

Thursday Night PreCalculus, April 4, 2024

Exam Preparation

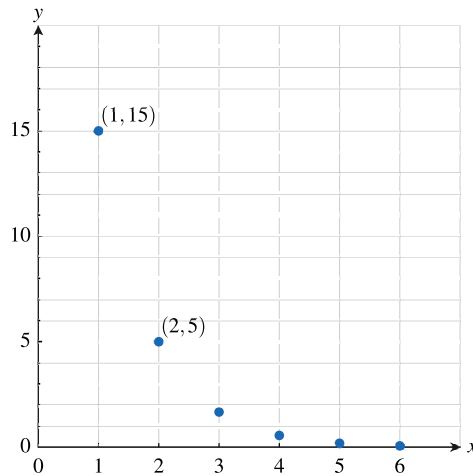
Problems

1. The function f is defined by $f(x) = \frac{2x^3 - 3x^2 + 7}{x - 3}$. What input value(s) in the domain of f yields an output value of -5 ?
2. The table shows values for a function f at selected values of x .

x	-2	-1	0	1	2
$f(x)$	-0.5	0.1	-2	0.5	10

A cubic regression is used to model the function f . What is the value of $f(0.5)$ predicted by the cubic regression model?

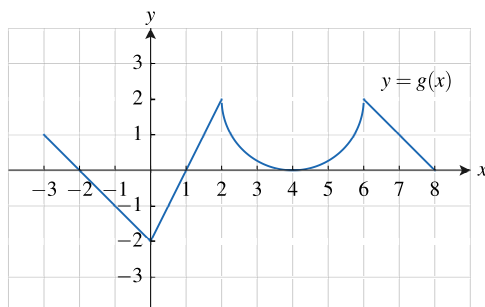
3. A geometric sequence has the form $g_n = g_k \cdot r^{(n-k)}$. The graph of a geometric sequence, g_n , is shown in the figure.



What is the value of g_5 .

4. The growth of bacteria in a culture is modeled by $y = 100e^{0.75t}$, where t is measured in days. At what time t is the number of bacteria approximately 1500?
5. Consider the logarithmic functions f and g defined by $f(x) = \log_3(2.5x + 1)$ and $g(x) = 3 - 2\log_3(1.4x - 1)$. Find a zero of the function h defined by $h(x) = f(x) + g(x)$.

6. The function f is given by $f(x) = \cos(2.3x) - \sin(1.7x)$. The function g is given by $g(x) = e^{0.75x} - 2.5$. Find the input value such that $f(x) = g(x)$.
7. The graph of the function g is shown in the figure, and consists of three line segments and a semicircle with radius 2.



The function f is given by $f(x) = \frac{-3x^2 + 1.9x + 4.5}{x^3 + 2x^2 + 1}$.

- (A) (i) The function h is defined by $h(x) = (f \circ g)(x) = f(g(x))$. Find the value of $h(7)$, or indicate that it is not defined.
(ii) Find all values of x for which $g(x) = -1$, or indicate there are no such values.
- (B) (i) Find all real zeros of f , or indicate there are no such values.
(ii) Determine the end behavior of f as x increases without bound. Express your answer using the mathematical notation of a limit.
- (C) (i) Determine if an inverse function of g can be constructed for all values of x in the closed interval $[2, 6]$.
(ii) Give a reason for your answer based on the definition of a function and the graph of g .
8. The cost of an Uber ride in Boston is modeled by the function C given by

$$C(m) = \begin{cases} am + bm^2 & \text{if } 0 < m \leq 5 \\ d(m - 5) + 25 & \text{if } m > 5 \end{cases}$$

where m is measured in miles and C is measured in dollars. Two Uber riders reported that for $m = 1$ the cost was \$9.00 and for $m = 3$, the cost was \$21.00.

- (A) (i) Use the given data to write two equations that can be used to find the values for the constants a and b in the expression for $C(m)$.
(ii) Find the values for a and b .
- (B) (i) Use the given data to find the average rate of change of the cost of a ride, in dollars per mile, from $m = 2$ to $m = 4$. Show the computations that lead to your answer.
(ii) Interpret the meaning of your answer from (i) in the context of the problem.

(iii) The two pieces of the function C are connected at the transition point when $m = 5$. It is known that $\lim_{m \rightarrow 5} C(m) = 25$ and $C(6) = 27.5$. Consider the average rates of change of C from $m = 5$ to $m = p$ miles, where $p > 5$. Are these average rates of change less than or greater than the average rate of change from $m = 2$ to $m = 4$ miles found in (i)? Explain your reasoning.

(C) Using the model C to predict the cost of an Uber ride, what is the maximum amount a rider could pay? Explain your reasoning.