MCQ_Review_Unit_2

1. The functions f and g are given by $f(x) = x^2 + 1$ and $g(x) = 4x - 1$. Which of the following is an expression for $f(g(x))$?

   (A) $x^2 + 4x$

   (B) $4x^2 + 3$

   (C) $16x^2 - 8x + 2$

   (D) $4x^3 - x^2 + 4x - 1$

2. Two functions f and g are composed such that $f(g(x)) = 4\sqrt{x-3} + 2$. Which of the following could be the expressions for $f(x)$ and $g(x)$?

   (A) $f(x) = \sqrt{x}$ and $g(x) = 4x - 3$

   (B) $f(x) = 4x - 3$ and $g(x) = \sqrt{x}$

   (C) $f(x) = \sqrt{x-3}$ and $g(x) = 4x + 2$

   (D) $f(x) = 4x + 2$ and $g(x) = \sqrt{x-3}$

3. The functions f and g are given by $f(x) = \frac{1}{x}$ and $g(x) = \sqrt{x}$. What is the domain of the function h given by $h(x) = f(g(x))$?

   (A) All real numbers

   (B) All real numbers not equal to 0

   (C) All real numbers greater than 0

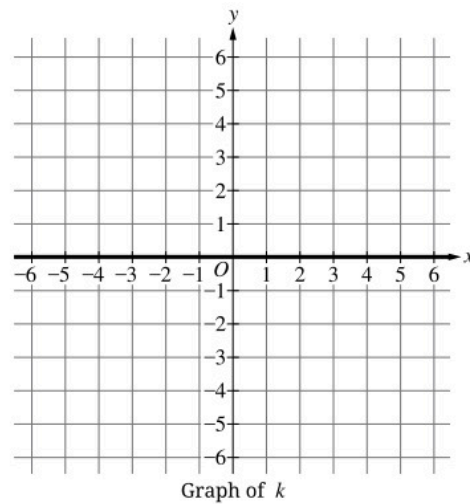   (D) All real numbers greater than or equal to 0

4.
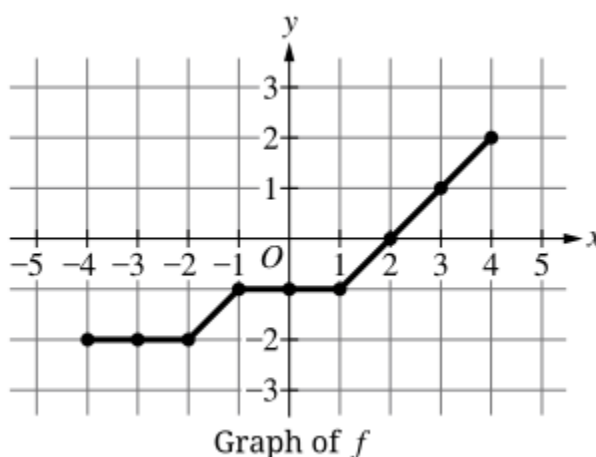
Graph of f

   The piecewise-linear function f, defined on $-4 \le x \le 4$, is shown in the graph. The function g is given by $g(x) = x + 3$. Which of the following is the graph of $y = f(g(x))$?

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(A)

(B)

(C)

(D)

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5.

Graph of f

Graph of g

Graph of h

Graph of k
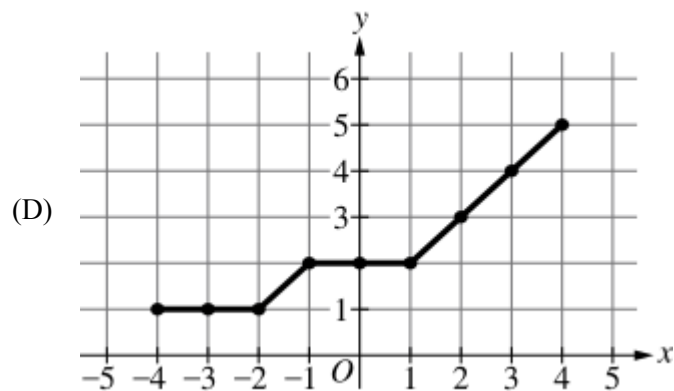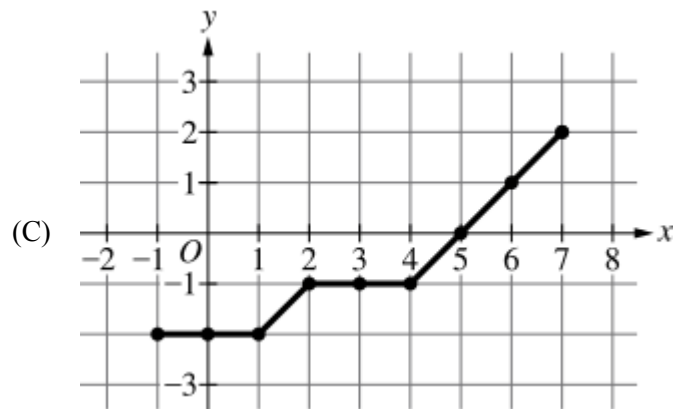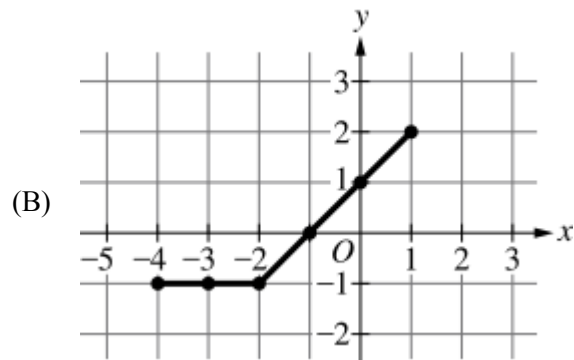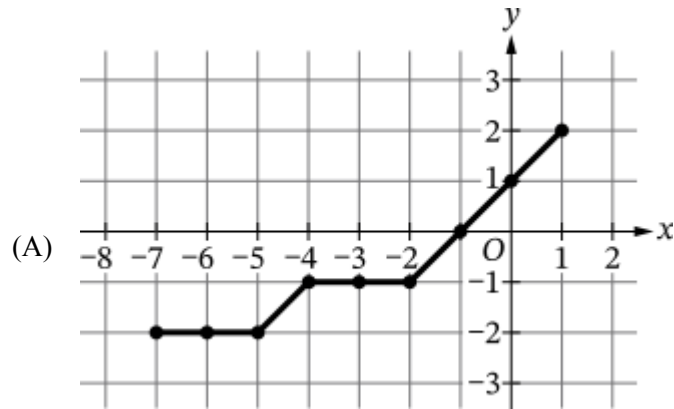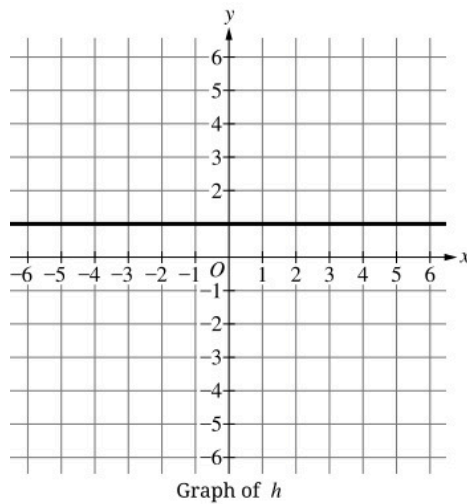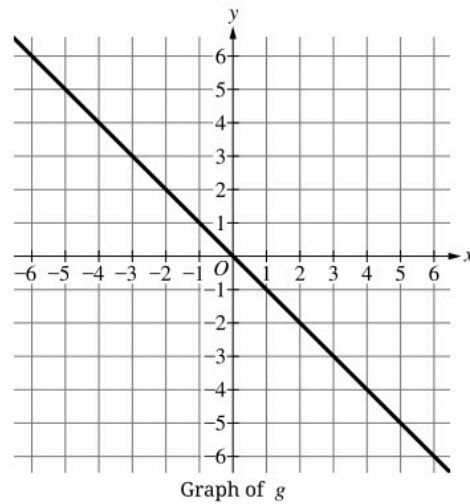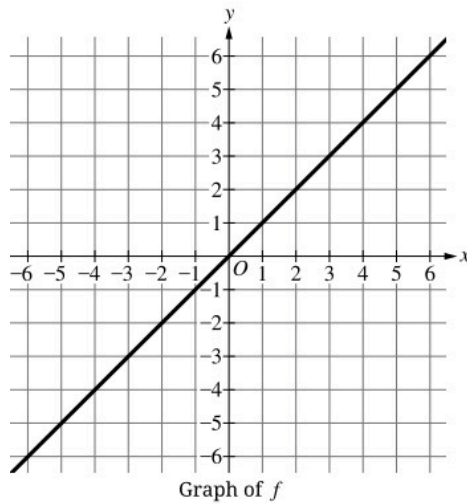
The function p (not shown) is a polynomial function of degree 3. The graphs of four functions f, g, h, and k are given.

The output values of p are the same as the output values of the composition function when p is composed with one of these functions as the input function. For which of the functions is this statement true?

(A) f

(B) g

(C) h

(D) k

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6.

x	-1	0	1
$f(x)$	0	1	-1

The table gives values of the function f for selected values of x. The function g is given by $g(x) = x^2$. Which of the following gives values of $g(f(x))$ for $x = -1$, $x = 0$, and $x = 1$?

(A)

x	-1	0	1
$g(f(x))$	-1	1	-1

(B)

x	-1	0	1
$g(f(x))$	0	0	-1

(C)

x	-1	0	1
$g(f(x))$	0	1	1

(D)

x	-1	0	1
$g(f(x))$	1	1	0

7. Which of the following tables provides evidence that f is an exponential function if $y = f(x)$?

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(A)

x	y
1	3
2	6
3	9
4	12

(B)

x	y
5	30
6	42
7	56
8	72

(C)

x	$\ln y$
1	1
2	3
3	9
4	27

(D)

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x	$\ln y$
5	50
6	60
7	70
8	80

8. The functions f and g are given by $f(x) = 4^{(5x-1)}$ and $g(x) = 8^{(x/4)}$. When solving the equation $f(x) = g(x)$, the functions can be rewritten in equivalent forms so that the equation can be solved without the use of technology. Which of the following are equivalent definitions of f and g that aid in solving $f(x) = g(x)$ without the use of technology?

(A) $f(x) = 2^{(\log_2 4 \cdot (5x-1))}$ and $g(x) = 2^{(\log_2 8 \cdot (x/4))}$

(B) $f(x) = 2^{(\log_2 8 \cdot (5x-1))}$ and $g(x) = 2^{(\log_2 4 \cdot (x/4))}$

(C) $f(x) = 4^{(\log_2 4 \cdot (5x-1))}$ and $g(x) = 8^{(\log_2 8 \cdot (x/4))}$

(D) $f(x) = 2 \cdot 4^{(\log_2 4 \cdot (5x-1))}$ and $g(x) = 8^{(\log_2 8 \cdot (x/4))}$

9. The function f is given by $f(x) = 4 \cdot 2^{(x-3)}$. If the function g is the inverse of f, which of the following could define $g(x)$?

(A) $\log_8 x + 3$

(B) $\log_2(4x) + 3$

(C) $\log_2\left(\frac{x}{4}\right) + 3$

(D) $\log_2\left(\frac{x-3}{4}\right)$

10. Iodine-131 has a half-life of 8 days. In a particular sample, the amount of iodine-131 remaining after d days can be modeled by the function h given by $h(d) = A_0(0.5)^{(d/8)}$, where A_0 is the amount of iodine-131 in the sample at time $d = 0$. Which of the following functions k models the amount of iodine-131 remaining after t hours, where A_0 is the amount of iodine-131 in the sample at time $t = 0$? (There are 24 hours in a day, so $t = 24d$.)

(A) $k(t) = A_0(0.5)^{(t/24)}$

(B) $k(t) = A_0\left(0.5^{(1/24)}\right)^{(8t)}$

(C) $k(t) = A_0\left(0.5^{(24)}\right)^{(t/8)}$

(D) $k(t) = A_0\left(0.5^{(1/192)}\right)^{t}$

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11. The value, in millions of dollars, of transactions processed by an online payment platform is modeled by the function M. The value is expected to increase by 6.1% each quarter of a year. At time $t = 0$ years, 54 million dollars of transactions were processed. If t is measured in years, which of the following is an expression for $M(t)$? (Note: A quarter is one fourth of a year.)

   (A) $54(0.061)^{(t/4)}$

   (B) $54(0.061)^{(4t)}$

   (C) $54(1.061)^{(t/4)}$

   (D) $54(1.061)^{(4t)}$

12. The function g is a function of the form $g(x) = a \cdot b^x$, where $a \neq 0$ and $b > 0$. The function f is given by $f(x) = g(x) + 4$. Which of the following statements is true?

   (A) The output values of both f and g are proportional over equal-length input-value intervals.

   (B) The output values of f only, not g, are proportional over equal-length input-value intervals.

   (C) The output values of g only, not f, are proportional over equal-length input-value intervals.

   (D) The output values of neither f nor g are proportional over equal-length input-value intervals.

13. The value $(2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 4.7)$ is the output value of an exponential function of the form $f(x) = a \cdot b^x$, where a and b are constants. Which of the following describes the function and input value that corresponds to this output value?

   (A) The exponential function has an initial value of 1 and a base of $(2 \cdot 4.7)$, and the input value is 5.

   (B) The exponential function has an initial value of 2 and a base of 2, and the input value is 4.7.

   (C) The exponential function has an initial value of 4.7 and a base of 2, and the input value is 4.7.

   (D) The exponential function has an initial value of 4.7 and a base of 2, and the input value is 5.

14. The function f is given by $f(x) = 5 \cdot (0.7)^x$. Which of the following describes f ?

   (A) The function f models exponential decay and $\lim\limits_{x \to \infty} f(x) = 0$.

   (B) The function f models exponential decay and $\lim\limits_{x \to \infty} f(x) = \infty$.

   (C) The function f models exponential growth and $\lim\limits_{x \to \infty} f(x) = 0$.

   (D) The function f models exponential growth and $\lim\limits_{x \to \infty} f(x) = \infty$.

15. The function f is given by $f(x) = 2^x$, and the function g is given by $g(x) = \frac{f(x)}{8}$. For which of the following transformations is the graph of g the image of the graph of f ?

   (A) A horizontal translation to the left 3 units

   (B) A horizontal translation to the right 3 units

   (C) A vertical translation up $\frac{1}{8}$ unit

   (D) A vertical translation down $\frac{1}{8}$ unit

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16.

x	0	1	2	3	4
$f(x)$	$\frac{3}{4}$	$\frac{3}{2}$	3	6	12

The exponential function f is defined by $f(x) = ab^x$, where a and b are positive constants. The table gives values of $f(x)$ at selected values of x. Which of the following statements is true?

(A) f demonstrates exponential decay because $a > 0$ and $0 < b < 1$.

(B) f demonstrates exponential decay because $a > 0$ and $b > 1$.

(C) f demonstrates exponential growth because $a > 0$ and $0 < b < 1$.

(D) f demonstrates exponential growth because $a > 0$ and $b > 1$.

17.

x	0	2	4	6
$f(x)$	3	48	768	12,288

The table gives values of the function f for selected values of x. Which of the following expressions could define $f(x)$?

(A) $2 + 4^x$

(B) $3 \cdot 4^x$

(C) $3 \cdot 16^x$

(D) $4 \cdot 3^x$

18. In a certain town, the population in the year 2000 was about $30{,}000$. The population grows at a rate of 2.3% per year, and time is measured in years since 2000. Which of the following functions gives output values, in years since 2000, for input values of the town's population p ?

(A) $f(p) = 30{,}000 \cdot (1.023)^p$

(B) $g(p) = \log_{1.023}\left(\frac{p}{30{,}000}\right)$

(C) $h(p) = \frac{p - 30{,}000}{2.3}$

(D) $k(p) = 30{,}000 \cdot \log_{1.023} p$

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19. The function m is given by $m(x) = 36^{(x/2)}$. Which of the following expressions could also define $m(x)$?

   (A) 6^x

   (B) $6 \cdot 6^x$

   (C) 18^x

   (D) $18 \cdot 36^x$

20. The function h is given by $h(x) = 5 \cdot 3^{(-x/2)}$. What is the value of $h(1)$?

   (A) $-5\sqrt{3}$

   (B) $\dfrac{1}{\sqrt{15}}$

   (C) $\dfrac{5}{9}$

   (D) $\dfrac{5}{\sqrt{3}}$

21. The function k is given by $k(x) = 9^x$. Which of the following expressions also defines $k(x)$?

   (A) $2^{(3x)}$

   (B) $3^{(2x)}$

   (C) $3^{(3x)}$

   (D) $3^{(x/2)}$

22. The function f is given by $f(x) = 3^x$. The function g is given by $g(x) = (f(x))^b$, where $b < 0$. Which of the following describes the relationship between the graphs of f and g ?

   (A) The graph of g is a combination of a horizontal dilation of the graph of f and a reflection over the x-axis.

   (B) The graph of g is a combination of a horizontal dilation of the graph of f and a reflection over the y-axis.

   (C) The graph of g is a combination of a vertical dilation of the graph of f and a reflection over the x-axis.

   (D) The graph of g is a combination of a vertical dilation of the graph of f and a reflection over the y-axis.

23. Water hyacinth is an invasive plant species found in many lakes that typically grows at a rate of 7% per day. As part of a study, a scientist introduces a 150-gram sample of water hyacinth into a testing pool. Which of the following functions gives the amount of water hyacinth in the testing pool t weeks after the sample is introduced? (Note: 1 week is 7 days.)

   (A) $f(t) = 150\left(1 + 0.07^{(1/7)}\right)^t$

   (B) $g(t) = 150\left(1.07^{(1/7)}\right)^t$

   (C) $h(t) = 150\left(1 + 0.07^{(7)}\right)^t$

   (D) $k(t) = 150\left(1.07^{(7)}\right)^t$

24. The function f is given by $f(x) = x^2 + 1$, and the function g is given by $g(x) = \frac{(x-3)}{x}$. Which of the following is an expression for $f(g(x))$?

(A) $\frac{x^3 - 3x^2 + x - 3}{x}$

(B) $\frac{x^2 - 2}{x^2 + 1}$

(C) $\frac{x^2 - 6x + 9}{x^2} + 1$

(D) $\frac{x^2 - 8}{x^2}$

25.

| x	$g(x)$
-2	4
0	$\frac{1}{2}$
3	-2
4	3
36	9

The table gives values of the function g for selected values of x. The function f is given by $f(x) = 3^x + x^2$. What is the value of $f(g(3))$?

(A) -72

(B) $\frac{37}{9}$

(C) 9

(D) 97

26. The functions f and g are given by $f(x) = 2^x$ and $g(x) = 2^x \cdot 2^a$, where $a > 0$. Which of the following describes the relationship between the graph of f and the graph of g ?

(A)   The graph of g is a vertical translation of the graph of f by a units.

(B)   The graph of g is a horizontal translation of the graph of f by a units.

(C)   The graph of g is a vertical translation of the graph of f by $-a$ units.

(D)   The graph of g is a horizontal translation of the graph of f by $-a$ units.

27.
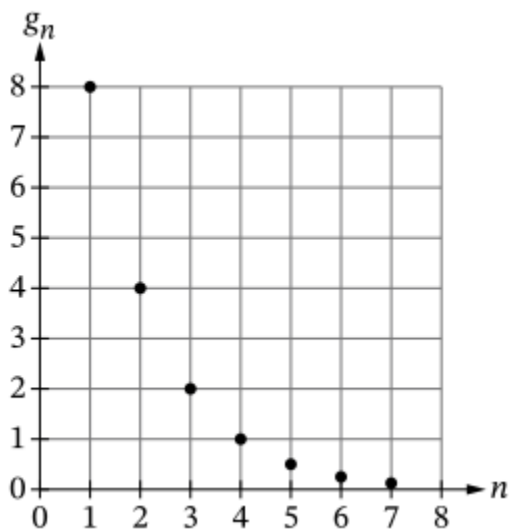
Values of the terms of a geometric sequence g_n are graphed in the figure. Which of the following is an expression for the nth term of the geometric sequence?

(A) $g_n = 4\left(\frac{1}{2}\right)^{(n-2)}$

(B) $g_n = 8(2)^{(n-1)}$

(C) $g_n = 8\left(\frac{1}{2}\right)^n$

(D) $g_n = 16\left(\frac{1}{2}\right)^{(n-1)}$

28.   The function g has the property that for each time the input values double, the output values increase by 1. Which of the following could be the graph of $y = g(x)$ in the xy-plane?
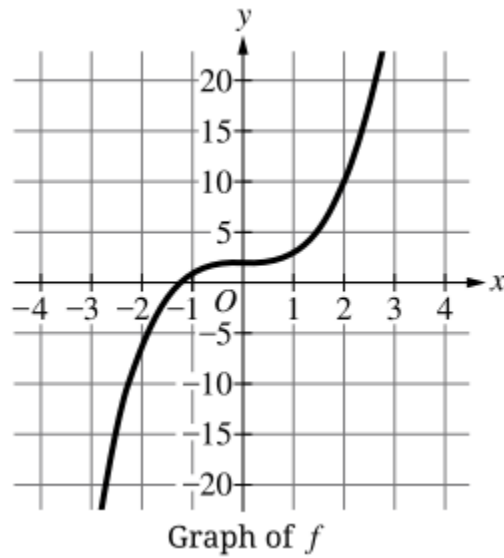
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(A)

(B)

(C)

(D)
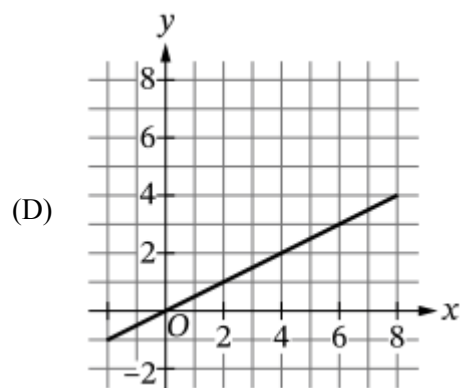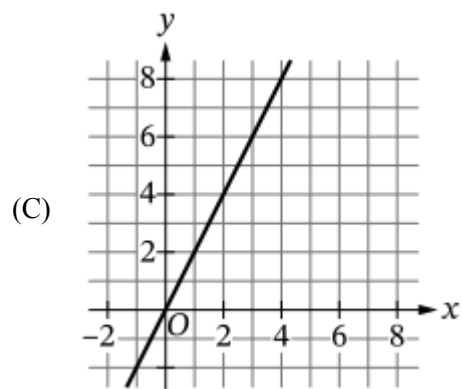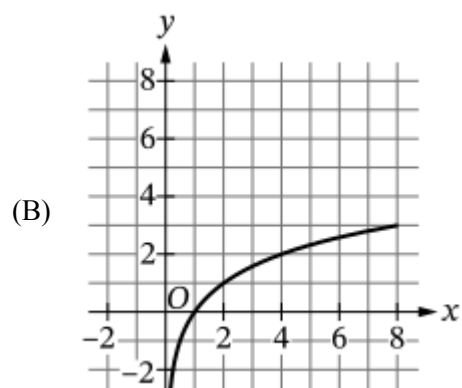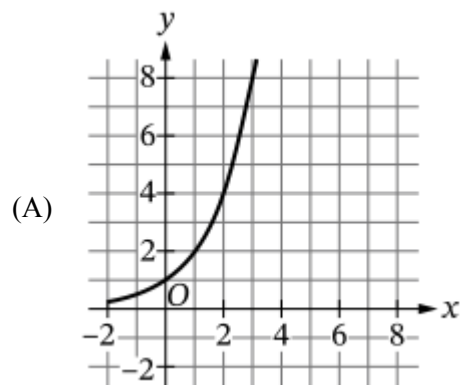
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29. The function f is defined by $f(x) = \sqrt{4 - x^2}$ for $-2 \leq x \leq 0$. Which of the following expressions defines $f^{-1}(x)$?

    (A) $-\sqrt{4 - x^2}$ for $-2 \leq x \leq 0$

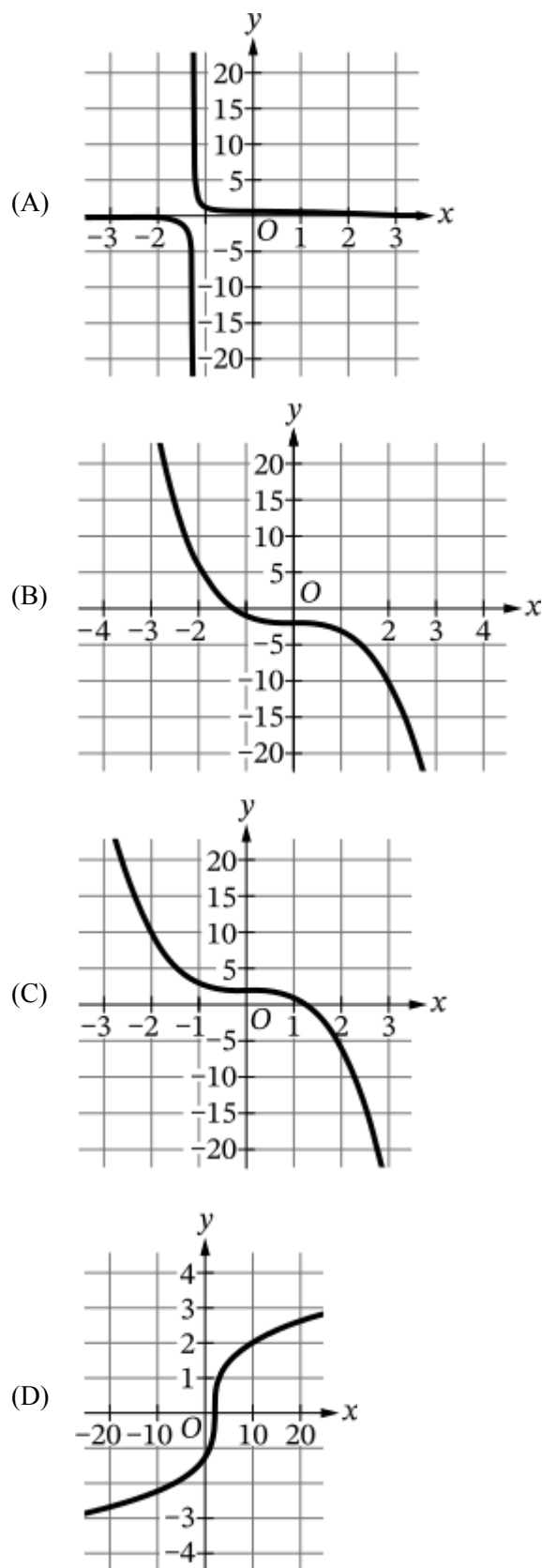   (B) $\sqrt{4 - x^2}$ for $-2 \leq x \leq 0$

    (C) $-\sqrt{4 - x^2}$ for $0 \leq x \leq 2$

    (D) $\sqrt{4 - x^2}$ for $0 \leq x \leq 2$

30.

Graph of f

The graph of the function $y = f(x)$ is given. Which of the following is the graph of $y = f^{-1}(x)$?

(A)

(B)

(C)

(D)

31. The function g is given by $g(x) = \frac{4x+6}{5}$. Which of the following defines $g^{-1}(x)$?

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(A) $\frac{5}{4x+6}$

(B) $\frac{5x+6}{4}$

(C) $\frac{5x}{4} - 6$

(D) $\frac{5x-6}{4}$

32. The function f is defined by $f(x) = 4x^2 + 3$ for $x \geq 0$. Which of the following expressions defines the inverse function of f ?

(A) $f^{-1}(x) = \frac{x^2}{4} - 3$ for $x \geq 0$

(B) $f^{-1}(x) = \sqrt{\frac{x}{4}} - 3$ for $x \geq 0$

(C) $f^{-1}(x) = \sqrt{\frac{x-3}{4}}$ for $x \geq 3$

(D) $f^{-1}(x) = \frac{\sqrt{x-3}}{4}$ for $x \geq 3$

33. A water tank is leaking water from a crack in its base. The amount of water, in hundreds of gallons, remaining in the tank t hours after the crack formed can be modeled by W, a decreasing function of time t. Which of the following gives a verbal representation of the function W^{-1}, the inverse function of W ?

(A) W^{-1} is an increasing function of the amount of time after the crack formed.

(B) W^{-1} is a decreasing function of the amount of time after the crack formed.

(C) W^{-1} is an increasing function of the amount of water in the tank.

(D) W^{-1} is a decreasing function of the amount of water in the tank.

34. The function f is given by $f(x) = \log_2(\log_3 x)$. Which of the following is an expression for $f^{-1}(x)$?

(A) $2^{(3^x)}$

(B) $3^{(2^x)}$

(C) $2 \cdot 3^x$

(D) $3 \cdot 2^x$

35.

x	1	2	3	4
$f(x)$	2	4	8	16

The table gives values of the function f for selected values of x. Which of the following is a verbal representation of $f^{-1}(x)$, the inverse function of f ?

(A) $f^{-1}(x)$ is logarithmic with input values increasing by 1 every time output values double.

(B) $f^{-1}(x)$ is logarithmic with output values increasing by 1 every time input values double.

(C) $f^{-1}(x)$ is exponential with input values increasing by 1 every time output values double.

(D) $f^{-1}(x)$ is exponential with output values increasing by 1 every time input values double.

36. The exponential function g is given by $g(x) = 5^x$. Which of the following expressions defines $g^{-1}(x)$?

(A) $\log_5 x$

(B) $\log_x 5$

(C) $\sqrt[5]{x}$

(D) $\sqrt[x]{5}$

37.
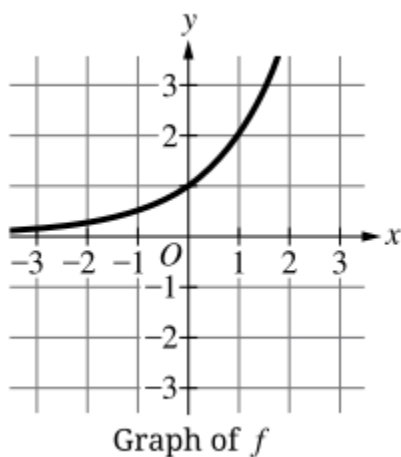
Graph of f

The graph of the exponential function f is given. Which of the following could be a table of values for the inverse function of f ?

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(A)

x	5	2
$f^{-1}(x)$	32	4

(B)

x	5	2
$f^{-1}(x)$	25	4

(C)

x	25	4
$f^{-1}(x)$	5	2

(D)

x	32	4
$f^{-1}(x)$	5	2

38. The function f is given by $f(x) = \log_3 x$. Which of the following could be the graph of $y = f^{-1}(x)$?

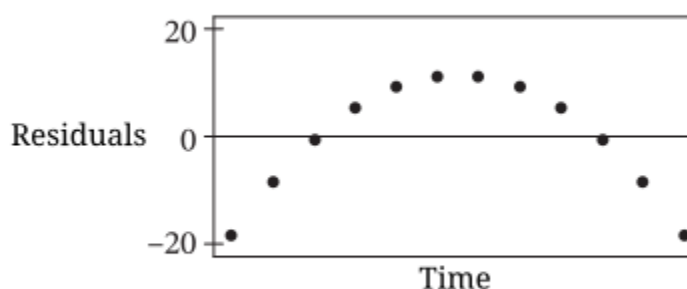# MCQ_Review_Unit_2

(A)

(B)

(C)

(D)
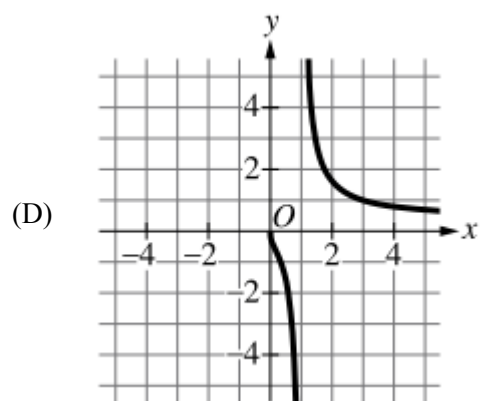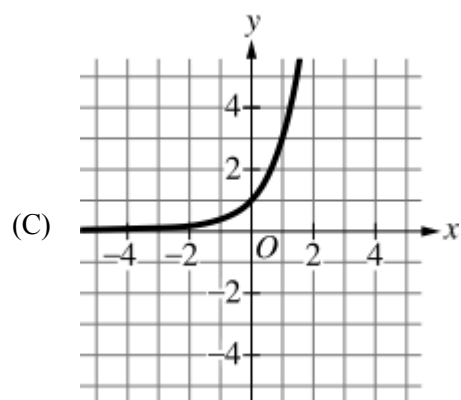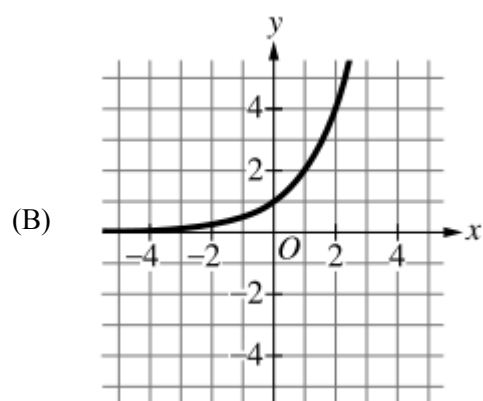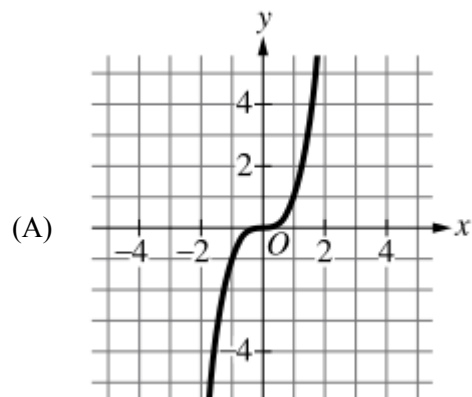
MCQ_Review_Unit_2

39. The function f is an increasing function such that every time the output values of the function f increase by 1, the corresponding input values multiply by 4. Which of the following could define $f(x)$?

(A) x^4

(B) 4^x

(C) $\sqrt[4]{x}$

(D) $\log_4 x$

40.

A food vendor developed a new sandwich type for sale. The vendor made estimates about the sales of the new sandwich type over time. A linear regression was used to develop a model for the sales over time. The figure shows a graph of the residuals of the linear regression. Which of the following statements about the linear regression is true?

(A) The linear model is not appropriate, because there is a clear pattern in the graph of the residuals.

(B) The linear model is not appropriate, because the graph of the residuals has more points above 0 than below 0.

(C) The linear model is appropriate, because there is a clear pattern in the graph of the residuals.

(D) The linear model is appropriate, because the positive residual farthest from 0 and the negative residual farthest from 0 are about the same distance, although more points are above 0 than below 0.

41. The range of function f is the positive real numbers. The function g is given by $g(x) = \ln(f(x))$. Solutions to which of the following equations are useful in solving $g(x) = 2$?

(A) $f(x) = 2$

(B) $f(x) = e^2$

(C) $f(x) = 10^2$

(D) $f(x) = \frac{2}{\ln x}$

42. To solve the equation $\log_8(x - 3) + \log_8(x + 4) = 1$, one method is to apply the properties of logarithms to write a new equation that can be used to identify possible solutions. Of the following, which is such an equation?

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   (A) $2x + 1 = 8$

   (B) $\frac{x-3}{x+4} = 8$

   (C) $x^2 - 12 = 8$

   (D) $x^2 + x - 12 = 8$

43.   Which of the following is the inverse of the function f given by $f(x) = 4\log_2(x+3) - 1$?

   (A) $g(x) = \frac{1}{4}(2^x + 1) - 3$

   (B) $g(x) = \frac{1}{4} \cdot 2^{(x+1)} - 3$

   (C) $g(x) = 2^{\left(\frac{x}{4}+1\right)} - 3$

   (D) $g(x) = 2^{\left(\frac{x+1}{4}\right)} - 3$

44.   What are all values of x for which $\ln\left(x^3\right) - \ln x = 4$?

   (A) $x = -2$ and $x = 2$

   (B) $x = -e^2$ and $x = e^2$

   (C) $x = e^2$ only

   (D) $x = e^4$

45.   An equation involves the expression $\log_9(27^x)$, which is equivalent to a rational multiple of x. By rewriting the expression in an equivalent form, the value of the rational number can be determined without use of a calculator or complicated calculations. Which of the following is an equivalent expression that satisfies this requirement?

   (A) $x\ln\left(\frac{27}{9}\right)$

   (B) $x\log_3\left(\frac{27}{9}\right)$

   (C) $\frac{x\ln 27}{\ln 9}$

   (D) $\frac{x\log_3 27}{\log_3 9}$

46.   If $m = \log_3 81$, which of the following is also true?

   (A) $3m = 81$

   (B) $3^m = 81$

   (C) $\sqrt[3]{m} = 81$

   (D) $\sqrt[3]{81} = m$

47.   The sales of a new product, in items per month, is modeled by the expression $225 + 500\log_{10}(15t + 10)$, where t represents the time since the product became available for purchase, in months. What is the number of items sold per month for time $t = 6$?

   (A)   725

   (B)   1225

   (C)   1700

   (D)   5225

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48. The function f is given by $f(x) = 2\log_5 x$. Which of the following describes f ?

    (A) f is an increasing function that increases at an increasing rate.

    (B) f is an increasing function that increases at a decreasing rate.

    (C) f is a decreasing function that decreases at an increasing rate.

    (D) f is a decreasing function that decreases at a decreasing rate.

49. Which of the following could describe a single logarithmic function f ?

    (A) $\lim\limits_{x \to 0^+} f(x) = -\infty$ and $\lim\limits_{x \to \infty} f(x) = -\infty$

    (B) $\lim\limits_{x \to 0^+} f(x) = -\infty$ and $\lim\limits_{x \to \infty} f(x) = k$, where k is a positive constant

    (C) $\lim\limits_{x \to 0^+} f(x) = \infty$ and $\lim\limits_{x \to \infty} f(x) = 0$

    (D) $\lim\limits_{x \to 0^+} f(x) = \infty$ and $\lim\limits_{x \to \infty} f(x) = -\infty$

50. The logarithmic function f is defined by $f(x) = \log_3 x$ on a domain of f is $0 < x \le 9$. Which of the following is true of f ?

    (A) f has both a maximum and a minimum value.

    (B) f has a maximum value, but no minimum value.

    (C) f has a minimum value, but no maximum value.

    (D) f has neither a minimum value nor a maximum value.

51. The function f is given by $f(x) = 9 \cdot 25^x$. Which of the following is an equivalent form for $f(x)$?

    (A) $f(x) = 3 \cdot 5^{(x/2)}$

    (B) $f(x) = 3 \cdot 5^{(2x)}$

    (C) $f(x) = 9 \cdot 5^{(x/2)}$

    (D) $f(x) = 9 \cdot 5^{(2x)}$

52. Consider the functions f and g given by $f(x) = \log_{10}(x - 1) + \log_{10}(x + 3)$ and $g(x) = \log_{10}(x + 9)$. In the xy-plane, what are all x-coordinates of the points of intersection of the graphs of f and g ?

    (A) $x = 3$ only

    (B) $x = 7$

    (C) $x = -4$ and $x = 3$

    (D) $x = -7$ and $x = -4$

53. The function g is given by $g(x) = \ln(3x + 1) - \ln(x^2 + x - 2)$. What are all values of x for which $g(x) < 0$?

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

    (B) $(-1,3)$

    (C) $(1,3)$ only

    (D) $(3, \infty)$ only

54.   A decibel (dB) is a unit of measure for loudness of sound. The decibel scale is based in sound intensity N, in watts per square meter. A decibel value is given by the function d, where $d(N) = 10 \log_{10}\left(\frac{N}{10^{-12}}\right)$. Which of the following gives all intensities N, in watts per square meter, for which the decibel value is greater than 140 decibels?

    (A) $N > 14 \cdot 10^{-12}$

    (B) $N > 2$

    (C) $N > 100$

    (D) $N > 10^{26}$

55.   The function f is given by $f(x) = \log_2 x$. Which of the following is equivalent to $f(7)$?

    (A) $\log_{10}\left(\frac{7}{2}\right)$

    (B) $\frac{\log_{10} 2}{\log_{10} 7}$

    (C) $\frac{\log_7 10}{\log_2 10}$

    (D) $\frac{\log_3 7}{\log_3 2}$

56.   The function g is given by $g(x) = \log_7 x$, and the function h is given by $h(x) = \log_{49} x$. Which of the following describes the relationships between g and h ?

    (A) For equal input values, the output values of h are half the output values of g.

    (B) For equal input values, the output values of h are twice the output values of g.

    (C) For equal input values, the output values of h are the square of the output values of g.

    (D) For equal input values, the output values of h are the square root of the output values of g.

57.   The function h is given by $h(x) = \log_3 x$. Which of the following is equivalent to the expression $2 \cdot h(w) + h(p)$, where w and p are values in the domain of h ?

    (A) $\log_3\left((wp)^2\right)$

    (B) $(\log_3 w)^2 \cdot (\log_3 p)$

    (C) $\log_3\left(w^2 p\right)$

    (D) $\log_3(2wp)$

58.   The function f is given by $f(x) = \log_{10} x$. The function g is given by $g(x) = \log_{10}\left(x^3\right)$. Which of the following describes a transformation for which the graph of g is the image of the graph of f ?

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(A) A vertical dilation by a factor of 3

(B) A vertical dilation by a factor of $\frac{1}{3}$

(C) A horizontal dilation by a factor of 3

(D) A horizontal dilation by a factor of $\frac{1}{3}$

59. The function f is given by $f(x) = \ln x$. Which of the following describes input values for which the output values of f are integers?

(A) Integer powers of e

(B) Integer powers of 10

(C) Integers raised to the power e

(D) Integers raised to the power 10

60. The function g is given by $g(x) = a\log_b c$, where a, b, and c are positive integers. Which of the following is an equivalent representation of $g(x)$?

(A) $\log_b(c^a)$

(B) $(\log_b c)^a$

(C) $\log_b(c^{(1/a)})$

(D) $a\log_{10} b + a\log_{10} c$

61. The function f is logarithmic, and the points $(2,1)$ and $(4,2)$ are on the graph of f in the xy-plane. Which of the following could define $f(x)$?

(A) $\log_4 x$

(B) $2\log_2 x$

(C) $2\log_4 x$

(D) $\log_4(x+2)$

62. The initial population size of an animal species is measured to be 2000. The population doubles every 8 years. Which of the following functions gives the time, in years, as an output value, and a certain number x for the population size as an input value?

(A) $f(x) = \frac{1}{8}\log_2\left(\frac{x}{2000}\right)$

(B) $g(x) = \log_2\left(\frac{8x}{2000}\right)$

(C) $h(x) = 8\log_2\left(\frac{x}{2000}\right)$

(D) $k(x) = 2000\log_8 x$

63. Let x and y be positive constants. Which of the following is equivalent to $2\ln x - 3\ln y$?

(A) $\ln\left(\frac{x^2}{y^3}\right)$

(B) $\ln\left(x^2 y^3\right)$

(C) $\ln(2x - 3y)$

(D) $\ln\left(\frac{2x}{3y}\right)$

64. Let k, w, and z be positive constants. Which of the following is equivalent to $\log_{10}\left(\frac{kz}{w^2}\right)$?

   (A) $\log_{10}(k + z) - \log_{10}(2w)$

   (B) $\log_{10} k + \log_{10} z - 2\log_{10} w$

   (C) $\log_{10} k + \log_{10} z - \frac{1}{2}\log_{10} w$

   (D) $\log_{10} k - \log_{10} z + 2\log_{10} w$

65. The function f is given by $f(x) = a \cdot c^x$, where $a > 0$ and $c > 1$. Which of the following is true about the values of constants m and b in the equation $\ln(f(x)) = mx + b$?

   (A) $m > 0$ because $\ln c > 0$; b can be any real number because $\ln a$ can be any real number.

   (B) $m > 0$ because $\ln c > 0$; $b > 0$ because $\ln a > 0$.

   (C) m can be any real number because $\ln c$ can be any real number; b can be any real number because $\ln a$ can be any real number.

   (D) m can be any real number because $\ln c$ can be any real number; $b > 0$ because $\ln a > 0$.

66. In a semi-log plot, which of the following pairs of functions appear linear as parallel lines?

   (A) $f(x) = 2x$ and $g(x) = 2x + 3$

   (B) $f(x) = x^2$ and $g(x) = 3x^2$

   (C) $f(x) = 2^x$ and $g(x) = 3 \cdot 2^x$

   (D) $f(x) = \ln(2x)$ and $g(x) = 3\ln(2x)$

67.

x	5	6	7	8
$\ln y$	3	6	9	12

The table gives ordered pairs $(x, \ln y)$. For the function $y = f(x)$, which of the following statements about f is supported by the data in the table?
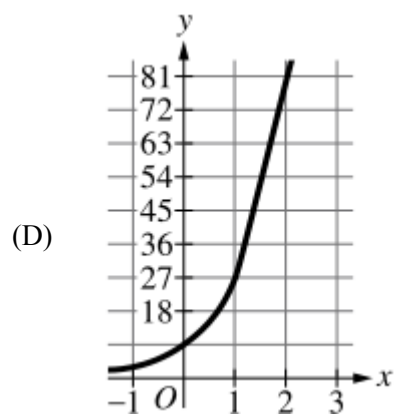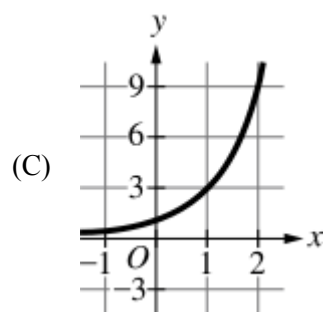
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(A)   The function f is logarithmic because the values of x and the values of $\ln y$ both form arithmetic sequences.

(B)   The function f is linear because the values in each column form an arithmetic sequence.

(C)   The function f is exponential because the values of x and the values of $\ln y$ both form arithmetic sequences.

(D)   The function f is exponential because the values of $\ln y$ increase faster than the values of x.

68.

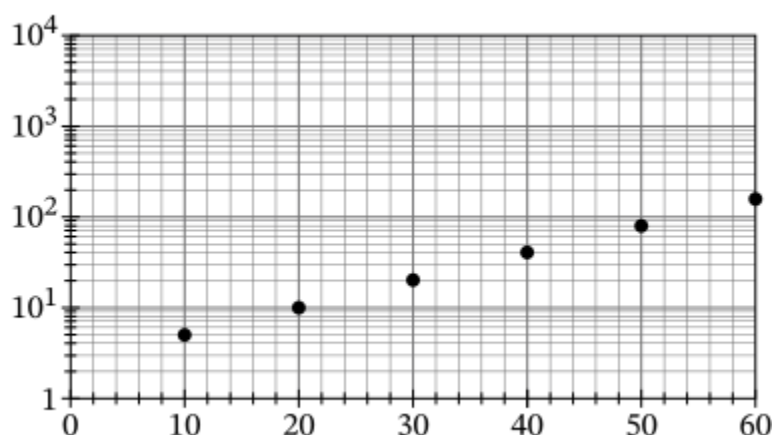| x	0	1	2	3
$\log_3(f(x))$	2	3	4	5

Consider the function f. The table gives values of $\log_3(f(x))$ for selected values of x. Which of the following is a graph of $y = f(x)$?

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(A)

(B)

(C)

(D)
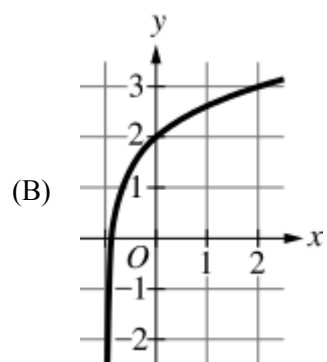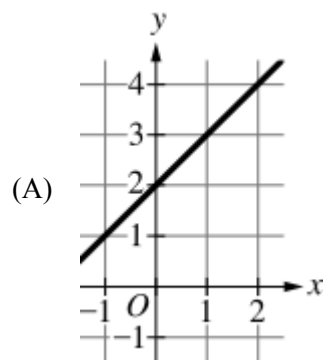
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69.

The number of thousands of people that have visited a new website is recorded every 10 days for 60 days. These data are used to produce a semi-log plot as shown. The function N gives the number of thousands of people that have visited the website for day t. Which of the following could define $N(t)$?

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

(B) $\frac{1}{10}t + 5$

(C) $2.5 \cdot 2^{(t/10)}$

(D) $3 + 2^{(t/10)}$

70. A family needs to buy one shovel and between one and eight plants, inclusive, for their new garden. The cost of the shovel is s dollars, and the cost of one plant is p dollars. The output values of which of the following give the possible costs for these items, in dollars? (Note: Assume any taxes are included in the costs.)

(A) The linear function $C(x) = s + px$ for $1 \le x \le 8$

(B) The exponential function $C(x) = s \cdot p^x$ for $1 \le x \le 8$

(C) The arithmetic sequence $C_n = s + pn$ for $1 \le n \le 8$

(D) The geometric sequence $C_n = s \cdot p^n$ for $1 \le n \le 8$

71. Which of the following includes the input-output pairs $(2,4)$ and $(3,8)$?

(A) The arithmetic sequence $a_n = 4n$

(B) The linear function $f(n) = 2 + 4(n - 1)$

(C) The geometric sequence $g_n = 2^{(n-1)}$

(D) The exponential function $h(n) = 2 \cdot 2^{(n-1)}$

72. The second term of a sequence is 6, and the fourth term is 24. Of the following, which statement is true?

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    (A)   If the sequence is geometric, the first term could be 1.

    (B)   If the sequence is arithmetic, the third term could be 12.

    (C)   If the sequence is geometric, the fifth term could be 48.

    (D)   If the sequence is arithmetic, the sixth term could be 48.

73.   An exponential function G has a known common ratio of $\frac{1}{2}$ and includes the input-output pair $(1,4)$. Which of the following could define $G(x)$?

    (A) $4 + \frac{1}{2}(x - 1)$

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

    (C) $4 \cdot \left(\frac{1}{2}\right)^x$

    (D) $4 \cdot \left(\frac{1}{2}\right)^{(x-1)}$

74.   The general term of a sequence is given by $a_n = 51 + 3(n - 10)$, where a_0 is the initial value. Which of the following expressions also gives the general term of the sequence?

    (A) $10 + 3(51 - n)$

    (B) $17 + 3n$

    (C) $21 + 3n$

    (D) $51 \cdot 3^{(n-10)}$

75.

t **(months)**	0	1	2	3	4
$P(t)$ **(thousands)**	20	30	45	67.5	101.25

The increasing function P gives the number of followers, in thousands, for a new musical group on a social media site. The table gives values of $P(t)$ for selected values of t, in months, since the musical group created their account on this social media site. If a model is constructed to represent these data, which of the following best applies to this situation?

    (A) $y = 10t + 20$

    (B) $y = \frac{325}{16}t + 20$

    (C) $y = 20\left(\frac{2}{3}\right)^t$

    (D) $y = 20\left(\frac{3}{2}\right)^t$