

1. The function f is decreasing and is defined for all real numbers. The table gives values for $f(x)$ at selected values of x .

x	-2	-1	0	1	2
$f(x)$	14	7	3.5	1.75	0.875

The function g is given by $g(x) = -0.167x^3 + x^2 - 1.834$.

A.

- The function h is defined by $h(x) = (g \circ f)(x) = g(f(x))$. Find the value of $h(1)$ as a decimal approximation, or indicate that it is not defined. Show the work that leads to your answer.
- Find the value of $f^{-1}(3.5)$, or indicate that it is not defined.

B.

- Find all values of x , as decimal approximations, for which $g(x) = 0$, or indicate that there are no such values.
- Determine the end behavior of g as x increases without bound. Express your answer using the mathematical notation of a limit.

C.

- Based on the table, which of the following function types best models function f : linear, quadratic, exponential, or logarithmic?
- Give a reason for your answer in part C (i) based on the relationship between the change in the output values of f and the change in the input values of f . Refer to the values in the table in your reasoning.

2. A musician released a new song on a streaming service. A streaming service is an online entertainment source that allows users to play music on their computers and mobile devices.

Several months later, the musician began using an app (at time $t = 0$) that counts the total number of plays for the song since its release. A “play” is a single stream of the song on the streaming service. The table gives the total number of plays, in thousands, for selected times t months after the musician began using the app. At $t = 0$, the total number of plays was 25 thousand. At $t = 2$, the total number of plays was 30 thousand. At $t = 4$, the total number of plays was 34 thousand.

Months after the musician began using the app	0	2	4
Total number of plays for the song since its release (thousands)	25	30	34

The total number of plays, in thousands, for the song since its release can be modeled by the function D given by $D(t) = at^2 + bt + c$, where $D(t)$ is the total number of plays, in thousands, for the song since its release, and t is the number of months after the musician began using the app.

A.

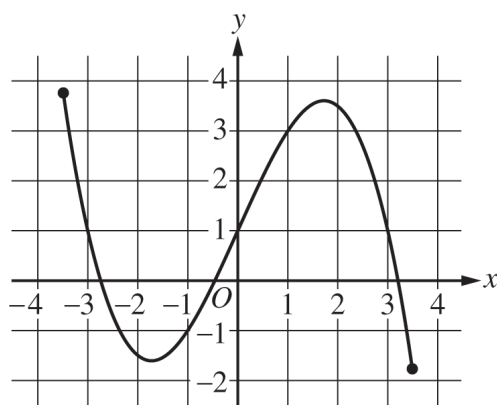
- Use the given data to write three equations that can be used to find the values for constants a , b , and c in the expression for $D(t)$.
- Find the values for a , b , and c as decimal approximations.

B.

- Use the given data to find the average rate of change of the total number of plays for the song, in thousands per month, from $t = 0$ to $t = 4$ months. Express your answer as a decimal approximation. Show the computations that lead to your answer.
- Use the average rate of change found in part B (i) to estimate the total number of plays for the song, in thousands, for $t = 1.5$ months. Show the work that leads to your answer.
- Let A_t represent the estimate of the total number of plays for the song, in thousands, using the average rate of change found in part B (i). For $A_{1.5}$ found in part B (ii), it can be shown that $A_{1.5} < D(1.5)$.
Explain why, in general, $A_t < D(t)$ for all t , where $0 < t < 4$. Your explanation should include a reference to the graph of D and its relationship to A_t .

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

END OF PART A

Graph of f

1. The figure shows the graph of the function f on its domain of $-3.5 \leq x \leq 3.5$. The points $(-3, 1)$, $(0, 1)$, and $(3, 1)$ are on the graph of f . The function g is given by $g(x) = 2.916 \cdot (0.7)^x$.
- (A) (i) The function h is defined by $h(x) = (g \circ f)(x) = g(f(x))$. Find the value of $h(3)$ as a decimal approximation, or indicate that it is not defined.
- (ii) Find all values of x for which $f(x) = 1$, or indicate that there are no such values.
- (B) (i) Find all values of x , as decimal approximations, for which $g(x) = 2$, or indicate that there are no such values.
- (ii) Determine the end behavior of g as x increases without bound. Express your answer using the mathematical notation of a limit.
- (C) (i) Determine if f has an inverse function.
- (ii) Give a reason for your answer based on the definition of a function and the graph of $y = f(x)$.

Write your responses to this question only on the designated pages in the separate Free Response booklet. Write your solution to each part in the space provided for that part.