CHAPTER 4.1–4.2

Exponential Functions and the Natural Exponential

Multiple-Choice Old Exam Questions

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

Topic 1 | Finding Constants and Function Values

Using given points, inverse values or asymptotes to find the constants of an exponential function • Questions 1–10

Q **1**

If the points $(-2,\ 1)$ and $(2,\ 81)$ lie on the graph of the exponential function $y = b^{x+c}$, then $b + c =$

A) 3

B) 6

C) 5

D) -2

E) 0

Q **2**

If $f(x) = a^x$ and $f(-1) = \frac{1}{2}$, then $f^{-1}(16) =$

A) 4

B) 2

C) $\frac{1}{4}$

D) 8

E) -2

Q
3

If $f(x) = a^{2x-3}$ and $f\left(\frac{1}{2}\right) = \frac{1}{4}$, then $f^{-1}(32) =$

A) 2

B) 4

C) -2

D) -4

E) $\frac{5}{2}$

Q
4

Let $f(x) = a - 2^{bx}$. If $f^{-1}(0) = 0$ and $f^{-1}(-3) = -1$, then $a + b =$

A) -1

B) 0

C) -2

D) 1

E) 2

Q
5

If $f(x) = a^x$ is an exponential function and $f^{-1}\left(\frac{1}{9}\right) = -2$, then $f(4) =$

A) 81

B) 27

C) 16

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

E) $\frac{1}{16}$

Q
6

If $f(x) = a^x$ and the graph of f passes through the point $(-3, 64)$, then $f\left(\frac{5}{2}\right) =$

A) $\frac{1}{32}$

B) $\frac{1}{16}$

C) -16

D) -32

E) $\frac{1}{243}$

Q
7

If $f(x) = 3^{k-x}$ and $f(-3) = 3$, then $f(2) =$

A) $\frac{1}{32}$

B) $\frac{1}{9}$

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

D) $\frac{1}{81}$

E) $\frac{1}{27}$

Q
8

Let $f(x) = a^x$ be an exponential function. If $f\left(\frac{5}{2}\right) = 4\sqrt{2}$ and $f(-3) = k$, then $a + k =$

A) $\frac{17}{8}$

B) $\frac{8}{17}$

C) $\frac{17}{2}$

D) $\frac{2}{17}$

E) $\frac{65}{32}$

Q
9

If the points $(3,\ 4)$ and $(4,\ 16)$ lie on the graph of $f(x) = b^{x+3c}$, then $f(2) =$

A) 1

B) -2

C) 6

D) 7

E) -6

Q
10

If the graph of the function $f(x) = 1 + |2^x - b|$, where $b > 0$, has a horizontal asymptote at $y = 3$, then $b + 1 =$

A) 3

B) 2

C) 4

D) 5

E) 1

Topic 2 | Rewriting and Simplifying Exponential Expressions

Writing an exponential function in the form ka^x and simplifying expressions with f(x)=a^x • Questions 11–14

Q **11**

If $f(x) = a^x$, $a > 0$ and $a \neq 1$, then $\frac{f(x+2)}{f(x+1)} + \frac{2f(x+1)}{f(x)}$ is equal to:

A) $3a$

B) $2a$

C) $3a^x$

D) 3

E) $3a^{x+1}$

Q **12**

If $f(x) = 2^{3-x}$ is written in the form $f(x) = ka^x$, then

A) $k = 8,\ a = \frac{1}{2}$

B) $k = 9,\ a = \frac{1}{2}$

C) $k = 2,\ a = \frac{1}{8}$

D) $k = 8,\ a = -\frac{1}{2}$

E) $k = 8,\ a = -2$

Q
13

If $f(x) = \left(\frac{1}{2}\right)^{1-2x}$, then $f(x)$ can be written as

A) $f(x) = \frac{1}{2} \cdot 4^x$

B) $f(x) = \frac{1}{2} \cdot 4^{-x}$

C) $f(x) = \frac{1}{4} \cdot 2^x$

D) $f(x) = \frac{1}{4} \cdot 2^{-4x}$

E) $f(x) = \frac{1}{2} \cdot 2^x$

Q
14

If $f(x) = \left(\frac{2}{3}\right)^{2-3x}$ is written as $f(x) = ka^x$, then $8a - 27k =$

A) 15

B) 39

C) 19

D) -15

E) -19

Topic 3 | Range, Domain of the Inverse and Inverse Values

Finding the range of an exponential function, the domain of its inverse, and values of the inverse • Questions 15–20

Q **15**

The range of the function $f(x) = 1 + e^{-|x-2|}$ is

A) $(2, \infty)$

B) $(0, 2]$

C) $(1, \infty)$

D) $(1, 2]$

E) $(-\infty, 2]$

Q **16**

The range of the function $f(x) = 3 + 2^{-|x|}$ is

A) $(3, 4]$

B) $[3, \infty)$

C) $(-\infty, 3]$

D) $(-3, 2]$

E) $(0, 3)$

Q
17

The range of the function $f(x) = 2 - \left(\frac{1}{3}\right)^{x-1}$ is

A) $(2, \infty)$

B) $(-3, \infty)$

C) $(-\infty, 2)$

D) $(-\infty, 0)$

E) $(-\infty, 3)$

Q
18

If $f(x) = 2 + e^{x-3}$, then the domain of f^{-1} is

A) $(3, \infty)$

B) $(2, \infty)$

C) $(-\infty, 2)$

D) $[2, \infty)$

E) $(-\infty, 3)$

Q
19

If $f(x) = -\left(\frac{1}{2}\right)^{2-x} + 2$, then the domain of the inverse function f^{-1} is

A) $(-\infty, 2)$

B) $[2, \infty)$

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

D) $(2, \infty)$

E) $(-\infty, 2]$

Q
20

If $f(x) = -\left(\frac{1}{3}\right)^{x+2} + 3$, then $f^{-1}(2)$ is equal to:

A) -2

B) 1

C) 3

D) 0

E) -1

Topic 4 | Sign, Intercepts and Monotonicity

Where a graph lies below the x-axis, its intercepts, and where it is increasing • Questions 21–26

Q **21**

The graph of $f(x) = 1 - 2^{x+1}$ lies below the x-axis on the interval

A) $(-1, \infty)$

B) $(1, \infty)$

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

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

E) $(-\infty, 1)$

Q **22**

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

A) $(2, \infty)$

B) $(-\infty, 2)$

C) $(-\infty, 1)$

D) $(1, \infty)$

E) $(1, 2)$

Q
23

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

A) $(-\infty, 0)$

B) $(0, \infty)$

C) $(-\infty, 1)$

D) $(1, \infty)$

E) $(0, 1)$

Q
24

The graph of the function $y = |e^{-x} - 1|$ is increasing on the interval

A) $(0, \infty)$

B) $(-\infty, 0)$

C) $(-\infty, 1)$

D) $(-1, \infty)$

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

Q
25

If $(a,\ 0)$ is the x-intercept and $(0,\ b)$ is the y-intercept of the function $f(x) = -2^{-x+2} + 8$, then $b - a =$

A) 5

B) 0

C) -3

D) 3

E) -4

Q
26

Let $(a,\ 0)$ and $(0,\ b)$ be the x- and y-intercepts of the graph of $y = -4 + \left(\frac{1}{2}\right)^{x-3}$. Then $a + b =$

A) $\frac{11}{4}$

B) 5

C) -3

D) -6

E) 9

Topic 5 | Statements about Exponential Functions

Deciding which statement about an exponential function is true or false, and finding a constant from an asymptote • Questions 27–36

Q 27

Which one of the following statements is FALSE about the graph of the function $f(x) = \left(\frac{1}{3}\right)^{-x+1} - 9$?

A) The x-intercept is -1.

B) The y-intercept is $-\frac{26}{3}$.

C) The graph of f is increasing on the interval $(-\infty, \infty)$.

D) The graph of f has the horizontal asymptote $y = -9$.

E) The range of f is $(-9, \infty)$.

Q 28

If $g(x) = \left(\frac{1}{3}\right)^{3-x} - 27$, then which one of the following statements is TRUE?

A) The x-intercept of g is 6.

B) g is a decreasing function.

C) The range of g is $(27, \infty)$.

D) The line $y = 27$ is a horizontal asymptote of g.

E) The domain of g is $(3, \infty)$.

Q
29

Which one of the following statements is TRUE about the function $f(x) = \left(\frac{1}{2}\right)^{1-x} - 1$?

A) The range of f is $(-1, \infty)$.

B) The x-intercept of f is -1.

C) f is decreasing on $(-\infty, \infty)$.

D) The domain of f is $(-\infty, 1)$.

E) The y-intercept of f is -1.

Q
30

If $a > 0$ and $a \neq 1$, which one of the following statements is TRUE?

A) The base of the exponential function $f(x) = a^x$ whose graph contains the point $\left(-4, \frac{1}{16}\right)$ is 2.

B) The range of $f(x) = a^x$ is $[0, \infty)$.

C) The graph of $f(x) = a^{x+2}$ has $x = 2$ as a vertical asymptote.

D) The graph of $y = a^x$ is the same as the graph of $y = -\left(\frac{1}{a}\right)^x$.

E) The domain of $f(x) = a^x$ is $(0, \infty)$.

Q
31

Which one of the following statements is FALSE about the function $f(x) = -2^{x-1} + 4$?

A) The graph of f has x-intercept 3 and y-intercept 3.

B) f is a decreasing function over the interval $(-\infty, \infty)$.

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

D) The horizontal asymptote of the graph of f is $y = 4$.

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

Q
32

Which of the following statements is NOT TRUE about the function $f(x) = -\left(\frac{1}{8}\right)^x$?

A) f is a one-to-one function.

B) The graph of f is asymptotic to the negative x-axis.

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

D) The function f is increasing on $(-\infty, \infty)$.

E) The graph of f passes through the point $(0, -1)$.

Q
33

The graph of $y = 2^{4-x} - 4$

A) is below the x-axis on the interval $(2, \infty)$.

B) is increasing on the interval $(-\infty, \infty)$.

C) has an x-intercept at $(12, 0)$.

D) is decreasing on the interval $(0, \infty)$ only.

E) has a horizontal asymptote $y = 0$.

Q
34

Which one of the following statements is TRUE about the function $f(x) = -\left(\frac{1}{5}\right)^{x-3} + 25$?

A) The range is $(-\infty, 25)$.

B) The x-intercept is -1.

C) The y-intercept is -10.

D) The graph of f is decreasing.

E) The graph of f has the horizontal asymptote $y = -25$.

Q
35

Which one of the following statements is TRUE about $f(x) = 1 - 2^{-|x|}$?

A) The range of $f(x)$ is $[0, 1)$.

B) The range of $f(x)$ is $(-1, 0]$.

C) The graph of $f(x)$ is increasing on $(-\infty, 0)$.

D) The graph of $f(x)$ is decreasing on $(0, \infty)$.

E) The line $y = -1$ is an asymptote to the graph of $f(x)$.

Q
36

For $a > 1$, if $y = 3$ is the asymptote of the function $f(x) = -a^{-|x|} + b$ and $f(1) = \frac{5}{2}$, then $a + b =$

A) -1

B) 2

C) 5

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

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

Topic 6 | Graphs of Exponential Functions

Finding the constants or the equation of an exponential function from its graph • Questions 37–42

Q **37**

If the function $f(x) = 2^{(ax+b)} + c$ represents the graph below, then $a + b + c =$

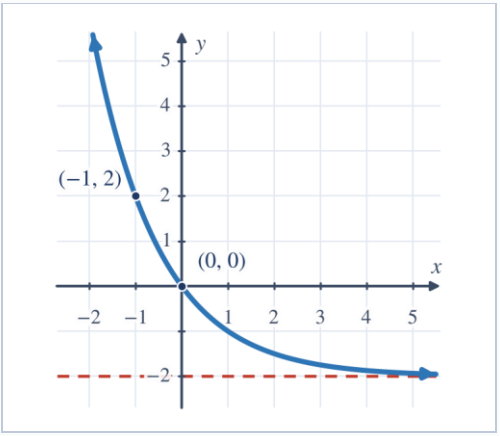
A) -2

B) -1

C) 0

D) 2

E) 1



Q **38**

The equation of the adjacent graph is

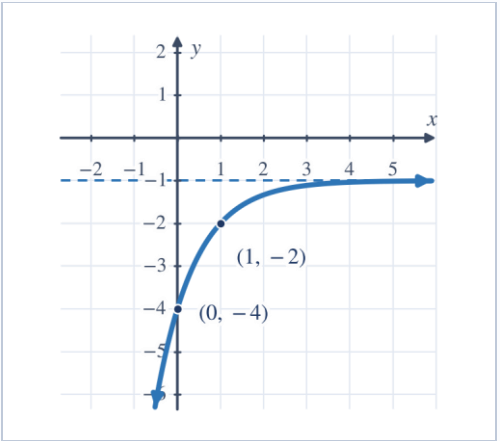
A) $y = -3^{1-x} - 1$

B) $y = -3^{x+1} - 1$

C) $y = 3^{x-1} - 1$

D) $y = -\left(\frac{1}{3}\right)^{1-x} - 1$

E) $y = 3^{1+x} - 1$



Q
39

If $y = -\left(\frac{1}{2}\right)^{ax+b} + 3$ is the function of the graph below, then $a + b =$

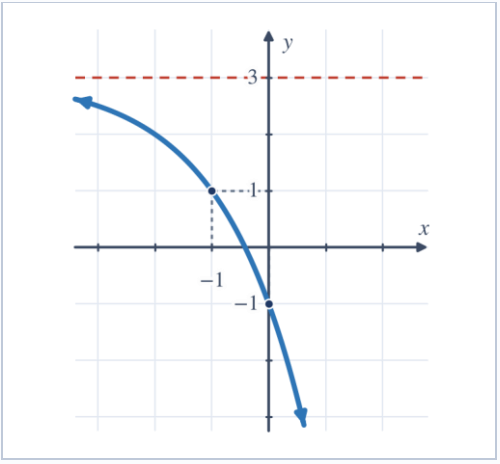
A) -3

B) -1

C) 1

D) 2

E) -2



Q
40

The equation of the adjacent graph is

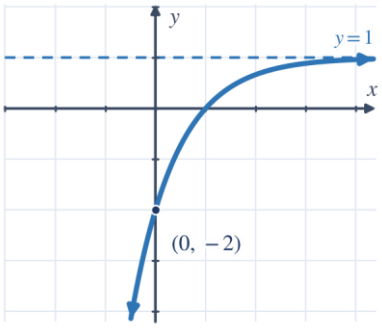
A) $y = -\left(\frac{1}{3}\right)^{x-1} + 1$

B) $y = -\left(\frac{1}{3}\right)^{x+1} + 1$

C) $y = -\left(\frac{1}{3}\right)^{x-1} - 1$

D) $y = -\left(\frac{1}{3}\right)^{x+1} - 1$

E) $y = -\left(\frac{1}{3}\right)^{1-x} + 1$



Q
41

The adjacent figure represents the graph of:

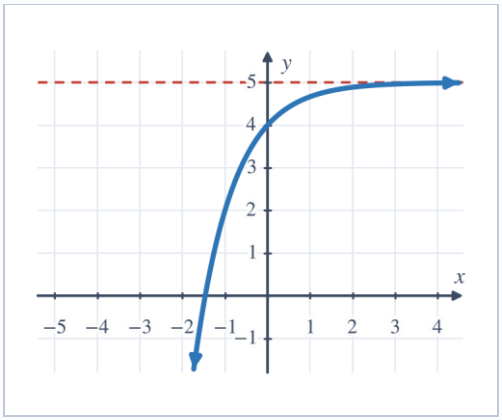
A) $5 - 3^{-x}$

B) $5 + 3^{-x}$

C) $-3 + 5^{x}$

D) $5 - 3^{x}$

E) $3 + 5^{x}$



Q
42

The adjacent graph represents the function

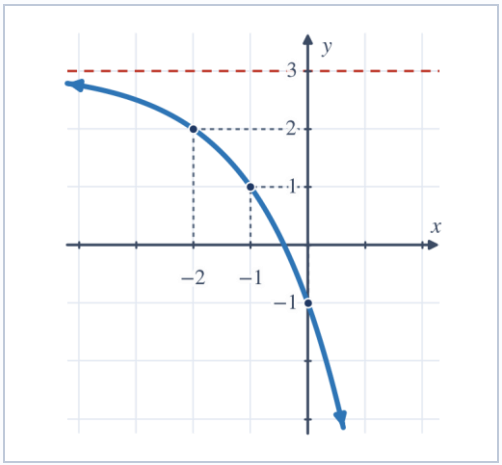
A) $y = -2^{x+2} + 3$

B) $y = -2^{2-x} + 3$

C) $y = 2^{-x} - 3$

D) $y = 2^{x+1} - 3$

E) $y = -2^{-x} + 5$



Answer Key

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

Q	Original	Ans.	Value
1	1	**C**	5
2	3	**A**	4
3	4	**B**	4
4	8	**A**	-1
5	15	**A**	81
6	18	**A**	$\frac{1}{32}$
7	20	**D**	$\frac{1}{81}$
8	27	**A**	$\frac{17}{8}$
9	37	**A**	1
10	41	**A**	3
11	22	**A**	$3a$
12	25	**A**	$k = 8,\ a = \frac{1}{2}$
13	29	**A**	$f(x) = \frac{1}{2} \cdot 4^x$
14	35	**A**	15
15	2	**D**	$(1, 2]$
16	19	**A**	$(3, 4]$
17	5	**C**	$(-\infty, 2)$
18	7	**B**	$(2, \infty)$
19	9	**A**	$(-\infty, 2)$
20	6	**A**	-2
21	10	**A**	$(-1, \infty)$
22	11	**A**	$(2, \infty)$
23	38	**A**	$(-\infty, 0)$
24	39	**A**	$(0, \infty)$
25	24	**A**	5
26	32	**B**	5
27	17	**A**	The x-intercept is -1.
28	21	**A**	The x-intercept of g is 6.
29	23	**A**	The range of f is $(-1, \infty)$.
30	28	**A**	The base of the exponential function $f(x) = a^x$ whose graph contains the point $\left(-4, \frac{1}{16}\right)$ is 2.
31	31	**A**	The graph of f has x-intercept 3 and y-intercept 3.
32	33	**B**	The graph of f is asymptotic to the negative x-axis.
33	34	**A**	is below the x-axis on the interval $(2, \infty)$.
34	36	**A**	The range is $(-\infty, 25)$.
35	40	**A**	The range of $f(x)$ is $[0, 1)$.

Q	Original	Ans.	Value
36	42	**C**	5
37	12	**A**	-2
38	13	**A**	$y = -3^{1-x} - 1$
39	14	**A**	-3
40	16	**A**	$y = -\left(\frac{1}{3}\right)^{x-1} + 1$
41	26	**A**	$5 - 3^{-x}$
42	30	**A**	$y = -2^{x+2} + 3$