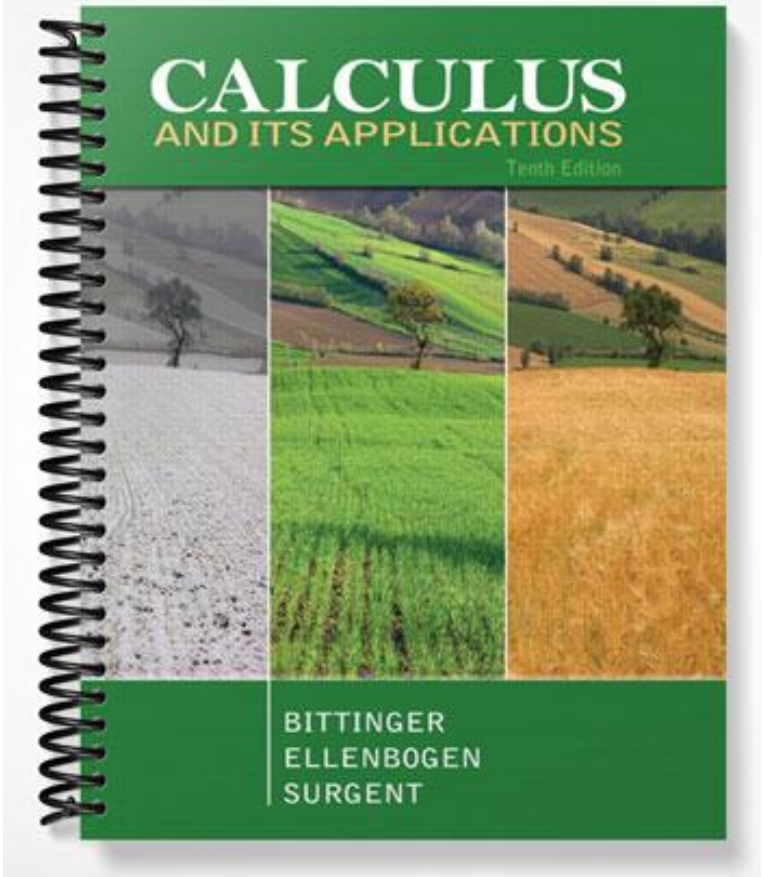
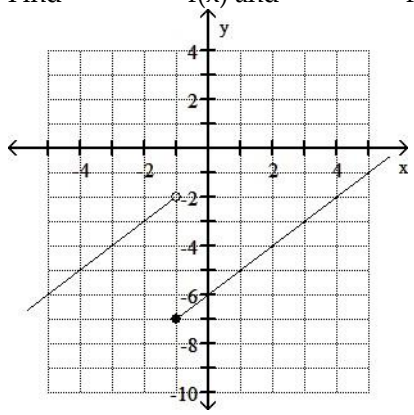
TEST BANK


CALCULUS
AND ITS APPLICATIONS
Tenth Edition
BITTINGER
ELLENBOGEN
SURGENT

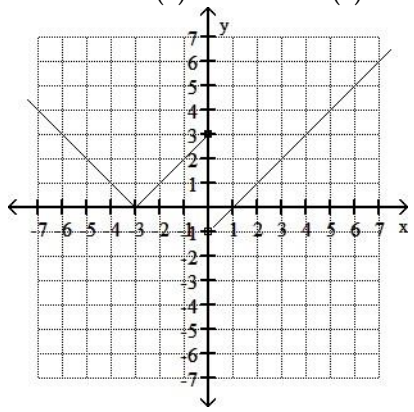
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.
Decide whether the limit exists. If it exists, find its value.

1) Find $\lim_{x\to(-1)^-} f(x)$ and $\lim_{x\to(-1)^+} f(x)$. 1) _____



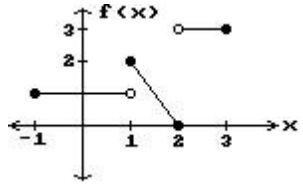
A) -5; -2 B) -7; -5 C) -7; -2 D) -2; -7

2) Find $\lim_{x\to0^-} f(x)$ and $\lim_{x\to0^+} f(x)$. 2) _____



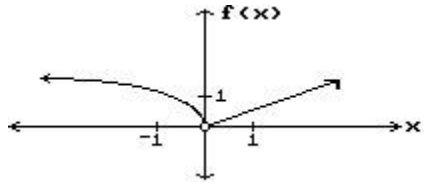
A) 3; -1 B) 3; 1 C) - 3; -1 D) -1; 3

3) Find $\lim_{x\to1} f(x)$. 3) _____



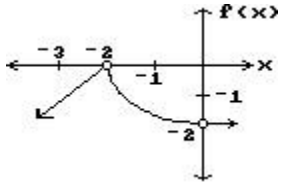
A) Does not exist B) 2 C) 1 D) 0

4) Find $\lim_{x\to0} f(x)$. 4) _____



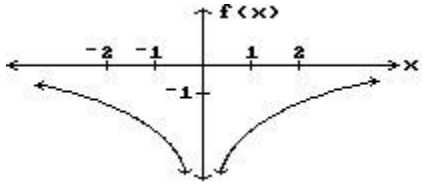
A) Does not exist B) 1 C) -1 D) 0

5) $\lim_{x \to 0}$ f(x). 5) _____



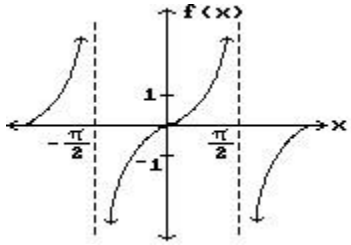
A) -1 B) 0 C) -2 D) Does not exist

6) $\lim_{x \to 0}$ f(x). 6) _____



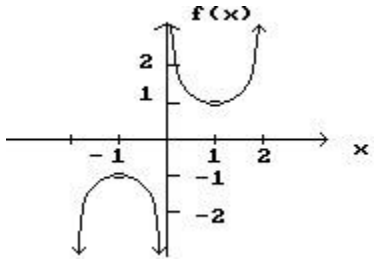
A) 2 B) -2 C) Does not exist D) 0

7) $\lim_{x \to \pi/2}$ f(x). 7) _____



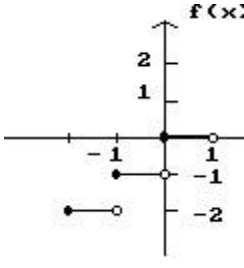
A) $\frac{\pi}{2}$ B) Does not exist C) 0 D) 1

8) $\lim_{x \to 1}$ f(x). 8) _____



A) 0 B) -1 C) 1 D) Does not exist

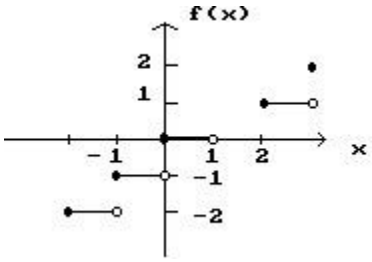
9) $\lim_{x \to -1}$ f(x).



9) _____

A) Does not exist B) 0 C) -2 D) -1

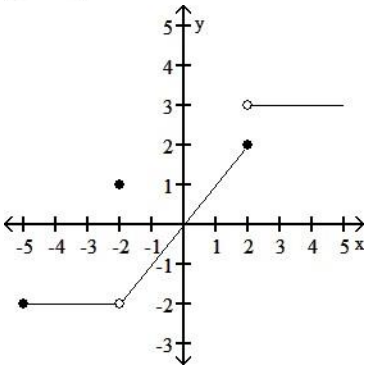
10) Find $\lim_{x \to -1/2} f(x)$. 10) _____



A) -1 B) Does not exist C) 0 D) -2

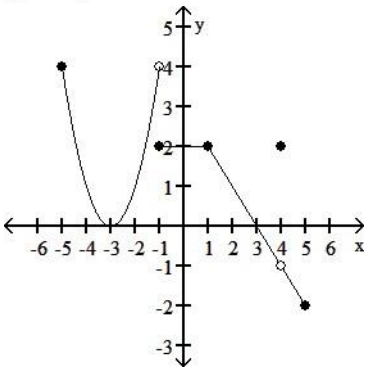
Use the graph to determine whether each statement is true or false.

11) $\lim_{x \to -2^+} f(x) = -2$ 11) _____



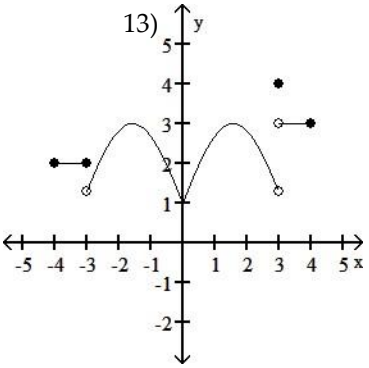
A) True B) False

12) $\lim_{x \to -1^-} f(x) = 4$ 12) _____



A) False B) True

13) $\lim_{x \to -3} f(x)$ exists.

13) 

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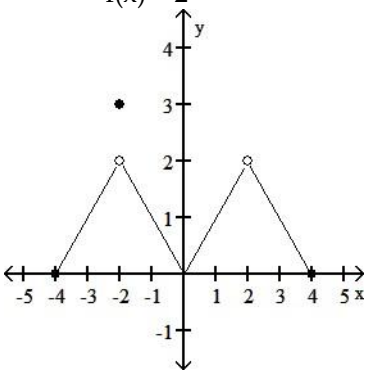
A) False B) True

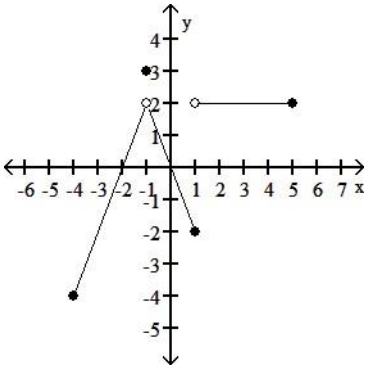
14) $\lim_{x \to 2^+} f(x) = 2$



14) _____

A) True B) False

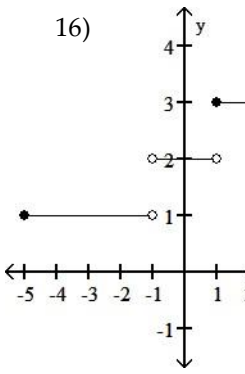
15) $\lim_{x \to 1^+} f(x) = \lim_{x \to 1^-} f(x)$



15) _____

A) True B) False

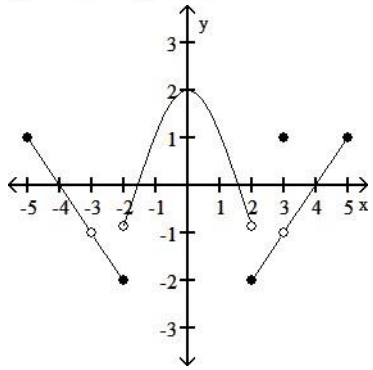
16) $\lim_{x \to -1^-} f(x) = 1$

16) 

_____

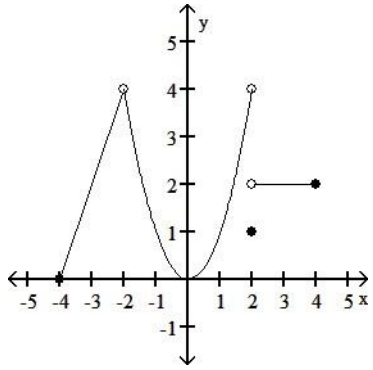
A) True B) False

17) $\lim_{x \to -3^-} f(x) = \lim_{x \to -3^+} f(x)$ 17) _____



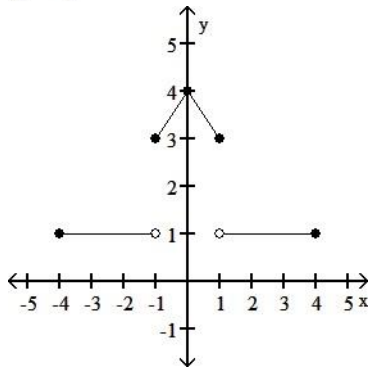
A) True B) False

18) $\lim_{x \to 2^+} f(x) = \lim_{x \to 2^-} f(x)$ 18) _____



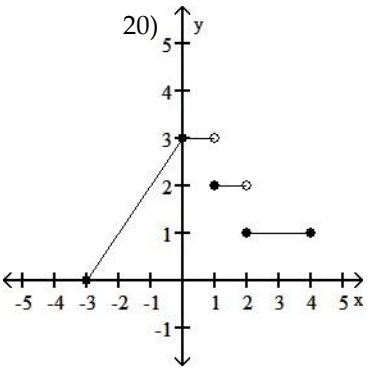
A) True B) False

19) $\lim_{x \to 1} f(x)$ exists. 19) _____



A) True B) False

20) $\lim_{x \to 0} f(x) = f(0)$

20) 

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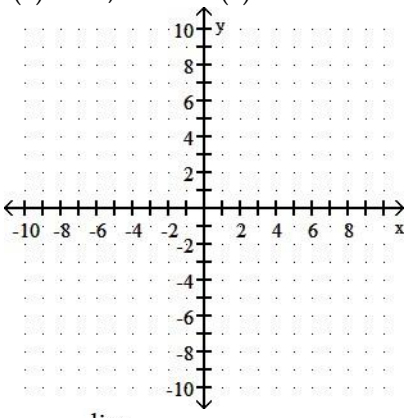
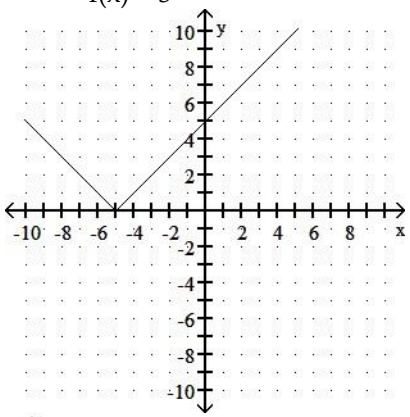
A) False B) True

Graph the function and then find the specified limit. When necessary, state that the limit does not exist.

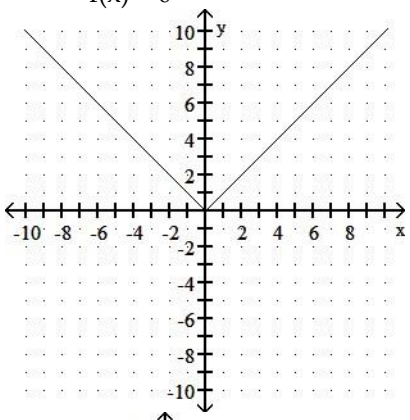
21) $f(x) = |x|$; $\lim_{x \to -2} f(x)$ 21) _____



A) $\lim_{x \to -2} f(x) = 3$

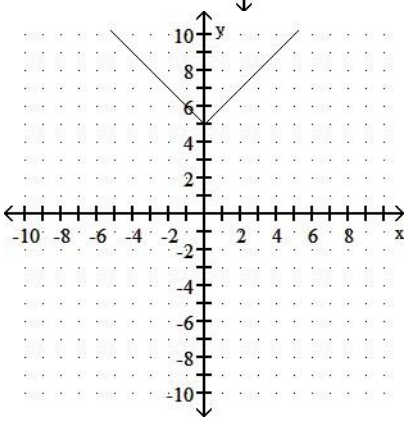


B) $\lim_{x \to -2} f(x) = 0$

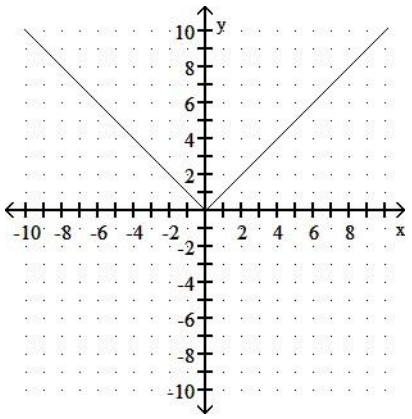


C) $\lim_{x \to -2} f(x) = 7$

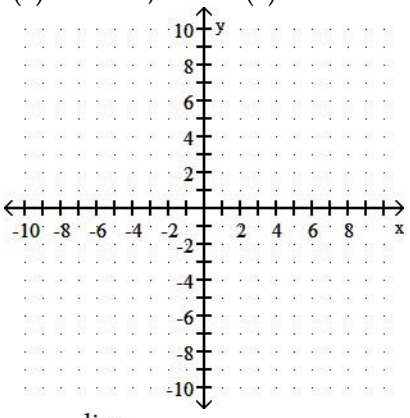
D)



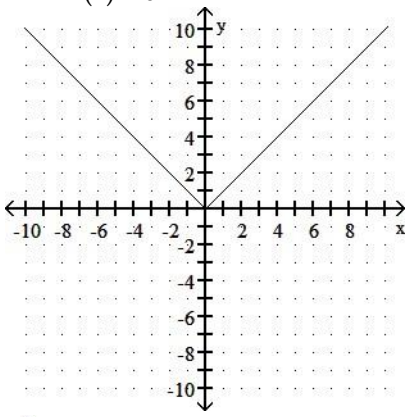
$\lim_{x \to -2} f(x) = 2$



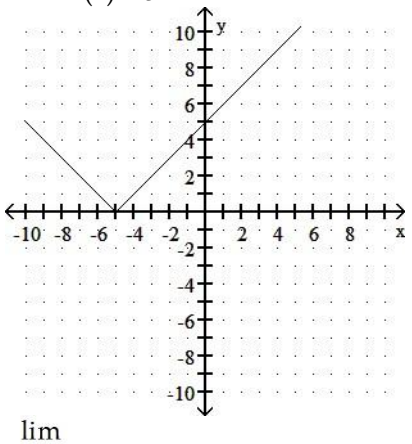
22) $f(x) = |x + 5|$; $\lim_{x \to 0} f(x)$ 22) _____



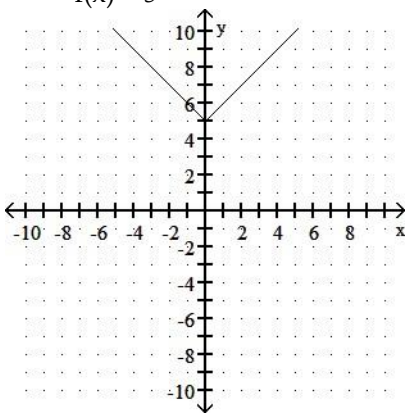
A) $\lim_{x \to 0} f(x) = 0$



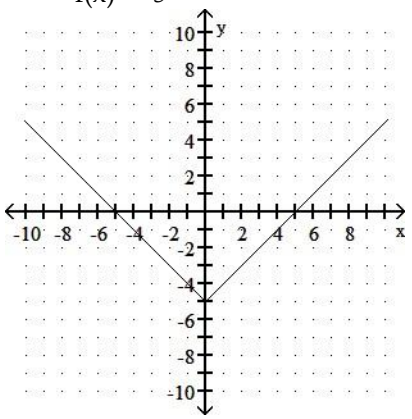
B) $\lim_{x \to 0} f(x) = 5$



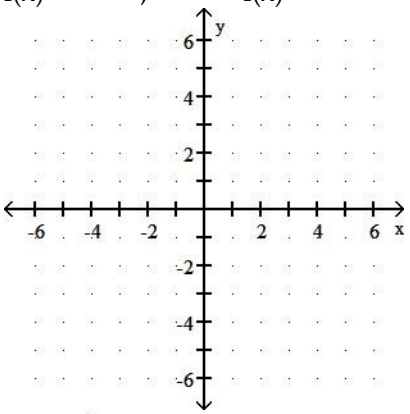
C) $\lim_{x \to 0} f(x) = 5$



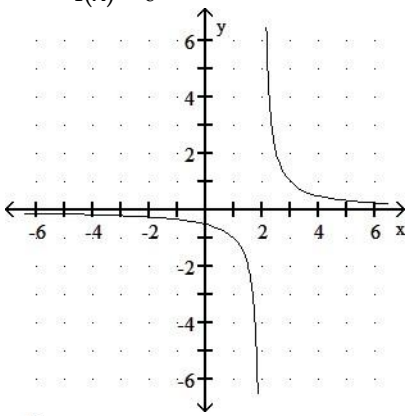
D) $\lim_{x \to 0} f(x) = -5$



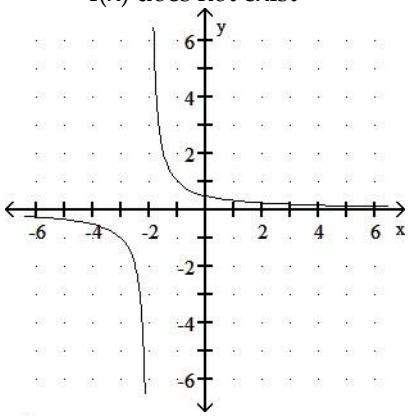
23) $f(x) = \frac{1}{x+2}$; $\lim_{x \to -2} f(x)$ 23) _____



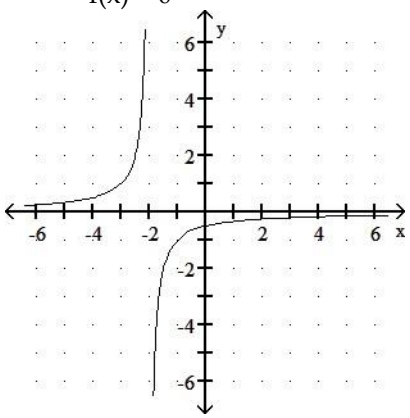
A) $\lim_{x \to 2} f(x) = 0$



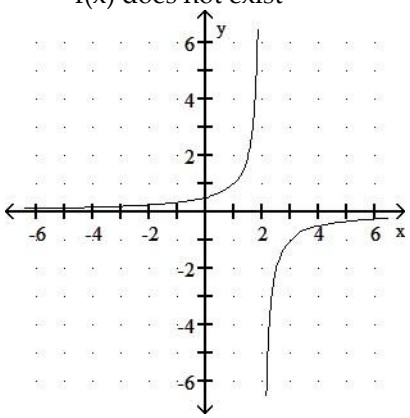
B) $\lim_{x \to -2} f(x)$ does not exist



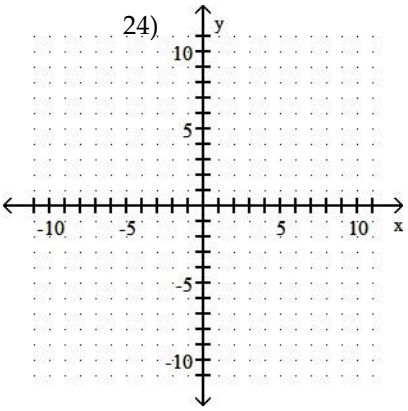
C) $\lim_{x \to -2} f(x) = 0$



D) $\lim_{x \to 2} f(x)$ does not exist



24) $f(x) = -4^{x^2}$; $\lim_{x \to 0} f(x)$

24) 

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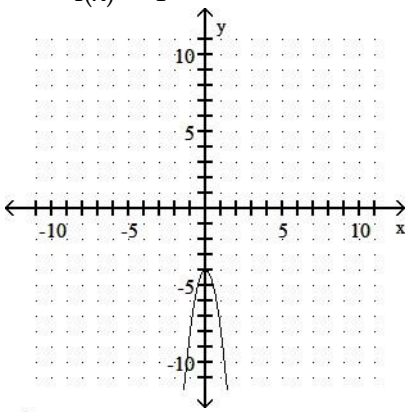
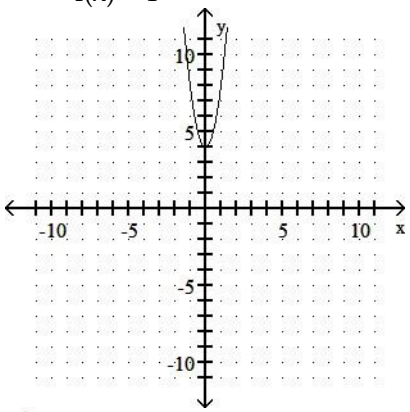
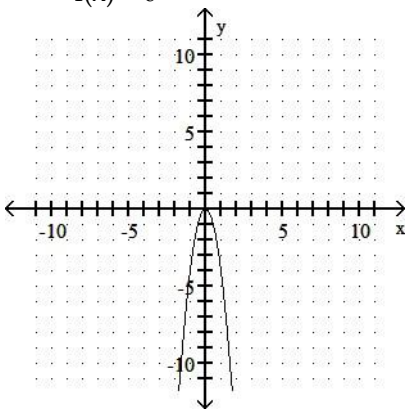
A) $\lim_{x \to 0}$ f(x) = -4



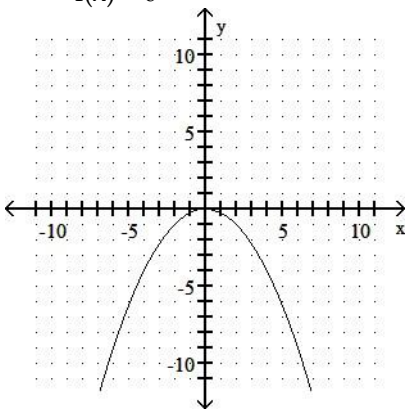
B) $\lim_{x \to 0}$ f(x) = 4



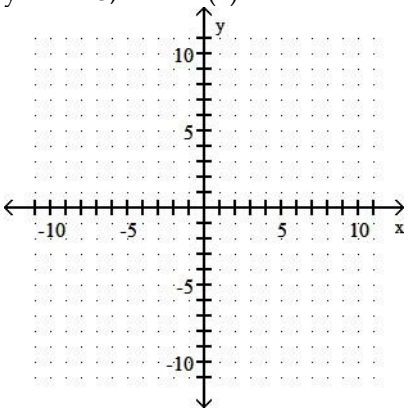
C) $\lim_{x \to 0}$ f(x) = 0



D) $\lim_{x \to 0}$ f(x) = 0

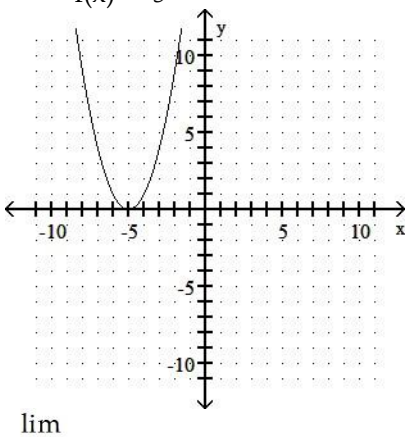


25) $\lim_{x \to 0}$ f(x)
$y = x^2 - 5$;

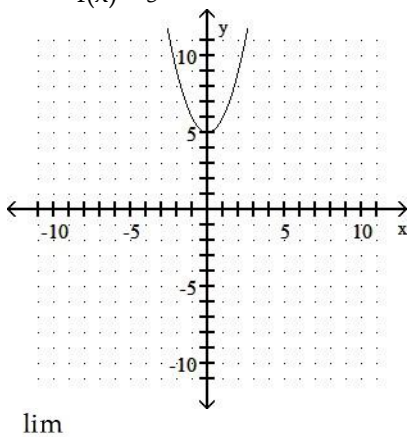


25) _____

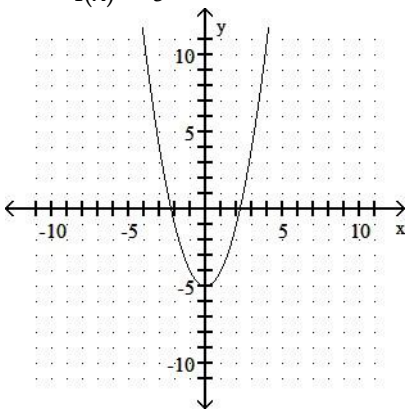
A) $\lim_{x \to 0}$ f(x) = -5



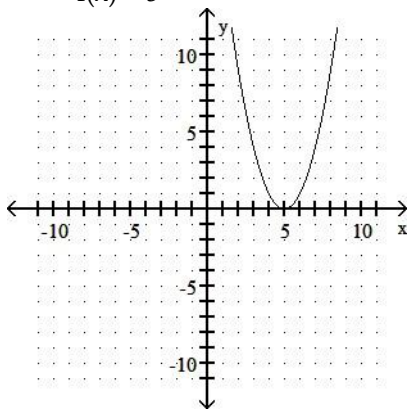
B) $\lim_{x \to 0}$ f(x) = 5



C) $\lim_{x \to 0}$ f(x) = -5

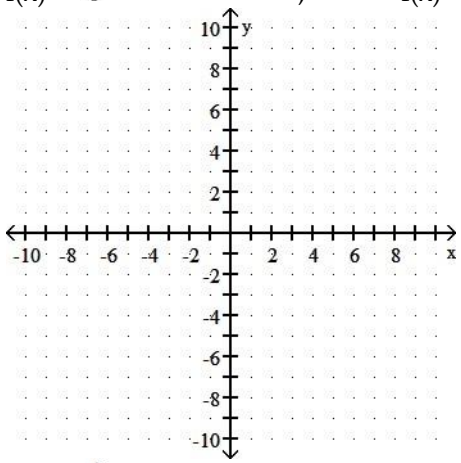


D) $\lim_{x \to 0}$ f(x) = 5

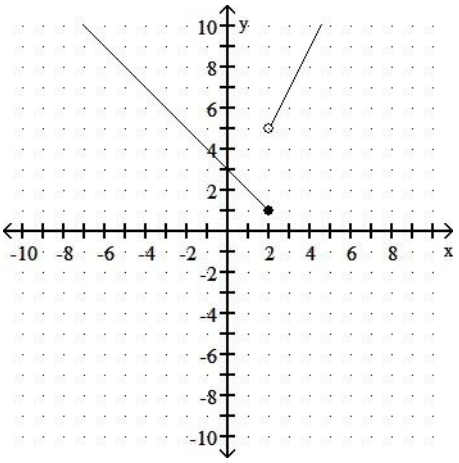


26) $f(x) = \begin{cases} 3 - x, & \text{for } x \le 2, \\ 1 + 2x, & \text{for } x > 2. \end{cases}$; $\lim_{x \to 2^+} f(x)$

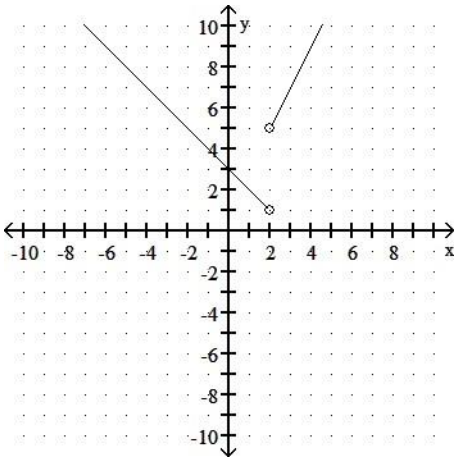
26) _____



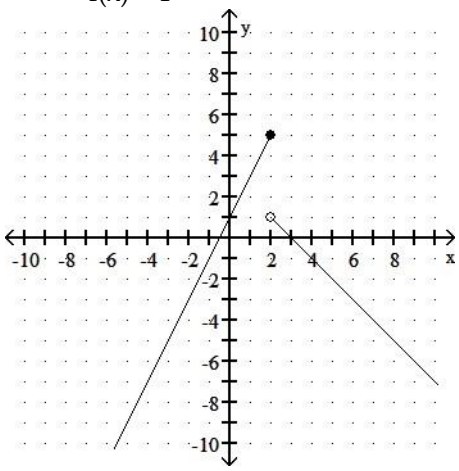
A) $\lim_{x \to 2^+}$ f(x) = 5



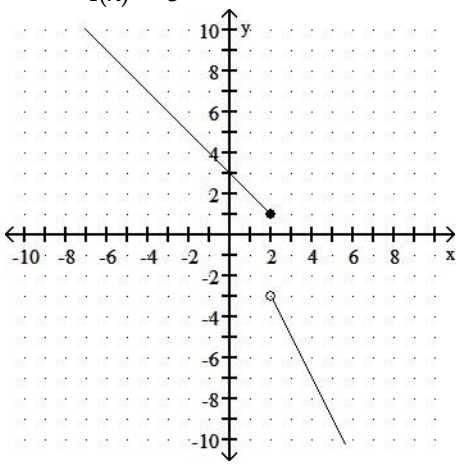
B) $\lim_{x \to 2^+} f(x) = 5$



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

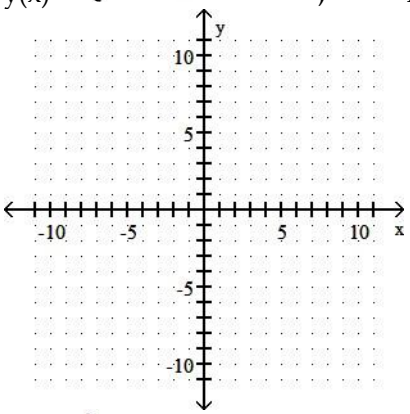


D) $\lim_{x \to 2^+} f(x) = -3$

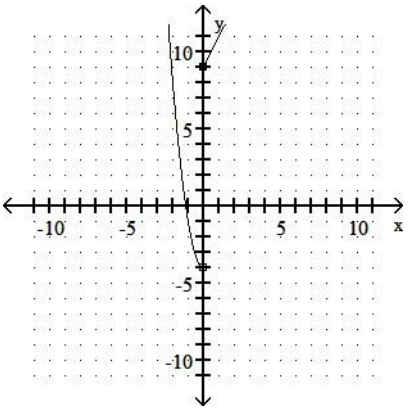


27) $y(x) = \begin{cases} 2x + 9, & \text{for } x < 0, \\ 4x^2 - 4, & \text{for } x \geq 0. \end{cases}$; $\lim_{x \to 0} f(x)$

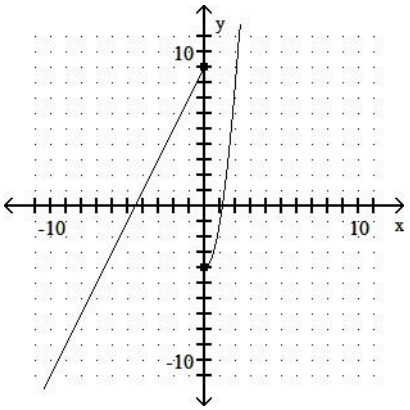
27) _____



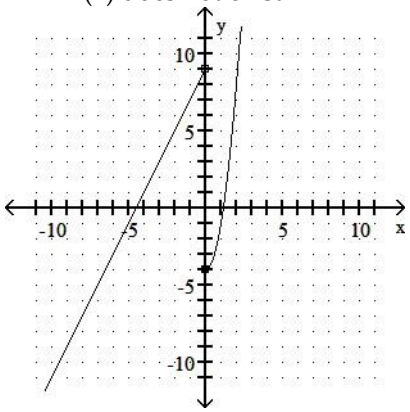
A) $\lim_{x \to 0} f(x)$ does not exist



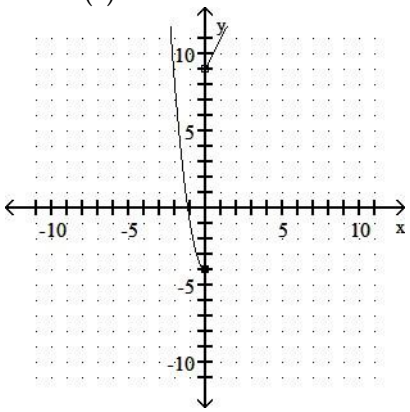
B) $\lim_{x \to 0} f(x) = 9$



C) $\lim_{x \to 0}$ f(x) does not exist

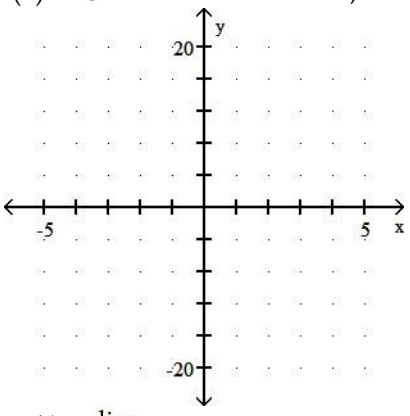


D) $\lim_{x \to 0}$ f(x) = -4

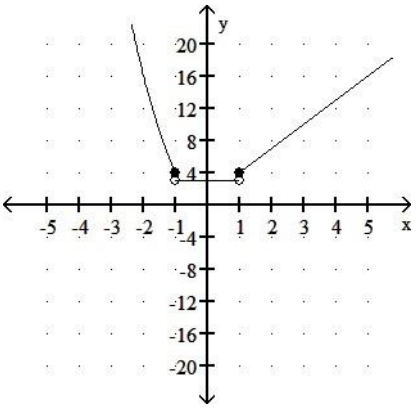


28) $f(x) = \begin{cases} 3x^2, & \text{for } x \le -1, \\ 3, & \text{for } -1 < x \le 1, \\ 3x + 1, & \text{for } x > 1. \end{cases}$; $\lim_{x \to -1^-} f(x)$

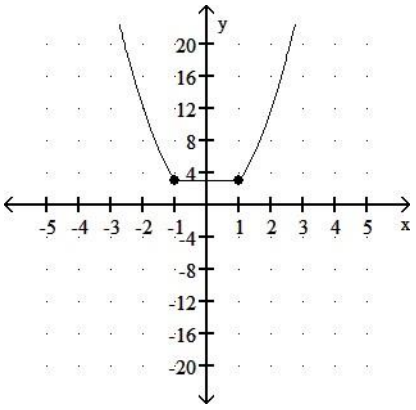
28) _____



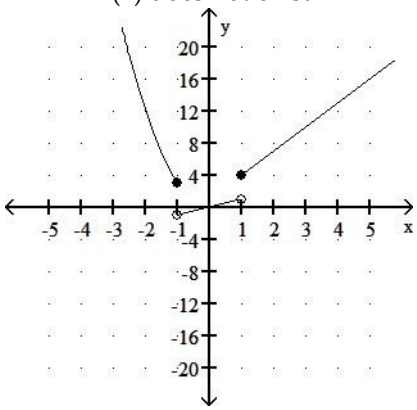
A) $\lim_{x \to -1^-} f(x) = 4$



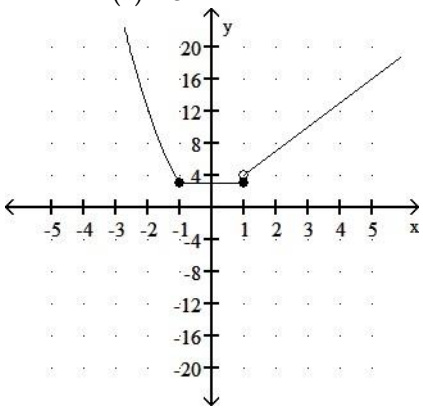
B) $\lim_{x \to -1^-} f(x) = 3$



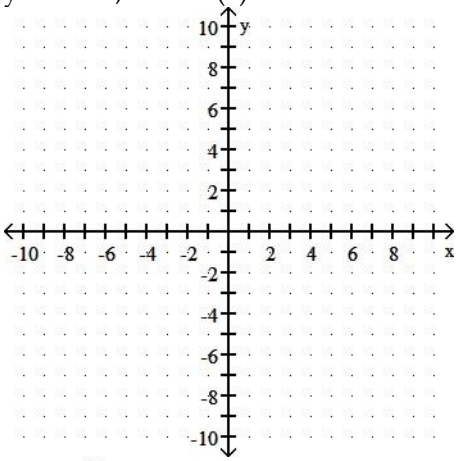
C) $\lim_{x \to -1^-} f(x)$ does not exist



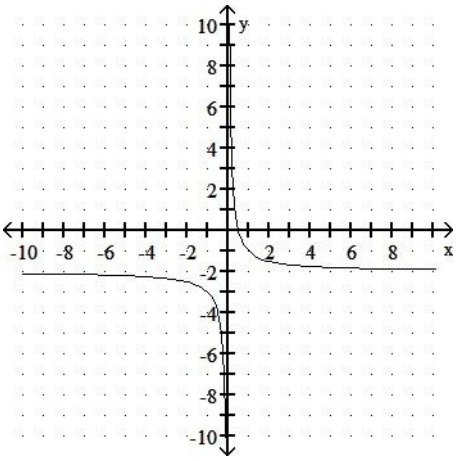
D) $\lim_{x \to -1^-} f(x) = 3$



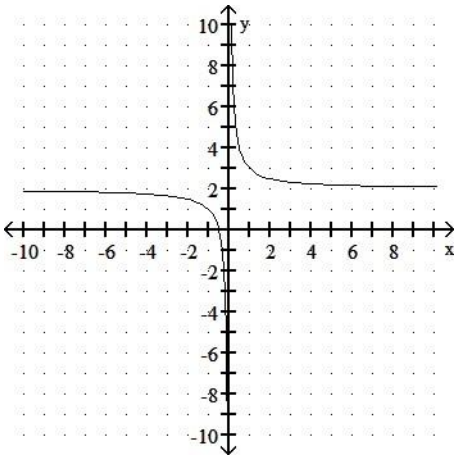
29) $y = \frac{1}{x} - 2$; $\lim_{x \to \infty} f(x)$ 29) _____



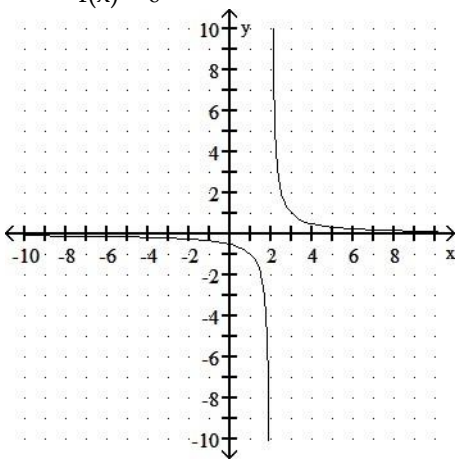
A) $\lim_{x \to \infty} f(x) = -2$



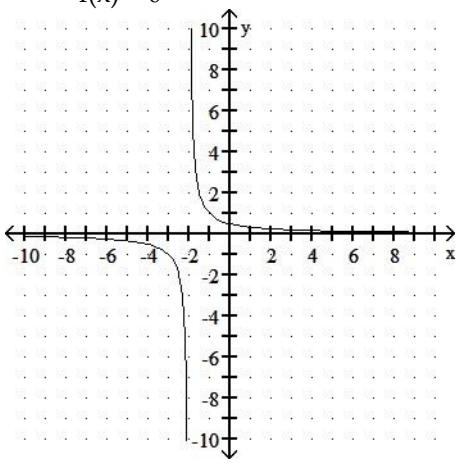
B) $\lim_{x \to \infty} f(x) = 2$



C) $\lim_{x \to \infty} f(x) = 0$



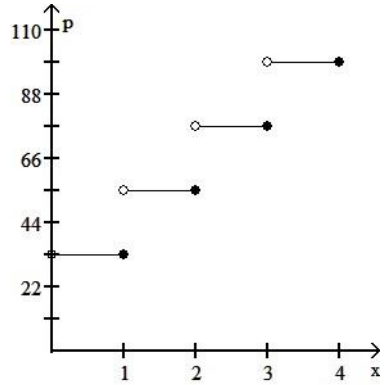
D) $\lim_{x \to \infty} f(x) = 0$



Solve the problem.

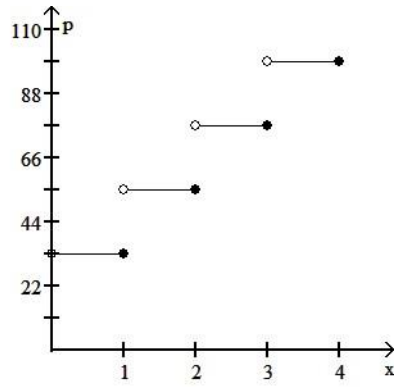
30) Given is a graph of a portion of the postage function, which depicts the cost (in cents) of mailing a letter, p, versus the weight (in ounces) of the letter, x. Find each limit, if it exists: 30) _____

$\lim_{x \to 3^-} p(x)$, $\lim_{x \to 3^+} p(x)$, $\lim_{x \to 3} p(x)$



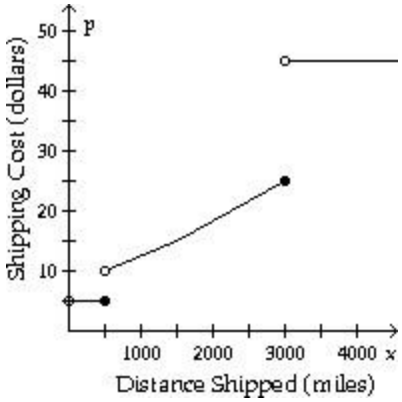
A) 77; 99; 77
B) 77; 99; does not exist
C) 99; 77; does not exist
D) 77; 77; 77

31) Given is a graph of a portion of the postage function, which depicts the cost (in cents) of mailing a letter, p, versus the weight (in ounces) of the letter, x. What is the postage for a letter weighing 1.1 ounces? 2 ounces? 2.1 ounces? Is the postage function continuous? 31) _____



A) 55 cents; 55 cents; 77 cents; no
B) 33 cents; 55 cents; 77 cents; no
C) 55 cents; 77 cents; 77 cents; no
D) 55 cents; 55 cents; 77 cents; yes

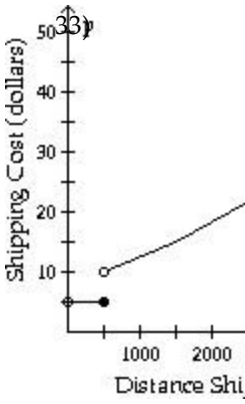
32) Suppose that the cost, p, of shipping a 3-pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. Is p continuous at $x = 50$? at $x = 500$? at $x = 1500$? at $x = 3000$? 32) _____



A) No; no; yes; no
B) Yes; yes; yes; no
C) Yes; no; no; no
D) Yes; no; yes; no

33) Suppose that the cost, p, of shipping a 3-pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. Find each limit, if it exists: 33)

$\lim_{x \to 100} p(x)$, $\lim_{x \to 500} p(x)$, $\lim_{x \to 1500} p(x)$

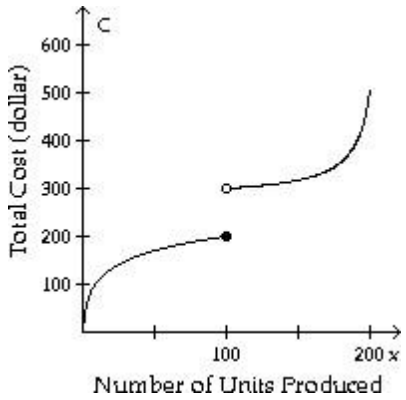


_____

A) 5; 10; 15
B) 5; does not exist; 15
C) 5; does not exist; does not exist
D) 5; 5; 15

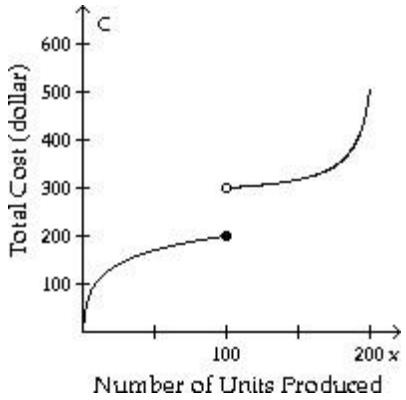
34) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. Find each limit, if it exists: 34) _____

$\lim_{x \to 100^-} p(x)$, $\lim_{x \to 100^+} p(x)$, $\lim_{x \to 100} p(x)$



A) 200; 300; does not exist
B) 200; 200; 200
C) 200; 300; 200
D) 200; does not exist; does not exist

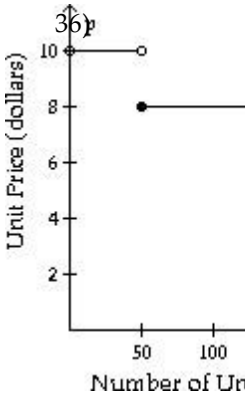
35) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. Is $C(x)$ continuous at $x = 50?$ $x = 100?$ $x = 150?$ 35) _____



A) Yes; yes; yes
B) No; no; no
C) Yes; no; no
D) Yes; no; yes

36) Suppose that the unit price, p, for x units of a product can be illustrated by the given graph. Find each limit, if it exists: 36)

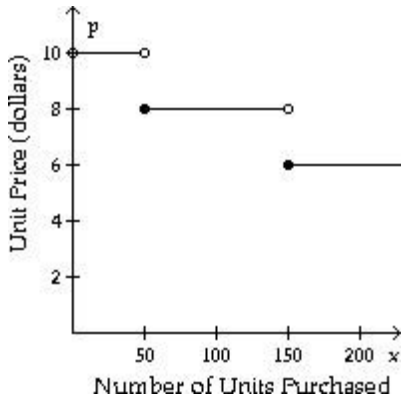
$\lim_{x \to 50^-} p(x)$, $\lim_{x \to 50^+} p(x)$, $\lim_{x \to 50} p(x)$, $\lim_{x \to 75} p(x)$



_____

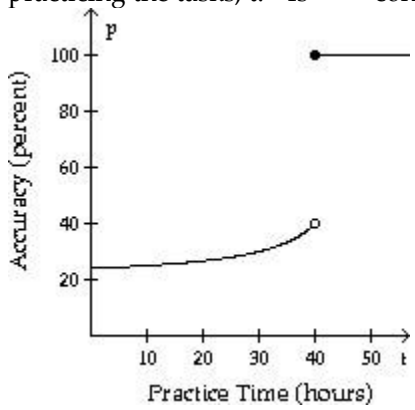
A) 8; 8; does not exist; 8 B) 8; 8; 8; 8
C) 10; 8; does not exist; 8 D) 10; 8; 8; 8

37) Suppose that the unit price, p, for x units of a product can be illustrated by the given graph. Is p continuous at $x = 50?$ $x = 100?$ $x = 150?$ 37) _____



A) No; no; no B) No; yes; no C) Yes; no; yes D) No; yes; yes

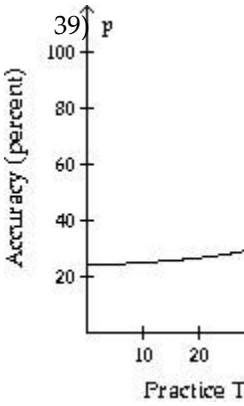
38) Consider the learning curve defined in the graph. Depicted is the accuracy, p, expressed as a percentage, in performing a series of short tasks versus the accumulated amount of time spent practicing the tasks, t. Is $p(t)$ continuous at $t = 25?$ at $t = 40?$ at $t = 45?$ 38) _____



A) Yes; yes; yes B) Yes; no; yes C) Yes; no; no D) No; no; no

39) Consider the learning curve defined in the graph. Depicted is the accuracy, p, expressed as a percentage, in performing a series of short tasks versus the accumulated amount of time spent practicing the tasks, t. Find each limit, if it exists: 39)

$\lim_{x \to 40^-} p(x)$, $\lim_{x \to 40^+} p(x)$, $\lim_{x \to 40} p(x)$



_____

A) 40; 100; 100 B) 40; 100; does not exist
C) 100; 100; 100 D) 40; 40; 40

Find the limit, if it exists.

40) $\lim_{x \to 6} (8x + 8)$ 40) _____

A) -40 B) 16 C) 8 D) 56

41) $\lim_{x \to 2} (x^2 + 8x - 2)$ 41) _____

A) 0 B) Does not exist C) -18 D) 18

42) $\lim_{x \to 0} (x^2 - 5)$ 42) _____

A) 0 B) Does not exist C) -5 D) 5

43) $\lim_{x \to 2} (x^3 + 5x^2 - 7x + 1)$ 43) _____

A) Does not exist B) 0 C) 15 D) 29

44) $\lim_{x \to 2} (2x^5 - 2x^4 + 4x^3 + x^2 - 5)$ 44) _____

A) 63 B) -1 C) 127 D) 31

45) $\lim_{x \to 2} \frac{x^2 + 4}{x + 2}$ 45) _____

A) Does not exist B) 2 C) 4 D) 0

46) $\lim_{x \to -7} \frac{x^2 - 49}{x - 7}$ 46) _____

A) 14 B) 0 C) 1 D) Does not exist

In the exercise below, the initial substitution of x = a yields the form 0/0. Look for ways to simplify the function algebraically, or use a table and/or graph to determine the limit. When necessary, state that the limit does not exist.

47) $\lim_{x \to 7} \frac{x^2 - 49}{x - 7}$ 47) _____

A) Does not exist B) 1 C) 7 D) 14

48) $\lim_{x \to -8} \frac{x^2 - 64}{x + 8}$ 48) _____

A) -16 B) -8 C) 1 D) Does not exist

49) $\lim_{x \to 1} \frac{x^2 + 6x - 7}{x^2 - 1}$ 49) _____

A) - 3 B) Does not exist C) 4 D) 0

50) $\lim_{x \to -3} \frac{2x^2 - 2x - 24}{9 - x^2}$ 50) _____

A) -

$\frac{7}{3}$ B) $\frac{7}{3}$ C) $\frac{1}{3}$ D) $-\frac{1}{3}$

51) $\lim_{x\to 1} \frac{1-x^3}{x-1}$ 51) _____

A) -3 B) $\frac{3}{2}$ C) $-\frac{3}{2}$ D) 3

52) $\lim_{x\to 2} \frac{x^3-8}{2-x}$ 52) _____

A) - 6 B) -12 C) 12 D) 6

53) $\lim_{x\to 16} \frac{x-16}{\sqrt{x}-4}$ 53) _____

A) -8 B) 8 C) -4 D) 16

54) $\lim_{x\to 49} \frac{\sqrt{x}-7}{x-49}$ 54) _____

A) 0 B) $\frac{1}{7}$ C) 7 D) $\frac{1}{14}$

Find the limit, if it exists.

55) $\lim_{x\to 0} \sqrt{x} - 2$ 55) _____

A) 2 B) 0 C) -2 D) Does not exist

56) $\lim_{x\to 7} \sqrt{x^2+14x+49}$ 56) _____

A) ±14 B) Does not exist C) 196 D) 14

57) $\lim_{x\to 1} \sqrt{x-2}$ 57) _____

A) -1 B) Does not exist C) 1 D) 0

58) $\lim_{x\to 14} \sqrt{x^2-9}$ 58) _____

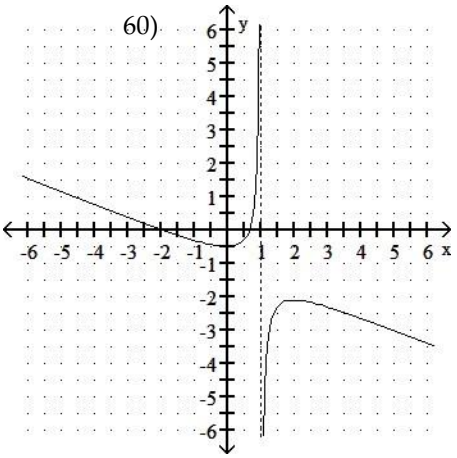
A) Does not exist B) $\pm\sqrt{187}$ C) 93.5 D) $\sqrt{187}$

59) $\lim_{x\to -7^-} \sqrt{x^2-49}$ 59) _____

A) 0 B) Does not exist C) 3.5 D) $7\sqrt{2}$

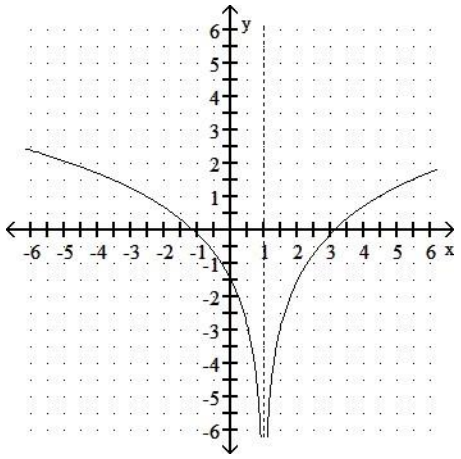
Determine whether the function shown is continuous over the interval (-5, 5).

60)

60) 

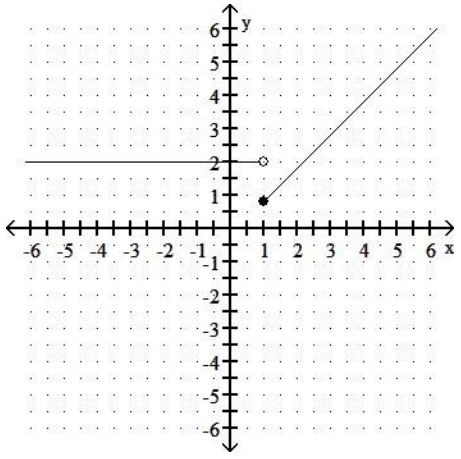
___
___

A) Yes B) No

61) 

61) _____

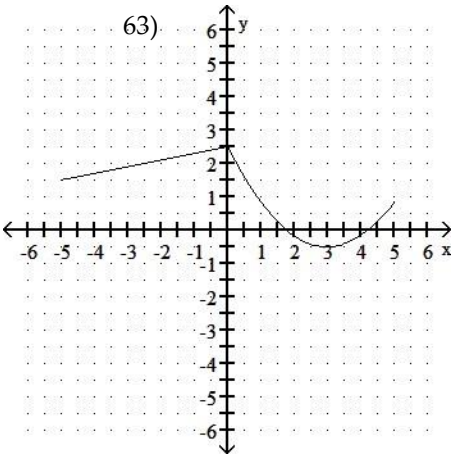
A) Yes B) No

62) 

62) _____

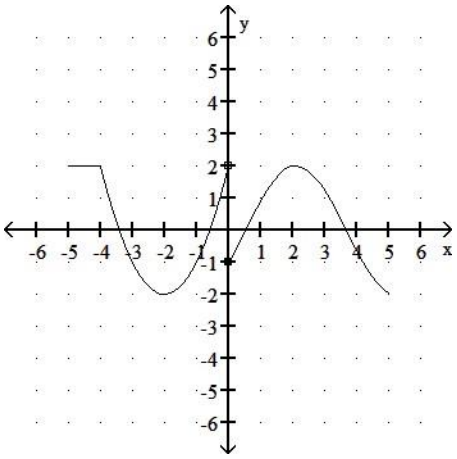
A) Yes B) No

63)

63) 

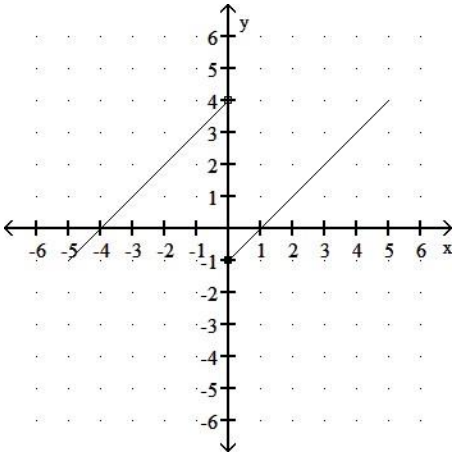
___
___

A) Yes B) No

64) 

64) _____

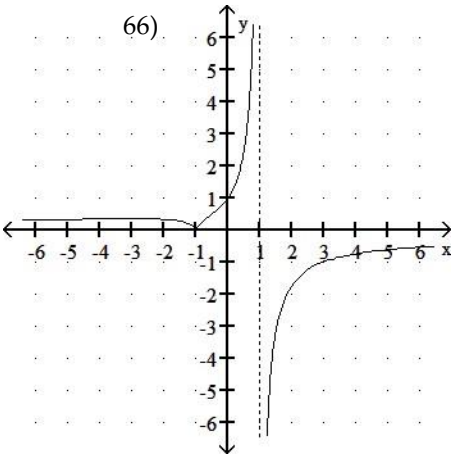
A) Yes B) No

65) 

65) _____

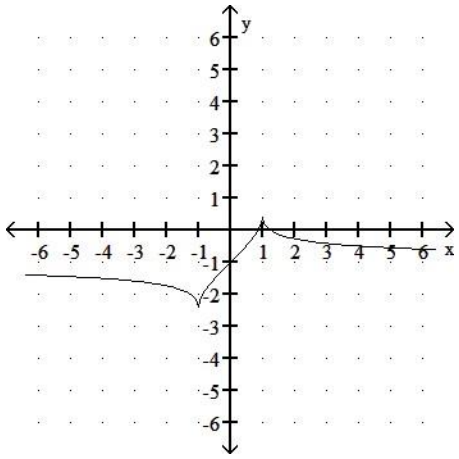
A) Yes B) No

66)

66) 

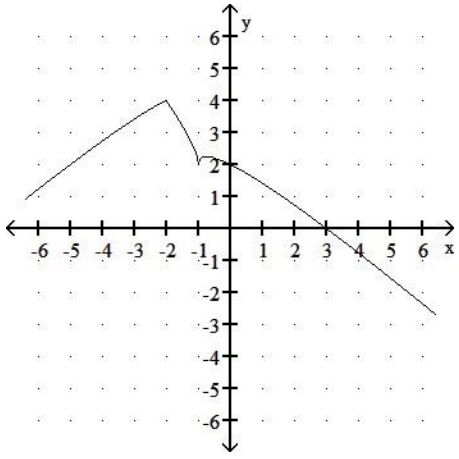
___
___

A) Yes B) No

67) 

67) _____

A) Yes B) No

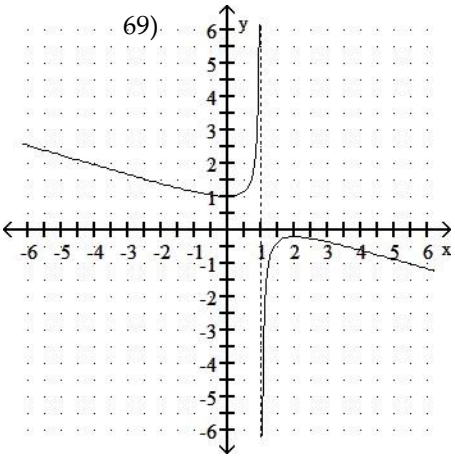
68) 

68) _____

A) Yes B) No

Use the graph to answer the question.

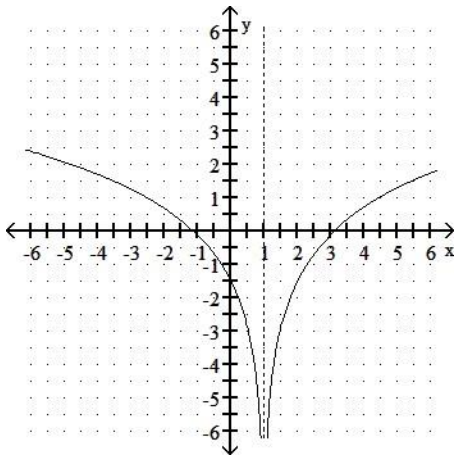
69) Is f continuous at x = 1?

69) 

___
___

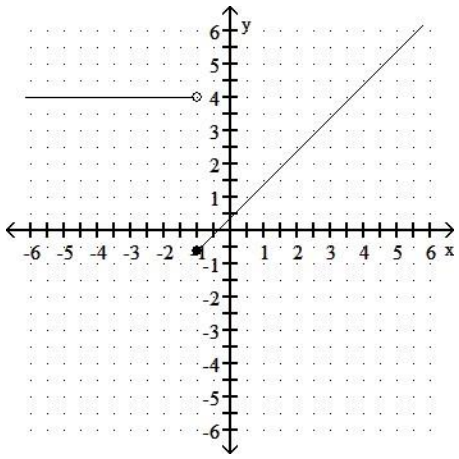
A) Yes B) No

70) Is f continuous at x = 1? 70) _____



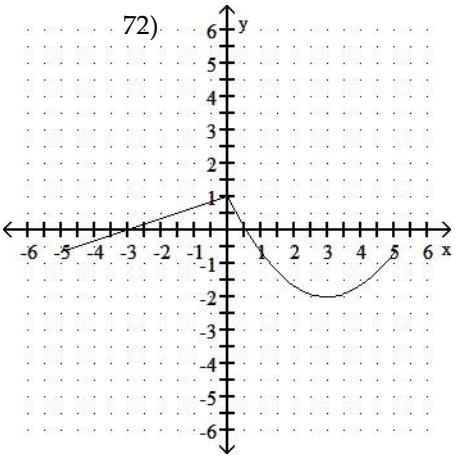
A) No B) Yes

71) Is f continuous at x = -1? 71) _____



A) Yes B) No

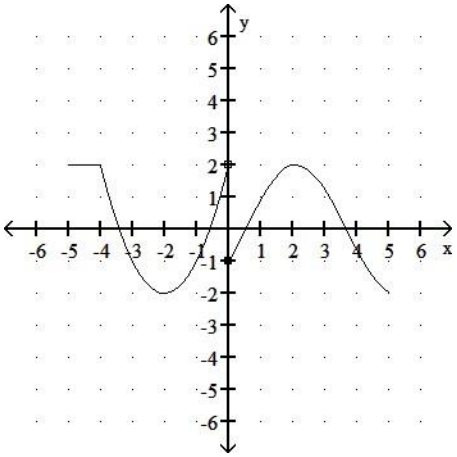
72) Is f continuous at x = 3?

72) 

___
___

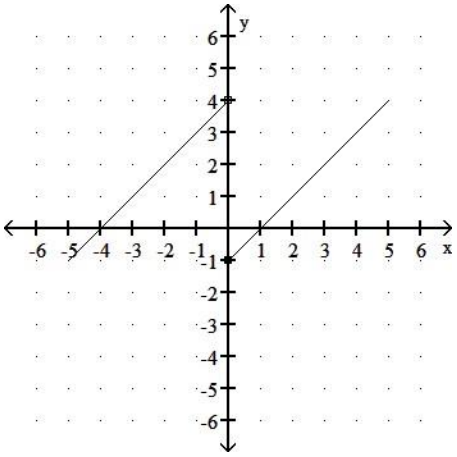
A) Yes B) No

73) Is f continuous at x = 0? 73) _____



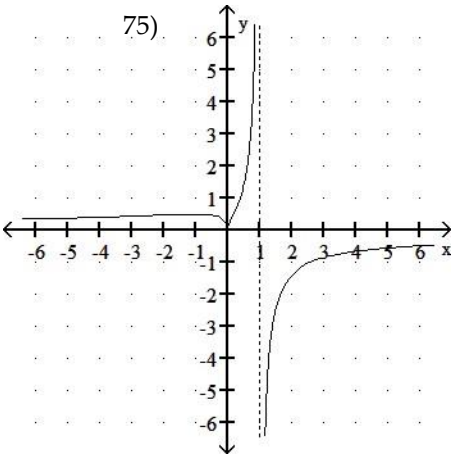
A) Yes B) No

74) Is f continuous at x = 4? 74) _____



A) No B) Yes

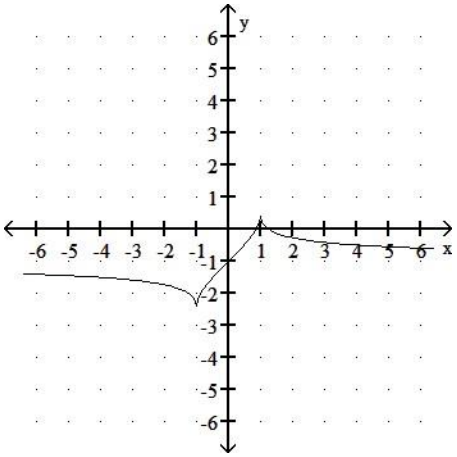
75) Is f continuous at x = 0?

75) 

___
___

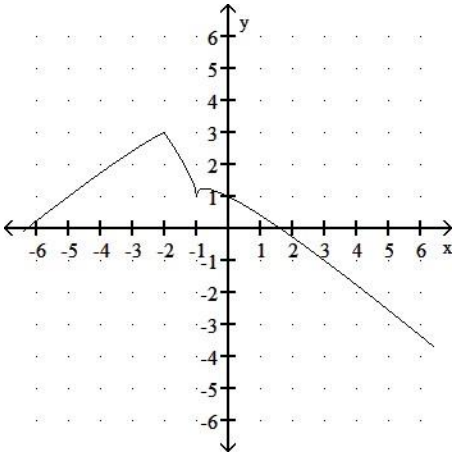
A) Yes B) No

76) Is f continuous at x = -1? 76) _____



A) Yes B) No

77) Is f continuous at x = 2? 77) _____



A) Yes B) No

Evaluate or determine that the limit does not exist for each of the limits $\lim_{x \to d-} f(x)$, $\lim_{x \to d+} f(x)$, **and** $\lim_{x \to d} f(x)$ **for the given function f and number d.**

78) $f(x) = \begin{cases} x^2 - 5, & \text{for } x < 0 \\ -3, & \text{for } x \geq 0 \end{cases}$; d = -1 78) _____

A) (a) -5
(b) -3
(c) -3

B) (a) -3
(b) -5
(c) Does not exist

C) (a) -5
(b) -3
(c) Does not exist

D) (a) -4
(b) -4
(c) -4

79) $f(x) = \begin{cases} 2x - 3, & \text{for } x < 1 \\ 1, & \text{for } x = 1 \\ -4x + 8, & \text{for } x > 1 \end{cases}$; d = 1 79) _____

A) (a) 4
(b) -1
(c) 3

B) (a) -1
(b) 4
(c) Does not exist

C) (a) -1
(b) 4
(c) 3

D) (a) 4
(b) -1
(c) Does not exist

80) $f(x) = \begin{cases} 3x - 10, & \text{for } x \le 1 \\ 4x - 11, & \text{for } x > 1 \end{cases}$; d = 1 80) _____

A) (a) -10
(b) -11
(c) Does not exist

B) (a) -7
(b) -7
(c) -7

C) (a) -7
(b) -7
(c) Does not exist

D) (a) -11
(b) -10
(c) Does not exist

81) $f(x) = \begin{cases} \dfrac{1}{x - 4}, & \text{for } x > 4 \\ x^2 - 3x, & \text{for } x \le 4 \end{cases}$; d = 4 81) _____

A) (a) 4
(b) Does not exist
(c) 4

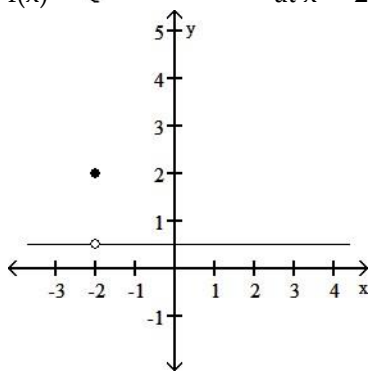
B) (a) Does not exist
(b) 4
(c) 4

C) (a) 4
(b) Does not exist
(c) Does not exist

D) (a) Does not exist
(b) 4
(c) Does not exist

Determine the continuity of the function at the given points.

82) $f(x) = \begin{cases} 2, & \text{for } x = -2 \\ 0.5, & \text{for } x \ne -2 \end{cases}$ at x = -2 and x = -3 82) _____



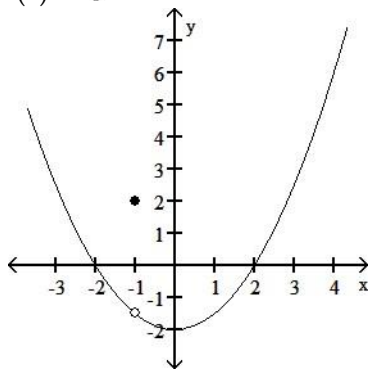
A) The function f is continuous at $x = -3$ but not at $x = -2$.

B) The function f is continuous at both $x = -3$ and $x = -2$.

C) The function f is continuous at neither $x = -3$ nor $x = -2$.

D) The function f is continuous at $x = -2$ but not at $x = -3$.

83) $f(x) = \begin{cases} 2, & \text{for } x = -1 \\ \frac{1}{2}x^2 - 2, & \text{for } x \neq -1 \end{cases}$ at x = -1 and x = 0 83) _____



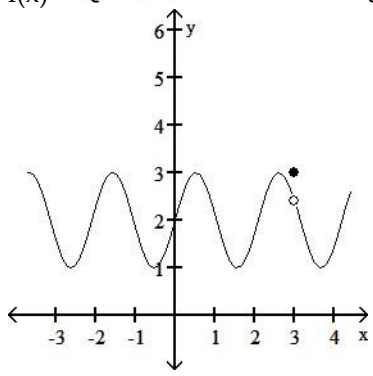
A) The function f is continuous at neither $x = 0$ nor $x = -1$.

B) The function f is continuous at both $x = 0$ and $x = -1$.

C) The function f is continuous at $x = -1$ but not at $x = 0$.

D) The function f is continuous at $x = 0$ but not at $x = -1$.

84) $f(x) = \begin{cases} 3, & \text{for } x = 3 \\ \sin(3x) + 2, & \text{for } x \neq 3 \end{cases}$ at x = 3 and x = -2 84) _____



A) The function f is continuous at $x = 3$ but not at $x = -2$.

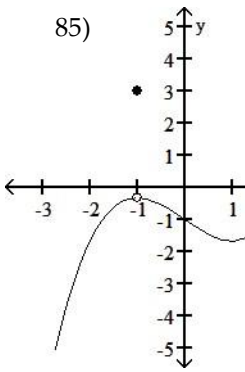
B) The function f is continuous at both $x = -2$ and $x = 3$.

C) The function f is continuous at $x = -2$ but not at $x = 3$.

D) The function f is continuous at neither $x = -2$ nor $x = 3$.

85) $f(x) = \begin{cases} 3, & \text{for } x = -1, \\ \frac{1}{3}x^3 - x - 1, & \text{for } x \neq -1 \end{cases}$ at x = -1 and x = 1.5

85)



_____

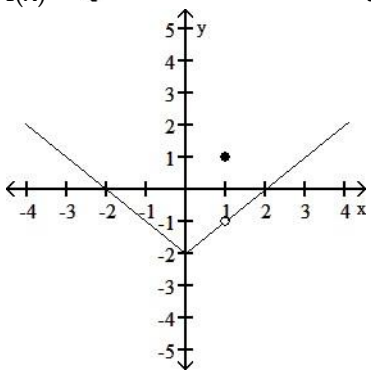
A) The function f is continuous at $x = -1$ but not at $x = 1.5$.

B) The function f is continuous at neither $x = 1.5$ nor $x = -1$.

C) The function f is continuous at both $x = 1.5$ and $x = -1$.

D) The function f is continuous at $x = 1.5$ but not at $x = -1$.

86) $f(x) = \begin{cases} 1, & \text{for } x = 1 \\ |x| - 2, & \text{for } x \neq 1 \end{cases}$ at x = 1 and x = 0 86) _____



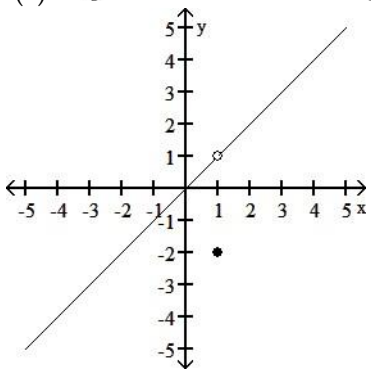
A) The function f is continuous at both $x = 0$ and $x = 1$.

B) The function f is continuous at $x = 0$ but not at $x = 1$.

C) The function f is continuous at neither $x = 0$ nor $x = 1$.

D) The function f is continuous at $x = 1$ but not at $x = 0$.

87) $f(x) = \begin{cases} -2, & \text{for } x = 1 \\ x, & \text{for } x \neq 1 \end{cases}$ at x = 1 and x = 2 87) _____



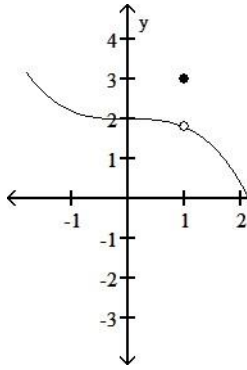
A) The function f is continuous at $x = 2$ but not at $x = 1$.

B) The function f is continuous at neither $x = 2$ nor $x = 1$.

C) The function f is continuous at both $x = 2$ and $x = 1$.

D) The function f is continuous at $x = 1$ but not at $x = 2$.

88) $f(x) = \begin{cases} 3, & \text{for } x = 1 \\ 2 - \frac{1}{3}x^3, & \text{for } x \neq 1 \end{cases}$ at x = 1 and x = 2



88) _____

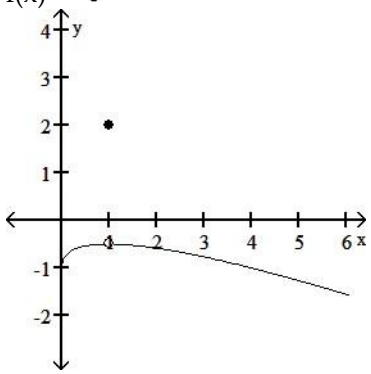
A) The function f is continuous at both $x = 2$ and $x = 1$.

B) The function f is continuous at $x = 1$ but not at $x = 2$.

C) The function f is continuous at neither $x = 2$ nor $x = 1$.

D) The function f is continuous at $x = 2$ but not at $x = 1$.

89) $f(x) = \begin{cases} 2, & \text{for } x = 1 \\ \sqrt{x} - \frac{1}{2}x - 1, & \text{for } x \neq 1 \end{cases}$ at x = 1 and x = 3 89) _____



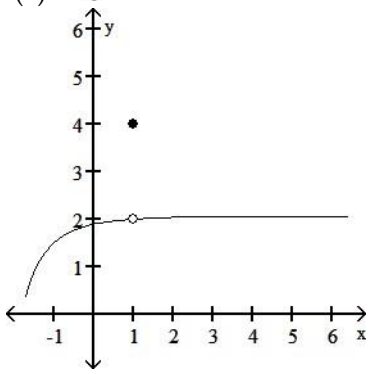
A) The function f is continuous at neither $x = 3$ nor $x = 1$.

B) The function f is continuous at $x = 1$ but not at $x = 3$.

C) The function f is continuous at $x = 3$ but not at $x = 1$.

D) The function f is continuous at both $x = 3$ and $x = 1$.

90) $f(x) = \begin{cases} 4, & \text{for } x = 1, \\ \frac{(x-1)}{(x+3)^2} + 2, & \text{for } x \neq 1 \end{cases}$ at x = 1 and x = -1 90) _____



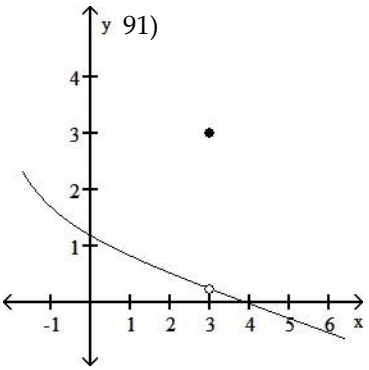
A) The function f is continuous at both $x = -1$ and $x = 1$.

B) The function f is continuous at $x = 1$ but not at $x = -1$.

C) The function f is continuous at $x = -1$ but not at $x = 1$.

D) The function f is continuous at neither $x = -1$ nor $x = 1$.

91) $f(x) = \begin{cases} 3, & \text{for } x = 3 \\ \frac{(3-x)}{(x+4)^2} - \frac{1}{4}x + 1, & \text{for } x \neq 3 \end{cases}$ at x = 3 and x = 1

91) 

A) The function f is continuous at $x = 1$ but not at $x = 3$.
B) The function f is continuous at $x = 3$ but not at $x = 1$.
C) The function f is continuous at neither $x = 1$ nor $x = 3$.
D) The function f is continuous at both $x = 1$ and $x = 3$.

Provide an appropriate response.

92) Is the function given by f(x) = 16x + 3 continuous at x = 2? Why or why not? 92) _____
A) No, $\lim_{x \to 2}$ f(x) does not exist
B) Yes, $\lim_{x \to 2}$ f(x) = f(2)

93) Is the function given by f(x) = $\sqrt{x}$ continuous at x = - 9? Why or why not? 93) _____
A) No, f(- 9) does not exist
B) Yes, $\lim_{x \to -9}$ f(x) = f(- 9)

94) Is the function given by f(x) = $\dfrac{x + 5}{x^2 - 11x + 30}$ continuous at x = 5? Why or why not? 94) _____
A) Yes, $\lim_{x \to 5}$ f(x) = f(5)
B) No, f(5) does not exist and $\lim_{x \to 5}$ f(x) does not exist

95) Is the function given by f(x) = $\sqrt{3x + 8}$ continuous at x = - $\dfrac{8}{3}$? Why or why not? 95) _____
A) No, $\lim_{x \to -\frac{8}{3}}$ f(x) does not exist
B) Yes, $\lim_{x \to -\frac{8}{3}}$ f(x) = f$\left(-\frac{8}{3}\right)$

96) Is the function given by f(x) = $\begin{cases} x^2 - 5, & \text{for } x < 0 \\ 4, & \text{for } x \geq 0 \end{cases}$ continuous at x = -2? Why or why not? 96) _____
A) No, $\lim_{x \to -2}$ f(x) = f(-2) does not exist
B) Yes, $\lim_{x \to -2}$ f(x) = f(-2)

97) Is the function given by f(x) = $\begin{cases} -7x + 14, & \text{for } x < 1 \\ 1, & \text{for } x = 1 \\ -4x + 2, & \text{for } x > 1 \end{cases}$ continuous at x = 1? Why or why not? 97) _____
A) No, $\lim_{x \to 1}$ f(x) does not exist
B) Yes, $\lim_{x \to 1}$ f(x) = f(1)

98) Is the

function given by $f(x) = \begin{cases} -5x + 6, & \text{for } x \le 1 \\ -2x + 3, & \text{for } x > 1 \end{cases}$ continuous at x = 1? Why or why not? 98) ___ ___

A) Yes, $\lim_{x \to 1} f(x) = f(1)$

B) No, $\lim_{x \to 1} f(x)$ does not exist

99) Is the function given by $f(x) = \begin{cases} \frac{1}{x - 4}, & \text{for } x > 4 \\ x^2 - 2x, & \text{for } x \le 4 \end{cases}$ continuous at x = 4? Why or why not? 99) _____

A) Yes, $\lim_{x \to 4} f(x) = f(4)$

B) No, $\lim_{x \to 4} f(x)$ does not exist

Find the intervals on which the function is continuous.

100) Is the function given by $f(x) = x^2 - 15x + 56$ continuous over the interval (-7, 7)? Why or why not? 100) _____

A) No, since f(x) is not continuous at x = 7

B) Yes, f(x) is continuous at each point on (-7, 7)

101) Is the function given by $f(x) = \frac{1}{x + 3}$ continuous over the interval (-∞, 0)? Why or why not? 101) _____

A) Yes, f(x) is continuous at each point on (-∞, 0)

B) No, since f(x) is not continuous at x = -3

102) Is the function given by $f(x) = \frac{5}{(x + 1)^2 + 2}$ continuous on $\mathcal{R}$? Why or why not? 102) _____

A) Yes, f(x) is continuous at each real number

B) No, since f(x) is not continuous at x = - 1

103) Is the function given by $f(x) = \frac{x + 5}{x^2 - 7x + 12}$ continuous over the interval [-3, 3]? Why or why not? 103) _____

A) No, since f(x) is not continuous at x = 3

B) Yes, f(x) is continuous at each point on [-3, 3]

104) Is the function given by $f(x) = \sqrt{2x + 2}$ continuous continuous on $\mathcal{R}$? 104) _____

A) No, since f(x) is not continuous over the interval $(-\infty, -1)$

B) Yes, f(x) is continuous at each real number

Solve the problem.

105) A coffee house sells coffee by the pound, charging $8.75 per pound for quantities up to and including 60 pounds. Above 60 pounds, the coffee house charges $7.75 per pound for the entire quantity, plus a quantity surcharge, k. If x represents the number of pounds, the price function is $p(x) = \begin{cases} 8.75x, & \text{for } x \le 6 \\ 7.75x + k, & \text{for } x > 6 \end{cases}$ Find k such that

the price function p is continuous at x = 60. Then explain why it is preferable to have continuity at x = 60. 105) ____

A) k = 990; It is preferable so that the coffee house does not lose revenue.
B) k = 602.5; It is preferable so that the coffee house makes a profit.
C) k = 60; It is preferable so that the coffee house does not lose revenue.
D) k = 447.5; It is preferable so that the coffee house makes a profit.

106) A biologist controls the humidity H (as a percentage) inside a terrarium. From an initial humidity level of 0%, she allows the humidity in the terrarium to increase by 7% per hour for the next 10 hours. After the 10th hour, she allows the terrarium to dry out (lose humidity) at the rate of 10% per hour. The humidity function H is defined by 106) _____

$$H(t) = \begin{cases} 7t, & \text{for } t \le 10, \\ k - 10t, & \text{for } t > 10. \end{cases}$$

Find k such that H is continuous at t = 24. Then explain why H must be continuous at t = 10 hours.

A) k = 130; H must be continuous at t = 10 hours because time changes continuously.
B) k = 30; H must be continuous at t = 10 hours because the humidity level changes continuously.
C) k = 170; H must be continuous at t = 10 hours because the humidity level changes continuously.
D) k = 270; H must be continuous at t = 10 hours because time changes continuously.

Find the limit by using the TABLE and TRACE features of your graphing calculator.

107) $\lim_{x \to 25} \frac{\sqrt{x} - 5}{x - 25}$ 107) _____

A) 0 B) $\frac{1}{5}$ C) 5 D) $\frac{1}{10}$

108) $\lim_{x \to 49} \frac{7 - \sqrt{x}}{49 - x}$ 108) _____

A) $\frac{1}{14}$ B) 7 C) 14 D) 0

109) $\lim_{x \to 0} \frac{\sqrt{16 + x} - \sqrt{16 - x}}{x}$ 109) _____

A) $\frac{1}{4}$ B) $\frac{1}{8}$ C) 4 D) 0

110) $\lim_{x\to 0} \frac{\sqrt{1-x}-1}{x}$ 110) _____

A) 2 B) $\frac{1}{2}$ C) 1 D) $\frac{1}{2}$

111) $\lim_{x\to 0} \frac{\sqrt{16+2x}-4}{x}$ 111) _____

A) $\frac{1}{4}$ B) 16 C) $\frac{1}{2}$ D) $\frac{1}{8}$

112) $\lim_{x\to 0} \frac{\sqrt{6+6x}-\sqrt{6}}{x}$ 112) _____

A) $\sqrt{6}$ B) $\frac{\sqrt{6}}{2}$ C) $\frac{1}{2}$ D) 0

113) $\lim_{x\to 0} \frac{5-\sqrt{25-x^2}}{x}$ 113) _____

A) 0 B) $\frac{1}{10}$ C) $\frac{1}{5}$ D) 10

114) $\lim_{x\to 3} \frac{x^2-9}{\sqrt{x^2+7}-4}$ 114) _____

A) $\frac{1}{4}$ B) 8 C) 3 D) 4

115) $\lim_{x\to -1} \frac{x^2-1}{\sqrt{x^2+3}-2}$ 115) _____

A) $\frac{1}{4}$ B) 1 C) 4 D) 2

Provide an appropriate response.

116) Decide whether the function $f(x) = x^2 + 6x - 3$ is continuous for all x, and provide a short statement supporting your conclusion. 116) _____

A) Yes, polynomial functions are defined for all x.

B) No, there is a break in the graph of this function at $x = 0$.

C) No, this polynomial is not defined for all x.

D) Yes, polynomial functions are continuous; there are no breaks in the graph of a polynomial function.

117) Given $f(x) = x + 4$ and $g(x) = x - 4$, where is the function $f(x)/g(x)$ continuous? 117) _____

A) The function f(x)/g(x) is continuous for all x except $x = -4$ and $x = 4$.

B) The function f(x)/g(x) is continuous for all x.

C) The function f(x)/g(x) is continuous for all x except $x = -4$.

D) The function f(x)/g(x) is continuous for all x except $x = 4$.

118) Given $f(x) = \sqrt[3]{4x}$ and $g(x) = x - 2$, where is the function $f(x)/g(x)$ continuous? 118) _____

A) The function f(x)/g(x) is continuous for all x except $x < 0$ and $x = -2$.

B) The function f(x)/g(x) is continuous for all x except $x = 2$.

C) The function f(x)/g(x) is continuous for all x except $x = -2$.

D) The function f(x)/g(x) is continuous for all x.

119) Why does the general continuity principle regarding the quotient $g(x)/f(x)$ include the phrase "so long as the inputs x do not yield outputs $f(x) = 0$"? 119) _____

A) The function g(x)/f(x) is not defined for any x such that f(x) = 0, and a function cannot be continuous at any point at which it is undefined.

B) Whenever $f(x) = 0$, the function $g(x)/f(x)$ is so large that it would be difficult to graph it.

C) The quotient $g(x)/f(x)$ is an invalid function unless there is no x for which $f(x) = 0$.

D) One needs to avoid an infinite g(x).

120) Write the formal notation for the principle "the limit of a quotient is the quotient of the limits" and include a statement of any restrictions on the principle. 120) _____

A) If $\lim_{x \to a} g(x) = M$ and $\lim_{x \to a} f(x) = L$, then $\lim_{x \to a} \frac{g(x)}{f(x)} = \frac{\lim_{x \to a} g(x)}{\lim_{x \to a} f(x)} = \frac{M}{L}$, provided that $L \neq 0$.

B) $\lim_{x \to a} \frac{g(x)}{f(x)} = \frac{g(a)}{f(a)}$, provided that $f(a) \neq 0$.

C) $\lim_{x \to a} \frac{g(x)}{f(x)} = \frac{g(a)}{f(a)}$.

D) If $\lim_{x \to a} g(x) = M$ and $\lim_{x \to a} f(x) = L$, then $\lim_{x \to a} \frac{g(x)}{f(x)} = \frac{\lim_{x \to a} g(x)}{\lim_{x \to a} f(x)} = \frac{M}{L}$, provided that $f(a) \neq 0$.

121) What conditions, when present, are sufficient to conclude that a function f(x) is continuous at $x = a$? 121) _____

A) The limit of $f(x)$ as $x \to a$ from the left exists, the limit of $f(x)$ as $x \to a$ from the right exists, and these two limits are the same.

B) f(a) exists, the limit of $f(x)$ as $x \to a$ from the left exists, and the limit of $f(x)$ as $x \to a$ from the right exists.

C) f(a) exists, and the limit of $f(x)$ as $x \to a$ exists.

D) f(a) exists, the limit of $f(x)$ as $x \to a$ exists, and the limit of $f(x)$ as $x \to a$ is $f(a)$.

122) What conditions, when present, are sufficient to conclude that a function f(x) has a limit as x approaches some value of a? 122) _____

A) Either the limit of $f(x)$ as $x \to a$ from the left exists or the limit of $f(x)$ as $x \to a$ from the right exists

B) The limit of $f(x)$ as $x \to a$ from the left exists, the limit of $f(x)$ as $x \to a$ from the right exists, and at least one of these limits is the same as f(a).

C) The limit of $f(x)$ as $x \to a$ from the left exists, the limit of $f(x)$ as $x \to a$ from the right exists, and these two limits are the same.

D) f(a) exists, the limit of $f(x)$ as $x \to a$ from the left exists, and the limit of $f(x)$ as $x \to a$ from the right exists.

123) Provide a short sentence that summarizes the general limit principle given by the formal notation $\lim_{x \to a} [f(x) \pm g(x)] = \lim_{x \to a} f(x) \pm \lim_{x \to a} g(x) = L \pm M$, given that $\lim_{x \to a} f(x) = L$ and $\lim_{x \to a} g(x) = M$. 123) _____

A) The limit of a sum or a difference is the sum or the difference of the functions.
B) The sum or the difference of two functions is the sum of two limits.
C) The sum or the difference of two functions is continuous.
D) The limit of a sum or a difference is the sum or the difference of the limits.

124) The statement "the limit of a constant times a function is the constant times the limit" follows from a combination of two fundamental limit principles. What are they? 124) _____

A) The limit of a function is a constant times a limit, and the limit of a constant is the constant.
B) The limit of a product is the product of the limits, and a constant is continuous.
C) The limit of a product is the product of the limits, and the limit of a quotient is the quotient of the limits.
D) The limit of a constant is the constant, and the limit of a product is the product of the limits.

125) When can direct substitution of a for x be used to find the limit of a function f(x) as x approaches a? 125) _____

A) When f is continuous at a
B) When f is continuous for all x, except x = a
C) Always
D) Only when f is continuous for all x

Find a simplified difference quotient for the function.

126) $f(x) = 2^{x^2}$ 126) _____

A) 2x + h B) 4x + h C) 4x + 2h D) 4x

127) $f(x) = -8^{x^2}$ 127) _____

A) - 16x B) - 16x - 8h C) - 16x + h D) 16x

128) $f(x) = 6^{x^3}$ 128) _____

A) $18^{x^2} + 18xh + 6h$ B) $18^{x^2} + 18xh + 6^{h^2}$
C) $18^{x^2} + h$ D) 18^{x^2}

129) $f(x) = -4^{x^3}$ 129) _____

A) $12^{x^2} - h$ B) $-12^{x^2} - 12xh - 4^{h^2}$
C) -12^{x^2} D) $-12^{x^2} - 12xh - 4h$

130) $f(x) = \frac{3}{x}$ 130) _____

A) $\frac{3}{x^2 + xh}$ B) $-\frac{3}{x^2 + h}$ C) $\frac{3}{x^2 + h}$ D) $-\frac{3}{x^2 + xh}$

131) f(x) = 8x + 10 131) _____

A) 8 + h B) 8 C) - 8 D) 8h

132) $f(x) = x^2 + 9x$ 132) _____

A) $2x + h + 9$ B) $2(x + h) + 9$ C) $2x + 9h$ D) $2xh + h + 9$

133) $f(x) = x^3 + x$ 133) _____

A) $3x^2 + 3xh + h^2 + h$ B) $2x^3 + 3x^2 + 3xh + h^2 + 1$

C) $3x^2 + 3xh + h^2 + 1$ D) $2x^3 + 3x^2 + 3xh + h^2$

Complete the table after finding a simplified form of the difference quotient.

134) For the function $f(x) = -7x^2$, complete the table below: 134) _____

x	h	$\frac{f(x+h)-f(x)}{h}$
5	2	
5	1	
5	0.1	
5	0.01	

A)

x	h	$\frac{f(x+h)-f(x)}{h}$
5	2	−84
5	1	−77
5	0.1	−70.7
5	0.01	−70.07

B)

x	h	$\frac{f(x+h)-f(x)}{h}$
5	2	12
5	1	11
5	0.1	10.1
5	0.01	10.01

C)

x	h	$\frac{f(x+h)-f(x)}{h}$
5	2	−98
5	1	−84
5	0.1	−71.4
5	0.01	−70.14

D)

x	h	$\frac{f(x+h)-f(x)}{h}$
5	2	−49
5	1	−42
5	0.1	−35.7
5	0.01	−35.07

135) For the function $f(x) = 4x^3$, complete the table below: 135) _____

x	h	$\frac{f(x+h)-f(x)}{h}$
2	2	
2	1	
2	0.1	
2	0.01	

A)

x	h	$\frac{f(x+h)-f(x)}{h}$
2	2	104
2	1	76
2	0.1	50.8
2	0.01	48.28

B)

x	h	$\frac{f(x+h)-f(x)}{h}$
2	2	80
2	1	60
2	0.1	48.84
2	0.01	48.0804

C)

x	h	$\frac{f(x+h)-f(x)}{h}$
2	2	64
2	1	55
2	0.1	48.61
2	0.01	48.0601

D)

x	h	$\frac{f(x+h)-f(x)}{h}$
2	2	112
2	1	76
2	0.1	50.44
2	0.01	48.2404

136) For the function f(x) = 6x - 2, complete the table below: 136) _____

x	h	$\frac{f(x+h)-f(x)}{h}$
3	2	
3	1	
3	0.1	
3	0.01	

A)

x	h	$\frac{f(x+h)-f(x)}{h}$
3	2	12
3	1	6
3	0.1	0.6
3	0.01	0.06

B)

x	h	$\frac{f(x+h)-f(x)}{h}$
3	2	6
3	1	6
3	0.1	6
3	0.01	6

C)

x	h	$\frac{f(x+h)-f(x)}{h}$
3	2	8
3	1	7
3	0.1	6.1
3	0.01	6.01

D)

x	h	$\frac{f(x+h)-f(x)}{h}$
3	2	18
3	1	18
3	0.1	18
3	0.01	18

137) For the function $f(x) = \frac{-4}{x}$, complete the table below: 137) _____

x	h	$\frac{f(x+h)-f(x)}{h}$
4	2	
4	1	
4	0.1	
4	0.01	

Round to four decimal places.

A)

x	h	$\frac{f(x+h)-f(x)}{h}$
4	2	0.3333
4	1	0.1667
4	0.1	0.0167
4	0.01	0.0017

B)

x	h	$\frac{f(x+h)-f(x)}{h}$
4	2	0.6667
4	1	0.8
4	0.1	0.9756
4	0.01	0.9975

C)

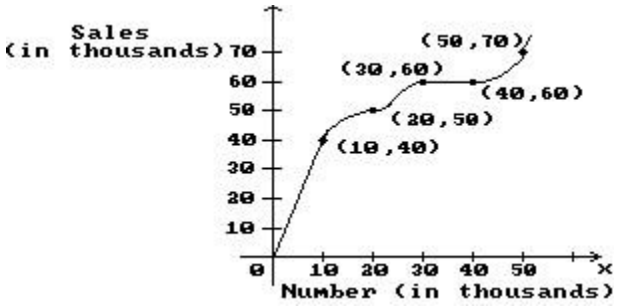
x	h	$\frac{f(x+h)-f(x)}{h}$
4	2	0.1667
4	1	0.2
4	0.1	0.2439
4	0.01	0.2494

D)

x	h	$\frac{f(x+h)-f(x)}{h}$
4	2	−0.1667
4	1	−0.2
4	0.1	−0.2439
4	0.01	−0.2494

Solve the problem.

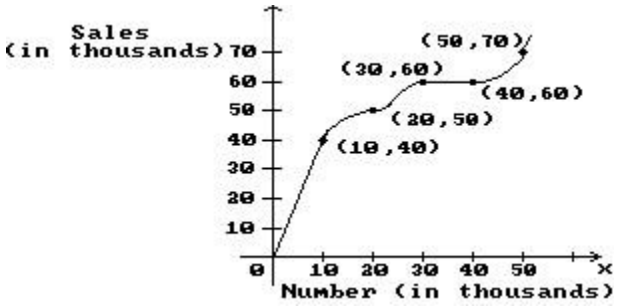
138) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x. 138) _____



10 to 20

A) $\frac{1}{2}$ B) $\frac{3}{2}$ C) 1 D) 2

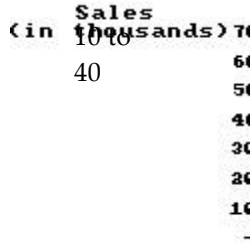
139) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x. 139) _____



10 to 30

A) 1 B) $\frac{1}{3}$ C) 3 D) $\frac{2}{3}$

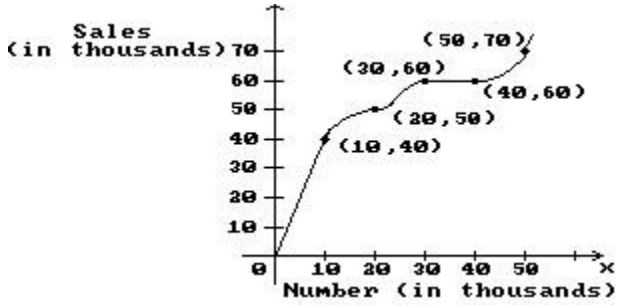
140) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x.



140) _____

A) $\frac{2}{3}$ B) $\frac{1}{4}$ C) $\frac{1}{3}$ D) 4

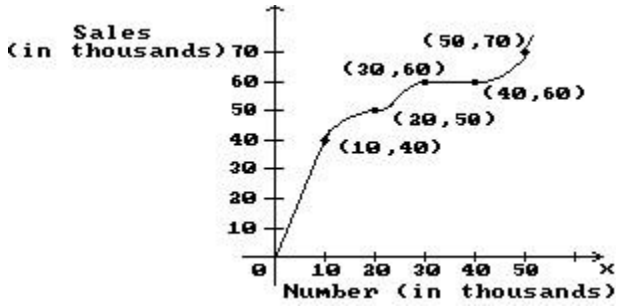
141) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x. 141) _____



10 to 50

A) $\frac{3}{4}$ B) 1 C) 2 D) $\frac{1}{4}$

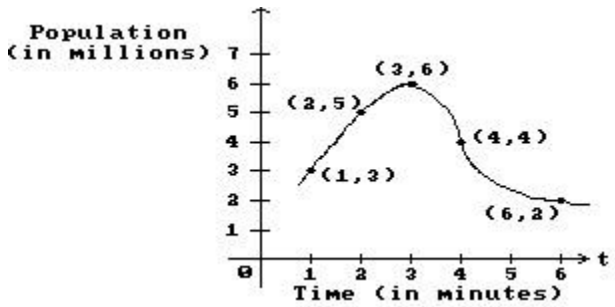
142) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x. 142) _____



20 to 30

A) 2 B) $\frac{3}{2}$ C) 1 D) $\frac{2}{3}$

143) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time for the time interval. 143) _____

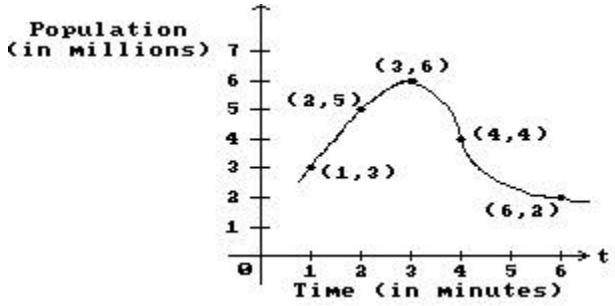


1 to 2

A) -2 B) 2 C) -

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

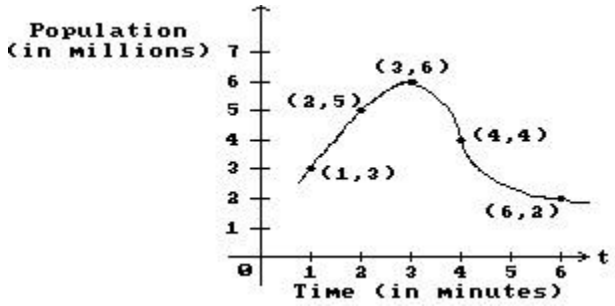
144) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time for the time interval. 144) _____



1 to 3

A) 2 B) $\frac{3}{2}$ C) 1 D) $\frac{2}{3}$

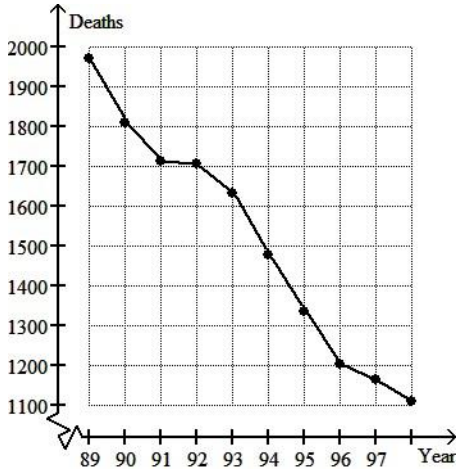
145) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time for the time interval. 145) _____



1 to 4

A) $\frac{1}{3}$ B) 3 C) 4 D) $\frac{1}{4}$

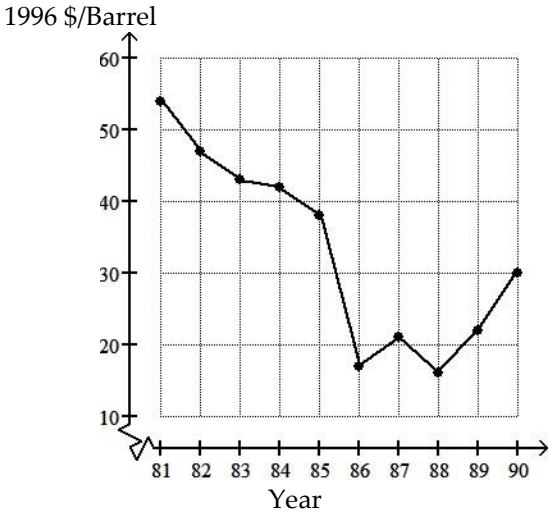
146) The graph below shows the number of tuberculosis deaths in the United States from 1989 to 1998. 146) _____



Estimate the average rate of change in tuberculosis deaths from 1991 to 1993.

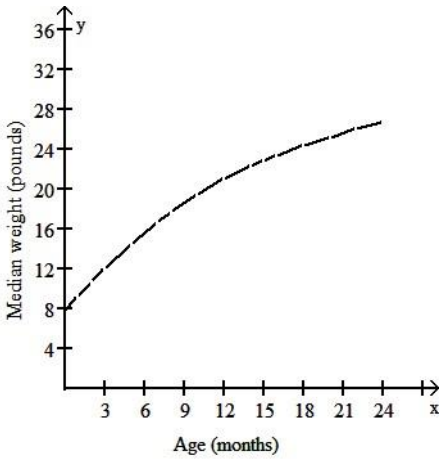
A) About - 45 deaths per year
B) About - 80 deaths per year
C) About - .4 deaths per year
D) About - 30 deaths per year

147) The graph shows the average cost of a barrel of crude oil for the years 1981 to 1990 in constant 1996 dollars. Find the approximate average change in price from 1981 to 1985. 147) _____



A) About - $16/year
B) About - $8/year
C) About - $4/year
D) About - $37/year

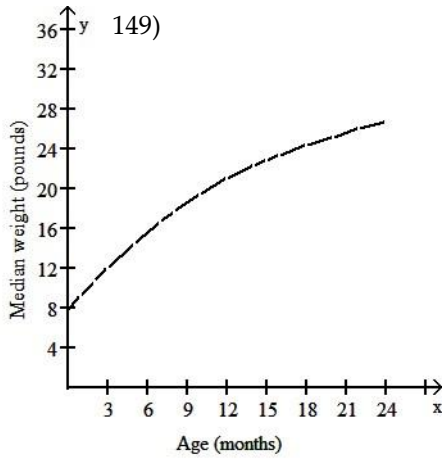
148) The graph shows the median weight of girls between the ages of 0 and 24 months. 148) _____



Use the graph to find the average growth rate of a typical girl during the first year of her life. Give your answer in pounds per month.

A) 1.8 lb/month
B) 1.1 lb/month
C) 1.2 lb/month
D) 0.8 lb/month

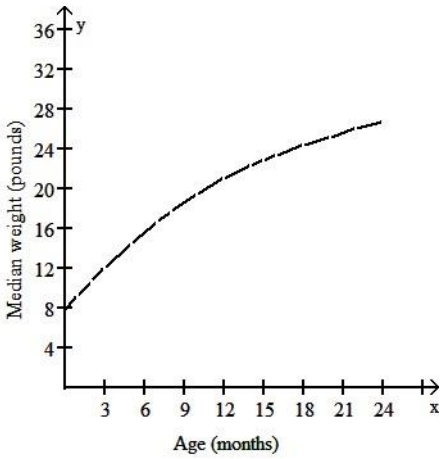
149) The graph shows the median weight of girls between the ages of 0 and 24 months.

149) 

Use the graph to find the average growth rate of a typical girl during the second year of her life. Give your answer in pounds per month.

A) 0.2 lb/month B) 0.5 lb/month C) 0.8 lb/month D) 1.1 lb/month

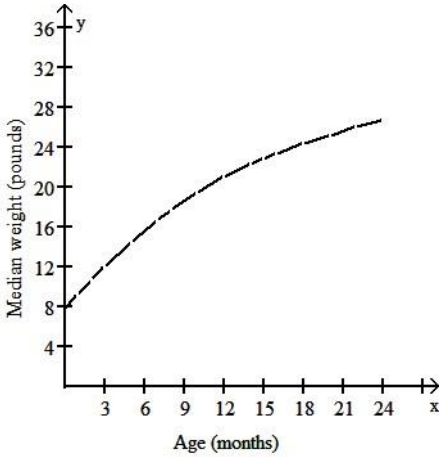
150) The graph shows the median weight of girls between the ages of 0 and 24 months.



Use the graph to find the average growth rate of a typical girl during the first two years of her life. Give your answer in pounds per month.

A) 0.8 lb/month B) 1.1 lb/month C) 1.6 lb/month D) 0.6 lb/month

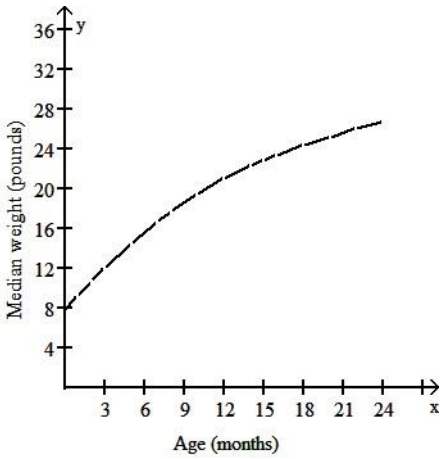
151) The graph shows the median weight of girls between the ages of 0 and 24 months. 151) _____



Use the graph to find the average growth rate of a typical girl during the first nine months of her life. Give your answer in pounds per month.

A) 2.0 lb/month B) 1.2 lb/month C) 1.4 lb/month D) 1.0 lb/month

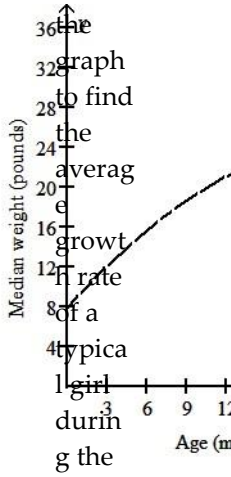
152) The graph shows the median weight of girls between the ages of 0 and 24 months. 152) _____



Use the graph to find the average growth rate of a typical girl during the first six months of her life. Give your answer in pounds per month.

A) 1.6 lb/month B) 1.0 lb/month C) 2.6 lb/month D) 1.3 lb/month

153) The graph shows the median weight of girls between the ages of 0 and 24 months.



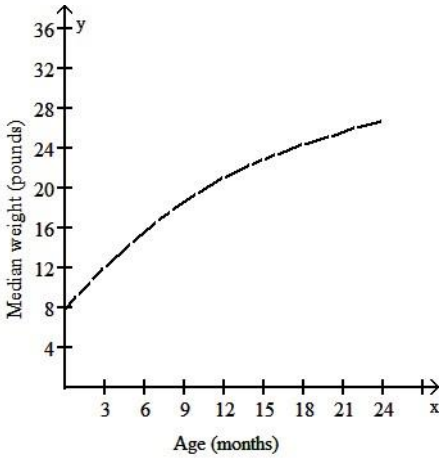
Use the graph to find the average growth rate of a typical girl during the

first three months of her life. Give your answer in pounds per month.

153) ____

A) 4.0 lb/month B) 2.2 lb/month C) 1.2 lb/month D) 1.3 lb/month

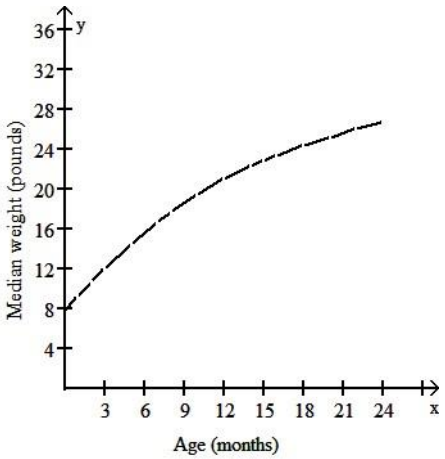
154) The graph shows the median weight of girls between the ages of 0 and 24 months. 154) _____



Use the graph to find the average growth rate of a typical girl between ages 12 and 18 months. Give your answer in pounds per month.

A) 0.6 lb/month B) 1.1 lb/month C) 1.4 lb/month D) 0.8 lb/month

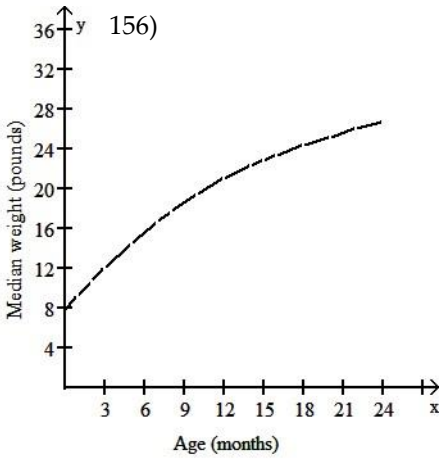
155) The graph shows the median weight of girls between the ages of 0 and 24 months. 155) _____



Use the graph to find the average growth rate of a typical girl between ages 12 and 15 months. Give your answer in pounds per month.

A) 1.5 lb/month B) 0.6 lb/month C) 0.5 lb/month D) 1.0 lb/month

156) The graph shows the median weight of girls between the ages of 0 and 24 months.

156) 

Use the graph to find the average growth rate of a typical girl between ages 12 and 21 months. Give your answer in pounds per month.

A) 0.5 lb/month B) 1.2 lb/month C) 0.9 lb/month D) 0.7 lb/month

157) The average price of a ticket to a minor league baseball game can be approximated by $p(x) = 0.04^{x^2} + 0.44x + 6.96$,
where x is the number of years after 1990 and p(x) is in dollars.
(i) Find p(4).
(ii) Find p(12).
(iii) Find p(12) - p(4).
(iv) Find $\frac{p(12) - p(4)}{12 - 4}$, and interpret this result.

A) (i) \$9.36
(ii) \$18.00
(iii) \$-8.64
(iv) \$-1.08 is the average annual increase in ticket price from the 4th to the 12th year after 1990 (or from 1994 to 2002).

B) (ii) \$-8.08
(ii) \$-6.48
(iii) \$-1.60
(iv) \$-0.20 is the average annual increase in ticket price from the 4th to the 12th year after 1990 (or from 1994 to 2002).

C) (i) $11.28
(ii) $81.36
(iii) $-70.08
(iv) $-8.76 is the average ticket price in 1994.

D) (i) $5.84
(ii) $7.44
(iii) $-1.60
(iv) $-0.20 is the average annual increase in ticket price from the 4th to the 12th year after 1990 (or from 1994 to 2002).

158) When a balance of $3000 is owed on a credit card and interest is being charged at a rate of 18% per year, the total amount owed after t years, A(t), is given by $A(t) = 3000(1.18)^t$. Find $\frac{A(12) - A(6)}{12 - 6}$, and interpret this result. 158) _____

A) $115,868,187.39 is the average annual increase in the debt from the 6th to the 12th year.
B) $2294.02 is the average annual increase in the debt from the 6th to the 12th year.
C) $115,868,187.39 is the total amount owed on the debt up to and including the 12th year.
D) $2294.02 is the total amount owed on the debt from the 6th to the 12th year.

159) Suppose that the dollar cost of producing x radios is $c(x) = 200 + 10x - 0.2x^2$. Find the average cost per radio of producing the first 30 radios. 159) _____

A) $4.00 B) $120.00 C) $320.00 D) $2.00

160) A car's distance s in miles from its starting point after t hours is given by 160) _____

$$s(t) = 7^{t^2}$$

Find the average rate of change of distance with respect to time (average velocity) as t changes from $t_1 = 4$ to $t_2 = 7$.

A) 38.5 miles/hr B) 33 miles/hr C) 49 miles/hr D) 77 miles/hr

161) At the beginning of a trip, the odometer on a car reads 22,488 and the car has a full tank of gas. At the end of the trip the odometer reads 22,716 and there are 1.6 gallons remaining in the tank. The tank can hold a total of 9 gallons. What is the average rate of change of the number of miles with respect to the number of gallons? Assume that the tank was not filled during the trip. 161) _____

A) 228 miles B) 30.81 miles/gal C) 21.51 miles/gal D) 25.33 miles/gal

Find a simplified form of the difference quotient for the function.

162) $f(x) = b - mx$ 162) _____

A) $-mx + h$ B) $-m + h$ C) $-mx$ D) $-m$

163) $f(x) = a^{x^3} + bx$ 163) _____

A) $a(2^{x^2} + 3^{x^2} + 3xh + h^2) + h$
B) $3a^{x^2} + 3axh + h^2 + b$
C) $a(3^{x^2} + 3xh + h^2) + b$
D) $a(3^{x^2} + 3xh + h^2) + h$

164) $f(x) = a^{x^4}$ 164) _____

A) $a^{h^3} + 4x^{h^2} + 6^{x^2}h + 4^{x^3}$
B) $a(^{h^3} + 4xh + 6^{x^2}h) + 4^{x^3}$
C) $a(^{h^3} + 4x^{h^2} + 6^{x^2}h + 4^{x^3})$
D) $a(^{h^3} + 4x^{h^2} + 4^{x^2}h + 4^{x^3})$

165) f(x) =

$\frac{9}{x+9}$ 165) ____

A) $\frac{9}{(x+9)(x+9)}$ B) $\frac{-9}{h(x+9)(x+9+h)}$

C) $\frac{-9}{(x+9)(x+9+h)}$ D) $\frac{9h}{(x+9)(x+9+h)}$

166) $f(x) = \frac{x}{8-x}$ 166) _____

A) $\frac{8h}{(x-8)(x+h-8)}$ B) $\frac{8}{(x-8)(x+h-8)}$

C) $\frac{x}{(x-8)(x+h-8)}$ D) $\frac{1}{(x-8)(x+h-8)}$

167) $f(x) = \sqrt{x-8}$ 167) _____

A) $\frac{h}{\sqrt{x-8+h}-\sqrt{x-8}}$ B) $\sqrt{x-8+h}+\sqrt{x-8}$

C) $\frac{1}{\sqrt{x-8+h}+\sqrt{x-8}}$ D) $\frac{1}{\sqrt{x+h}+\sqrt{x}}$

168) $f(x) = \sqrt{7-2x}$ 168) _____

A) $\sqrt{7-2(x+h)}+\sqrt{7-2x}$ B) $\frac{2}{\sqrt{7-2(x+h)}-\sqrt{7-2x}}$

C) $\frac{2}{\sqrt{7-2(x+h)}+\sqrt{7-2x}}$ D) $\frac{1}{\sqrt{7h-2(x+h)}+\sqrt{7-2x}}$

169) $f(x) = \frac{x^3+1}{x}$ 169) _____

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

C) $2x+h-1$ D) $\frac{2x+h-1}{x(x+h)}$

170) $f(x) = \frac{1}{\sqrt{x+2}}$ 170) _____

A) $\frac{h}{\sqrt{x+2}\sqrt{x+2+h}(\sqrt{x+2}-\sqrt{x+2+h})}$ B) $\frac{1}{\sqrt{x+2}\sqrt{x+2+h}(\sqrt{x+2}+\sqrt{x+2+h})}$

C) $\frac{1}{\sqrt{x+2}\sqrt{x+2+h}(\sqrt{x+2}+\sqrt{x+2+h})}$ D) $\frac{1}{\sqrt{x+2}\sqrt{x+2+h}(\sqrt{x+2}-\sqrt{x+2+h})}$

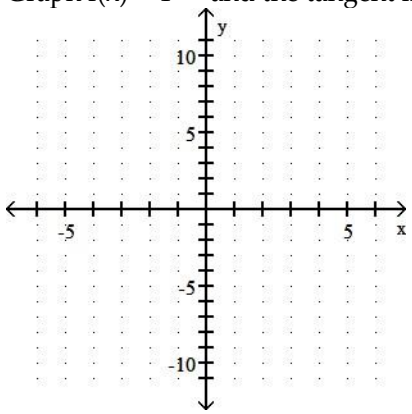
171) $f(x) = \frac{8}{x^2}$ 171) _____

A) $\frac{8(h+2x+xh)}{x^2(x+h)^2}$ B) $\frac{(h+2x)}{x^2(x+h)^2}$

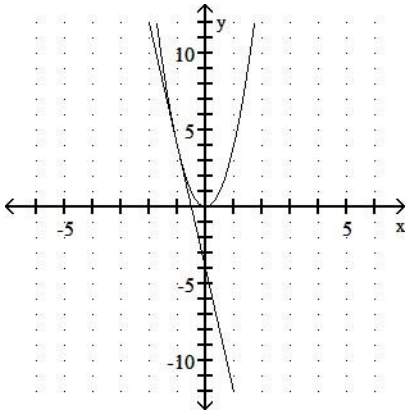
C) $\frac{8(h+x)}{x^2(x+h)^2}$ D) $\frac{8(h+2x)}{x^2(x+h)^2}$

Graph the function and the indicated tangent line.

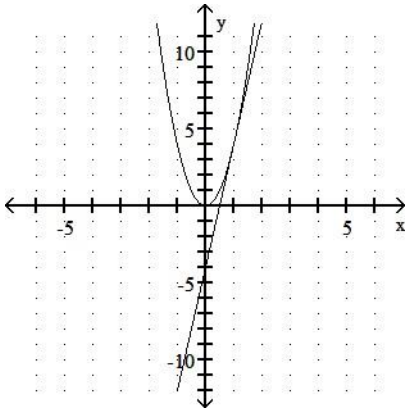
172) Graph $f(x) = 4^{x^2}$ and the tangent line to the graph at the point whose x-coordinate is 1. 172) _____



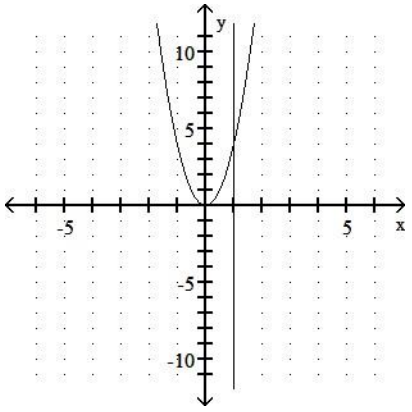
A)



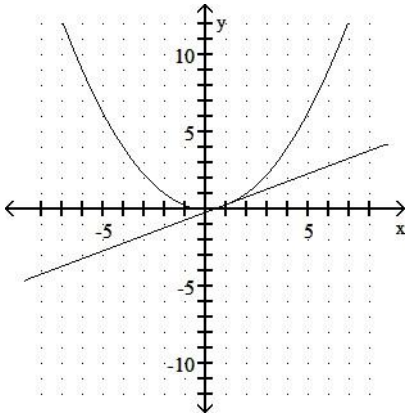
B)



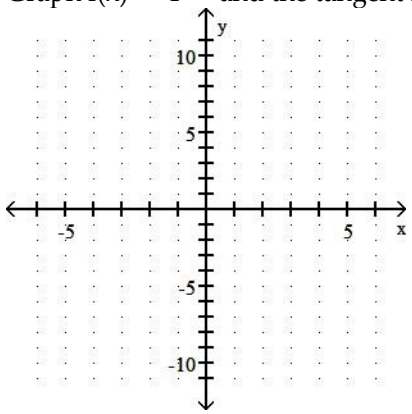
C)



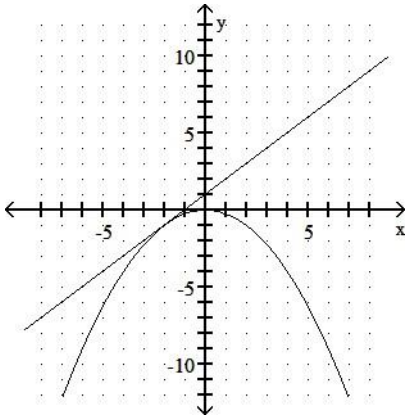
D)



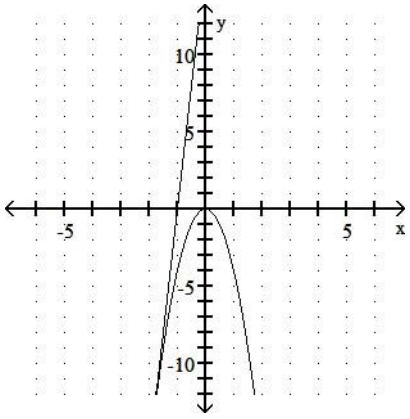
173) Graph $f(x) = -4^{x^2}$ and the tangent line to the graph at the point whose x-coordinate is -2. 173) _____



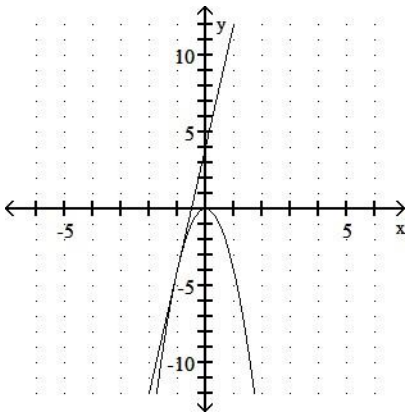
A)



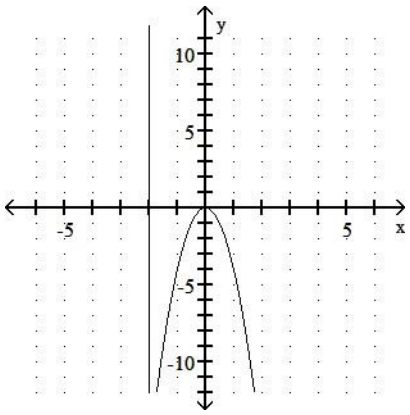
B)



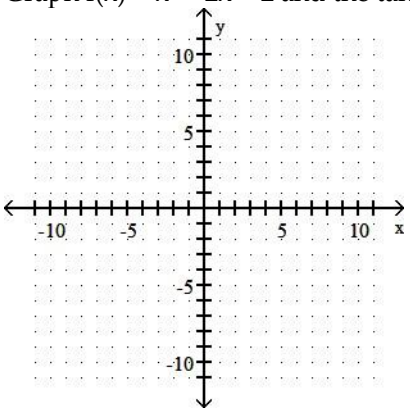
C)



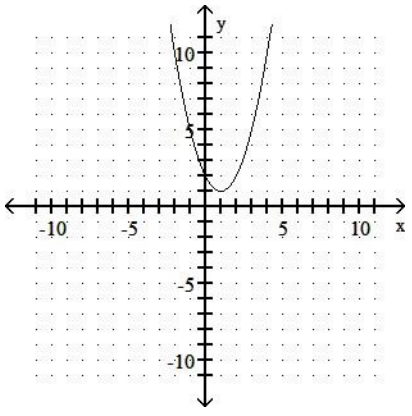
D)



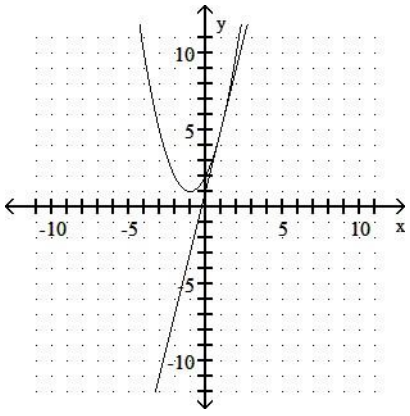
174) Graph $f(x) = x^2 - 2x + 2$ and the tangent line to the graph at the point whose x-coordinate is 1. 174) _____



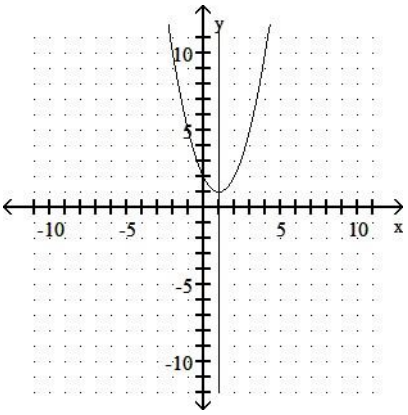
A)



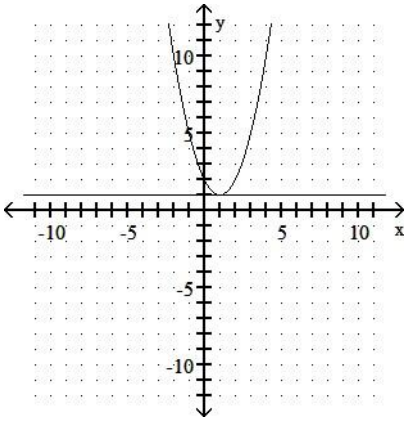
B)



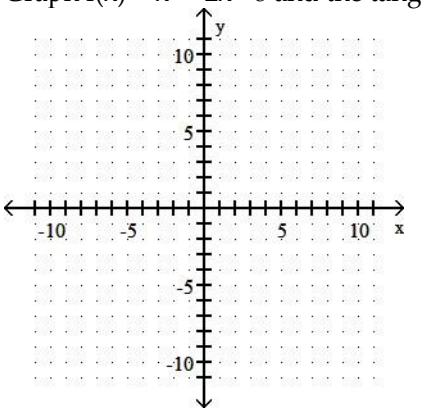
C)



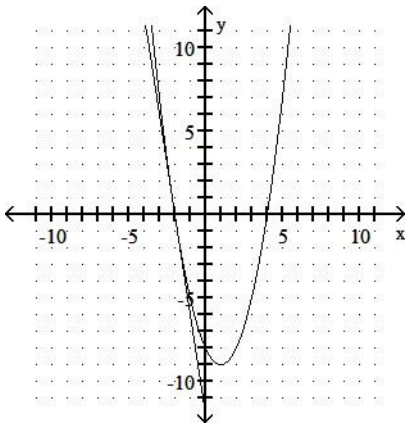
D)



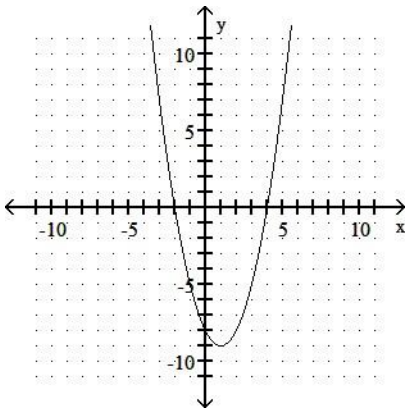
175) Graph $f(x) = x^2 - 2x - 8$ and the tangent line to the graph at the point whose x-coordinate is -2. 175) _____



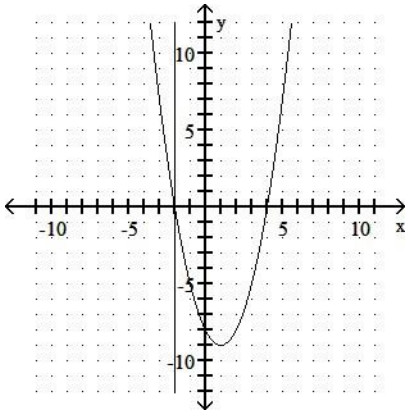
A)



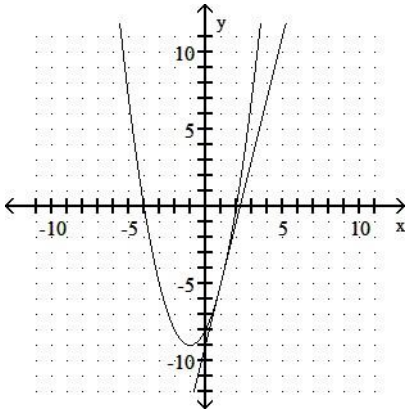
B)



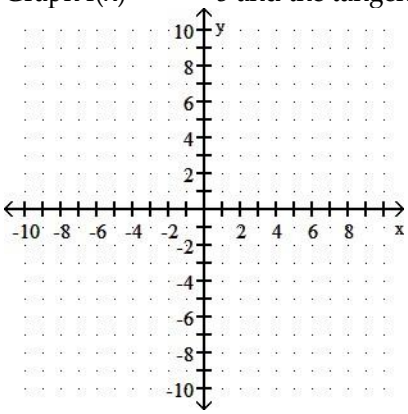
C)



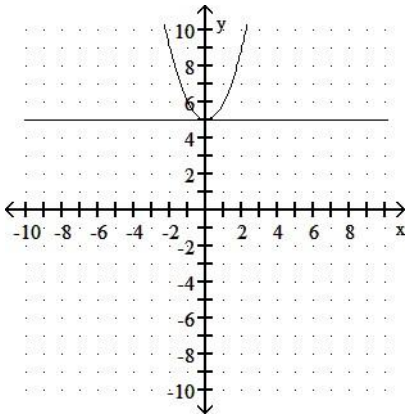
D)



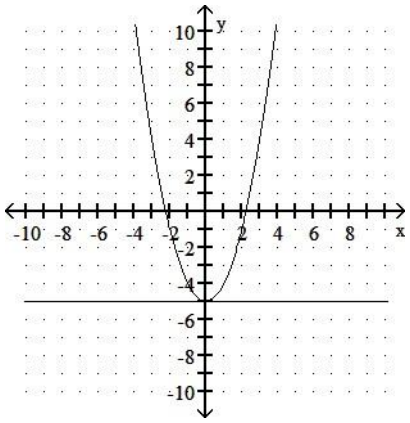
176) Graph f(x) = x^3 - 5 and the tangent line to the graph at the point whose x-coordinate is 0. 176) _____



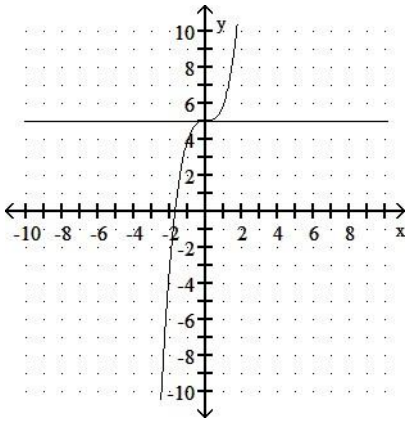
A)



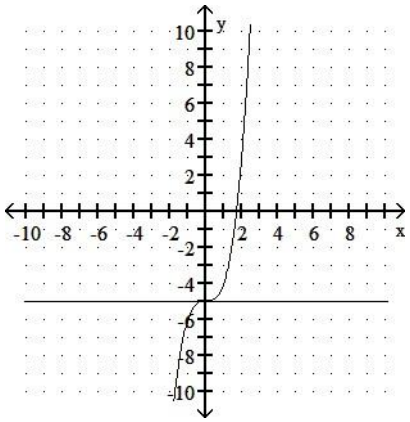
B)



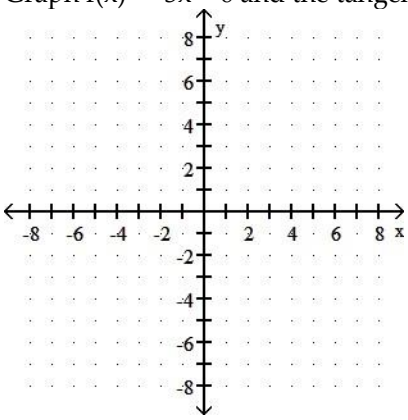
C)



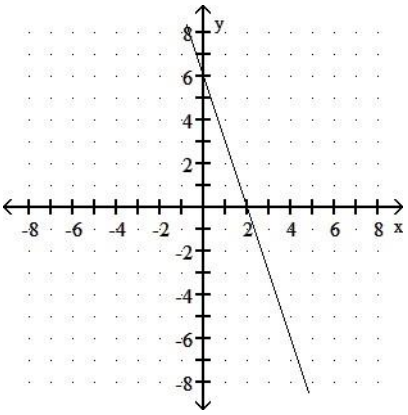
D)



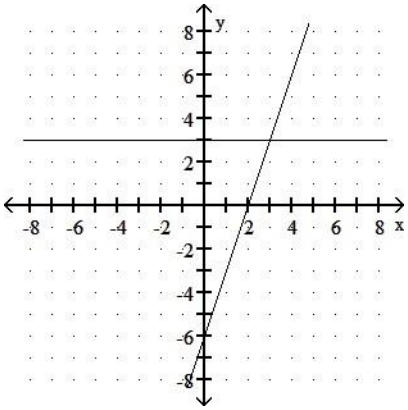
177) Graph f(x) = -3x + 6 and the tangent line to the graph at the point whose x-coordinate is -3. 177) _____



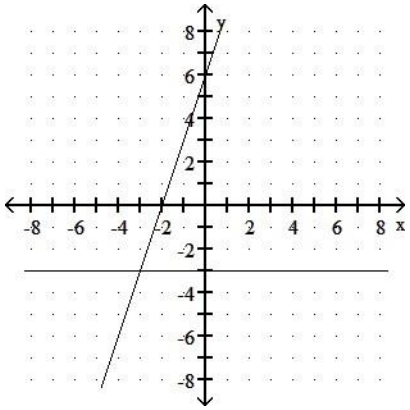
A) The tangent line is identical to the graph of the original function.



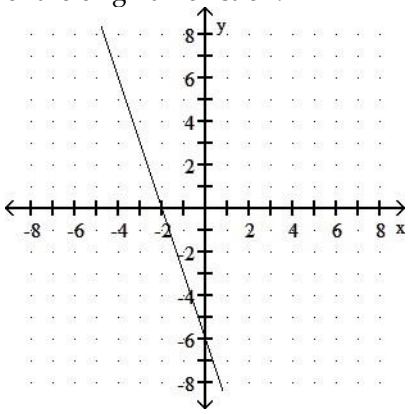
B)



C)

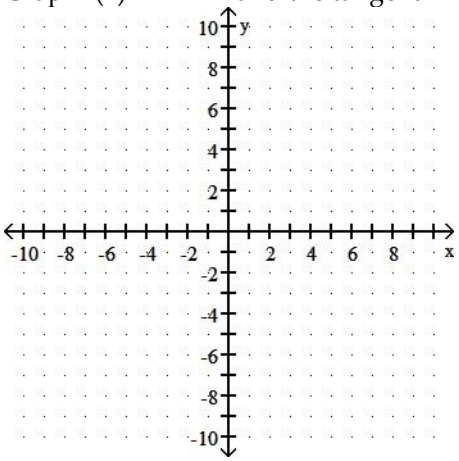


D) The tangent line is identical to the graph of the original function.

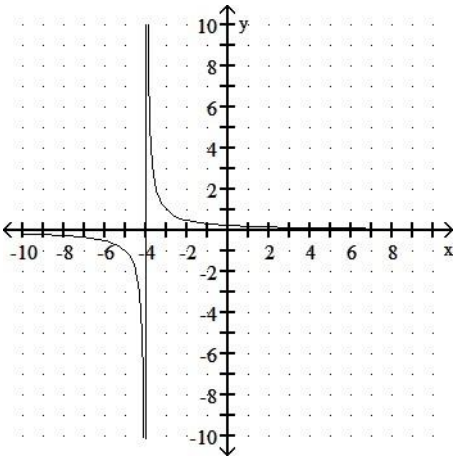


178) Graph $f(x) = \frac{1}{x} + 4$ and the tangent line to the graph at the point whose x-coordinate is 0.

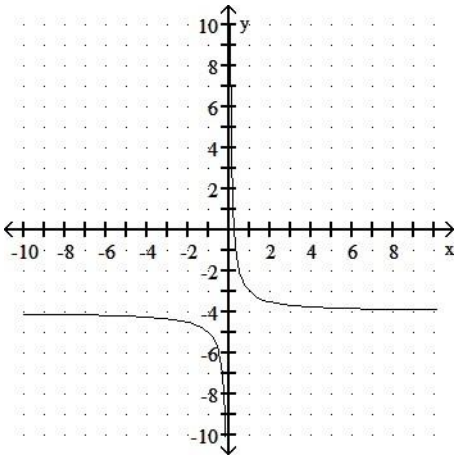
178) _____



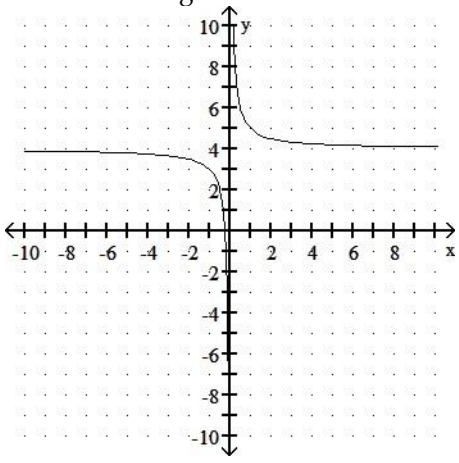
A)



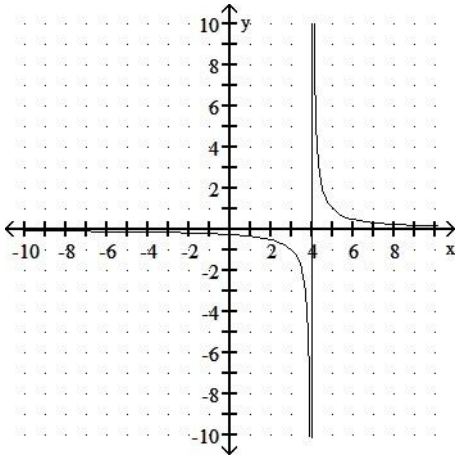
B) There is no tangent line for x = 0.



C) There is no tangent line for x = 0.



D)



Find the derivative of the function and evaluate the derivative at the given x-value.

179) $f(x) = 3^{x^2}$ at x = 1 179) _____

A) f'(x) = 3x; f'(1) = 3

B) f'(x) = 6x; f'(1) = 3

C) f'(x) = 6x; f'(1) = 6

D) $f'(x) = 6^{x^2}$; f'(1) = 6

180) f(x) = 5x + 9 at x = 2 180) _____

A) f'(x) = 9; f'(2) = 9

B) f'(x) = 5; f'(2) = 5

C) f'(x) = 0; f'(2) = 0

D) f'(x) = 5x; f'(2) = 10

181) $f(x) = x^2 + 5x$ at $x = 4$ 181) _____

A) $f'(x) = 2x + 5$; $f'(4) = 13$
B) $f'(x) = x + 5$; $f'(4) = 9$
C) $f'(x) = 4x + 5$; $f'(4) = 21$
D) $f'(x) = 2x - 5$; $f'(4) = 3$

182) $f(x) = \frac{1}{5}x - \frac{1}{2}$ at $x = 10$ 182) _____

A) $f'(x) = \frac{1}{2}$; $f'(10) = \frac{1}{2}$
B) $f'(x) = -\frac{1}{2}$; $f'(10) = -\frac{1}{2}$
C) $f'(x) = -\frac{1}{5}$; $f'(10) = -\frac{1}{5}$
D) $f'(x) = \frac{1}{5}$; $f'(10) = \frac{1}{5}$

183) $f(x) = 5x^2 + x$ at $x = -4$ 183) _____

A) $f'(x) = 10x - 1$; $f'(-4) = -41$
B) $f'(x) = x + 10$; $f'(-4) = 6$
C) $f'(x) = 10x + 1$; $f'(-4) = -39$
D) $f'(x) = x - 10$; $f'(-4) = -14$

184) $f(x) = 2x^2 + x - 3$ at $x = 4$ 184) _____

A) $f'(x) = 4x + 3$; $f'(4) = 19$
B) $f'(x) = 2x - 3$; $f'(4) = 5$
C) $f'(x) = 4x - 1$; $f'(4) = 15$
D) $f'(x) = 4x + 1$; $f'(4) = 17$

185) $f(x) = x^2 + 11x - 15$ at $x = 1$ 185) _____

A) $f'(x) = 2x + 11$; $f'(1) = 13$
B) $f'(x) = 11x$; $f'(1) = 11$
C) $f'(x) = 2x - 11$; $f'(1) = -9$
D) $f'(x) = 11x + 15$; $f'(1) = 26$

186) $f(x) = 3x^2 + 5x - 7$ at $x = -2$ 186) _____

A) $f'(x) = 3x + 5$; $f'(-2) = -1$
B) $f'(x) = 2x + 5$; $f'(-2) = 1$
C) $f'(x) = 6x - 5$; $f'(-2) = -17$
D) $f'(x) = 6x + 5$; $f'(-2) = -7$

187) $f(x) = 1 - x^3$ at $x = 1$ 187) _____

A) $f'(x) = -3x$; $f'(1) = -3$
B) $f'(x) = 3x^2 - 1$; $f'(1) = 2$
C) $f'(x) = 1 - 3x$; $f'(1) = -2$
D) $f'(x) = -3x^2$; $f'(1) = -3$

188) $f(x) = \frac{8}{x}$ at $x = -1$ 188) _____

A) $f'(x) = \frac{8}{x^2}$; $f'(-1) = 8$
B) $f'(x) = -\frac{8}{x^2}$; $f'(-1) = -8$
C) $f'(x) = -8x^2$; $f'(-1) = -8$
D) $f'(x) = 8$; $f'(-1) = 8$

Find an equation for the line tangent to the graph of the given function at the indicated point.

189) $f(x) = \frac{x^2}{4}$ at (2, 1) 189) _____

A) $y = 4 - 1$
B) $y = 1x - 1$
C) $y = 1x - 2$
D) $y = 1x + 1$

190) $f(x) = \frac{x^3}{4}$ at (3, 6.75) 190) _____

A) $y = \frac{27}{2}x + \frac{27}{4}$
B) $y = \frac{9}{4}x - \frac{27}{2}$
C) $y = \frac{27}{4}x - \frac{27}{2}$
D) $y = \frac{9}{4}x + \frac{27}{2}$

191) $f(x) = \frac{x^3}{2}$ at (- 2, - 4) 191) _____

A) y = 6x + 8 B) y = 8x + 6 C) y = 8x + 2 D) y = 2x + 8

192) $f(x) = \frac{16}{x}$ at (2, 8) 192) _____

A) y = - 4x B) y = - 8x + 24 C) y = - 4x + 16 D) y = - 4x + 8

193) $f(x) = \frac{45}{x}$ at (9, 5) 193) _____

A) $y = -\frac{5}{9}x + 10$ B) $y = -\frac{5}{9}x + 5$ C) $y = -\frac{10}{9}x + 15$ D) $y = -\frac{5}{9}x$

194) $f(x) = x^2 - 4$ at (2, 0) 194) _____

A) y = 4x - 8 B) y = 4x - 12 C) y = 2x - 8 D) y = 4x - 16

195) $f(x) = x^2 + 4$ at (3, 13) 195) _____

A) y = 6x - 5 B) y = 6x - 14 C) y = 3x - 5 D) y = 6x - 10

196) $f(x) = x^2 - x$ at (-4, 20) 196) _____

A) y = -9x - 16 B) y = -9x - 12 C) y = -9x + 12 D) y = -9x + 16

197) $f(x) = x^3 - x^2$ at (0, 0) 197) _____

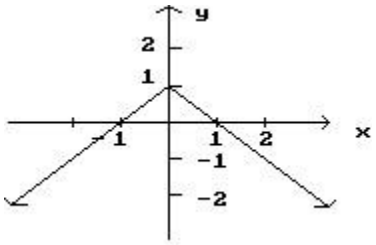
A) y = -2 B) y = 3 C) y = 1 D) y = 0

198) $f(x) = x - x^2$ at (-4, -20) 198) _____

A) y = 9x + 16 B) y = -9x + 16 C) y = -7x - 16 D) y = -7x + 16

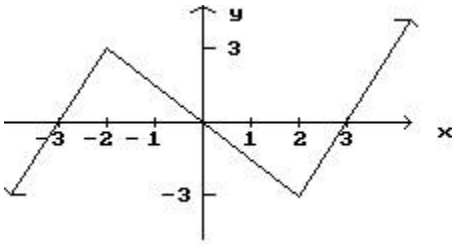
List the x-values in the graph at which the function is not differentiable.

199) 199) _____



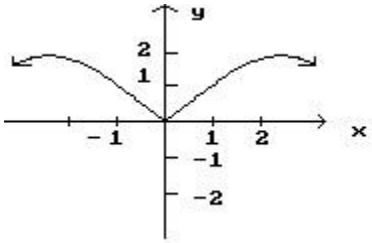
A) x = 0 B) x = -1 C) x = 2 D) x = 1

200) 200) _____



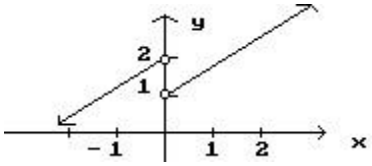
A) x = -2, x = 0, x = 2 B) x = -2, x = 2

C) x = -3, x = 3 D) x = -3, x = 0, x = 3

201) 

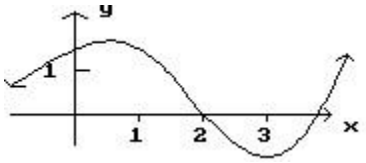
201) _____

A) x = -2, x = 0, x = 2
B) x = -2, x = 2
C) x = 0
D) x = 2

202) 

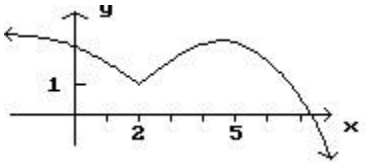
202) _____

A) x = 2
B) x = 1
C) x = 0, x = 1, x = 2
D) x = 0

203) 

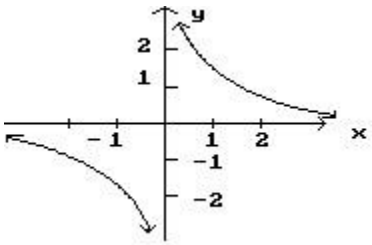
203) _____

A) x = 2
B) x = 1, x = 2, x = 3
C) x = 1, x = 3
D) Function is differentiable at all points

204) 

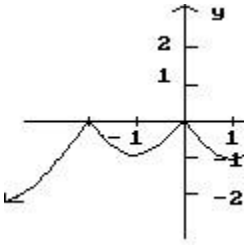
204) _____

A) x = 2
B) Function is differentiable at all points.
C) x = 2, x = 5
D) x = 5

205) 

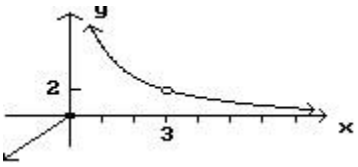
205) _____

A) x = -1, x = 0, x = 1
B) x = 0
C) x = -1, x = 1
D) Function is differentiable at all points.

206) 

206) _____

A) x = 0
B) x = -2, x = 2
C) x = -2, x = 0, x = 2
D) Function is differentiable at all points.

207) 

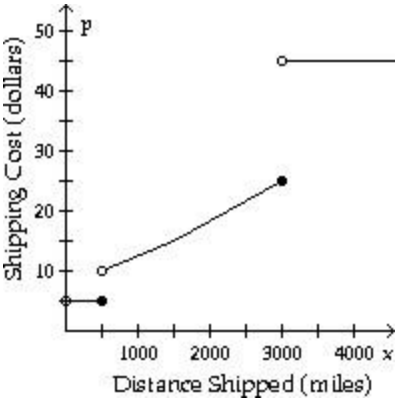
207) _____

A) x = 0, x = 3
B) Function is differentiable at all points.
C) x = 3
D) x = 0

Solve the problem.

208) Suppose that the cost, p, of shipping a 3-pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. At what values is the function p not differentiable?

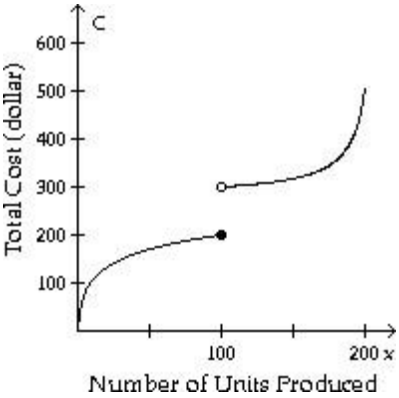
208) _____



A) Function is differentiable for all x in the domain
B) 0, 3000
C) 500, 3000
D) 0, 500, 3000

209) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. At what values is the function C not differentiable?

209) _____



A) 100
B) Function is differentiable for all x in the domain
C) 0, 100
D) 0, 100, 200

210) Postal rates are $0.37 for the first ounce and $0.23 for each additional ounce (or fraction thereof). If x is the

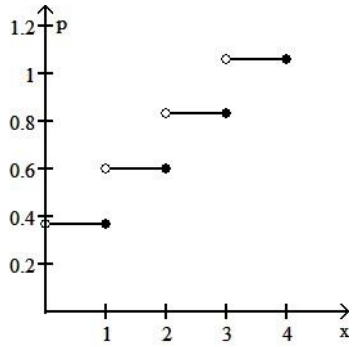
weight of function p not differentiable? 210) _____

a letter in ounces, then p(x) is the cost of mailing the letter, where

p(x) = $0.37, if $0 < x \leq 1$,

p(x) = $0.60, if $1 < x \leq 2$,

p(x) = $0.83, if $2 < x \leq 3$, and so on, up to 13 ounces. The graph of p is shown below.



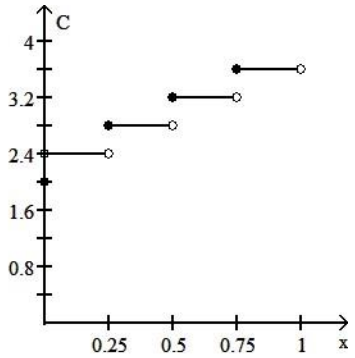
At what values is the

A) Function is differentiable for all x in the domain
B) 0, 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12
C) 0, 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12, ...
D) 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12

211) In one city, taxicabs charge passengers $2.00 for entering a cab and then $0.40 for each one-quarter of a mile (or fraction thereof) that the cab travels. (There are additional charges for slow traffic and idle times, but these are not considered here). If x is the distance traveled in miles, then C(x) is the cost of the taxi fare, where 211) _____

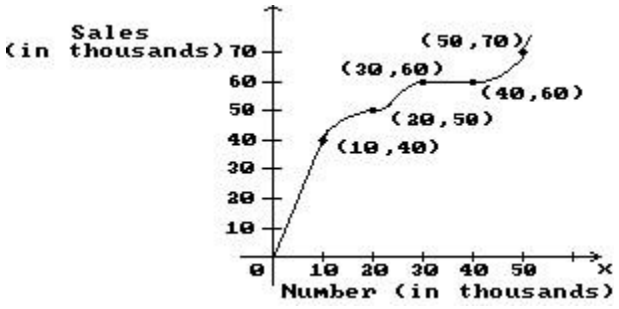
$C(x) = \$2.00$, if $x = 0$,
$C(x) = \$2.40$, if $0 < x < 0.25$,
$C(x) = \$2.80$, if $0.25 \le x < 0.5$,
$C(x) = \$3.20$, if $0.5 \le x < 0.75$,

and so on. The graph of C is shown below.



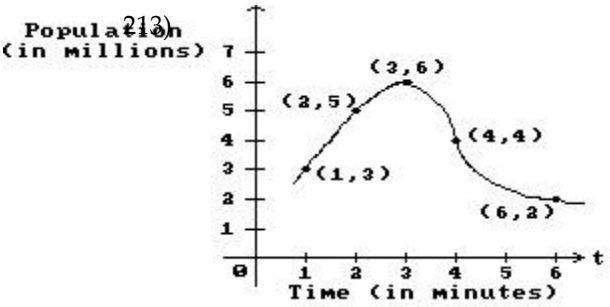
At what values is the function C not differentiable?
A) 0.25, 0.5, 0.75, 1.0
B) Function is differentiable for all x in the domain
C) 0.25, 0.5, 0.75
D) 0.25, 0.5, 0.75, 1.0, 1.25, 1.5.....

212) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. At what values is the function not differentiable? 212) _____



A) Function is differentiable for all x in the domain
B) 20, 30
C) 10, 20, 40
D) 10, 20, 30, 40, 50

213) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. At what values of t is the function not differentiable?

213) 

____
_

A) 3, 4
B) 1, 2, 3, 4, 6
C) 3
D) Function is differentiable for all t in the domain

Find f'(x).

214) $f(x) = \frac{1}{5x^2}$ 214) _____

A) $f'(x) = -\frac{2}{5x}$ B) $f'(x) = -\frac{1}{5x^3}$ C) $f'(x) = -\frac{2}{5x^3}$ D) $f'(x) = \frac{2}{5x^3}$

215) $f(x) = \frac{4}{x^3}$ 215) _____

A) $f'(x) = \frac{12}{x^4}$ B) $f'(x) = -\frac{12}{x^2}$ C) $f'(x) = -\frac{12}{x^4}$ D) $f'(x) = \frac{4}{x^4}$

216) $f(x) = \frac{8}{x+2}$ 216) _____

A) $f'(x) = -\frac{8}{(x+2)^2}$ B) $f'(x) = \frac{8}{(x+2)^2}$

C) $f'(x) = 8$ D) $f'(x) = -8(x+2)^2$

217) $f(x) = \sqrt{x-6}$ 217) _____

A) $f'(x) = \frac{1}{2\sqrt{x-6}}$ B) $f'(x) = \frac{\sqrt{x-6}}{2}$

C) $f'(x) = -\frac{1}{2\sqrt{x-6}}$ D) $f'(x) = \frac{\sqrt{x-6}}{x-6}$

218) $f(x) = \frac{x}{x+7}$ 218) _____

A) $f'(x) = \frac{7}{(x+7)^2}$ B) $f'(x) = \frac{-7}{(x+7)^2}$ C) $f'(x) = \frac{7}{x^2}$ D) $f'(x) = \frac{7}{x+7}$

219) $f(x) = \sqrt{5x}$ 219) _____

A) $f'(x) = \frac{1}{\sqrt{5x}}$ B) $f'(x) = \frac{5}{2\sqrt{5x}}$ C) $f'(x) = 5\sqrt{5x}$ D) $f'(x) = \frac{5}{\sqrt{5x}}$

1) D
2) A
3) A
4) D
5) C
6) C
7) B
8) C
9) A
10) A
11) A
12) B
13) A
14) A
15) B
16) A
17) A
18) B
19) B
20) B
21) D
22) B
23) B
24) C
25) C
26) A
27) C
28) D
29) A
30) B
31) A
32) D
33) B
34) A
35) D
36) C
37) B
38) B
39) B
40) D
41) D
42) C
43) C
44) A
45) B
46) B
47) D
48) A
49) C
50) A
51) A

52) B
53) B
54) D
55) C
56) D
57) B
58) D
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73) B
74) B
75) A
76) A
77) A
78) D
79) B
80) B
81) C
82) A
83) D
84) C
85) D
86) B
87) A
88) D
89) C
90) C
91) A
92) B
93) A
94) B
95) B
96) B
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100) B
101) B
102) A
103) A

104) A
105) C
106) C
107) D
108) A
109) A
110) B
111) A
112) B
113) A
114) B
115) C
116) D
117) D
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147) C
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153) D
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155) B

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197) D
198) A
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200) B
201) C
202) D
203) D
204) A
205) B
206) C
207) A

208) C
209) A
210) D
211) D
212) A
213) D
214) C
215) C
216) A
217) A
218) A
219) B