience is at least zero. Based on this information, what is the largest value of *t* for which model is appropriate? Give a reason for your answer.

2) Fans eagerly anticipated the new Algebros math video and so the first day (t = 0) that it was released on YouTube it had 85 thousand views. 45 days later (t = 45), there were 110 thousand views.

The number of views of the Algebros new video on a given day can be modeled by the function *V* given by $V(t) = a + b\ln(t+1)$, where *V(t)* is the number of views, in thousands, on day *t* since the initial day it was released.

(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 $V(t)$

(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 number of views of the new Algebros Video, in thousands per day, from *t = 0* to *t = 45* 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 views, in thousands, on day *t = 25*. Show the work that leads to your answer.

(iii) Let A_t represent the estimate of the number of views of the new video, in thousands, using the average rate of change found in (i). For A_{25}, found in (ii), it can be show that $A_{25} < V(25)$. Explain why, in general, $A_t < G(t)$, where $0 < t < 45$.

(C) The Algebros reported that daily views of the new video decreased each day after *t = 45*. Explain why the error in model *V* increases after *t* = 45.

3) The temperature of TK's World's Best Chicken when it comes off the grill $(t = 0)$ is 165˚ Fahrenheit. Eight minutes later $(t = 8)$, TK finds the temperature of his World's Best Chicken is 120˚ Fahrenheit.

The temperature of TK's World's Best Chicken can be modeled by the function C given by $C(t) = ab^t + 68$, where $C(t)$ is the temperature of the World's Best Chicken, in degrees Fahrenheit (˚F), and t is the number of minutes since the soup was removed from the stove.

(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 C(t).

(ii) Find the values of a and b as decimal approximations.

(B) (i) Use the given data to find the average rate of change of the temperature of TK's World's Best Chicken, in degrees Fahrenheit per minute, from $t = 0$ to $t = 8$. 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 temperature of TK's World's Best Chicken when t = 6. Show the work that leads to your answer.

(iii) The average rate of change calculated in part (i) can be used to estimate the temperature of TK's World's Best Chicken at time t for values of t between $t = 0$ and $t = 8$. Will the values estimated using the average rate of change be strictly greater than, strictly less than, or sometimes greater and sometimes less than the values predicted by the model, C, for $0 \leq t \leq 8$? Explain why this is the case.

(C) According to the model, the temperature of TK's Best Chicken will always exceed a certain temperature, R, which corresponds to the temperature of the room in which the soup is cooling. In other words, C$(t) > R$ for all t. However, TK finishes his TK's World's Best Chicken by the time the TK's World's Best Chicken's temperature has cooled to 15˚ Fahrenheit above the room temperature, R. Explain how this information could be used to determine an appropriate domain for C based on the context.