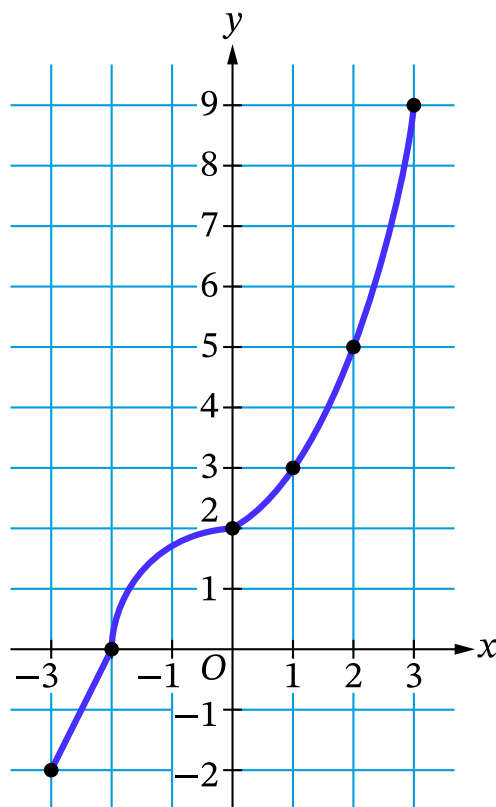


1. The figure shows the graph of the increasing function f on its domain of $-3 \leq x \leq 3$.



Graph of f

The function g is given by $g(x) = -4.792 + \ln(6x - 6)$.

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 all values of x for which $f(x) = 3$, or indicate that there are no such values.

B.

- Find all values of x , as decimal approximations, for which $g(x) = -1.5$, or indicate that there are no such values.
- Determine the behavior of g as x -values decrease and get arbitrarily close to 1. Express your answer using the mathematical notation of a limit.

C.

- Is the function f invertible?
- Give a reason for your answer in part C (i) based on properties of the function f . Refer to points on the graph of f in your reasoning.

4. Directions:

- Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number. Angle measures for trigonometric functions are assumed to be in radians.
- Solutions to equations must be real numbers. Determine the exact value of any expression that can be obtained without a calculator. For example, $\log_2 8$, $\cos\left(\frac{\pi}{2}\right)$, and $\sin^{-1}(1)$ can be evaluated without a calculator.
- Unless otherwise specified, combine terms using algebraic methods and rules for exponents and logarithms, where applicable. For example, $2x + 3x$, $5^2 \cdot 5^3$, $\frac{x^5}{x^2}$, and $\ln 3 + \ln 5$ should be rewritten in equivalent forms.
- For each part of the question, show the work that leads to your answers.

A. The functions g and h are given by

$$g(x) = e^{2x}$$

$$h(x) = \log_2(5x)$$

- Solve $g(x) = \frac{1}{e^6}$ for values of x in the domain of g .
- Solve $h(x) = 3$ for values of x in the domain of h .

B. The functions j and k are given by

$$j(x) = 7^{(3x+1)} \cdot 7^x$$

$$k(x) = \sin(2x) \sec x$$

- Rewrite $j(x)$ as an expression of the form $7^{(\text{expression})}$.
- Rewrite $k(x)$ as an expression in which $\sin x$ appears exactly once and no other trigonometric functions are involved.

C. The function m is given by $m(x) = \tan^2(3x)$.

Find all input values for m in the interval $\left[0, \frac{\pi}{2}\right]$ that yield an output value of 1.

STOP
END OF EXAM

4. Directions:

- Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number. Angle measures for trigonometric functions are assumed to be in radians.
- Solutions to equations must be real numbers. Determine the exact value of any expression that can be obtained without a calculator. For example, $\log_2 8$, $\cos\left(\frac{\pi}{2}\right)$, and $\sin^{-1}(1)$ can be evaluated without a calculator.
- Unless otherwise specified, combine terms using algebraic methods and rules for exponents and logarithms, where applicable. For example, $2x + 3x$, $5^2 \cdot 5^3$, $\frac{x^5}{x^2}$, and $\ln 3 + \ln 5$ should be rewritten in equivalent forms.
- For each part of the question, show the work that leads to your answers.

A. The functions g and h are given by

$$g(x) = 2 \log_3 x$$

$$h(x) = 4 \cos^2 x$$

- Solve $g(x) = 4$ for values of x in the domain of g .
- Solve $h(x) = 3$ for values of x in the interval $\left[0, \frac{\pi}{2}\right)$.

B. The functions j and k are given by

$$j(x) = \log_2 x + 3 \log_2 2$$

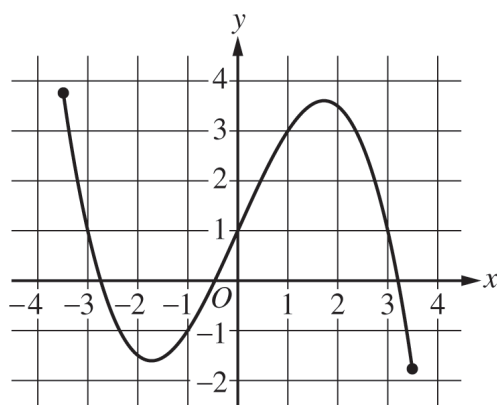
$$k(x) = \frac{6}{\tan x (\csc^2 x - 1)}$$

- Rewrite $j(x)$ as a single logarithm base 2 without negative exponents in any part of the expression. Your result should be of the form $\log_2(\text{expression})$.
- Rewrite $k(x)$ as an expression in which $\tan x$ appears exactly once and no other trigonometric functions are involved.

C. The function m is given by $m(x) = e^{2x} - e^x - 12$. Find all input values in the domain of m that yield an output value of 0.

STOP

END OF EXAM

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.