

Write your questions
and thoughts here!**CALCULATOR ACTIVE – NO CONTEXT****Units 1 and 2 – TABLE OR GRAPH****EXAMPLE 1 TABLE**

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

x	-1	0	1	2	3
$f(x)$	1	2	5	10	17

The function g is given by $g(x) = \frac{18}{x-1}$.

PART A: COMPOSITION OF FUNCTIONS

- 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. Show the work that leads to your answer.
- ii. Find values of $f^{-1}(2)$, or indicate that it is not defined.

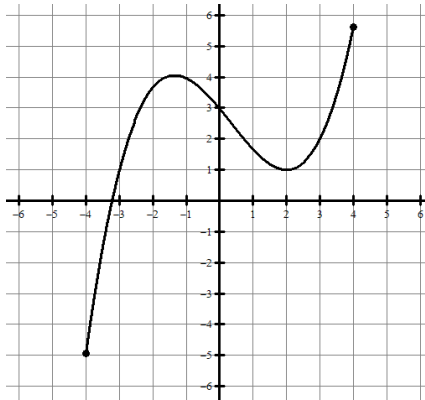
PART B: END BEHAVIOR

- i. Find all values of x , as decimal approximations, for which $g(x) = 4$, or indicate 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.

PART C: JUSTIFY USING THE TABLE/GRAPH

- i. Based on the table, which of the following function types best models function f : linear, quadratic, exponential or logarithmic?
- ii. 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.

EXAMPLE 2 GRAPH



graph of f

The figure shows the graph of the function f on its domain of $-4 \leq x \leq 4$. The function g is given by $g(x) = -4(1.8)^{x-1}$.

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. Show the work that leads to your answer.
- ii. Find all values of x for which $f(x) = 1$, or indicate there are no such values.

B.

- i. Find all values of x , as decimal approximations, for which $g(x) = -1$, or indicate 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 $y = f(x)$.

FRQ #1 Sentence Frames

Use to justify a function that is linear, quadratic, exponential or logarithmic from a table of values.

Linear: (constant rate of change)

When the input increases by ___ units, the output increases by ___ units. Since equal changes in the input produce equal changes in the output, the rate of change is constant at ___, so the function is linear.

Example:

When the input increases by 2 units, the output increases by 3 units. Since equal changes in the input produce equal changes in the output, the rate of change is constant at $\frac{3}{2}$, so the function is linear.

x	-2	0	2	4
$f(x)$	5	8	11	14

$$\frac{f(0) - f(-2)}{0 - (-2)} = \frac{8 - 5}{0 + 2} = \frac{3}{2}$$

Quadratic: (second difference is a constant rate of change)

The first differences in the output are ___, ___, and ___. The second differences are constant at ___. Since the second differences are constant for equal changes in the input, the function is quadratic.

Example:

The first differences in the output are 3, 5, and 7. The second differences are constant at 2. Since the second differences are constant for equal changes in the input, the function is quadratic.

x	0	1	2	3
$f(x)$	1	4	9	16

First Difference $\underbrace{\quad\quad\quad}_3 \quad \underbrace{\quad\quad\quad}_5 \quad \underbrace{\quad\quad\quad}_7$
Second Difference $\underbrace{\quad\quad}_2 \quad \underbrace{\quad\quad}_2$

Exponential: (multiply by a constant ratio)

When the input increases by ___ units, the output is multiplied by ___. Since equal changes in the input result in a constant ratio of ___ in the output, the function is exponential.

Example:

When the input increases by 1 unit, the output is multiplied by 3. Since equal changes in the input result in a constant ratio of 3 in the output, the function is exponential.

x	-2	-1	0	1
$f(x)$	4	12	36	108

$$\frac{f(-1)}{f(-2)} = \frac{12}{4} = 3$$

Logarithmic: (inverse of exponential so x is multiplied by a constant ratio)

When the input is multiplied by ____, the output increases by ____. Since changes in the input are a constant ratio of ____ and produce equal changes in the output, the function is logarithmic.

Example:

When the input is multiplied by 2, the output increases by 1. Since changes in the input are a constant ratio of 2 and produce equal changes in the output, the function is logarithmic.

x	3	6	12	24
$f(x)$	-1	0	1	2

$$\frac{6}{3} = 2$$

Inverse Functions

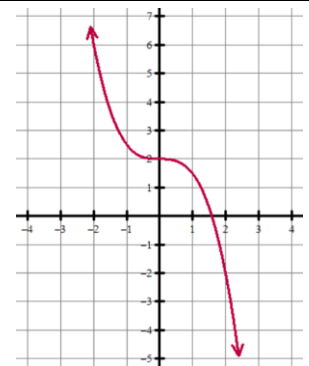
Use to justify that a function does or does not have an inverse function from a graph.

Does have an inverse function: (passes the horizontal line test)

Every output value corresponds to exactly one input value. Therefore, the function is one-to-one and has an inverse function.

Example:

Every output value corresponds to exactly one input value. Therefore, the function is one-to-one and has an inverse function.

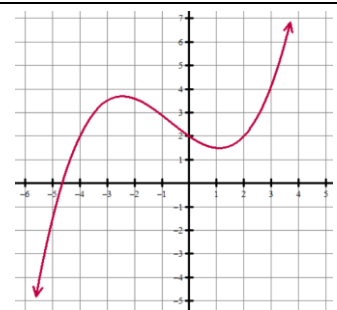


Does not have an inverse function: (fails the horizontal line test)

Two different input values, $x =$ __ and __, produce the same output value __. Therefore, the function is not one-to-one and does not have an inverse.

Example:

Two different input values, $x = -4$ and 0 , produce the same output value 2 . Therefore, the function is not one-to-one and does not have an inverse.



Free Response Question #1

AP Precalculus

PRACTICE

Calculator Active – Answer the following practice FRQ #1 questions. Grade using the scoring rubric.

1. The function f is increasing 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
$f(x)$	2	6	18	54	162

The function g is given by $g(x) = 5.2(0.6)^x$.

A.

- The function h is defined by $h(x) = (g \circ f)(x) = g(f(x))$. Find the value of $h(-2)$ as a decimal approximation, or indicate that it is not defined. Show the work that leads to your answer.
- Find values of $f^{-1}(2)$, or indicate that it is not defined.

B.

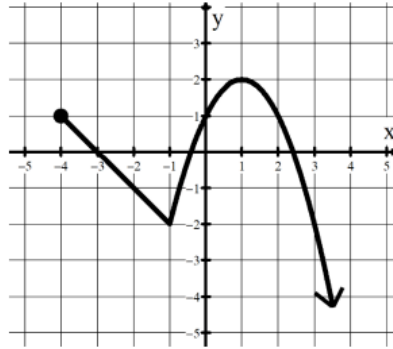
- Find all values of x , as decimal approximations, for which $g(x) = 1$, or indicate there are no such values.
- Determine the end behavior of g as x increases without bound. Express your answer using the mathematical notation of a limit.

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.

Your Score: ____ out of 6 points

2.



graph of f

The figure shows the graph of the function f on its domain of $x \geq -4$. The function g is given by $g(x) = 0.25x^3 - 3.2x^2 + 6$.

A.

- i. 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.
- ii. Find all values of x for which $f(x) = -2$, or indicate there are no such values.

B.

- i. Find all values of x , as decimal approximations, for which $g(x) = -4$, or indicate 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 $y = f(x)$.

Your Score: ____ out of 6 points

Calculator Active – Answer the following practice FRQ #1 questions. Grade using the scoring rubric.

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

x	-3	0	3	6	9
$f(x)$	2	6	10	14	18

The function g is given by $g(x) = 4.2 \ln(2x)$.

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. Show the work that leads to your answer.

- ii. Find values of $f^{-1}(6)$, or indicate that it is not defined.

B.

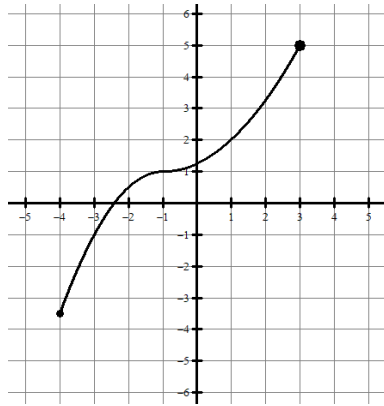
- i. Find all values of x , as decimal approximations, for which $g(x) = 3$, or indicate there are no such values.
- ii. Determine the end behavior of g as x decreases without bound. Express your answer using the mathematical notation of a limit.

C.

- i. Based on the table, which of the following function types best models function f : linear, quadratic, exponential or logarithmic?
- ii. 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.

Your Score: ____ out of 6 points

4.



graph of f

The figure shows the graph of the function f on its domain of $-4 \leq x \leq 3$. The function g is given by $g(x) = -0.45x^2 - 5.2x - 2$.

A.

i. 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.

ii. Find all values of x for which $f(x) = -1$, or indicate there are no such values.

B.

i. Find all values of x , as decimal approximations, for which $g(x) = 0$, or indicate 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 $y = f(x)$.

Your Score: ____ out of 6 points