AP Precalculus FRQ #1 Practice

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- Rather than use numbers or letters to refer to each problem, each problem is labeled with the title of a famous novel. This is to avoid the goofiness of saying "I have a question on problem C part B" or "Can we look at FRQ #4 question #3?" Plus, it is fun to say "We need to talk about Dracula."
- In case it helps you find a specific type of problem you wish to practice, the following table summarizes the practice problems in this document.

Problem	$f(x)$	$g(x)$	**A(i)**	**A(ii)**	**B(i)**	**B(ii)**	**C**
AAIW	Table	Rational	$g(f(6))$	Evaluate f Inverse	Solve $g(x)$ Equation	Left End Behavior (∞)	Type of Model? - Exponential
BNW	Graph	Exponential	$g(f(2))$	Solve $f(x)$ Equation	Solve $g(x)$ Equation [NO SOLUTION]	Right End Behavior $(-\infty)$	Has Inverse? – Yes, Graph
Clarissa	Table	Rational	$f(g(-2))$	Evaluate f Inverse	Solve $g(x)$ Equation	Left End Behavior (Finite)	Type of Model? - Exponential
Dracula	Graph	Logarithmic	$g(f(0))$	Find f zeros	Solve $g(x)$ Equation	Limit from Left $(-\infty)$	Has Inverse? – No, graph
Emma	Table	Exponential	$g(f(6))$	Evaluate f Inverse [UNDEFINED]	Solve $g(x)$ Equation	Left End Behavior (0)	Type of Model? - Quadratic
Frankenstein	Graph	Rational	$f(g(1))$	Solve $f(x)$ Equation	Solve $g(x)$ Equation	Limit From Right (∞)	Has Inverse? – No, graph

FRQ 1 Practice – Alice's Adventures in Wonderland

x	3	6	9	12	15
$f(x)$	48	24	12	6	3

Let f be a decreasing function defined for $x \geq 0$. The table gives values for $f(x)$ at selected values of x.
The function g is given by $g(x) = \frac{2x^3 - 11x + 1}{x - 5}$.

A.

(i) The function h is defined by $h(x) = (g \circ f)(x) = g\big(f(x)\big)$. Find the value of $h(6)$ as a decimal approximation, or indicate that it is not defined.

(ii) Find the value of $f^{-1}(3)$, or indicate that it is not defined.

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = 2$, or indicate that there are no such values.

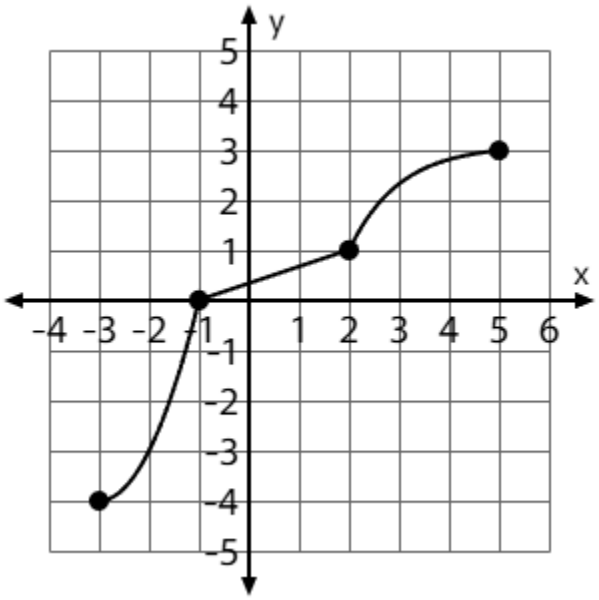
(ii) Determine the end behavior of $g(x)$ as x decreases without bound. Express your answer using the mathematical notation of a limit.

C.

(i) Based on the table, determine 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 output values of f and the change in input values of f. Refer to the values in the table in your reasoning.

FRQ 1 Practice – Brave New World



Graph of f

The figure shows the graph of increasing function f on its domain of $-3 \leq x \leq 5$.

The function g is given by $g(x) = -3e^{x+1} + 6$.

A.

(i) The function h is defined by $h(x) = (g \circ f)(x) = g\big(f(x)\big)$. 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.

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

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = 10$, 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 whether the function f has an inverse function or does not have an inverse function.

(ii) 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.

FRQ 1 Practice – Clarissa

x	-2	0	2	4	6	8
$f(x)$	4	10	25	62.5	156.25	390.625

The domain of f consists of the six real numbers $-2, 0, 2, 4, 6$, and 8. The table defines the function f for these values. The function g is given by $g(x) = \frac{3(x-1)(x+2)}{(x-3)(x+5)}$.

A.

(i) The function h is defined by $h(x) = (f \circ g)(x) = f\big(g(x)\big)$. 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.

(ii) Find the value of $f^{-1}(4)$, or indicate that it is not defined.

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = 4$, or indicate there are no such values.

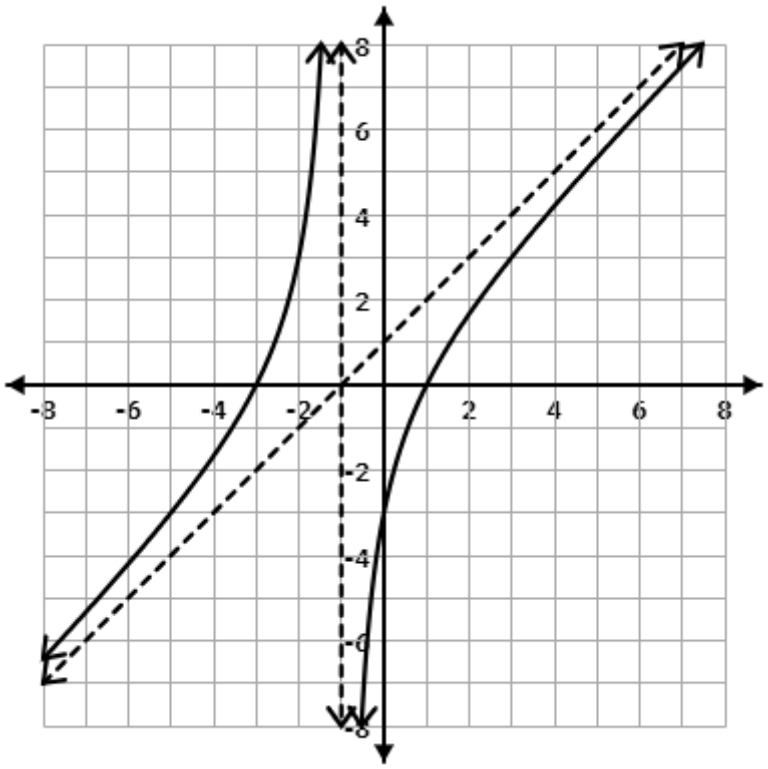
(ii) Determine the end behavior of g as x decreases without bound. Express your answer using the mathematical notation of a limit.

C.

(i) Based on the table, determine 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 output values of f and the change in input values of f. Refer to the values in the table in your reasoning.

FRQ 1 Practice – Dracula



Graph of f

The figure shows the graph of the rational function f on its domain of all real numbers $x \neq -1$. The graph of f has two x-intercepts, both at integer values of x. Further, the points $(-5,-3)$, $(0,-3)$, and $(3,3)$ are on the graph of f. The function g is given by $g(x) = \ln\left(-\frac{1}{2}x + 2\right)$.

A.

(i) The function h is defined by $h(x) = (g \circ f)(x) = g\big(f(x)\big)$. Find the value of $h(0)$ as a decimal approximation, or indicate that it is not defined. Show the work that leads to your answer.

(ii) Find all real zeros of f, or indicate there are no real zeros.

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = 1.9$, or indicate there are no such values.

(ii) Determine the behavior of g as x-values increase and get arbitrarily close to 4. Express your answer using the mathematical notation of a limit.

C.

(i) Determine whether the function f has an inverse function or does not have an inverse function.

(ii) 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.

FRQ 1 Practice – Emma

x	-9	-6	-3	0	3	6
$f(x)$	18	11	6	3	2	3

The domain of f consists of the six real numbers $-9, -6, -3, 0, 3,$ and 6. The table defines the function f for these values. The function g is given by $g(x) = -\frac{2}{5}(7)^{x-2}$.

A.

(i) The function h is defined by $h(x) = (g \circ f)(x) = g\big(f(x)\big)$. 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 the value of $f^{-1}(3)$, or indicate that it is not defined.

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = -3.1$, or indicate there are no such values.

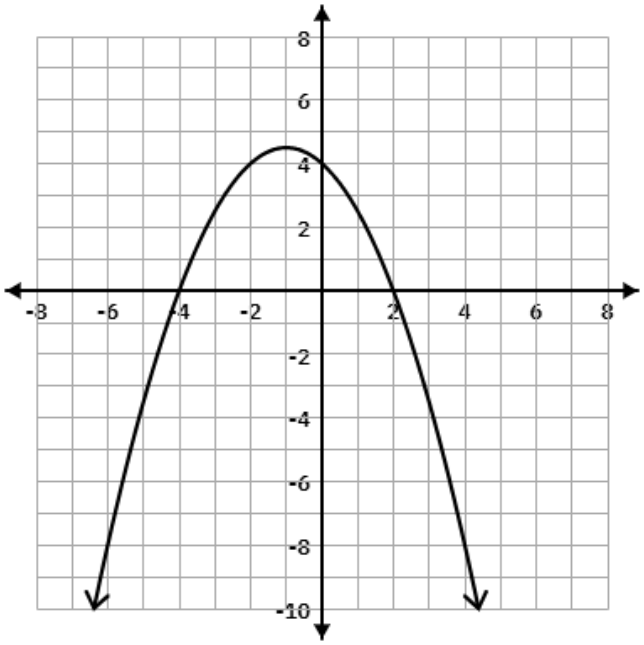
(ii) Determine the end behavior of g as x decreases without bound. Express your answer using the mathematical notation of a limit.

C.

(i) Based on the table, determine 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.

FRQ 1 Practice – Frankenstein



Graph of f

The figure shows the graph of the quadratic function f on its domain of all real numbers. The graph of f has two x-intercepts, both at integer values of x. Further, the points $(-2,4)$ and $(4,-8)$ are on the graph of f. The function g is given by $g(x) = \frac{x-7}{x^2-4}$.

A.

(i) The function h is defined by $h(x) = (f \circ g)(x) = f\big(g(x)\big)$. 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 $f(x) = 4$, or indicate there are no such values.

B.

(i) Find all values of x, as decimal approximations, for which $g(x) = 1.25$, or indicate there are no such values.

(ii) Determine the behavior of g as x-values decrease and get arbitrarily close to -2. Express your answer using the mathematical notation of a limit.

C.

(i) Determine whether the function f has an inverse function or does not have an inverse function.

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

Solutions to FRQ 1 Practice – Alice's Adventures in Wonderland

A.

(i) $h(6) = g\big(f(6)\big) = g(24) = 1441.316$

(ii) $f^{-1}(3) = 15$ since $f(15) = 3$

B.

(i) $x = -2.898$, $x = 1$, and 1.898

(ii) $\lim\limits_{x \to -\infty} g(x) = \infty$

C.

(i) Exponential

(ii) f is best modeled by an exponential function since consecutive equally spaced input values correspond with output values changing proportionally (constant ratio of $r = \frac{1}{2}$). For example, from an input of $x = 3$ to an input of $x = 6$, the ratio between output values is $\frac{24}{48} = \frac{1}{2}$, and from an input of $x = 6$ to an input of $x = 9$, the ratio between output values is $\frac{12}{24} = \frac{1}{2}$.

Solutions to FRQ 1 Practice – Brave New World

A.

(i) $h(2) = g\big(f(2)\big) = g(1) = -16.167$

(ii) $x = -2$

B.

(i) There are no such x-values. For all inputs, $g(x) < 6$.

(ii) $\lim\limits_{x \to \infty} g(x) = -\infty$

C.

(i) The function f has an inverse function.

(ii) The function f has an inverse function since every output value of f is mapped from a unique input value. For example, the output value of 1 is mapped from an input value of 2 and no other input value maps to that output value. The fact that over its domain f is always increasing guarantees this property.

Solutions to FRQ 1 Practice – Clarissa

A.

(i) $h(-2) = f\big(g(-2)\big) = f(0) = 10$

(ii) $f^{-1}(4) = -2$

B.

(i) $x = -10.262$ and $x = 5.262$

(ii) $\lim\limits_{x \to -\infty} g(x) = 3$

C.

(i) Exponential

(ii) f is best modeled by an exponential function since consecutive equally spaced input values correspond with output values changing proportionally (constant ratio of $r = \frac{5}{2}$). For example, from an input of $x = -2$ to an input of $x = 0$, the ratio between output values is $\frac{10}{4} = \frac{5}{2}$, and from an input of $x = 0$ to an input of $x = 2$, the ratio between output values is $\frac{25}{10} = \frac{5}{2}$.

Solutions to FRQ 1 Practice – Dracula

A.

(i) $h(0) = g\big(f(0)\big) = g(-3) = 1.253$

(ii) $f(-3) = 0$ and $f(1) = 0$

B.

(i) $x = -9.372$

(ii) $\lim\limits_{x \to 4^-} g(x) = -\infty$

C.

(i) The function f does not have an inverse function.

(ii) The function f does not have an inverse function since multiple input values yield the same output value. For example, $f(-5) = -3$ and $f(0) = -3$.

Solutions to FRQ 1 Practice – Emma

A.

(i) $h(3) = g\big(f(3)\big) = g(2) = -0.4$

(ii) Since $f(0) = 3$ and $f(6) = 3$, f does not have an inverse function. $f^{-1}(3)$ is not defined.

B.

(i) $x = 3.052$

(ii) $\lim\limits_{x \to -\infty} g(x) = 0$

C.

(i) Quadratic

(ii) f is best modeled by a quadratic function since consecutive equally spaced input values correspond with output values with a constant second difference. Increases of $+3$ in the input value correspond with output values with a second difference of $+2$.

Solutions to FRQ 1 Practice – Frankenstein

A.

(i) $h(1) = f\big(g(1)\big) = f(2) = 0$

(ii) $x = -2$ and $x = 0$

B.

(i) There is no value of x for which $g(x) = 1.25$

(ii) $\lim\limits_{x \to -2^+} g(x) = \infty$

C.

(i) The function f does not have an inverse function.

(ii) The function f does not have an inverse function since multiple input values yield the same output value. For example, $f(-4) = 0$ and $f(2) = 0$.