Unit One

Elementary Functions

Multiple Choice

Questions

1. The domain of the function

$f(x) = -\sqrt{81 - x^2}$ is

(A) $x \geq 0$

(B) $0 \leq y \leq 9$

(C) all real numbers

(D) $|x| \leq 9$

(E) $-81 < x < 81$

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3. The range of the function

$y = 1 + 2x - x^2$

is $y \leq k$

The value of k is

(A) 0

(B) 2

(C) 1

(D) ∞

(E) -1

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5. If $f(x) = x + \frac{1}{x}$

and $g(x) = x - \frac{1}{x}$

the value of $[f(x) + g(x)]^2$ is

(A) constant

(B) $2x^2$

(C) $4x$

(D) $4x^2$

(E) $[f(x)]^2 + [g(x)]^2$

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7. If $f(x) = x^3 - 3x^2$ and $g(x) = 4$

then $g[f(x)] =$

(A) 4

(B) 0

(C) $4x^3 - 12x^2$

(D) $f[g(x)]$

(E) $f(4)$

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9. For which of the following function PAIRS is

$f[g(x)] = x$

(A) $f(x) = x^2$, $g(x) = \frac{1}{x}$

(B) $f(x) = x^2$, $g(x) = \frac{1}{x^2}$

(C) $f(x) = 2x^2$, $g(x) = \sqrt{x}$

(D) $f(x) = x + 1$, $g(x) = \frac{x}{x + 1}$

(E) $f(x) = 2x - 1$, $g(x) = \frac{x + 1}{2}$

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11. The inverse of $f(x)$ is $h(x)$.

The composition of f and h (i.e. $f[h(x)]$) equals

(A) $f(x) \cdot h(x)$

(B) 1

(C) $\frac{1}{x}$

(D) x

(E) none of these

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13. Which of the following functions is NOT odd?

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

(B) $f(x) = x^3 + 2$

(C) $f(x) = 3 \sin x$

(D) $f(x) = (8x)^{\frac{1}{3}}$

(E) $f(x) = \sin 4x$

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15. Select the FALSE statement about any odd function $f(x)$.

(A) $f(x)$ always passes through the origin if $x = 0$ is in the domain of $f(x)$.

(B) $f(x)$ is symmetric in the y axis

(C) A possible $f(x)$ is $f(x) = \sin 2x$

(D) $f(-x) + f(x) = 0$, for all x in the domain of f.

(E) $\frac{f(a)}{f(-a)} = -1$ where a is in the domain of f and $f(-a) \neq 0$.

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17. The product of the zeros of

$$f(x) = x^3 + 3x^2 + 3x + 2$$

is

(A) -2

(B) 0

(C) 18

(D) -18

(E) -3

---

19. Which of the following functions is NOT symmetric in the y-axis

(A) $y = x^4 - x^2$

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

(C) $y = (x - 2)^2$

(D) $y = 9 - x^2$

(E) $y = \frac{1}{3} x^2$

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21. Which of the following is a reflection of

$f(x) = x^3 + 5$ in the y-axis?

(A) $y = 5 - x^3$

(B) $y = -5 + x^3$

(C) $y = -5 - x^3$

(D) $y = x^3$

(E) none of these

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23. The line $x + 4y - 8 = 0$ is reflected in the line $y = x$.

The equation of its mirror image in $y = x$ is

(A) $y = 8 - 4x$

(B) $x - 4y = 8$

(C) $y = \frac{8 - x}{4}$

(D) $x + 4y + 8 = 0$

(E) $y = 4x - 8$

25. Which of the following equations has a graph which is NOT symmetric with respect to the origin?

(A) $f(x) = \sin 3x$

(B) $f(x) = x^3 - 1$

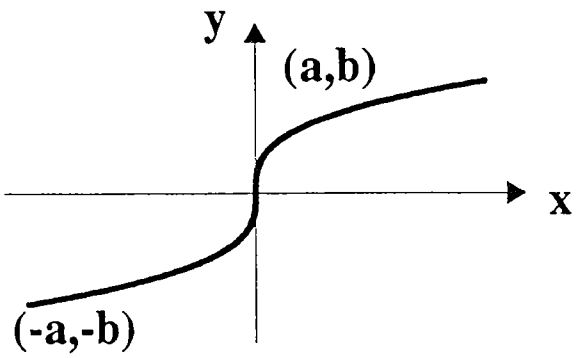
(C) $f(x) = \frac{2x}{x^2 + 1}$

(D) $f(x) = \sqrt[3]{27x}$

(E) $f(x) = \sin \frac{x}{2}$

27. The points (a, b) and (-a, -b) both lie on y = f(x).

Which of these is NOT a possible equation for f(x)?



(A) $f(x) = x^3$

(B) $f(x) = x^3 + 3x$

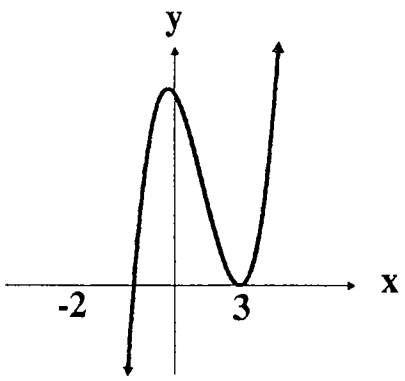
(C) $y = x^3 - x$

(D) $y = \dfrac{x}{x^3 + 1}$

(E) $y = \sqrt[3]{x}$

[CA010109-3]

29.



Which of the following is a possible equation for the function sketched above?

(A) $y = (x - 2)(x + 3)^2$

(B) $y = 4(x + 2)(x - 3)$

(C) $y = 4 - x^2$

(D) $y = -3(x + 2)(x - 3)^2$

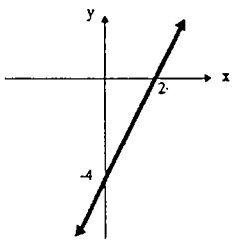
(E) $y = (x + 2)(x - 3)^2$

[CA010110-2]

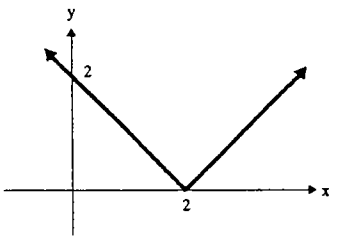
31. Given $f(x) = 2x - 4$

Which of the following is a sketch of the graph of $y = |f(x)|$

(A)



(B)



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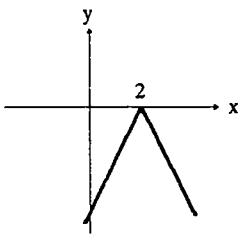

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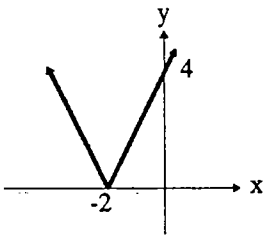

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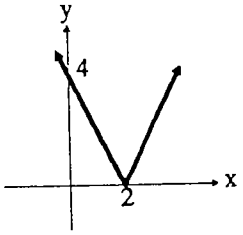
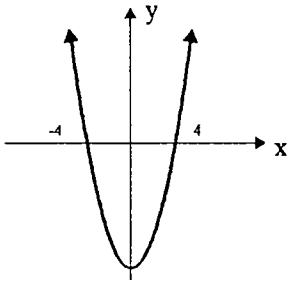


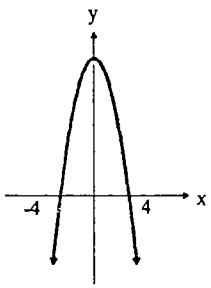
33. If $f(x) = 16 - x^2$, select the sketch below which most accurately represents a sketch of the graph of

$y = |f(x)|$

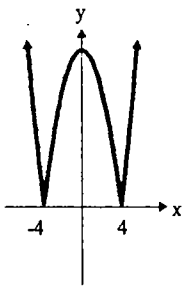
(A)



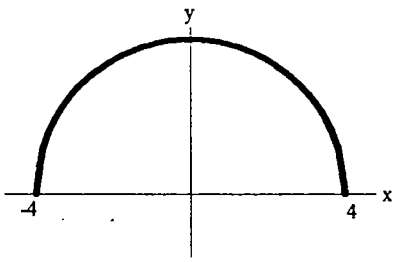
(B)



(C)



(D)



(E) none of these

[CA010111-3]

35. The RANGE of the function

$f(x) = -2 \cos \frac{x}{4}$ is

(A) $-\infty < y < \infty$

(B) $y \leq -2$

(C) 8π

(D) $-2 \leq y \leq 2$

(E) $-2 \leq y \leq 0$

37. The DOMAIN of the function

$y = 4 \csc x$ is

(A) $x \neq \frac{\pi}{2}$

(B) all reals

(C) $x \neq \pm \frac{n\pi}{2}$ where $n = 0, 1, 2, 3, \ldots$

(D) $|x| \leq 4$

(E) $x \neq \pm n\pi$ where $n = 0, 1, 2, 3 \ldots$

39. The range of $y = 2 \cot \pi x$ is

(A) $y > 0$

(B) $y \neq 0$

(C) $-2 \leq y \leq 2$

(D) $|y| \geq 0$

(E) 1

41. If $g(x) = \frac{\cos x + \sin x}{2}$

the value of $[g(\frac{3\pi}{4})]^2$

(A) $\frac{1}{4\sqrt{2}}$

(B) $\frac{1}{2}$

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

(D) 0

(E) 1

43. Let $f(x) = \cos \pi x$ and $g(x) = \sin \pi x$

The value of $f[g\left[\frac{3}{2}\right]]$ is

(A) $-\pi$

(B) 1

(C) 0

(D) -1

(E) none of these

45. Let $g(x) = \cos x$ on the closed interval $0 \leq x \leq \pi$.

The MINIMUM VALUE attained by

$h(x) = \sin (g(x))$ is

(A) -1

(B) π

(C) sin 1

(D) -sin 1

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

47. Which of the following trigonometric functions has(have) point symmetry about the origin?

(I) $y = \sin x$

(II) $y = \tan^2 x$

(III) $y = \cos \frac{x}{2}$

(IV) $y = \tan x$

(A) I only

(B) II and III

(C) IV only

(D) II and IV

(E) I and IV

49. Which of the following trigonometric functions have NO zeros?

(A) $y = \sin 2x$

(B) $y = -\cos \frac{x}{4}$

(C) $y = 2 \csc x$

(D) $y = \cot x$

(E) $y = \tan x$

51. The zeros of the trigonometric function

$f(x) = 2 \cos \pi x$

are separated on the x-axis by a distance of

(A) 1

(B) 2π

(C) π

(D) 2

(E) 4

53. How many asymptotes does $y = 3 \tan \frac{x}{4}$

have on the closed interval $[-3\pi, 3\pi]$?

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

55. The amplitude of the function

$f(x) = 4 \sin (x + \frac{2\pi}{3})$

is

(A) 2π

(B) 4

(C) $\frac{2\pi}{3}$

(D) 2

(E) π

57. The period of the function

$y = -2 \tan (kx + \frac{\pi}{4})$

is 2π. The value of k is

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

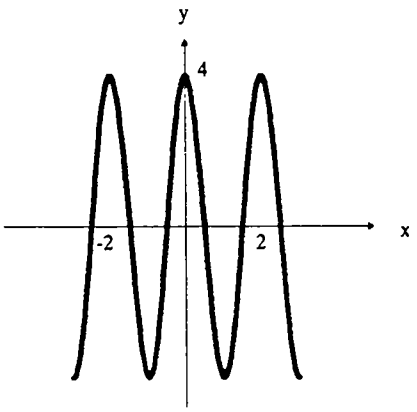
(B) 1

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

(D) $\frac{\pi}{2}$

(E) 2

59.



Which of the following trigonometric functions is represented by the graph above?

(A) $y = 4 \sin \pi x$

(B) $y = -4 \sin \frac{x}{2}$

(C) $y = \tan 2x$

(D) $y = 4 \cos \pi x$

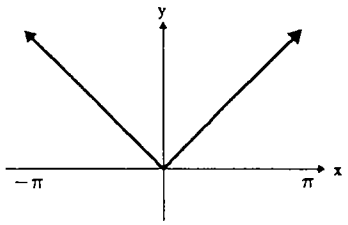
(E) none of these

[CA010209-2]

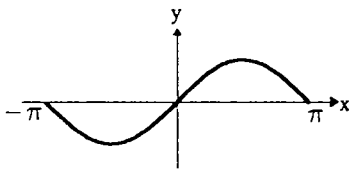
61. Which of the following is a possible sketch of

$y = \sin |x|$ on the interval $[-\pi, \pi]$

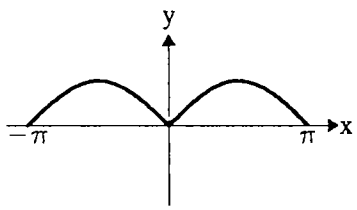
(A)



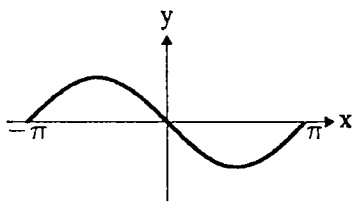
(B)



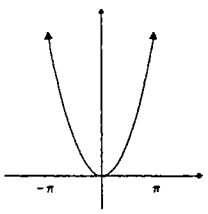
(C)



(D)



(E)



[CA010210-1]

63. Which of the following features is evident from an accurate sketch of the graph of

$y = |\tan x|$?

(A) it has asymptotes at $x = \pm (2k + 1)\pi$ where $k = 0, 1, 2, 3, \ldots$

(B) it is always below the x-axis

(C) it is always on or above the x-axis

(D) it is the same as the graph of $y = \tan x$

(E) it has zeros at the odd multiples of $\frac{\pi}{2}$

65. Which of the following is NOT an identity?

(A) $\sin^2 x + \cos^2 x = 1$

(B) $1 + \tan A = \sec A$

(C) $1 - \cos^2 x = \sin^2 x$

(D) $\csc^2 x - \cot^2 x = 1$

(E) $\cos^2 A = 1 - \sin^2 A$

67. For what value of k is the following an identity?

$$\frac{\sec B}{\tan B + \cot B} = k \sin B \ ?$$

(A) 1

(B) 2

(C) -1

(D) $\frac{1}{2}$

(E) 3

69. The value of k for which

$$\frac{\cos x}{1 + \sin x} + \frac{1 + \sin x}{\cos x} = k \sec x$$

is an identity is

(A) 1

(B) 2

(C) $\frac{-1}{2}$

(D) -1

(E) none of these

71. $\dfrac{\sin(\pi + x) - \sin(\pi - x)}{\cos(\pi + x) + \cos(\pi - x)} =$

(A) $2 \tan x$

(B) $\tan(\pi - x)$

(C) $\tan x$

(D) $\sin 2x$

(E) none of these

73. The DOMAIN of the exponential function $f(x) = 9^x$ is

(A) $x > 0$

(B) all real values of y

(C) $x \leq 0$

(D) $|x| \geq 0$

(E) $x > 9$

75. The RANGE of the exponential function $f(x) = 2e^{-x}$ is

(A) $y > 0$

(B) all real values of y

(C) $y < e$

(D) $y \geq 2$

(E) $y > 2$

77. Let $f(x) = (3^x + 3^{-x})^2$

The value of $f\left[\frac{1}{2}\right]$ is

(A) 0

(B) 3

(C) 2

(D) $\frac{16}{3}$

(E) none of these

79. The inverse of $f(x) = e^x$ is $g(x)$.

Which of the following is equal to $g(x)$?

(A) e^{-x}

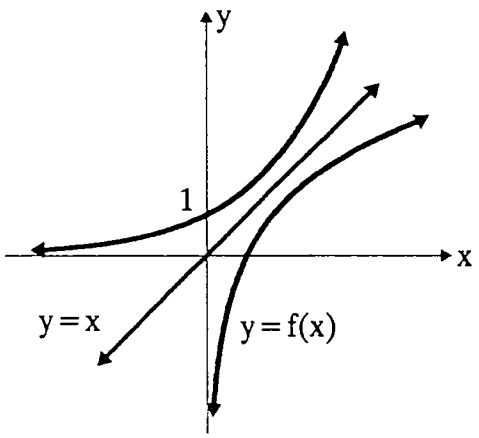
(B) $\log_{10} x$

(C) $\ln x$

(D) $\frac{1}{\ln x}$

(E) $-e^x$

81.



The exponential function $y = e^{\frac{x}{2}}$ is reflected in the line $y = x$ as shown in the accompanying diagram.

Its image is the curve $y = f(x)$.

$f(x) =$

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

(B) $\frac{1}{2} \ln x$

(C) $\ln \frac{x}{2}$

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

(E) $2 \ln x$

[CA010303-3]

83. Let $f(x) = 2e^x$ and $g(x) = \ln\left[\frac{x}{2}\right]$

The composition $f[g(x)]$ equals

(A) $2x$

(B) $\frac{x}{2}$

(C) x

(D) 1

(E) none of these

85. Which of the following exponential functions is symmetric in the y axis?

(A) $y = e^x$

(B) $y = e^{2x}$

(C) $y = e^{-x^2}$

(D) $y = 2^{2x}$

(E) none of these

87. The curve $y = 4^{2-x}$ is reflected in the y-axis.

The equation of its reflections is

(A) $y = -4^{2-x}$

(B) $y = \log_4 (2 - x)$

(C) $y = 16 \cdot 2^{2x}$

(D) $y = {}^{2x-4}$

(E) None of these

89. The exponential function

$y = 3^x - 27$

has a zero at $x = a$ and y intercept at $y = b$.

The value of a-b is

(A) 0

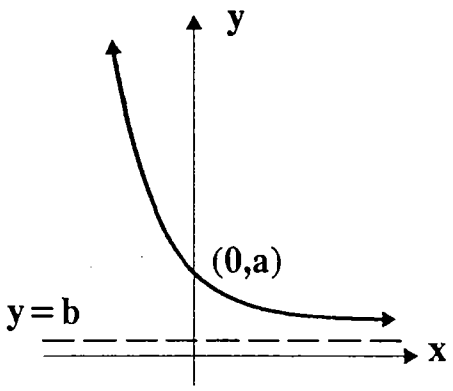
(B) 30

(C) -29

(D) -30

(E) 29

91.



The sketch above shows the function

$f(x) = 3 + e^{-x}$

The value of a + b is

(A) 7

(B) 6

(C) 5

(D) 8

(E) none of these

93. The curve

$y = -10e^{-x}$

(A) lies in quadrants 1 and 2 only

(B) is symmetric in the y axis

(C) increases for all values of x

(D) passes through (-10, 0)

(E) does not cross the y axis

95. Solve $2^{4y+1} = \frac{1}{128}$

(A) $y = \frac{-7}{4}$

(B) $y = \frac{5}{4}$

(C) $y = -2$

(D) $y = \frac{-3}{2}$

(E) $y = 2$

97. The function

$y = \log_e (2x + 1)$

has domain

(A) all real numbers

(B) $x \geq \frac{1}{2}$

(C) $x < \frac{-1}{2}$

(D) $x \geq \frac{-1}{2}$

(E) none of these

99. The range of the logarithmic function

$y = \log_{10} (2x + 1)$ is

(A) $y > \frac{-1}{2}$

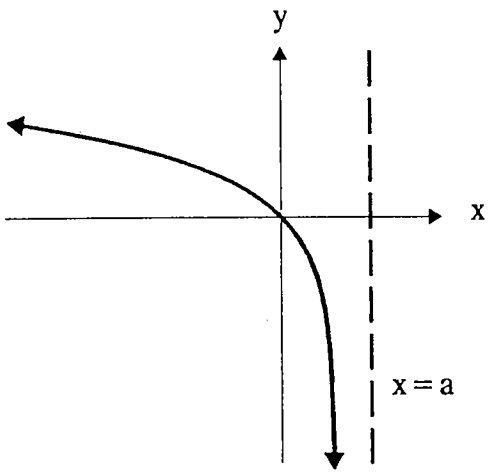
(B) $y > 0$

(C) $-\infty < y < \infty$

(D) $y < \frac{-1}{2}$

(E) none of these

101.



The line $x = a$ is an asymptote to the curve $y = \ln(1 - x)$ shown above.

The value of **a** is

(A) 0

(B) 2

(C) 1

(D) 3

(E) none of these

103. $\ln e\sqrt{x} =$

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

(B) $\frac{1}{2} \ln x$

(C) $1 + \frac{1}{2} \ln x$

(D) $e + \frac{1}{2} \ln x$

(E) $\frac{-1}{2} \ln x$

105. Assuming $x \neq 0$, $e^{-\ln x} =$

(A) $-x$

(B) 1

(C) $\frac{1}{x}$

(D) -1

(E) x

107. If $\log_e x = a$ and $\log_x e = b$, where $x > 0$, express a in terms of b.

(A) $ab = 1$

(B) $ab = x$

(C) $ax = b$

(D) $ab = -1$

(E) none of these

109. Let $f^{-1}(x)$ be the inverse of $f(x) = \log_2 x$

The value of $f^{-1}(4)$ is

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

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

(C) 16

(D) 8

(E) 4

111. Select the function pair which are the image of each other in the line $y = x$.

(A) $y = \ln x$ and $y = e^x$

(B) $y = 3x$ and $y = \log 3x$

(C) $f(x) = 4^x$ and $g(x) = 4^{-x}$

(D) $y = x$ and $y = \frac{1}{x}$

(E) $y = e^{2x}$ and $y = e^{-2x}$

113. The function

$f(x) = \ln|x|$, where $x \neq 0$, has two zeros.

One is at $x = a$ and the other at $x = b$.

The value of ab is

(A) 0

(B) -1

(C) e^2

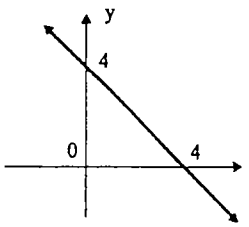
(D) 1

(E) $-e^2$

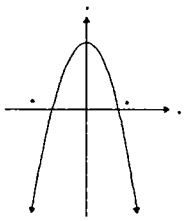
115. Which of the following is an accurate sketch of

$y = \log (4 - x)$?

(A)



(B)



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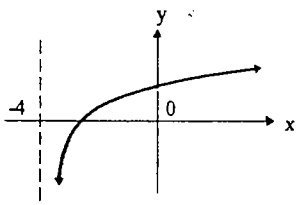
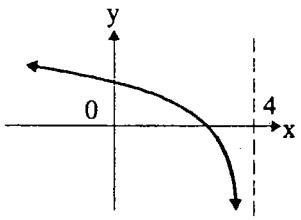
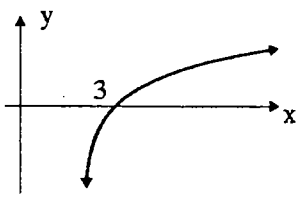


(D)

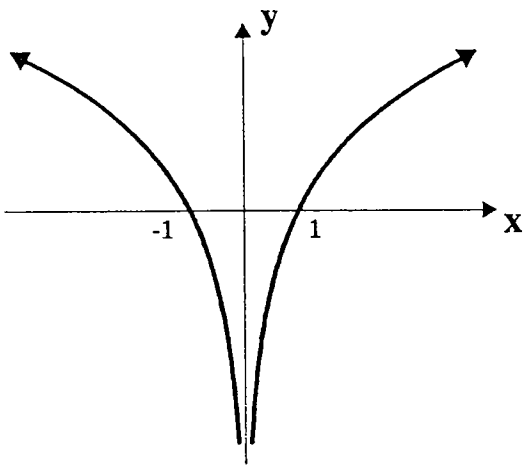


(E)



[CA010407-1]

117.



The graph above could be that of the function . . .

(A) $y = -x^2$

(B) $y = 2\ln x$

(C) $y = \ln x^2$

(D) $y = |\ln x|$

(E) $y = -\ln x$

119. Let $g(x) = \ln(6 - x)$

Which of the following lines is an asymptote to the graph of $y = |g(x)|$?

(A) $x = 6$

(B) $x = 0$

(C) $y = 0$

(D) $y = 6$

(E) $y = -6$

121. If $\log_x 6^x = \frac{x}{3}$, then x =

(A) $\sqrt[3]{6}$

(B) 36

(C) 216

(D) 18

(E) none of these

123. If $y = 1 - \log_2 (x - 1)$, then x =

(A) $2^{1-y} - 1$

(B) $1 - 2^{1-y}$

(C) $2 + 2^y$

(D) $2 - 2^y$

(E) $1 + \frac{2}{2^y}$

125. If $y = \cos^{-1} x$, then x =

(A) cos y

(B) $\frac{1}{y}$

(C) sin y

(D) $\frac{1}{\cos y}$

(E) $\cos \frac{1}{y}$

127. The DOMAIN of the function

$f(x) = \text{Arcsin } \frac{x}{2}$ is

(A) $|x| \leq 1$

(B) $x \neq 0$

(C) $\frac{-1}{2} \leq x \leq \frac{1}{2}$

(D) $-2 \leq x \leq 2$

(E) none of these

129. The DOMAIN of the inverse trigonometric function

$y = \text{Arccos } \frac{x}{3}$ is

(A) $|x| \leq 1$

(B) $|x| \leq 3$

(C) $\frac{-1}{3} \leq x \leq 0$

(D) $0 \leq x \leq \frac{1}{3}$

(E) $|x| \leq \frac{1}{3}$

131. $\cos\left(\text{Arccos}\left(\frac{-1}{2}\right)\right) =$

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

(B) $\frac{\sqrt{3}}{2}$

(C) $\frac{-1}{2}$

(D) $\frac{-\sqrt{3}}{2}$

(E) -1

133. Which of the following features is evident from an accurate graph of

$y = \text{Arcsin } \frac{x}{5}$?

(A) it decreases for all values of x

(B) the domain is restricted to $|x| \leq 5$

(C) it passes through (0, 5)

(D) the range is $|y| \leq \frac{5\pi}{2}$

(E) none of these

135. Which of the following features is evident from an accurate sketch of

$f(x) = \text{Arccos } 4x$?

(A) it decreases for all $|x| \leq \frac{1}{4}$

(B) it passes through the origin.

(C) it increases for all $|x| \leq \frac{1}{4}$

(D) it has domain $|x| \leq 4$

(E) none of these

137. The domain of $f(x) = \frac{x}{x^2 + 4}$

is

(A) all $x \neq -2$

(B) $x \neq \pm 2$

(C) $x \neq 0$

(D) all real numbers

(E) $x \neq \pm 4$

139. Which of the following functions is NOT symmetric in the y axis?

(A) $y = \dfrac{x^3 - 2x}{x^3 - 6x}$

(B) $y = \dfrac{x^2}{x^2 + 1}$

(C) $y = \dfrac{x}{x^2 + 1}$

(D) $y = \dfrac{1}{\sqrt{1 - x^2}}$

(E) $y = \dfrac{4}{x^4 + 1}$

141. Which of the following rational functions is an even function ?

(A) $f(x) = \dfrac{x}{x + 2}$

(B) $y = \dfrac{x^3 - 6x}{x^3 - 2x}$

(C) $f(x) = \dfrac{x^3}{1 + x^2}$

(D) $y = \dfrac{x^2 + 1}{x}$

(E) $y = \dfrac{x + 1}{x}$

143. The rational function

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

crosses the x axis at $x = a$ and $x = b$

The value of $a + b$ is

(A) 0

(B) -2

(C) 2

(D) -1

(E) 3

145. Which of the following lines is an asymptote to the function

$$f(x) = \frac{1}{4 - x^2} \quad ?$$

(A) $y = 1$

(B) $x = 4$

(C) $x = -2$

(D) $x = -4$

(E) $y = 4$

147. The rational function

$$f(x) = \frac{x^2}{x^2 - 9}$$

has three asymptotes. They are $x = a$, $x = b$, $y = c$.

The value of $a + b + c$ is

(A) -5

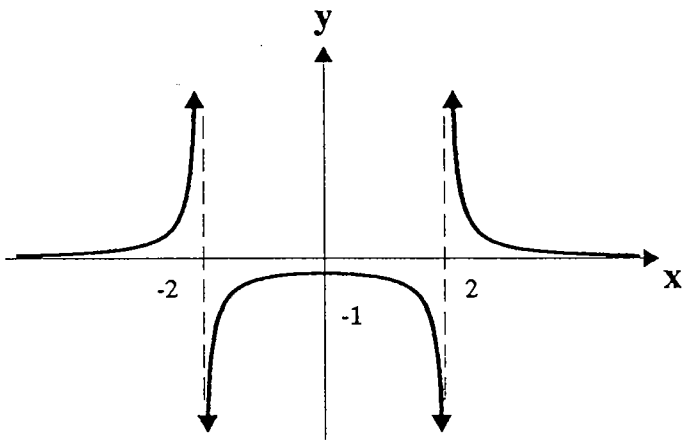
(B) 1

(C) 0

(D) -7

(E) -1

149.



Which of the following functions could have the graph sketched above?

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

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

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

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

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

[CA010605-2]