CHAPTER 4.3

Logarithmic Functions

Multiple-Choice Old Exam Questions

43 questions • 6 topics • options A–E • two questions per page

Topic 1 | Domain of Logarithmic Functions

Finding the domain, in interval notation, of logarithmic functions of rational, absolute value and exponential expressions • Questions 1–12

Q **1**

The domain of the function $f(x) = \log\left(\frac{x+2}{x-1}\right)^2$ is

A) $(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$

B) $(-\infty, 1) \cup (1, \infty)$

C) $(-\infty, -2) \cup (1, \infty)$

D) $(-\infty, \infty)$

E) $(-2, 1)$

Q **2**

The domain of the function $y = 1 + \log_2\left(\frac{2-x}{x+1}\right)$ is

A) $(-1, 2)$

B) $(-2, 2)$

C) $(-\infty, -2) \cup (1, \infty)$

D) $(-\infty, 1) \cup (2, \infty)$

E) $(-\infty, -1) \cup (2, \infty)$

Q
3

The domain of the function $f(x) = \ln\left(\frac{(1-x)^2}{4x-x^2}\right)$ is

A) $(0, 1) \cup (1, 4)$

B) $(0, 4)$

C) $(1, 4)$

D) $(0, 1)$

E) $(-\infty, 0) \cup (1, 4) \cup (4, \infty)$

Q
4

If the domain of $f(x) = \frac{\ln(x^2-x-2)}{\ln(x-2)}$ is $(a, b) \cup (b, \infty)$, then $a + b =$

A) 6

B) 7

C) 4

D) -1

E) 5

Q
5

The domain of the function $y = 3 + \log_2\left(\frac{4-2x}{x-1}\right)$ is

A) $(1, 2)$

B) $(-\infty, 1) \cup (2, \infty)$

C) $(-\infty, 1) \cup (1, \infty)$

D) $(-\infty, 1) \cup (4, \infty)$

E) $(1, 4)$

Q
6

The domain, in interval notation, of the function $f(x) = \ln(x - x^2)$ is

A) $(1, \infty)$

B) $(0, 1)$

C) $(-\infty, \infty)$

D) $(-\infty, 1)$

E) $(-\infty, 0)$

Q
7

The domain of $f(x) = \ln\left|\frac{3}{4-x^2}\right|$ is

A) $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$

B) $(-2, 2)$

C) $(-2, 0) \cup (0, 2)$

D) $(0, 2)$

E) $(-\infty, -2) \cup (2, \infty)$

Q
8

The domain of the function $f(x) = \log_4\left(\frac{|3-x|}{x^2+x-2}\right)$ is

A) $(-\infty, -2) \cup (1, 3)$

B) $(-\infty, 3) \cup (3, \infty)$

C) $(-\infty, -2) \cup (1, 3) \cup (3, \infty)$

D) $(-2, 1) \cup (1, 3)$

E) $(-\infty, -2) \cup (3, \infty)$

Q
9

The domain of the function $f(x) = \ln(e^{-x} - e^{x})$ is

A) $(-\infty, \infty)$

B) $(-\infty, 0)$

C) $(-\infty, 0]$

D) $(0, \infty)$

E) $(0, 1)$

Q
10

The domain, in interval notation, of the function $f(x) = \ln\left|\frac{x-5}{x}\right|$ is

A) $(-\infty, 0) \cup (5, \infty)$

B) $(-\infty, 0) \cup (0, 5) \cup (5, \infty)$

C) $(-\infty, 0) \cup [5, \infty)$

D) $(-\infty, \infty)$

E) $(5, \infty)$

Q
11

The domain of the function $f(x) = \ln\left(\frac{x-3}{x}\right) - 2$, in interval notation, is:

A) $(-\infty, 0) \cup (3, \infty)$

B) $(-\infty, 0) \cup (0, 3)$

C) $(3, \infty)$

D) $(-\infty, 0)$

E) $(0, 3)$

Q
12

The domain D and the range R of the function $f(x) = \left|\log_{1/3}(2 - x)\right| + 1$ are given by

A) $D = (-\infty, 2);\ R = [1, \infty)$

B) $D = (-\infty, \infty);\ R = [0, \infty)$

C) $D = (-\infty, 2) \cup (2, \infty);\ R = (-\infty, 1]$

D) $D = (2, \infty);\ R = (-\infty, \infty)$

E) $D = (-\infty, 1);\ R = (-\infty, 0]$

Topic 2 | Where the Graph Lies Above or Below the x-axis

Solving a logarithmic or exponential inequality to find where the graph is above or below the x-axis • Questions 13–20

Q **13**

The interval on which the graph of $f(x) = \left(\frac{1}{2}\right)^{x-2} - 3$ lies below the x-axis is

A) $(2 - \log_2 3, \infty)$

B) $(-\infty, 2 - \log_2 3)$

C) $(-2 + \log_2 3, \infty)$

D) $(0, \infty)$

E) $(-\infty, 3 - \log_3 2)$

Q **14**

The graph of $f(x) = 3 - 2^{-x}$ lies above the x-axis on the interval

A) $(-\log_2 3, \infty)$

B) $(-1, \infty)$

C) $(-\infty, 3)$

D) $\left(-\infty, \log_2 \frac{1}{3}\right)$

E) $(-\log_3 2, \infty)$

Q
15

The graph of the function $y = -\ln|x - 2|$ lies above the x-axis on

A) $(3, \infty)$

B) $(-\infty, 1)$

C) $(1, 3)$

D) $(1, 2) \cup (2, 3)$

E) $(-\infty, 1) \cup (3, \infty)$

Q
16

The graph of $f(x) = -\ln|x + 2|$ lies above the x-axis on the interval

A) $(-3, -2) \cup (-2, -1)$

B) $(-\infty, -3) \cup (-1, \infty)$

C) $(-2, -1) \cup (-1, \infty)$

D) $(-2, 0)$

E) $(-3, 0)$

Q
17

The graph of the function $y = \log_2|x - 2| - 1$ lies above the x-axis on

A) $(-\infty, 0) \cup (4, \infty)$

B) $(-\infty, 4) \cup (8, \infty)$

C) $(2, 6)$

D) $(2, \infty)$

E) $(-\infty, 6)$

Q
18

The graph of the function $y = \log|x - 2|$ lies below the x-axis over the interval

A) $(-\infty, 1) \cup (3, \infty)$

B) $(0, 1) \cup (1, 2)$

C) $(1, 2) \cup (2, 3)$

D) $(-\infty, 1) \cup (2, \infty)$

E) $(1, 3)$

Q
19

If $f(x) = e^x - 1$, then the graph of $f^{-1}(x)$ lies below the x-axis over the interval

A) $(-1, 0)$

B) $(-\infty, 0)$

C) $(-1, \infty)$

D) $(0, \infty)$

E) $(-\infty, -1)$

Q
20

The graph of the function $f(x) = \log_2(x-1)^2$ lies completely below the x-axis on the interval:

A) $(0, 1) \cup (1, 2)$

B) $(-\infty, -1) \cup (1, \infty)$

C) $(1, 2)$

D) $(-2, -1) \cup (-1, 0)$

E) $(-\infty, 0) \cup (2, \infty)$

Topic 3 | Increasing, Decreasing and Behavior of the Graph

Finding where a graph is increasing or decreasing, and describing the quadrants it passes through • Questions 21–26

Q **21**

The graph of the function $f(x) = |-e^{-x} + 4|$ is decreasing on the interval

A) $(-\infty, -2\ln 2)$

B) $(2\ln 2, \infty)$

C) $(-\infty, \infty)$

D) $(-2\ln 2, \infty)$

E) $(-\infty, 2\ln 2)$

Q **22**

The graph of the function $f(x) = \left|\log_{1/2}(-x + 2)\right|$ is increasing on the interval

A) $(1, 2)$

B) $(1, \infty)$

C) $(-2, -1)$

D) $(-\infty, 2)$

E) $(-\infty, 1)$

Q
23

The graph of the function $y = -\log|2 - x|$ is decreasing on the interval

A) $(2, \infty)$

B) $(-\infty, 2)$

C) $(-\infty, \infty)$

D) $(0, \infty)$

E) $(-\infty, 0)$

Q
24

The graph of the function $f(x) = |\log_2(x - 2)|$ is decreasing on the interval

A) $(0, 2)$

B) $(-\infty, 2)$

C) $(2, 3)$

D) $(3, \infty)$

E) $(-\infty, \infty)$

Q
25

The graph of $y = |\log(x+1)^2|$ is increasing on the interval

A) $(-2, -1) \cup (0, \infty)$

B) $(-\infty, -2) \cup (-1, 0)$

C) $(-2, \infty)$

D) $(-\infty, -2)$

E) $(-1, \infty)$

Q
26

The function $f(x) = \log_2\left(\frac{3+x}{8}\right)$ is

A) increasing and passing through quadrants I and IV.

B) decreasing and passing through quadrants III and IV.

C) increasing and passing through quadrants II and III.

D) decreasing and passing through quadrants II, III and IV.

E) increasing and passing through quadrants I, III and IV.

Topic 4 | Statements about Logarithmic Functions

Deciding which statement about a logarithmic function is true • Questions 27–30

Q **27**

If $f(x) = \log_2(4 - x)$, which one of the following statements is TRUE?

A) The graph of f is below the x-axis on the interval $(3, 4)$.

B) The graph of f is below the x-axis on the interval $(-\infty, 3)$.

C) The domain of f is $(4, \infty)$.

D) The domain of f is $(0, \infty)$.

E) The graph of f is above the x-axis on the interval $(3, \infty)$.

Q **28**

If $f(x) = -\log_{1/2}(-x)$, then

A) the graph of f is decreasing over the interval $(-\infty, 0)$.

B) the graph of f is neither decreasing nor increasing.

C) the point $\left(\frac{1}{2}, 1\right)$ is on the graph of f.

D) the range of f is $(0, \infty)$.

E) the x-axis is a horizontal asymptote.

Q
29

The graph of the function $f(x) = \log_{1/3}(3 - x)$

A) is increasing over its entire domain.

B) has domain $(-\infty, 0)$.

C) has the vertical asymptote $x = 2$.

D) has x-intercept -1.

E) has range $(0, \infty)$.

Q
30

If $f(x) = \log(x - 3)^2$, then:

A) the graph of f is above the x-axis on the interval $(-\infty, 2) \cup (4, \infty)$.

B) the graph of f is below the x-axis on the interval $(-3, 0) \cup (0, 3)$.

C) the graph of f is above the x-axis on the interval $(3, 4)$.

D) the line $x = 0$ is a vertical asymptote of f.

E) the graph of f has exactly one x-intercept.

Topic 5 | Graphs of Logarithmic Functions

Finding the constants or the equation of a logarithmic function from its graph • Questions 31–34

Q **31**

If the adjacent figure represents the graph of the function $f(x) = \log_b(a - x)$, then $a + b =$

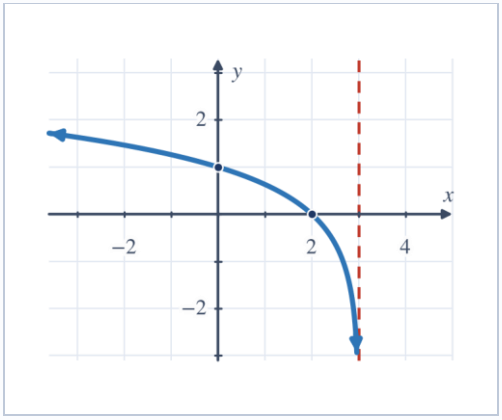
A) 6

B) 4

C) 3

D) 0

E) 9



Q **32**

If the adjacent figure is the graph of the function $f(x) = -\log_a(x + b)$, then $a + b =$

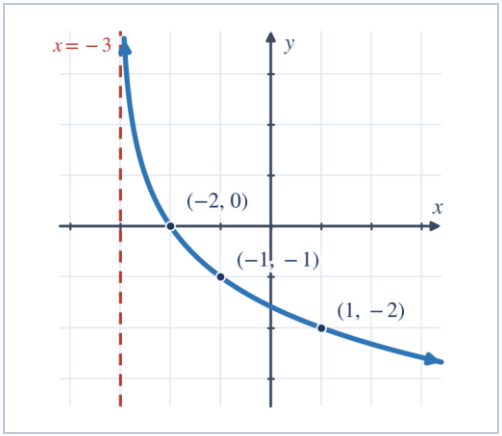
A) 5

B) -1

C) 13

D) 6

E) $\frac{7}{2}$



Q
33

The graph given on the right can be represented by

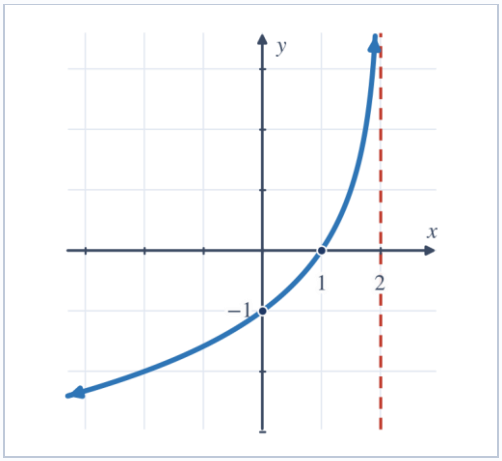
A) $y = \log_2(x - 2)$

B) $y = -\log_2|2 - x|$

C) $y = -\log_2(3 - x)$

D) $y = -\log_2(2 - x)$

E) $y = |\log_2(2 - x)|$



Q
34

If the adjacent figure represents the graph of $y = \log_2(-x + a) + b$, then $a + b =$

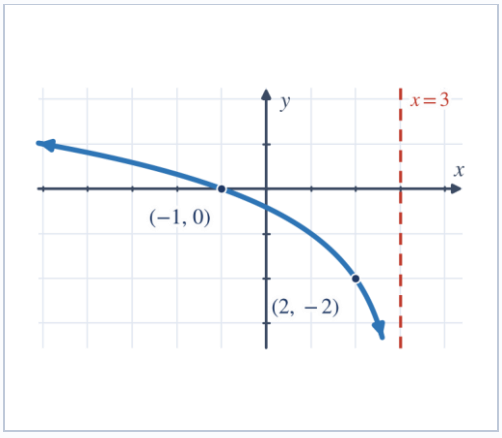
A) 1

B) 5

C) 3

D) 2

E) $\frac{3}{2}$



Topic 6 | Inverses, Intercepts and Values

Inverse functions, intercepts, and evaluating logarithmic and exponential expressions • Questions 35–43

Q **35**

If $f(x) = \log_{1/3}(1 - x)$, then $f^{-1}(-1)$ is equal to

A) -2

B) 2

C) 0

D) $\frac{2}{3}$

E) $-\frac{2}{3}$

Q **36**

If $x = e^{(-\ln 3 + 2\ln 5)}$ and $y = \ln \sqrt[4]{e^5}$, then $x + y =$

A) $\frac{115}{12}$

B) $\frac{101}{12}$

C) $\frac{30}{7}$

D) $\frac{100}{11}$

E) $\frac{100}{7}$

Q
37

If the inverse of $f(x) = 1 + e^{2x-3}$ is $f^{-1}(x) = a + b\ln(x + c)$, then $a + b + c =$

A) 4

B) -2

C) 2

D) 3

E) 1

Q
38

If $f(x) = \ln\left(2\sqrt{x} - e\right)$, then $f\left(e^{2\ln\, e}\right) =$

A) 1

B) 0

C) e

D) $\ln 2$

E) -1

Q
39

If $f(x) = \left(\frac{1}{2}\right)^x - 2$, then $f^{-1}(x)$ is equal to

A) $\log_{1/2}(x+2)$

B) $\log_2\left(x+\frac{1}{2}\right)$

C) $\log_{1/2}(x-2)$

D) $\log_2(x-2)$

E) $\log_{1/2} x$

Q
40

If $(p,\ 0)$ is the x-intercept and $(0,\ q)$ is the y-intercept of the graph of $f(x) = \log_{1/3}(3-x)$, then $p - q =$

A) 3

B) -1

C) 1

D) 2

E) $\frac{1}{3}$

Q
41

If $(a,\ 0)$ and $(0,\ b)$ are points on the graph of the function $f(x) = \log_3(x+1) - 1$, then $a + b =$

A) -2

B) 3

C) 1

D) -1

E) 2

Q
42

If $x = \ln(ke)$ is the x-intercept of the graph of $f(x) = -e^{-x+1} + 2$, then $k =$

A) $\frac{1}{2}$

B) 2

C) e

D) 1

E) $\frac{1}{e}$

Q
43

If $(u,\ 0)$ is the x-intercept and $(0,\ v)$ is the y-intercept of $y = -1 + \log_2\left(\frac{x-1}{x-4}\right)$, then $u - v =$

A) 10

B) -4

C) 4

D) 9

E) 5

Answer Key

"Original" shows the question number in the source worksheet.

Q	Original	Ans.	Value
1	11	**A**	$(-\infty, -2) \cup (-2, 1) \cup (1, \infty)$
2	12	**A**	$(-1, 2)$
3	13	**A**	$(0, 1) \cup (1, 4)$
4	15	**E**	5
5	18	**A**	$(1, 2)$
6	19	**B**	$(0, 1)$
7	22	**A**	$(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$
8	28	**C**	$(-\infty, -2) \cup (1, 3) \cup (3, \infty)$
9	30	**B**	$(-\infty, 0)$
10	31	**B**	$(-\infty, 0) \cup (0, 5) \cup (5, \infty)$
11	39	**A**	$(-\infty, 0) \cup (3, \infty)$
12	25	**A**	$D = (-\infty, 2);\ R = [1, \infty)$
13	2	**A**	$(2 - \log_2 3, \infty)$
14	5	**A**	$(-\log_2 3, \infty)$
15	6	**D**	$(1, 2) \cup (2, 3)$
16	20	**A**	$(-3, -2) \cup (-2, -1)$
17	21	**A**	$(-\infty, 0) \cup (4, \infty)$
18	27	**C**	$(1, 2) \cup (2, 3)$
19	36	**A**	$(-1, 0)$
20	38	**A**	$(0, 1) \cup (1, 2)$
21	4	**A**	$(-\infty, -2\ln 2)$
22	7	**A**	$(1, 2)$
23	9	**A**	$(2, \infty)$
24	10	**C**	$(2, 3)$
25	23	**A**	$(-2, -1) \cup (0, \infty)$
26	29	**E**	increasing and passing through quadrants I, III and IV.
27	32	**A**	The graph of f is below the x-axis on the interval $(3, 4)$.
28	33	**A**	the graph of f is decreasing over the interval $(-\infty, 0)$.
29	34	**A**	is increasing over its entire domain.
30	35	**A**	the graph of f is above the x-axis on the interval $(-\infty, 2) \cup (4, \infty)$.
31	8	**A**	6
32	24	**A**	5
33	26	**D**	$y = -\log_2(2 - x)$
34	41	**A**	1
35	1	**A**	-2
36	3	**A**	$\frac{115}{12}$
37	16	**E**	1
38	37	**A**	1

Q	Original	Ans.	Value
39	40	**A**	$\log_{1/2}(x+2)$
40	14	**A**	3
41	17	**C**	1
42	42	**A**	$\frac{1}{2}$
43	43	**A**	10