FRQ #2

AP Precalculus Name: _____ **CA #1**

Question #1

A concert promoter is tracking the total revenue from ticket sales for a high-demand show. The table below shows the total revenue *R*, in thousands of dollars, at time, *t* hours after tickets first went on sale at 10 AM *(t = 0).*

t (hours)	0	2	10
R(t) (thousands of dollars)	0	148	600

The total revenue can be modeled by the quadratic function *R* given by $R(t) = at^2 + bt + c$ where *R(t)* is the revenue, *t* hours after sales began.

(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 revenue from *t* = 2 to *t* = 10 hours. 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 revenue at 4pm (*t* = 6). *Show* the computations that lead to your answer.

(iii) The average rate of change found in (i) can be used to estimate the revenue for times *t = d* hours, where 2 < d < 10. Are these estimates less than or greater than the rainfall in inches predicted by *R* at time *t = d* hours. Explain your reasoning. Your explanation should include characteristics of the average rate of change and a reference to the graph of *R.*

(C) The quadratic function model *R* has exactly one absolute minimum or one absolute maximum. That minimum or maximum can be used to determine a domain restriction for *R*. Based on the context of the problem, explain how that minimum or maximum can be used to determine a boundary for the domain of *R*.

Question #2

A new fitness center, "Vertex Fitness," opened in a local community. On its opening day (t = 0), it had 20 thousand social media followers. 60 days later (t = 60), it had 85 thousand followers.

The number of social media followers for the fitness center can be modeled by the function *F* given by $F(t) = a + b\ln(t+1)$ where *F(t)* is the number of followers, in thousands, on day *t* since the opening day.

(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 of the number of followers, in thousands per day, from *t = 0* to *t = 60* days. Express your answer as a decimal approximation. Show the computations that lead to your answer.

(ii) Let *L(t)* be the linear function representing the average rate of change. Use *L(t)* to estimate the number of followers, in thousands, on day *t = 30*. Show the work that leads to your answer.

(iii) For the estimate *L(30)* found in (ii), it can be shown that *L(30) < F(30).* Explain why, in general, *L(t) < F(t)* for all *t,* where *0 < t < 60.*

(C)

The fitness center reported that due to a change in the social media platform's algorithm, its follower count began to decrease each day after *t = 60.* Explain why the error in the model *F(t)* increases after *t = 60.*

ANSWERS:

A(i): $0 = a(0^2) + b(0) + c;\ 148 = a(2^2) + b(2) + c;$ A(ii): a = -1.75, b = 77.5, c = 0

B(i): 56.5 dollars per hour. B(ii): y = $339. B(iii): The estimates are the secant line on the interval 2 < d < 10. The graph is concave down on the interval so the estimates are less than the actual.

C(i): The graph of *R* has a maximum at y = 858.036, therefore the range of the function would be $0 \le R(x) \le 858.036$.

A(i): $20 = a + b\ln(0+1);\ 85 = a + b\ln(60+1);$

B(i): 1.083 followers per day. B(ii): 52.49 followers, B(iii): The estimates are the secant line on the interval 0 < d < 60. The graph is concave down on the interval so the estimates are less than the actual.

C(i): According to the model as *t* increases without bound the model *F(t)* will increase so once the data goes against that by decreasing we know that *F(t)* will only work on the domain (0, 60) for sure.