

***Calculus Early Transcendentals 3rd edition Briggs  
Test Bank***

SKU: 9780134763644-TEST-BANK

Name \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.****Find the average velocity of an object which follows the position function  $s(t)$  over the given interval.**

1)  $s(t) = t^2 + 2t$ ,  $[2, 9]$  1) \_\_\_\_\_  
A) 13 B)  $\frac{91}{9}$  C)  $\frac{99}{7}$  D) 11

2)  $s(t) = 4t^3 + 8t^2 - 5$ ,  $[-8, -2]$  2) \_\_\_\_\_  
A) 256 B) - 768 C)  $-\frac{5}{6}$  D)  $\frac{5}{2}$

3)  $s(t) = \sqrt{2t}$ ,  $[2, 8]$  3) \_\_\_\_\_  
A) 2 B) 7 C)  $\frac{1}{3}$  D)  $-\frac{3}{10}$

4)  $s(t) = \frac{3}{t-2}$ ,  $[4, 7]$  4) \_\_\_\_\_  
A)  $\frac{1}{3}$  B) 7 C)  $-\frac{3}{10}$  D) 2

5)  $s(t) = 4t^2$ ,  $\left[0, \frac{7}{4}\right]$  5) \_\_\_\_\_  
A) 7 B)  $\frac{1}{3}$  C)  $-\frac{3}{10}$  D) 2

6)  $s(t) = -3t^2 - t$ ,  $[5, 6]$  6) \_\_\_\_\_  
A) -34 B) -2 C)  $-\frac{1}{6}$  D)  $\frac{1}{2}$

7)  $s(t) = \sin(3t)$ ,  $\left[0, \frac{\pi}{6}\right]$  7) \_\_\_\_\_  
A)  $-\frac{6}{\pi}$  B)  $\frac{6}{\pi}$  C)  $\frac{\pi}{6}$  D)  $\frac{3}{\pi}$

8)  $s(t) = 3 + \tan t$ ,  $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$  8) \_\_\_\_\_  
A) 0 B)  $-\frac{4}{\pi}$  C)  $\frac{4}{\pi}$  D)  $-\frac{8}{5}$

Use the table to find the instantaneous velocity of y at the specified value of x.

9)  $x = 1$ .

9) \_\_\_\_\_

| x   | y    |
|-----|------|
| 0   | 0    |
| 0.2 | 0.02 |
| 0.4 | 0.08 |
| 0.6 | 0.18 |
| 0.8 | 0.32 |
| 1.0 | 0.5  |
| 1.2 | 0.72 |
| 1.4 | 0.98 |

A) 1

B) 0.5

C) 2

D) 1.5

10)  $x = 1$ .

10) \_\_\_\_\_

| x   | y    |
|-----|------|
| 0   | 0    |
| 0.2 | 0.01 |
| 0.4 | 0.04 |
| 0.6 | 0.09 |
| 0.8 | 0.16 |
| 1.0 | 0.25 |
| 1.2 | 0.36 |
| 1.4 | 0.49 |

A) 1

B) 0.5

C) 2

D) 1.5

11)  $x = 1$ .

11) \_\_\_\_\_

| x   | y    |
|-----|------|
| 0   | 0    |
| 0.2 | 0.12 |
| 0.4 | 0.48 |
| 0.6 | 1.08 |
| 0.8 | 1.92 |
| 1.0 | 3    |
| 1.2 | 4.32 |
| 1.4 | 5.88 |

A) 2

B) 8

C) 6

D) 4

12)  $x = 2$ .

12) \_\_\_\_\_

| x   | y  |
|-----|----|
| 0   | 10 |
| 0.5 | 38 |
| 1.0 | 58 |
| 1.5 | 70 |
| 2.0 | 74 |
| 2.5 | 70 |
| 3.0 | 58 |
| 3.5 | 38 |
| 4.0 | 10 |

A) -8

B) 0

C) 4

D) 8

13)  $x = 1$ .

13) \_\_\_\_\_

| x     | y        |
|-------|----------|
| 0.900 | -0.05263 |
| 0.990 | -0.00503 |
| 0.999 | -0.0005  |
| 1.000 | 0.0000   |
| 1.001 | 0.0005   |
| 1.010 | 0.00498  |
| 1.100 | 0.04762  |

A) 0

B) -0.5

C) 0.5

D) 1

**Find the slope of the curve for the given value of x.**

14)  $y = x^2 + 5x$ ,  $x = 4$

14) \_\_\_\_\_

A) slope is  $-\frac{4}{25}$

B) slope is  $\frac{1}{20}$

C) slope is 13

D) slope is -39

15)  $y = x^2 + 11x - 15$ ,  $x = 1$

15) \_\_\_\_\_

A) slope is  $-\frac{4}{25}$

B) slope is 13

C) slope is  $\frac{1}{20}$

D) slope is -39

16)  $y = x^3 - 8x$ ,  $x = 1$

16) \_\_\_\_\_

A) slope is -5

B) slope is 1

C) slope is -3

D) slope is 3

17)  $y = x^3 - 2x^2 + 4$ ,  $x = 3$

17) \_\_\_\_\_

A) slope is 1

B) slope is 0

C) slope is -15

D) slope is 15

18)  $y = 4 - x^3$ ,  $x = -1$

18) \_\_\_\_\_

A) slope is 3

B) slope is -1

C) slope is -3

D) slope is 0

**Solve the problem.**

19) Given  $\lim_{x \rightarrow 0^-} f(x) = L_L$ ,  $\lim_{x \rightarrow 0^+} f(x) = L_R$ , and  $L_L \neq L_R$ , which of the following statements is true? 19) \_\_\_\_\_

I.  $\lim_{x \rightarrow 0} f(x) = L_L$

II.  $\lim_{x \rightarrow 0} f(x) = L_R$

III.  $\lim_{x \rightarrow 0} f(x)$  does not exist.

A) II

B) I

C) III

D) none

20) Given  $\lim_{x \rightarrow 0^-} f(x) = L_L$ ,  $\lim_{x \rightarrow 0^+} f(x) = L_R$ , and  $L_L = L_R$ , which of the following statements is false? 20) \_\_\_\_\_

I.  $\lim_{x \rightarrow 0} f(x) = L_L$

II.  $\lim_{x \rightarrow 0} f(x) = L_R$

III.  $\lim_{x \rightarrow 0} f(x)$  does not exist.

A) I

B) III

C) II

D) none

21) If  $\lim_{x \rightarrow 0} f(x) = L$ , which of the following expressions are true? 21) \_\_\_\_\_

I.  $\lim_{x \rightarrow 0^-} f(x)$  does not exist.

II.  $\lim_{x \rightarrow 0^+} f(x)$  does not exist.

III.  $\lim_{x \rightarrow 0^-} f(x) = L$

IV.  $\lim_{x \rightarrow 0^+} f(x) = L$

A) II and III only

B) I and IV only

C) I and II only

D) III and IV only

22) What conditions, when present, are sufficient to conclude that a function  $f(x)$  has a limit as  $x$  approaches some value of  $a$ ? 22) \_\_\_\_\_

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

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

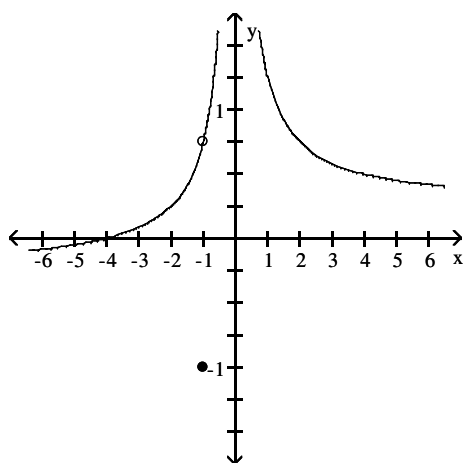
C) The limit of  $f(x)$  as  $x \rightarrow a$  from the left exists, the limit of  $f(x)$  as  $x \rightarrow a$  from the right exists, and at least one of these limits is the same as  $f(a)$ .

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

Use the graph to evaluate the limit.

23)  $\lim_{x \rightarrow -1} f(x)$

23) \_\_\_\_\_



A)  $\frac{3}{4}$

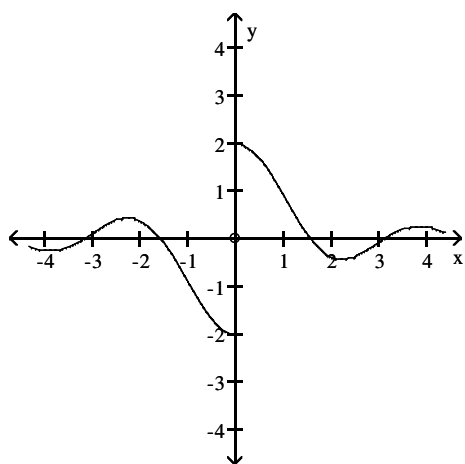
B)  $-\frac{3}{4}$

C) -1

D)  $\infty$

24)  $\lim_{x \rightarrow 0} f(x)$

24) \_\_\_\_\_



A) 2

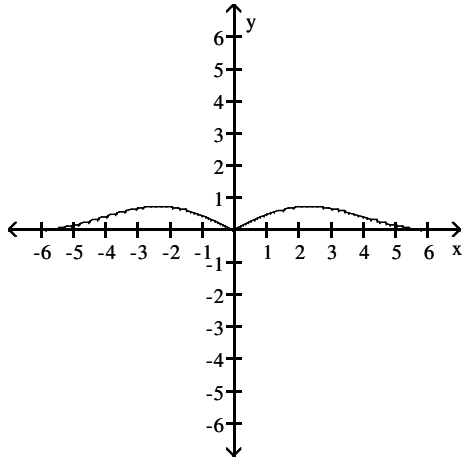
B) does not exist

C) -2

D) 0

25)  $\lim_{x \rightarrow 0} f(x)$

25) \_\_\_\_\_



A) 0

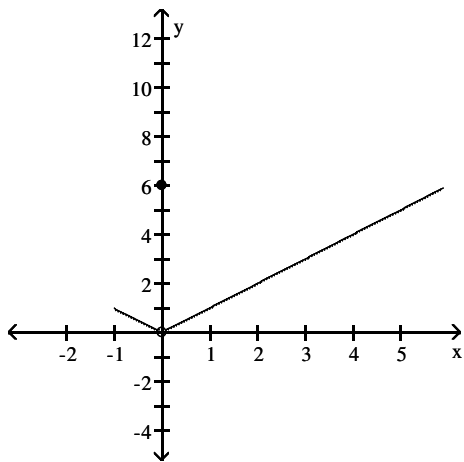
B) -1

C) 1

D) does not exist

26)  $\lim_{x \rightarrow 0} f(x)$

26) \_\_\_\_\_



A) 0

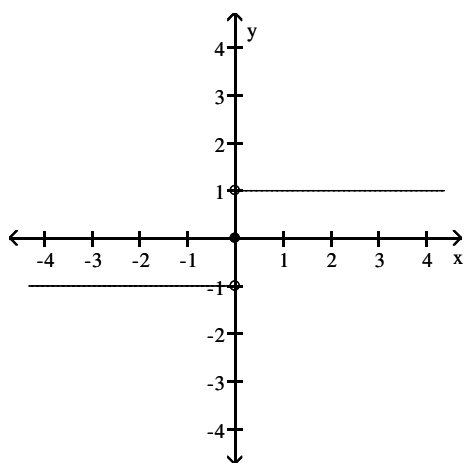
B) -1

C) 6

D) does not exist

27)  $\lim_{x \rightarrow 0} f(x)$

27) \_\_\_\_\_



A) -1

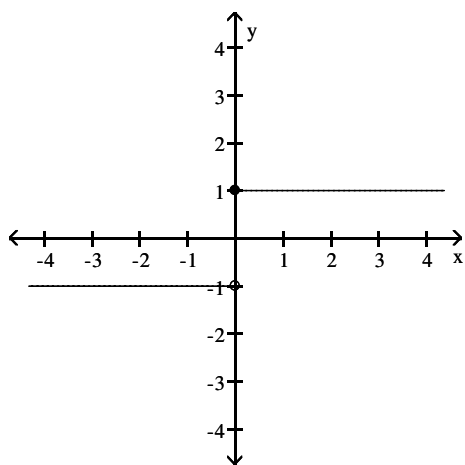
B) 1

C)  $\infty$

D) does not exist

28)  $\lim_{x \rightarrow 0} f(x)$

28) \_\_\_\_\_



A) does not exist

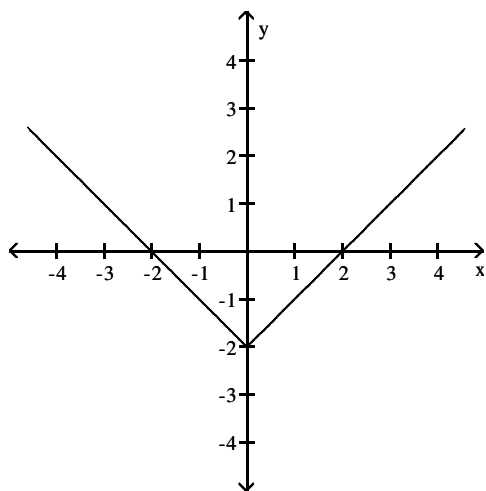
B) -1

C) 1

D)  $\infty$

29)  $\lim_{x \rightarrow 0} f(x)$

29) \_\_\_\_\_



A) 0

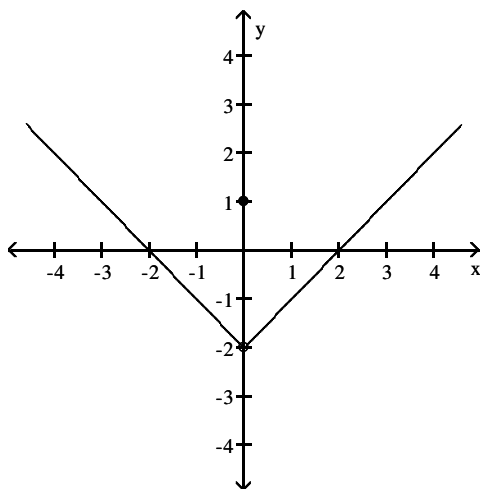
B) does not exist

C) -2

D) 2

30)  $\lim_{x \rightarrow 0} f(x)$

30) \_\_\_\_\_



A) 1

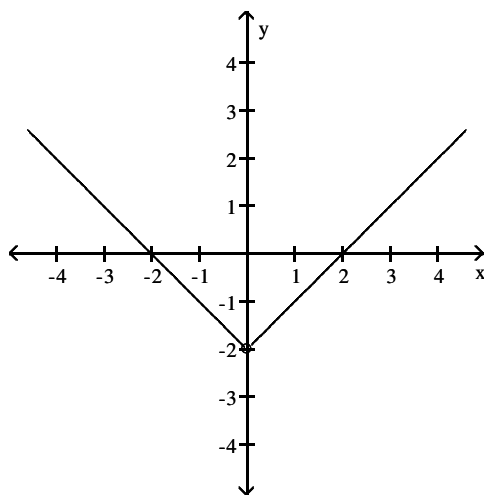
B) -2

C) does not exist

D) 0

31)  $\lim_{x \rightarrow 0} f(x)$

31) \_\_\_\_\_



A) -2

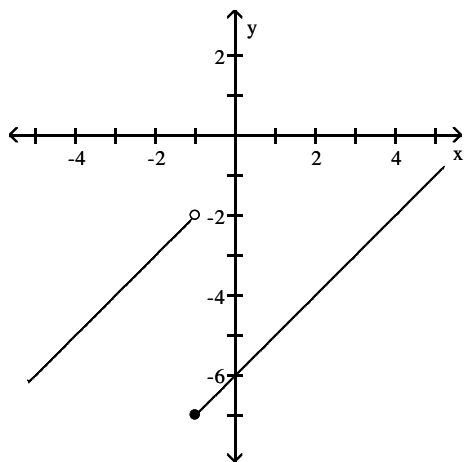
B) -1

C) does not exist

D) 2

32) Find  $\lim_{x \rightarrow (-1)^-} f(x)$  and  $\lim_{x \rightarrow (-1)^+} f(x)$

32) \_\_\_\_\_



A) -5; -2

B) -7; -2

C) -2; -7

D) -7; -5

Use the table of values of  $f$  to estimate the limit.

33) Let  $f(x) = x^2 + 8x - 2$ , find  $\lim_{x \rightarrow 2} f(x)$ .

33) \_\_\_\_\_

|        |     |      |       |       |      |     |
|--------|-----|------|-------|-------|------|-----|
| $x$    | 1.9 | 1.99 | 1.999 | 2.001 | 2.01 | 2.1 |
| $f(x)$ |     |      |       |       |      |     |

A)

|        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|
| $x$    | 1.9    | 1.99   | 1.999  | 2.001  | 2.01   | 2.1    |
| $f(x)$ | 16.692 | 17.592 | 17.689 | 17.710 | 17.808 | 18.789 |

; limit = 17.70

B)

|        |       |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|-------|
| $x$    | 1.9   | 1.99  | 1.999 | 2.001 | 2.01  | 2.1   |
| $f(x)$ | 5.043 | 5.364 | 5.396 | 5.404 | 5.436 | 5.763 |

; limit =  $\infty$

C)

|        |       |       |       |       |       |       |
|--------|-------|-------|-------|-------|-------|-------|
| $x$    | 1.9   | 1.99  | 1.999 | 2.001 | 2.01  | 2.1   |
| $f(x)$ | 5.043 | 5.364 | 5.396 | 5.404 | 5.436 | 5.763 |

; limit = 5.40

D)

|        |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|
| $x$    | 1.9    | 1.99   | 1.999  | 2.001  | 2.01   | 2.1    |
| $f(x)$ | 16.810 | 17.880 | 17.988 | 18.012 | 18.120 | 19.210 |

; limit = 18.0

34) Let  $f(x) = \frac{x-4}{\sqrt{x}-2}$ , find  $\lim_{x \rightarrow 4} f(x)$ .

34) \_\_\_\_\_

|        |     |      |       |       |      |     |
|--------|-----|------|-------|-------|------|-----|
| $x$    | 3.9 | 3.99 | 3.999 | 4.001 | 4.01 | 4.1 |
| $f(x)$ |     |      |       |       |      |     |

A)

|        |         |         |         |         |         |         |
|--------|---------|---------|---------|---------|---------|---------|
| $x$    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| $f(x)$ | 1.19245 | 1.19925 | 1.19993 | 1.20007 | 1.20075 | 1.20745 |

; limit = 1.20

B)

|        |         |         |         |         |         |         |
|--------|---------|---------|---------|---------|---------|---------|
| $x$    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| $f(x)$ | 3.97484 | 3.99750 | 3.99975 | 4.00025 | 4.00250 | 4.02485 |

; limit = 4.0

C)

|        |         |         |         |         |         |         |
|--------|---------|---------|---------|---------|---------|---------|
| $x$    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| $f(x)$ | 5.07736 | 5.09775 | 5.09978 | 5.10022 | 5.10225 | 5.12236 |

; limit = 5.10

D)

|        |         |         |         |         |         |         |
|--------|---------|---------|---------|---------|---------|---------|
| $x$    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| $f(x)$ | 1.19245 | 1.19925 | 1.19993 | 1.20007 | 1.20075 | 1.20745 |

; limit =  $\infty$

35) Let  $f(x) = x^2 - 5$ , find  $\lim_{x \rightarrow 0} f(x)$ .

35) \_\_\_\_\_

|      |      |       |        |       |      |     |
|------|------|-------|--------|-------|------|-----|
| x    | -0.1 | -0.01 | -0.001 | 0.001 | 0.01 | 0.1 |
| f(x) |      |       |        |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -1.4970 | -1.4999 | -1.5000 | -1.5000 | -1.4999 | -1.4970 |

; limit =  $\infty$

B)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -2.9910 | -2.9999 | -3.0000 | -3.0000 | -2.9999 | -2.9910 |

; limit = -3.0

C)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -1.4970 | -1.4999 | -1.5000 | -1.5000 | -1.4999 | -1.4970 |

; limit = -15.0

D)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -4.9900 | -4.9999 | -5.0000 | -5.0000 | -4.9999 | -4.9900 |

; limit = -5.0

36) Let  $f(x) = \frac{x - 5}{x^2 - 7x + 10}$ , find  $\lim_{x \rightarrow 5} f(x)$ .

36) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 4.9 | 4.99 | 4.999 | 5.001 | 5.01 | 5.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 4.9     | 4.99    | 4.999   | 5.001   | 5.01    | 5.1     |
| f(x) | -0.3448 | -0.3344 | -0.3334 | -0.3332 | -0.3322 | -0.3226 |

; limit = -0.3333

B)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 4.9    | 4.99   | 4.999  | 5.001  | 5.01   | 5.1    |
| f(x) | 0.4448 | 0.4344 | 0.4334 | 0.4332 | 0.4322 | 0.4226 |

; limit = 0.4333

C)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 4.9    | 4.99   | 4.999  | 5.001  | 5.01   | 5.1    |
| f(x) | 0.2448 | 0.2344 | 0.2334 | 0.2332 | 0.2322 | 0.2226 |

; limit = 0.2333

D)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 4.9    | 4.99   | 4.999  | 5.001  | 5.01   | 5.1    |
| f(x) | 0.3448 | 0.3344 | 0.3334 | 0.3332 | 0.3322 | 0.3226 |

; limit = 0.3333

37) Let  $f(x) = \frac{x^2 - 2x - 3}{x^2 + 2x - 15}$ , find  $\lim_{x \rightarrow 3} f(x)$ .

37) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 2.9 | 2.99 | 2.999 | 3.001 | 3.01 | 3.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 2.9     | 2.99    | 2.999   | 3.001   | 3.01    | 3.1     |
| f(x) | -1.1053 | -1.0101 | -1.0010 | -0.9990 | -0.9900 | -0.9048 |

B)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 2.9    | 2.99   | 2.999  | 3.001  | 3.01   | 3.1    |
| f(x) | 0.4937 | 0.4994 | 0.4999 | 0.5001 | 0.5006 | 0.5062 |

C)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 2.9    | 2.99   | 2.999  | 3.001  | 3.01   | 3.1    |
| f(x) | 0.5937 | 0.5994 | 0.5999 | 0.6001 | 0.6006 | 0.6062 |

D)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 2.9    | 2.99   | 2.999  | 3.001  | 3.01   | 3.1    |
| f(x) | 0.3937 | 0.3994 | 0.3999 | 0.4001 | 0.4006 | 0.4062 |

38) Let  $f(x) = \frac{\sin(4x)}{x}$ , find  $\lim_{x \rightarrow 0} f(x)$ .

38) \_\_\_\_\_

|      |      |            |        |       |            |     |
|------|------|------------|--------|-------|------------|-----|
| x    | -0.1 | -0.01      | -0.001 | 0.001 | 0.01       | 0.1 |
| f(x) |      | 3.99893342 |        |       | 3.99893342 |     |

A) limit = 0

B) limit = 3.5

C) limit does not exist

D) limit = 4

39) Let  $f(\theta) = \frac{\cos(5\theta)}{\theta}$ , find  $\lim_{\theta \rightarrow 0} f(\theta)$ .

39) \_\_\_\_\_

|      |            |       |        |       |      |           |
|------|------------|-------|--------|-------|------|-----------|
| x    | -0.1       | -0.01 | -0.001 | 0.001 | 0.01 | 0.1       |
| f(θ) | -8.7758256 |       |        |       |      | 8.7758256 |

A) limit = 8.7758256

B) limit = 0

C) limit does not exist

D) limit = 5

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

**Provide an appropriate response.**

40) It can be shown that the inequalities  $1 - \frac{x^2}{6} < \frac{x \sin(x)}{2 - 2 \cos(x)} < 1$  hold for all values of x close to zero. What, if anything, does this tell you about  $\frac{x \sin(x)}{2 - 2 \cos(x)}$ ? Explain.

40) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 41) 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. 41) \_\_\_\_\_

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

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

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

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

- 42) Provide a short sentence that summarizes the general limit principle given by the formal notation  $\lim_{x \rightarrow a} [f(x) \pm g(x)] = \lim_{x \rightarrow a} f(x) \pm \lim_{x \rightarrow a} g(x) = L \pm M$ , given that  $\lim_{x \rightarrow a} f(x) = L$  and  $\lim_{x \rightarrow a} g(x) = M$ . 42) \_\_\_\_\_

A) The sum or the difference of two functions is continuous.

B) The limit of a sum or a difference is the sum or the difference of the functions.

C) The sum or the difference of two functions is the sum of two limits.

D) The limit of a sum or a difference is the sum or the difference of the limits.

- 43) 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? 43) \_\_\_\_\_

A) The limit of a product is the product of the limits, and the limit of a quotient is the quotient of the limits.

B) The limit of a product is the product of the limits, and a constant is continuous.

C) The limit of a function is a constant times a limit, and the limit of a constant is the constant.

D) The limit of a constant is the constant, and the limit of a product is the product of the limits.

**Find the limit.**

- 44)  $\lim_{x \rightarrow 17} \sqrt{5}$  44) \_\_\_\_\_

A)  $\sqrt{5}$

B) 17

C)  $\sqrt{17}$

D) 5

- 45)  $\lim_{x \rightarrow 2} (7x - 4)$  45) \_\_\_\_\_

A) -18

B) 18

C) 10

D) -10

- 46)  $\lim_{x \rightarrow -5} (10 - 4x)$  46) \_\_\_\_\_

A) 30

B) -10

C) -30

D) 10

Give an appropriate answer.

47) Let  $\lim_{x \rightarrow 5} f(x) = -3$  and  $\lim_{x \rightarrow 5} g(x) = -6$ . Find  $\lim_{x \rightarrow 5} [f(x) - g(x)]$ . 47) \_\_\_\_\_  
 A) -9 B) 5 C) 3 D) -3

48) Let  $\lim_{x \rightarrow -9} f(x) = -7$  and  $\lim_{x \rightarrow -9} g(x) = -8$ . Find  $\lim_{x \rightarrow -9} [f(x) \cdot g(x)]$ . 48) \_\_\_\_\_  
 A) -8 B) 56 C) -15 D) -9

49) Let  $\lim_{x \rightarrow -3} f(x) = -6$  and  $\lim_{x \rightarrow -3} g(x) = 4$ . Find  $\lim_{x \rightarrow -3} \frac{f(x)}{g(x)}$ . 49) \_\_\_\_\_  
 A)  $-\frac{3}{2}$  B)  $-\frac{2}{3}$  C) -10 D) -3

50) Let  $\lim_{x \rightarrow -1} f(x) = 16$ . Find  $\lim_{x \rightarrow -1} \sqrt{f(x)}$ . 50) \_\_\_\_\_  
 A) 4 B) 2.0000 C) -1 D) 16

51) Let  $\lim_{x \rightarrow 3} f(x) = 3$  and  $\lim_{x \rightarrow 3} g(x) = -5$ . Find  $\lim_{x \rightarrow 3} [f(x) + g(x)]^2$ . 51) \_\_\_\_\_  
 A) 34 B) 8 C) 4 D) -2

52) Let  $\lim_{x \rightarrow 10} f(x) = 1024$ . Find  $\lim_{x \rightarrow 10} \sqrt[5]{f(x)}$ . 52) \_\_\_\_\_  
 A) 10 B) 4 C) 1024 D) 5

53) Let  $\lim_{x \rightarrow -8} f(x) = 5$  and  $\lim_{x \rightarrow -8} g(x) = -1$ . Find  $\lim_{x \rightarrow -8} \left[ \frac{-3f(x) - 2g(x)}{10 + g(x)} \right]$ . 53) \_\_\_\_\_  
 A)  $-\frac{17}{9}$  B) -8 C)  $-\frac{13}{9}$  D)  $-\frac{7}{2}$

Find the limit.

54)  $\lim_{x \rightarrow 2} (x^3 + 5x^2 - 7x + 1)$  54) \_\_\_\_\_  
 A) 29 B) 0 C) 15 D) does not exist

55)  $\lim_{x \rightarrow -2} (3x^5 - 3x^4 - 4x^3 + x^2 + 5)$  55) \_\_\_\_\_  
 A) -7 B) -167 C) 41 D) -103

56)  $\lim_{x \rightarrow -1} \frac{x}{3x + 2}$  56) \_\_\_\_\_  
 A) 0 B) does not exist C)  $-\frac{1}{5}$  D) 1

- 57)  $\lim_{x \rightarrow 0} \frac{x^3 - 6x + 8}{x - 2}$  57) \_\_\_\_\_  
 A) Does not exist B) -4 C) 0 D) 4
- 58)  $\lim_{x \rightarrow 1} \frac{3x^2 + 7x - 2}{3x^2 - 4x - 2}$  58) \_\_\_\_\_  
 A) 0 B)  $-\frac{7}{4}$  C)  $-\frac{8}{3}$  D) Does not exist
- 59)  $\lim_{x \rightarrow -1} (x + 3)^2(x - 3)^3$  59) \_\_\_\_\_  
 A) -1024 B) 32 C) 128 D) -256
- 60)  $\lim_{x \rightarrow 7} \sqrt{x^2 + 10x + 25}$  60) \_\_\_\_\_  
 A) does not exist B) 12 C)  $\pm 12$  D) 144
- 61)  $\lim_{x \rightarrow 5} \sqrt{9x + 91}$  61) \_\_\_\_\_  
 A)  $-2\sqrt{34}$  B) 136 C)  $2\sqrt{34}$  D) -136
- 62)  $\lim_{h \rightarrow 0} \frac{2}{\sqrt{3h + 4} + 2}$  62) \_\_\_\_\_  
 A) 2 B) 1/2 C) Does not exist D) 1
- 63)  $\lim_{x \rightarrow 0} \frac{\sqrt{1 + x} - 1}{x}$  63) \_\_\_\_\_  
 A) 0 B) 1/2 C) 1/4 D) Does not exist

**Determine the limit by sketching an appropriate graph.**

- 64)  $\lim_{x \rightarrow 5^-} f(x)$ , where  $f(x) = \begin{cases} -3x - 5 & \text{for } x < 5 \\ 5x - 4 & \text{for } x \geq 5 \end{cases}$  64) \_\_\_\_\_  
 A) -3 B) -4 C) 21 D) -20
- 65)  $\lim_{x \rightarrow 5^+} f(x)$ , where  $f(x) = \begin{cases} -5x - 5 & \text{for } x < 5 \\ 3x - 4 & \text{for } x \geq 5 \end{cases}$  65) \_\_\_\_\_  
 A) -3 B) 11 C) -30 D) -4
- 66)  $\lim_{x \rightarrow -1^+} f(x)$ , where  $f(x) = \begin{cases} x^2 + 3 & \text{for } x \neq -1 \\ 0 & \text{for } x = -1 \end{cases}$  66) \_\_\_\_\_  
 A) -2 B) 4 C) 0 D) 1

67)  $\lim_{x \rightarrow 4^-} f(x)$ , where  $f(x) = \begin{cases} \sqrt{1-x^2} & 0 \leq x < 1 \\ 1 & 1 \leq x < 4 \\ 4 & x = 4 \end{cases}$  67) \_\_\_\_\_

A) Does not exist      B) 1      C) 0      D) 4

68)  $\lim_{x \rightarrow -1^+} f(x)$ , where  $f(x) = \begin{cases} x & -1 \leq x < 0, \text{ or } 0 < x \leq 3 \\ 1 & x = 0 \\ 0 & x < -1 \text{ or } x > 3 \end{cases}$  68) \_\_\_\_\_

A) -0      B) 7      C) -1      D) Does not exist

**Find the limit, if it exists.**

69)  $\lim_{x \rightarrow 0} \frac{x^3 + 12x^2 - 5x}{5x}$  69) \_\_\_\_\_

A) Does not exist      B) 0      C) 5      D) -1

70)  $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1}$  70) \_\_\_\_\_

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

71)  $\lim_{x \rightarrow 9} \frac{x^2 - 81}{x - 9}$  71) \_\_\_\_\_

A) 1      B) 18      C) 9      D) Does not exist

72)  $\lim_{x \rightarrow -7} \frac{x^2 + 11x + 28}{x + 7}$  72) \_\_\_\_\_

A) Does not exist      B) 154      C) 11      D) -3

73)  $\lim_{x \rightarrow 2} \frac{x^2 + 4x - 12}{x - 2}$  73) \_\_\_\_\_

A) 4      B) 0      C) Does not exist      D) 8

74)  $\lim_{x \rightarrow 3} \frac{x^2 + 5x - 24}{x^2 - 9}$  74) \_\_\_\_\_

A) 0      B)  $\frac{11}{6}$       C)  $-\frac{5}{6}$       D) Does not exist

75)  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 5x + 4}$  75) \_\_\_\_\_

A) Does not exist      B)  $-\frac{2}{3}$       C) 0      D)  $-\frac{1}{3}$

76)  $\lim_{x \rightarrow 5} \frac{x^2 - 11x + 30}{x^2 - 7x + 10}$  76) \_\_\_\_\_

- A)  $-\frac{1}{3}$  B)  $\frac{1}{3}$  C)  $\frac{11}{3}$  D) Does not exist

77)  $\lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h}$  77) \_\_\_\_\_

- A) 0 B)  $3x^2 + 3xh + h^2$  C)  $3x^2$  D) Does not exist

78)  $\lim_{x \rightarrow 10} \frac{|10 - x|}{10 - x}$  78) \_\_\_\_\_

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

**Provide an appropriate response.**

79) It can be shown that the inequalities  $-x \leq x \cos\left(\frac{1}{x}\right) \leq x$  hold for all values of  $x \geq 0$ . 79) \_\_\_\_\_

Find  $\lim_{x \rightarrow 0} x \cos\left(\frac{1}{x}\right)$  if it exists.

- A) 1 B) 0 C) does not exist D) 0.0007

80) The inequality  $1 - \frac{x^2}{2} < \frac{\sin x}{x} < 1$  holds when  $x$  is measured in radians and  $|x| < 1$ . 80) \_\_\_\_\_

Find  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$  if it exists.

- A) does not exist B) 0.0007 C) 0 D) 1

81) If  $x^3 \leq f(x) \leq x$  for  $x$  in  $[-1, 1]$ , find  $\lim_{x \rightarrow 0} f(x)$  if it exists. 81) \_\_\_\_\_

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

Compute the values of  $f(x)$  and use them to determine the indicated limit.

82) If  $f(x) = x^2 + 8x - 2$ , find  $\lim_{x \rightarrow 2} f(x)$ .

82) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 1.9 | 1.99 | 1.999 | 2.001 | 2.01 | 2.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 1.9   | 1.99  | 1.999 | 2.001 | 2.01  | 2.1   |
| f(x) | 5.043 | 5.364 | 5.396 | 5.404 | 5.436 | 5.763 |

; limit =  $\infty$

B)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 1.9   | 1.99  | 1.999 | 2.001 | 2.01  | 2.1   |
| f(x) | 5.043 | 5.364 | 5.396 | 5.404 | 5.436 | 5.763 |

; limit = 5.40

C)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 1.9    | 1.99   | 1.999  | 2.001  | 2.01   | 2.1    |
| f(x) | 16.810 | 17.880 | 17.988 | 18.012 | 18.120 | 19.210 |

; limit = 18.0

D)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 1.9    | 1.99   | 1.999  | 2.001  | 2.01   | 2.1    |
| f(x) | 16.692 | 17.592 | 17.689 | 17.710 | 17.808 | 18.789 |

; limit = 17.70

83) If  $f(x) = \frac{x^4 - 1}{x - 1}$ , find  $\lim_{x \rightarrow 1} f(x)$ .

83) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 0.9 | 0.99 | 0.999 | 1.001 | 1.01 | 1.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 0.9   | 0.99  | 0.999 | 1.001 | 1.01  | 1.1   |
| f(x) | 1.032 | 1.182 | 1.198 | 1.201 | 1.218 | 1.392 |

; limit =  $\infty$

B)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 0.9   | 0.99  | 0.999 | 1.001 | 1.01  | 1.1   |
| f(x) | 4.595 | 5.046 | 5.095 | 5.105 | 5.154 | 5.677 |

; limit = 5.10

C)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 0.9   | 0.99  | 0.999 | 1.001 | 1.01  | 1.1   |
| f(x) | 1.032 | 1.182 | 1.198 | 1.201 | 1.218 | 1.392 |

; limit = 1.210

D)

|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| x    | 0.9   | 0.99  | 0.999 | 1.001 | 1.01  | 1.1   |
| f(x) | 3.439 | 3.940 | 3.994 | 4.006 | 4.060 | 4.641 |

; limit = 4.0

84) If  $f(x) = \frac{x^3 - 6x + 8}{x - 2}$ , find  $\lim_{x \rightarrow 0} f(x)$ .

84) \_\_\_\_\_

|      |      |       |        |       |      |     |
|------|------|-------|--------|-------|------|-----|
| x    | -0.1 | -0.01 | -0.001 | 0.001 | 0.01 | 0.1 |
| f(x) |      |       |        |       |      |     |

A)

|      |          |          |          |          |          |          |
|------|----------|----------|----------|----------|----------|----------|
| x    | -0.1     | -0.01    | -0.001   | 0.001    | 0.01     | 0.1      |
| f(x) | -2.18529 | -2.10895 | -2.10090 | -2.99910 | -2.09096 | -2.00574 |

; limit = -2.10

B)

|      |          |          |          |          |          |          |
|------|----------|----------|----------|----------|----------|----------|
| x    | -0.1     | -0.01    | -0.001   | 0.001    | 0.01     | 0.1      |
| f(x) | -4.09476 | -4.00995 | -4.00100 | -3.99900 | -3.98995 | -3.89526 |

; limit = -4.0

C)

|      |          |          |          |          |          |          |
|------|----------|----------|----------|----------|----------|----------|
| x    | -0.1     | -0.01    | -0.001   | 0.001    | 0.01     | 0.1      |
| f(x) | -1.22843 | -1.20298 | -1.20030 | -1.19970 | -1.19699 | -1.16858 |

; limit =  $\infty$

D)

|      |          |          |          |          |          |          |
|------|----------|----------|----------|----------|----------|----------|
| x    | -0.1     | -0.01    | -0.001   | 0.001    | 0.01     | 0.1      |
| f(x) | -1.22843 | -1.20298 | -1.20030 | -1.19970 | -1.19699 | -1.16858 |

; limit = -1.20

85) If  $f(x) = \frac{x - 4}{\sqrt{x} - 2}$ , find  $\lim_{x \rightarrow 4} f(x)$ .

85) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 3.9 | 3.99 | 3.999 | 4.001 | 4.01 | 4.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| f(x) | 1.19245 | 1.19925 | 1.19993 | 1.20007 | 1.20075 | 1.20745 |

; limit = 1.20

B)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| f(x) | 1.19245 | 1.19925 | 1.19993 | 1.20007 | 1.20075 | 1.20745 |

; limit =  $\infty$

C)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| f(x) | 3.97484 | 3.99750 | 3.99975 | 4.00025 | 4.00250 | 4.02485 |

; limit = 4.0

D)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| f(x) | 5.07736 | 5.09775 | 5.09978 | 5.10022 | 5.10225 | 5.12236 |

; limit = 5.10

86) If  $f(x) = x^2 - 5$ , find  $\lim_{x \rightarrow 0} f(x)$ .

86) \_\_\_\_\_

|      |      |       |        |       |      |     |
|------|------|-------|--------|-------|------|-----|
| x    | -0.1 | -0.01 | -0.001 | 0.001 | 0.01 | 0.1 |
| f(x) |      |       |        |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -4.9900 | -4.9999 | -5.0000 | -5.0000 | -4.9999 | -4.9900 |

; limit = -5.0

B)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -1.4970 | -1.4999 | -1.5000 | -1.5000 | -1.4999 | -1.4970 |

; limit =  $\infty$

C)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -1.4970 | -1.4999 | -1.5000 | -1.5000 | -1.4999 | -1.4970 |

; limit = -15.0

D)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | -0.1    | -0.01   | -0.001  | 0.001   | 0.01    | 0.1     |
| f(x) | -2.9910 | -2.9999 | -3.0000 | -3.0000 | -2.9999 | -2.9910 |

; limit = -3.0

87) If  $f(x) = \frac{\sqrt{x+1}}{x+1}$ , find  $\lim_{x \rightarrow 1} f(x)$ .

87) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 0.9 | 0.99 | 0.999 | 1.001 | 1.01 | 1.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 0.9     | 0.99    | 0.999   | 1.001   | 1.01    | 1.1     |
| f(x) | 2.15293 | 2.13799 | 2.13656 | 2.13624 | 2.13481 | 2.12106 |

; limit = 2.13640

B)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 0.9     | 0.99    | 0.999   | 1.001   | 1.01    | 1.1     |
| f(x) | 0.72548 | 0.70888 | 0.70728 | 0.70693 | 0.70535 | 0.69007 |

; limit = 0.7071

C)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 0.9     | 0.99    | 0.999   | 1.001   | 1.01    | 1.1     |
| f(x) | 0.21764 | 0.21266 | 0.21219 | 0.21208 | 0.21160 | 0.20702 |

; limit =  $\infty$

D)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 0.9     | 0.99    | 0.999   | 1.001   | 1.01    | 1.1     |
| f(x) | 0.21764 | 0.21266 | 0.21219 | 0.21208 | 0.21160 | 0.20702 |

; limit = 0.21213

88) If  $f(x) = \sqrt{x} - 2$ , find  $\lim_{x \rightarrow 4} f(x)$ .

88) \_\_\_\_\_

|      |     |      |       |       |      |     |
|------|-----|------|-------|-------|------|-----|
| x    | 3.9 | 3.99 | 3.999 | 4.001 | 4.01 | 4.1 |
| f(x) |     |      |       |       |      |     |

A)

|      |         |         |         |         |         |         |
|------|---------|---------|---------|---------|---------|---------|
| x    | 3.9     | 3.99    | 3.999   | 4.001   | 4.01    | 4.1     |
| f(x) | 1.47736 | 1.49775 | 1.49977 | 1.50022 | 1.50225 | 1.52236 |

; limit = 1.50

B)

|      |          |          |          |         |         |         |
|------|----------|----------|----------|---------|---------|---------|
| x    | 3.9      | 3.99     | 3.999    | 4.001   | 4.01    | 4.1     |
| f(x) | -0.02516 | -0.00250 | -0.00025 | 0.00025 | 0.00250 | 0.02485 |

; limit = 0

C)

|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 3.9    | 3.99   | 3.999  | 4.001  | 4.01   | 4.1    |
| f(x) | 3.9000 | 2.9000 | 1.9000 | 2.0000 | 3.0000 | 4.0000 |

; limit = 1.95

D)

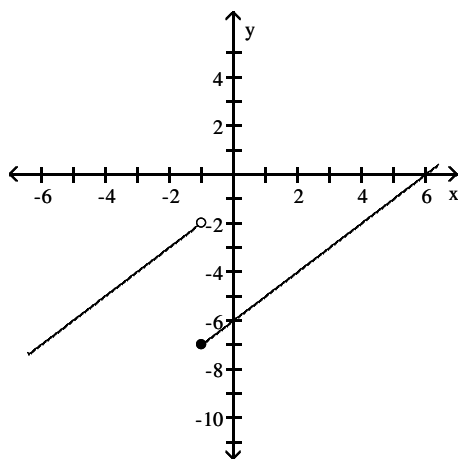
|      |        |        |        |        |        |        |
|------|--------|--------|--------|--------|--------|--------|
| x    | 3.9    | 3.99   | 3.999  | 4.001  | 4.01   | 4.1    |
| f(x) | 3.9000 | 2.9000 | 1.9000 | 2.0000 | 3.0000 | 4.0000 |

; limit =  $\infty$

For the function  $f$  whose graph is given, determine the limit.

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

89) \_\_\_\_\_



A) -5; -2

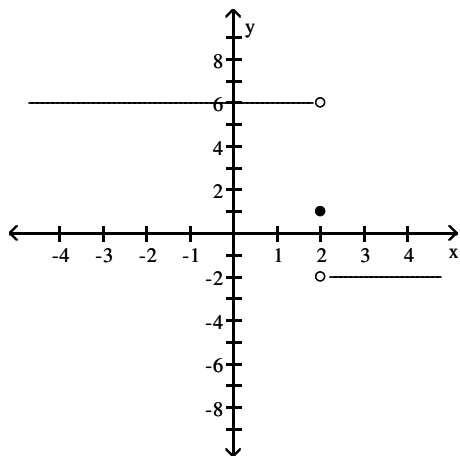
B) -2; -7

C) -7; -5

D) -7; -2

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

90) \_\_\_\_\_

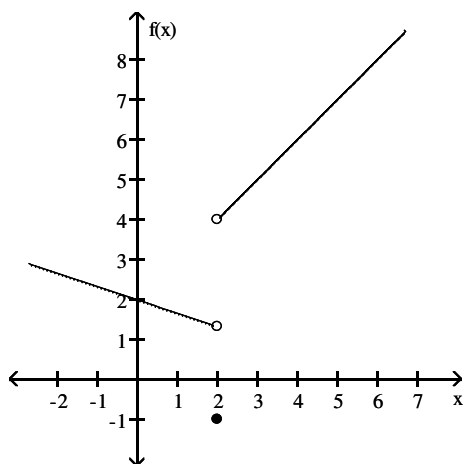


- A) -2; 6  
C) 6; -2

- B) 1; 1  
D) does not exist; does not exist

91) Find  $\lim_{x \rightarrow 2^-} f(x)$ .

91) \_\_\_\_\_



A) 2.3

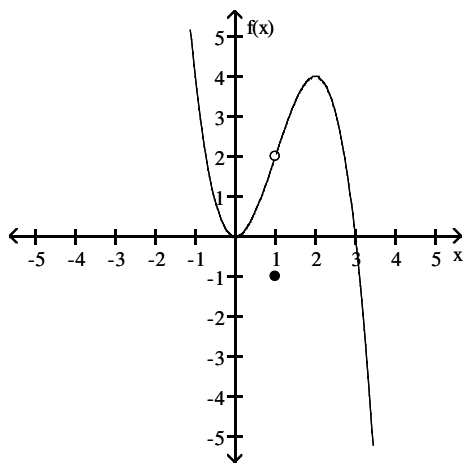
B) 1.3

C) 4

D) -1

92) Find  $\lim_{x \rightarrow 1^-} f(x)$ .

92) \_\_\_\_\_



A) 2

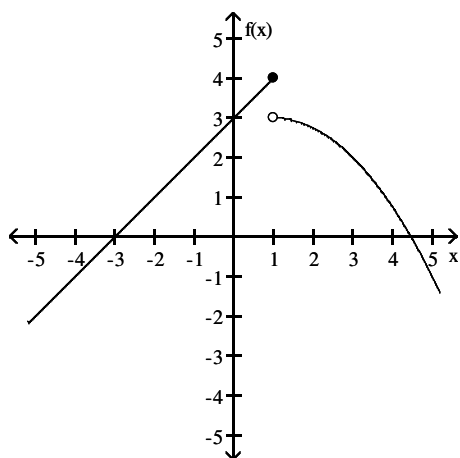
B) does not exist

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

D) -1

93) Find  $\lim_{x \rightarrow 1^+} f(x)$ .

93) \_\_\_\_\_



A) does not exist

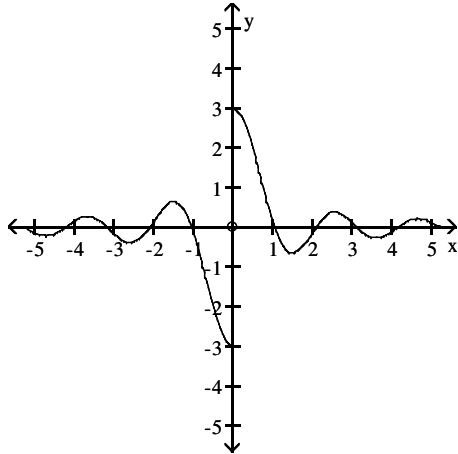
B)  $3\frac{1}{2}$

C) 3

D) 4

94) Find  $\lim_{x \rightarrow 0} f(x)$ .

94) \_\_\_\_\_



A) -3

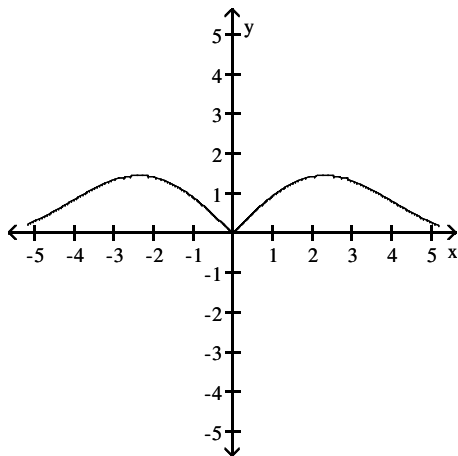
B) 0

C) 3

D) does not exist

95) Find  $\lim_{x \rightarrow 0} f(x)$ .

95) \_\_\_\_\_



A) -2

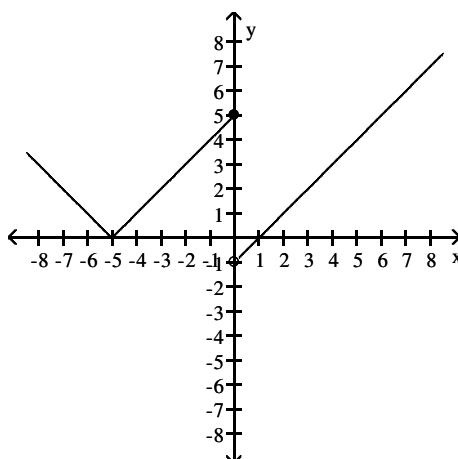
B) 0

C) does not exist

D) 2

96) Find  $\lim_{x \rightarrow 0} f(x)$ .

96) \_\_\_\_\_



A) 0

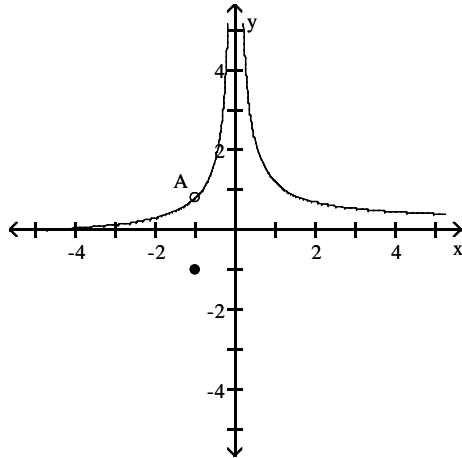
B) does not exist

C) 5

D) -5

97) Find  $\lim_{x \rightarrow -1} f(x)$ .

97) \_\_\_\_\_



A) does not exist

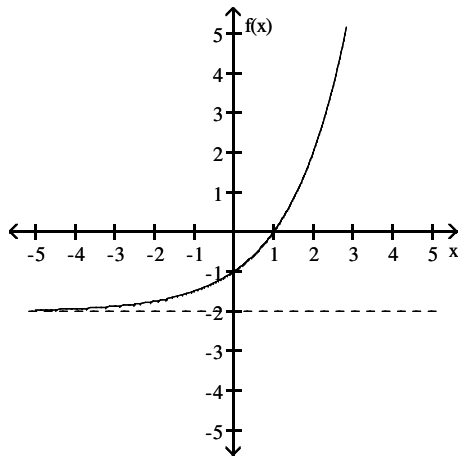
B) -1

C)  $\frac{4}{5}$

D)  $-\frac{4}{5}$

98) Find  $\lim_{x \rightarrow -\infty} f(x)$ .

98) \_\_\_\_\_



A) does not exist

B)  $-\infty$

C) -2

D) 0

**Find the limit.**

99)  $\lim_{x \rightarrow -2} \frac{1}{x+2}$

99) \_\_\_\_\_

A)  $\infty$

B) Does not exist

C)  $-\infty$

D)  $1/2$

100)  $\lim_{x \rightarrow -6^+} \frac{1}{x+6}$

100) \_\_\_\_\_

A)  $-\infty$

B) 0

C) -1

D)  $\infty$

101)  $\lim_{x \rightarrow 8^+} \frac{1}{(x-8)^2}$

101) \_\_\_\_\_

A)  $\infty$

B) -1

C) 0

D)  $-\infty$

102)  $\lim_{x \rightarrow -5^-} \frac{4}{x^2 - 25}$  102) \_\_\_\_\_  
 A)  $-\infty$  B)  $\infty$  C) 0 D) -1

103)  $\lim_{x \rightarrow 3^+} \frac{5}{x^2 - 9}$  103) \_\_\_\_\_  
 A)  $-\infty$  B) 0 C)  $\infty$  D) 1

104)  $\lim_{x \rightarrow (\pi/2)^+} \tan x$  104) \_\_\_\_\_  
 A) 1 B) 0 C)  $\infty$  D)  $-\infty$

105)  $\lim_{x \rightarrow (-\pi/2)^-} \sec x$  105) \_\_\_\_\_  
 A)  $\infty$  B)  $-\infty$  C) 1 D) 0

106)  $\lim_{x \rightarrow 0^+} (1 + \csc x)$  106) \_\_\_\_\_  
 A)  $\infty$  B) 1 C) 0 D) Does not exist

107)  $\lim_{x \rightarrow 0} (1 - \cot x)$  107) \_\_\_\_\_  
 A)  $\infty$  B)  $-\infty$  C) 0 D) Does not exist

108)  $\lim_{x \rightarrow -3^+} \frac{x^2 - 7x + 12}{x^3 - 9x}$  108) \_\_\_\_\_  
 A) Does not exist B) 0 C)  $-\infty$  D)  $\infty$

109)  $\lim_{x \rightarrow 4^+} \frac{x^2 - 6x + 8}{x^3 - 4x}$  109) \_\_\_\_\_  
 A)  $-\infty$  B)  $\infty$  C) Does not exist D) 0

**Find all vertical asymptotes of the given function.**

110)  $h(x) = \frac{3x}{x - 4}$  110) \_\_\_\_\_  
 A)  $x = 3$  B) none C)  $x = 4$  D)  $x = -4$

111)  $f(x) = \frac{x + 2}{x^2 - 36}$  111) \_\_\_\_\_  
 A)  $x = 0, x = 36$  B)  $x = 36, x = -2$   
 C)  $x = -6, x = 6, x = -2$  D)  $x = -6, x = 6$

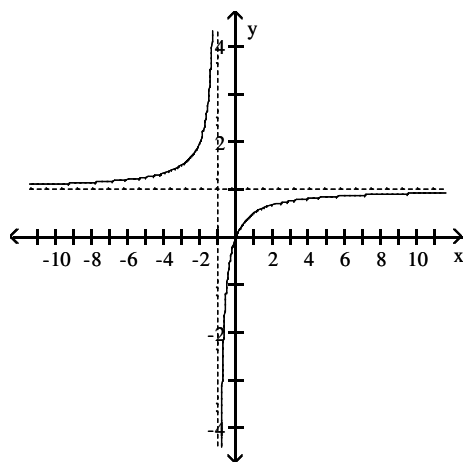
- 112)  $f(x) = \frac{x+3}{x^2+36}$  112) \_\_\_\_\_  
 A)  $x = -6, x = 6, x = -3$  B)  $x = -6, x = -3$   
 C) none D)  $x = -6, x = 6$
- 113)  $f(x) = \frac{x+11}{x^2+4x}$  113) \_\_\_\_\_  
 A)  $x = -4, x = -11$  B)  $x = 0, x = -4$   
 C)  $x = -2, x = 2$  D)  $x = 0, x = -2, x = 2$
- 114)  $f(x) = \frac{x-1}{x^3+36x}$  114) \_\_\_\_\_  
 A)  $x = -6, x = 6$  B)  $x = 0, x = -6, x = 6$   
 C)  $x = 0$  D)  $x = 0, x = -36$
- 115)  $R(x) = \frac{-3x^2}{x^2+4x-60}$  115) \_\_\_\_\_  
 A)  $x = -10, x = 6, x = -3$  B)  $x = 10, x = -6$   
 C)  $x = -10, x = 6$  D)  $x = -60$
- 116)  $R(x) = \frac{x-1}{x^3+2x^2-48x}$  116) \_\_\_\_\_  
 A)  $x = -8, x = 6$  B)  $x = -6, x = 0, x = 8$   
 C)  $x = -8, x = 0, x = 6$  D)  $x = -6, x = -30, x = 8$
- 117)  $f(x) = \frac{-2x(x+2)}{5x^2-4x-9}$  117) \_\_\_\_\_  
 A)  $x = -\frac{5}{9}, x = 1$  B)  $x = \frac{9}{5}, x = -1$  C)  $x = \frac{5}{9}, x = -1$  D)  $x = -\frac{9}{5}, x = 1$
- 118)  $f(x) = \frac{x-3}{9x-x^3}$  118) \_\_\_\_\_  
 A)  $x = 0, x = -3, x = 3$  B)  $x = 0, x = -3$   
 C)  $x = -3, x = 3$  D)  $x = 0, x = 3$
- 119)  $f(x) = \frac{-x^2+16}{x^2+5x+4}$  119) \_\_\_\_\_  
 A)  $x = -1, x = 4$  B)  $x = -1, x = -4$  C)  $x = 1, x = -4$  D)  $x = -1$

Choose the graph that represents the given function without using a graphing utility.

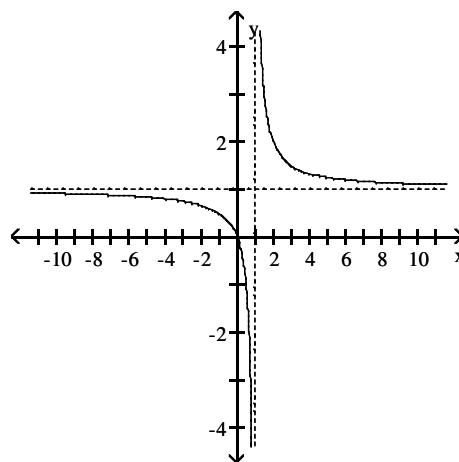
120)  $f(x) = \frac{x}{x-1}$

120) \_\_\_\_\_

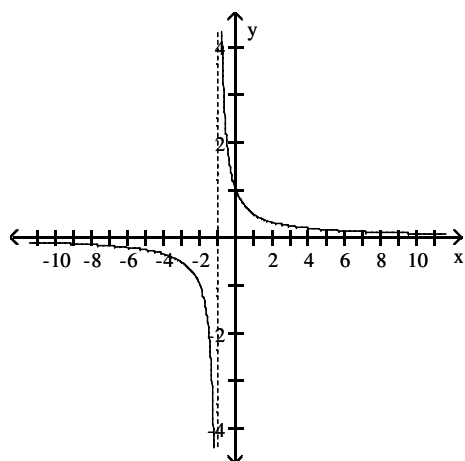
A)



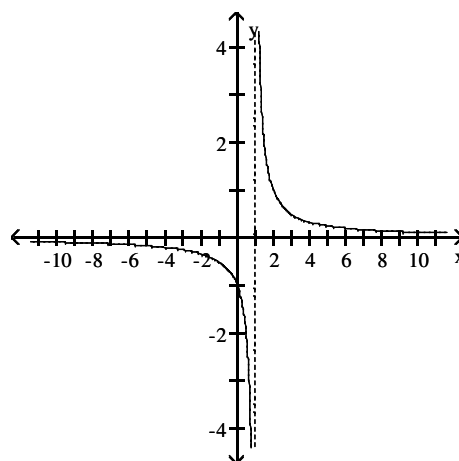
B)



C)



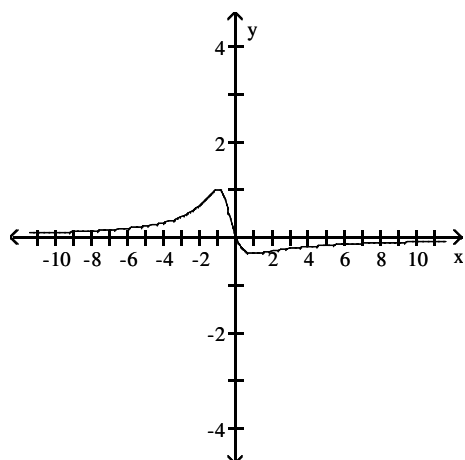
D)



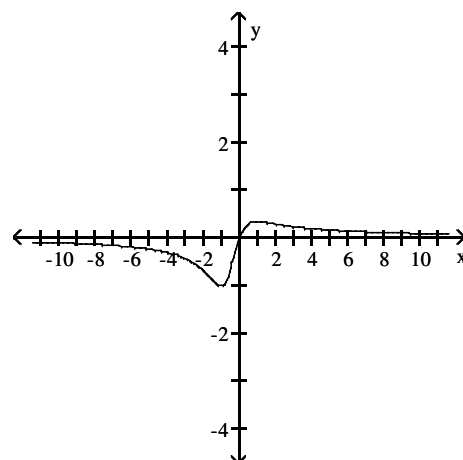
121)  $f(x) = \frac{x}{x^2 + x + 1}$

121) \_\_\_\_\_

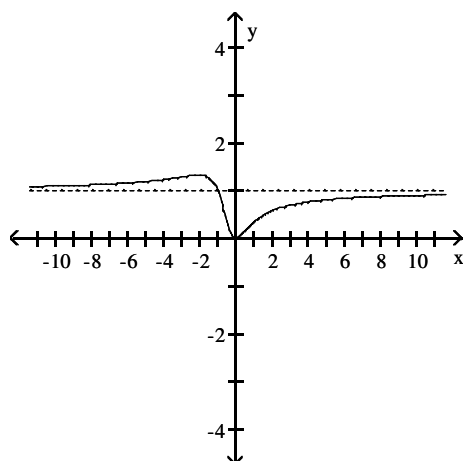
A)



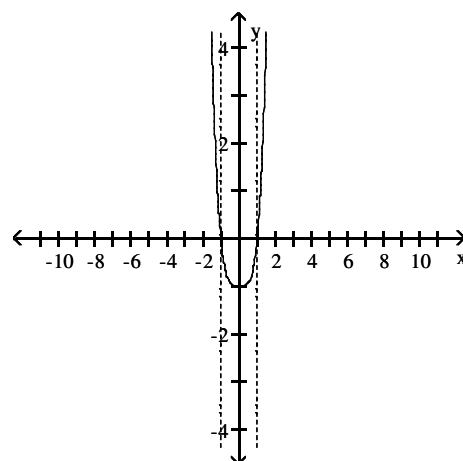
B)



C)



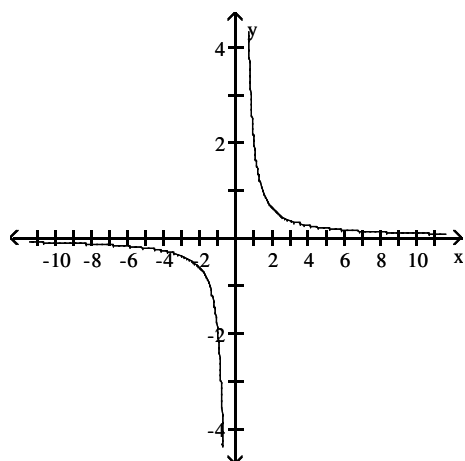
D)



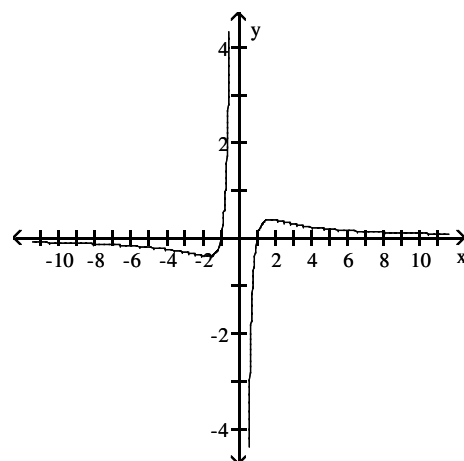
122)  $f(x) = \frac{x^2 - 1}{x^3}$

122) \_\_\_\_\_

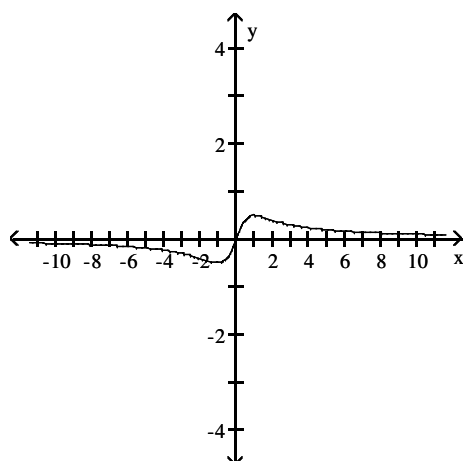
A)



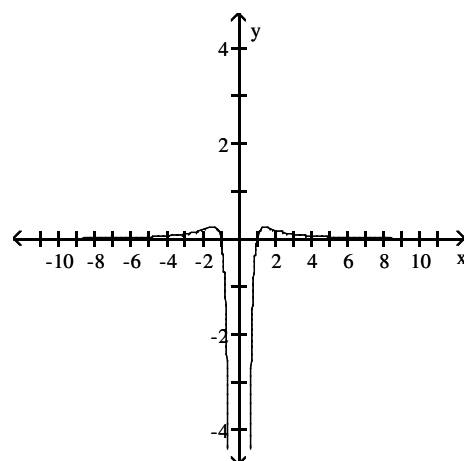
B)



C)



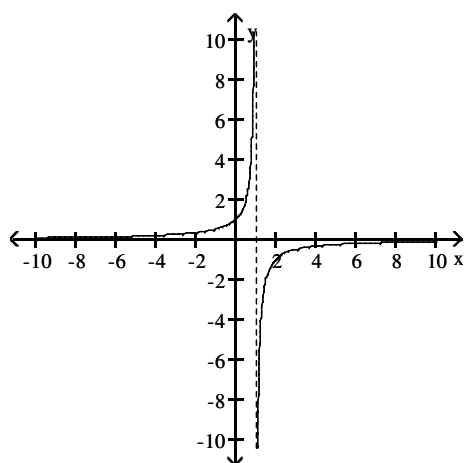
D)



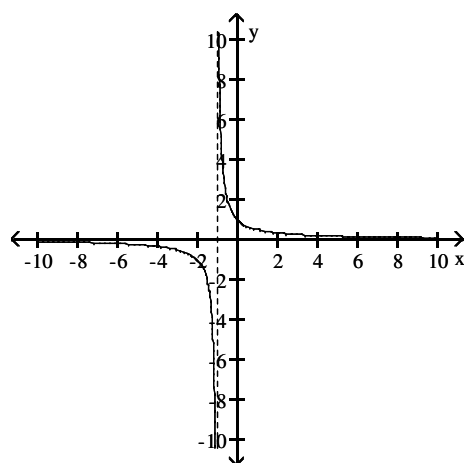
123)  $f(x) = \frac{1}{x+1}$

123) \_\_\_\_\_

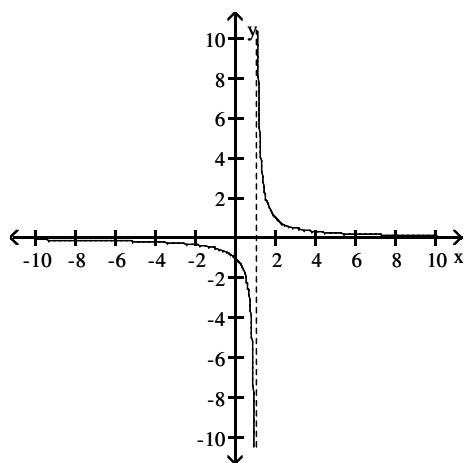
A)



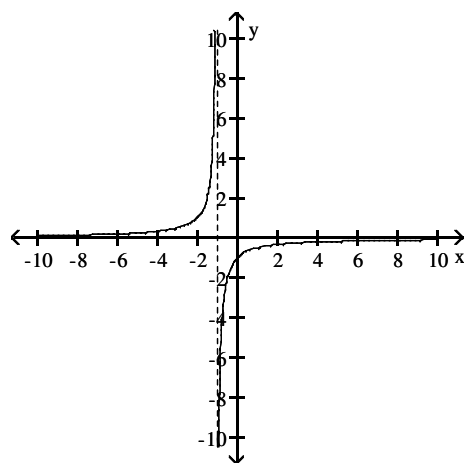
B)



C)



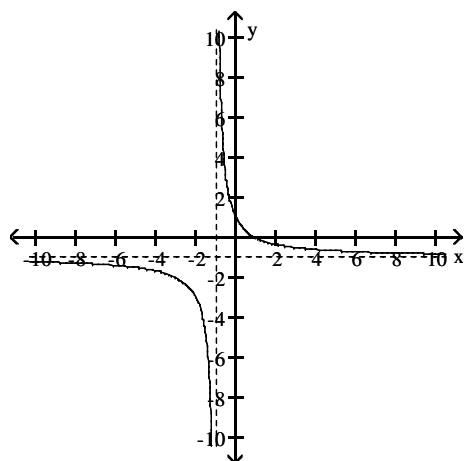
D)



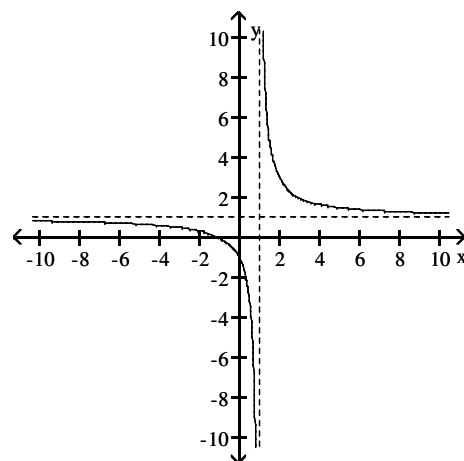
124)  $f(x) = \frac{x-1}{x+1}$

124) \_\_\_\_\_

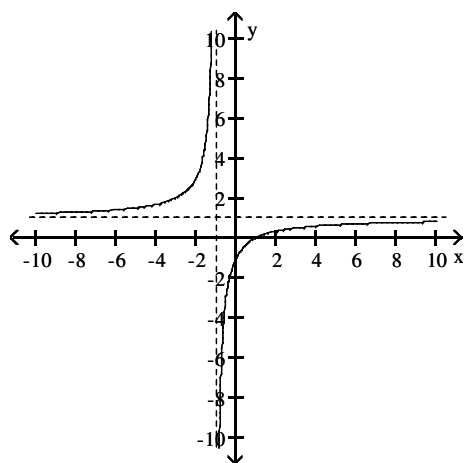
A)



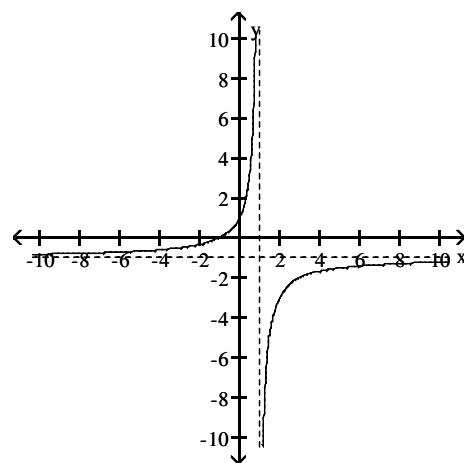
B)



C)



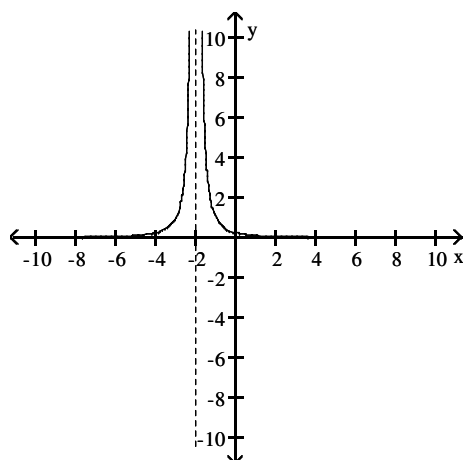
D)



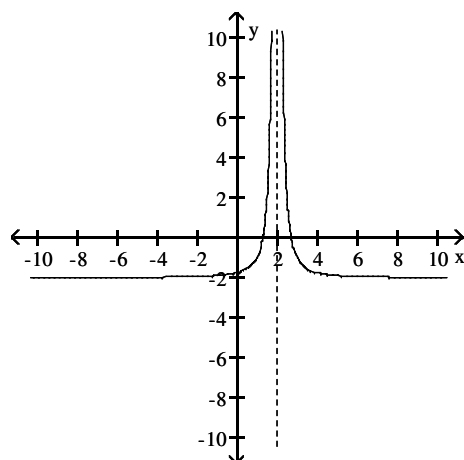
125)  $f(x) = \frac{1}{(x+2)^2}$

125) \_\_\_\_\_

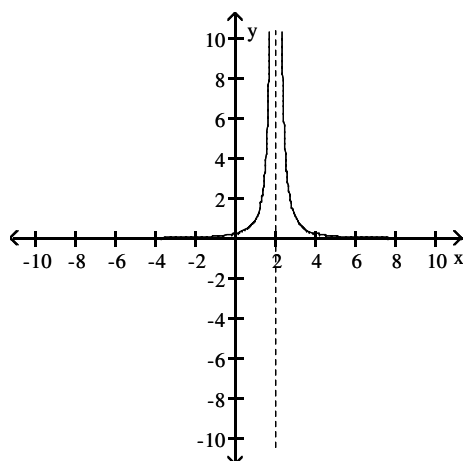
A)



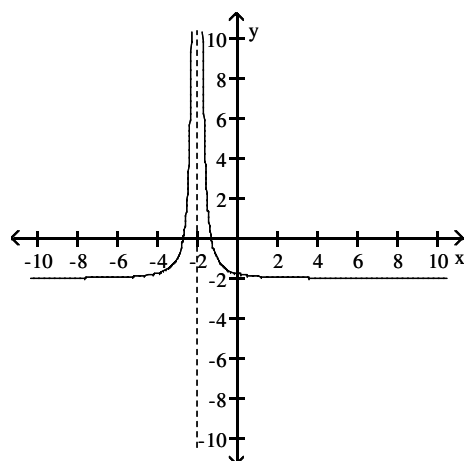
B)



C)



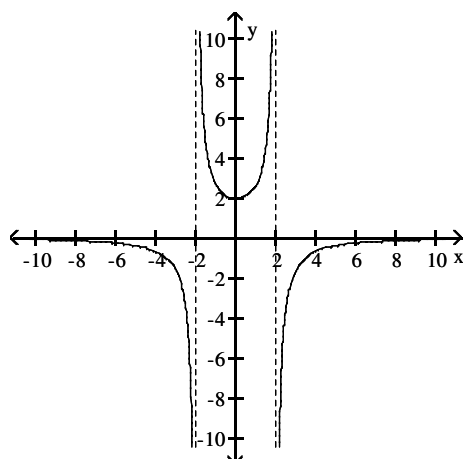
D)



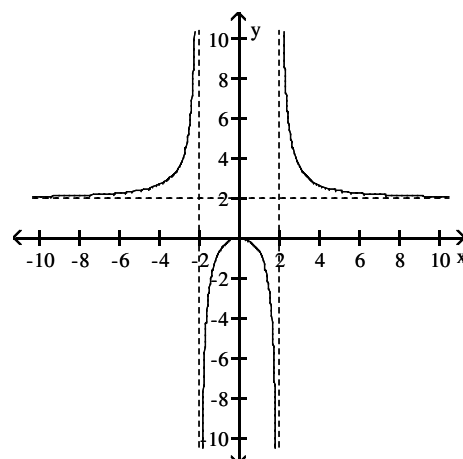
126)  $f(x) = \frac{2x^2}{4 - x^2}$

126) \_\_\_\_\_

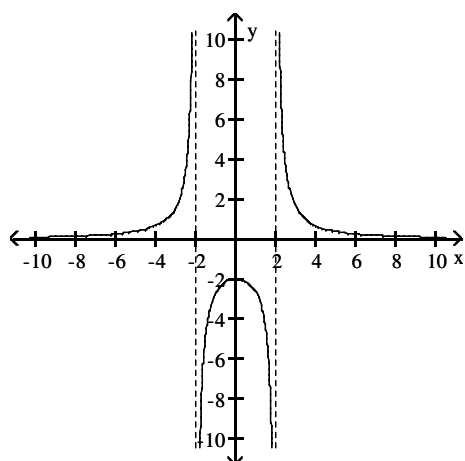
A)



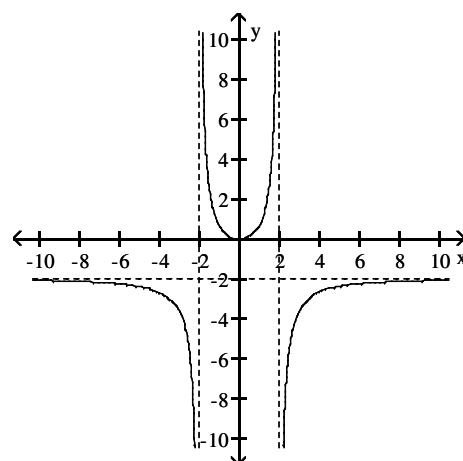
B)



C)



D)



Determine the limit at infinity.

127)  $\lim_{x \rightarrow \infty} \frac{8}{x} - 8$

127) \_\_\_\_\_

A) -8

B) 8

C) -16

D) 0

128)  $\lim_{x \rightarrow \infty} \frac{4}{9 - (5/x^2)}$

128) \_\_\_\_\_

A)  $-\infty$

B) 4

C) 1

D)  $\frac{4}{9}$

129)  $\lim_{x \rightarrow \infty} \frac{-6 + (3/x)}{5 - (1/x^2)}$

129) \_\_\_\_\_

A)  $-\infty$

B)  $-\frac{6}{5}$

C)  $\infty$

D)  $\frac{6}{5}$

130)  $\lim_{x \rightarrow \infty} \frac{x^2 - 5x + 13}{x^3 - 3x^2 + 4}$  130) \_\_\_\_\_

A)  $\frac{13}{4}$  B)  $\infty$  C) 1 D) 0

131)  $\lim_{x \rightarrow -\infty} \frac{-15x^2 - 8x + 13}{-5x^2 + 3x + 2}$  131) \_\_\_\_\_

A) 1 B)  $\frac{13}{2}$  C) 3 D)  $\infty$

132)  $\lim_{x \rightarrow \infty} \frac{3x + 1}{14x - 7}$  132) \_\_\_\_\_

A)  $\frac{3}{14}$  B)  $-\frac{1}{7}$  C)  $\infty$  D) 0

133)  $\lim_{x \rightarrow \infty} \frac{7x^3 - 2x^2 + 3x}{-x^3 - 2x + 7}$  133) \_\_\_\_\_

A)  $\frac{3}{2}$  B) 7 C)  $\infty$  D) -7

134)  $\lim_{x \rightarrow -\infty} \frac{4x^3 + 3x^2}{x - 7x^2}$  134) \_\_\_\_\_

A)  $\infty$  B) 4 C)  $-\frac{3}{7}$  D)  $-\infty$

135)  $\lim_{x \rightarrow \infty} \frac{\cos 5x}{x}$  135) \_\_\_\_\_

A)  $-\infty$  B) 1 C) 0 D) 5

136)  $\lim_{x \rightarrow \infty} \left( 8 - \frac{3}{x} + \frac{1}{x^2} \right)$  136) \_\_\_\_\_

A) 6 B) 0 C) 8 D)  $\infty$

**Describe the end behavior.**

137)  $\ln x$  on  $(0, \infty)$  137) \_\_\_\_\_

A)  $\lim_{x \rightarrow 0^+} \ln x = -\infty$  and  $\lim_{x \rightarrow \infty} \ln x = 0$  B)  $\lim_{x \rightarrow 0^+} \ln x = -\infty$  and  $\lim_{x \rightarrow \infty} \ln x = \infty$

C)  $\lim_{x \rightarrow 0^+} \ln x = 1$  and  $\lim_{x \rightarrow \infty} \ln x = \infty$  D)  $\lim_{x \rightarrow 0^+} \ln x = 0$  and  $\lim_{x \rightarrow \infty} \ln x = 1$

Divide numerator and denominator by the highest power of x in the denominator to find the limit.

$$138) \lim_{x \rightarrow \infty} \sqrt{\frac{25x^2}{4 + 36x^2}} \quad 138) \underline{\hspace{2cm}}$$

A) does not exist

B)  $\frac{25}{4}$

C)  $\frac{25}{36}$

D)  $\frac{5}{6}$

$$139) \lim_{x \rightarrow \infty} \sqrt{\frac{9x^2 + x - 3}{(x - 7)(x + 1)}} \quad 139) \underline{\hspace{2cm}}$$

A) 0

B) 3

C) 9

D)  $\infty$

$$140) \lim_{x \rightarrow \infty} \frac{3\sqrt{x} + x^{-1}}{-4x + 2} \quad 140) \underline{\hspace{2cm}}$$

A)  $-\frac{3}{4}$

B)  $\infty$

C) 0

D)  $\frac{1}{-4}$

$$141) \lim_{x \rightarrow \infty} \frac{3x^{-1} + 2x^{-3}}{4x^{-2} + x^{-5}} \quad 141) \underline{\hspace{2cm}}$$

A)  $\frac{3}{4}$

B)  $-\infty$

C) 0

D)  $\infty$

$$142) \lim_{x \rightarrow \infty} \frac{\sqrt[3]{x} - 2x - 7}{3x + x^{2/3} + 4} \quad 142) \underline{\hspace{2cm}}$$

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

B)  $-\infty$

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

D) 0

$$143) \lim_{t \rightarrow \infty} \frac{\sqrt{64t^2 - 512}}{t - 8} \quad 143) \underline{\hspace{2cm}}$$

A) 512

B) 8

C) does not exist

D) 64

$$144) \lim_{t \rightarrow \infty} \frac{\sqrt{25t^2 - 125}}{t - 5} \quad 144) \underline{\hspace{2cm}}$$

A) does not exist

B) 5

C) 25

D) 125

$$145) \lim_{x \rightarrow \infty} \frac{2x + 5}{\sqrt{5x^2 + 1}} \quad 145) \underline{\hspace{2cm}}$$

A)  $\infty$

B) 0

C)  $\frac{2}{\sqrt{5}}$

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

Determine the limit.

$$146) \lim_{x \rightarrow \infty} \left( \frac{12x^2 + 7x + 1}{\sqrt{4x^4 + x^3}} \right) \quad 146) \underline{\hspace{2cm}}$$

A) 4

B) 6

C) 3

D) 0

147)  $\lim_{x \rightarrow \infty} (x - \sqrt{x^2 - 6x})$  (Hint: Multiply by  $\frac{x + \sqrt{x^2 - 6x}}{x + \sqrt{x^2 - 6x}}$  first.) 147) \_\_\_\_\_

A)  $\sqrt{6}$  B) 0 C) 6 D) 3

Find all horizontal asymptotes of the given function, if any.

148)  $h(x) = \frac{3x - 4}{x - 2}$  148) \_\_\_\_\_

A)  $y = 2$  B)  $y = 3$   
C)  $y = 0$  D) no horizontal asymptotes

149)  $h(x) = 7 - \frac{9}{x}$  149) \_\_\_\_\_

A)  $x = 0$  B)  $y = 9$   
C)  $y = 7$  D) no horizontal asymptotes

150)  $g(x) = \frac{x^2 + 3x - 4}{x - 4}$  150) \_\_\_\_\_

A)  $y = 4$  B)  $y = 0$   
C)  $y = 1$  D) no horizontal asymptotes

151)  $h(x) = \frac{8x^2 - 7x - 6}{9x^2 - 4x + 3}$  151) \_\_\_\_\_

A)  $y = \frac{7}{4}$  B)  $y = 0$   
C)  $y = \frac{8}{9}$  D) no horizontal asymptotes

152)  $h(x) = \frac{3x^4 - 8x^2 - 5}{8x^5 - 4x + 3}$  152) \_\_\_\_\_

A)  $y = \frac{3}{8}$  B)  $y = 2$   
C)  $y = 0$  D) no horizontal asymptotes

153)  $h(x) = \frac{7x^3 - 3x}{3x^3 - 4x + 3}$  153) \_\_\_\_\_

A)  $y = \frac{7}{3}$  B)  $y = \frac{3}{4}$   
C)  $y = 0$  D) no horizontal asymptotes

$$154) h(x) = \frac{3x^3 - 3x - 2}{6x^2 + 7}$$

154) \_\_\_\_\_

A)  $y = 0$

B)  $y = 3$

C)  $y = \frac{1}{2}$

D) no horizontal asymptotes

$$155) f(x) = \frac{2x + 1}{x^2 - 49}$$

155) \_\_\_\_\_

A) no horizontal asymptotes

B)  $y = 0$

C)  $y = -7, y = 7$

D)  $y = 2$

$$156) R(x) = \frac{-3x^2 + 1}{x^2 + 2x - 99}$$

156) \_\_\_\_\_

A)  $y = -11, y = 9$

B)  $y = -3$

C)  $y = 0$

D) no horizontal asymptotes

$$157) f(x) = \frac{x^2 - 5}{25x - x^4}$$

157) \_\_\_\_\_

A)  $y = -5, y = 5$

B)  $y = -1$

C)  $y = 0$

D) no horizontal asymptotes

$$158) f(x) = \frac{9x^4 + x^2 - 3}{x - x^3}$$

158) \_\_\_\_\_

A)  $y = 0$

B) no horizontal asymptotes

C)  $y = -9$

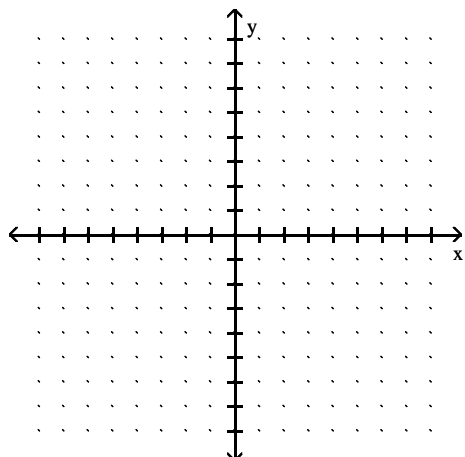
D)  $y = -1, y = 1$

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

**Sketch the graph of a function  $y = f(x)$  that satisfies the given conditions.**

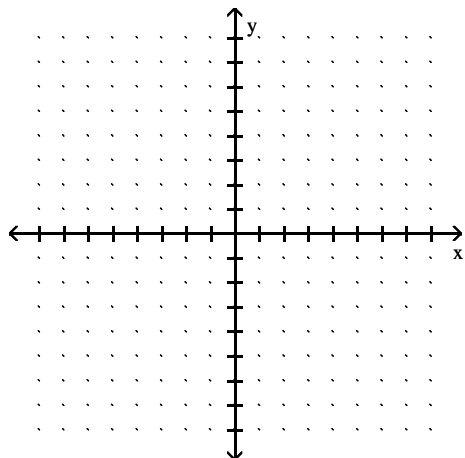
$$159) f(0) = 0, f(1) = 6, f(-1) = -6, \lim_{x \rightarrow -\infty} f(x) = -5, \lim_{x \rightarrow \infty} f(x) = 5.$$

159) \_\_\_\_\_



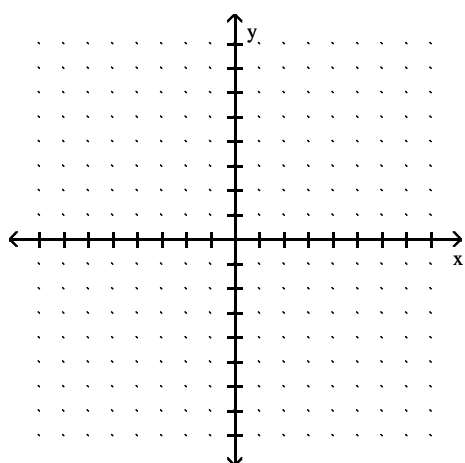
160)  $f(0) = 0, f(1) = 5, f(-1) = 5, \lim_{x \rightarrow \pm\infty} f(x) = -5.$

160) \_\_\_\_\_



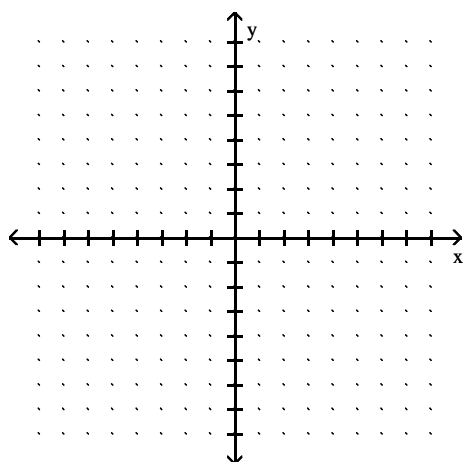
161)  $f(0) = 2, f(1) = -2, f(-1) = -2, \lim_{x \rightarrow \pm\infty} f(x) = 0.$

161) \_\_\_\_\_



162)  $f(0) = 0, \lim_{x \rightarrow \pm\infty} f(x) = 0, \lim_{x \rightarrow 3^-} f(x) = -\infty, \lim_{x \rightarrow -3^+} f(x) = -\infty, \lim_{x \rightarrow 3^+} f(x) = \infty, \lim_{x \rightarrow -3^-} f(x) = \infty.$

162) \_\_\_\_\_

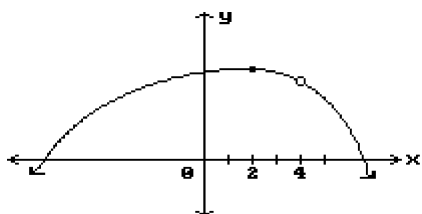


**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

Find all points where the function is discontinuous.

163)

163) \_\_\_\_\_



A)  $x = 4, x = 2$

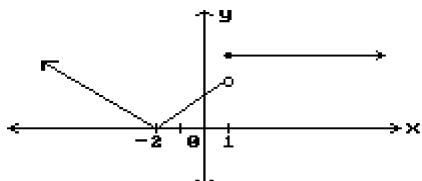
B)  $x = 4$

C) None

D)  $x = 2$

164)

164) \_\_\_\_\_



A)  $x = -2$

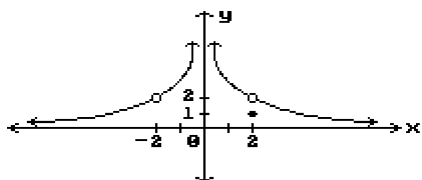
B)  $x = 1$

C) None

D)  $x = -2, x = 1$

165)

165) \_\_\_\_\_



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

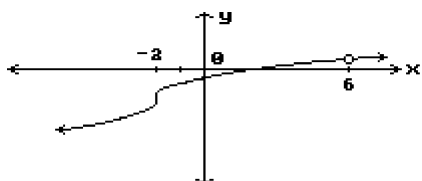
C)  $x = 2$

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

D)  $x = 0, x = 2$

166)

166) \_\_\_\_\_



A)  $x = -2$

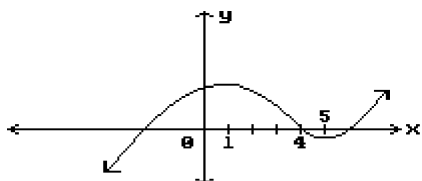
B) None

C)  $x = 6$

D)  $x = -2, x = 6$

167)

167) \_\_\_\_\_



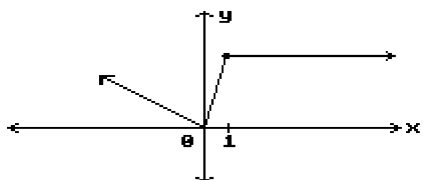
A) None

C)  $x = 1, x = 4, x = 5$

B)  $x = 4$

D)  $x = 1, x = 5$

168)

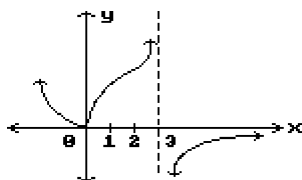


A) None

B)  $x = 0$ C)  $x = 0, x = 1$ D)  $x = 1$ 

168) \_\_\_\_\_

169)

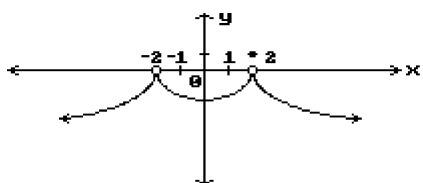
A)  $x = 0$ 

B) None

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

169) \_\_\_\_\_

170)

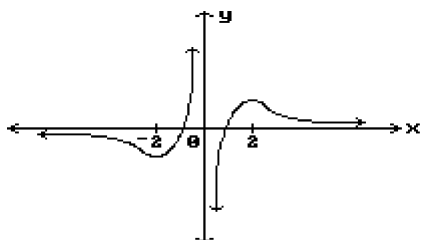
A)  $x = 2$ 

B) None

C)  $x = -2, x = 2$ D)  $x = -2$ 

170) \_\_\_\_\_

171)

A)  $x = 0$ 

C) None

B)  $x = -2, x = 2$ D)  $x = -2, x = 0, x = 2$ 

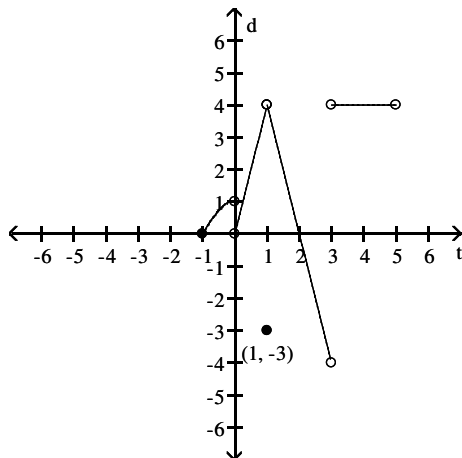
171) \_\_\_\_\_

Provide an appropriate response.

172) Is  $f$  continuous at  $f(1)$ ?

172) \_\_\_\_\_

$$f(x) = \begin{cases} -x^2 + 1, & -1 \leq x < 0 \\ 4x, & 0 < x < 1 \\ -3, & x = 1 \\ -4x + 8, & 1 < x < 3 \\ 4, & 3 < x < 5 \end{cases}$$



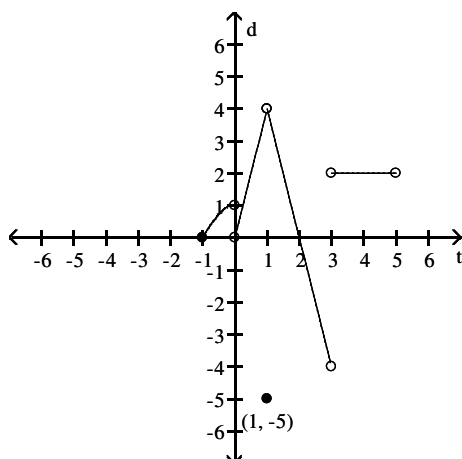
A) Yes

B) No

173) Is  $f$  continuous at  $f(0)$ ?

173) \_\_\_\_\_

$$f(x) = \begin{cases} -x^2 + 1, & -1 \leq x < 0 \\ 4x, & 0 < x < 1 \\ -5, & x = 1 \\ -4x + 8, & 1 < x < 3 \\ 2, & 3 < x < 5 \end{cases}$$



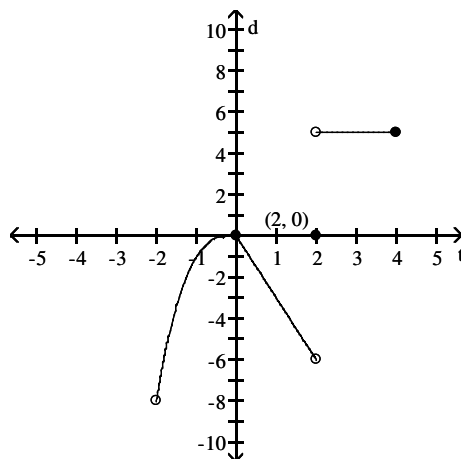
A) No

B) Yes

174) Is  $f$  continuous at  $x = 0$ ?

174) \_\_\_\_\_

$$f(x) = \begin{cases} x^3, & -2 < x \leq 0 \\ -3x, & 0 \leq x < 2 \\ 5, & 2 < x \leq 4 \\ 0, & x = 2 \end{cases}$$



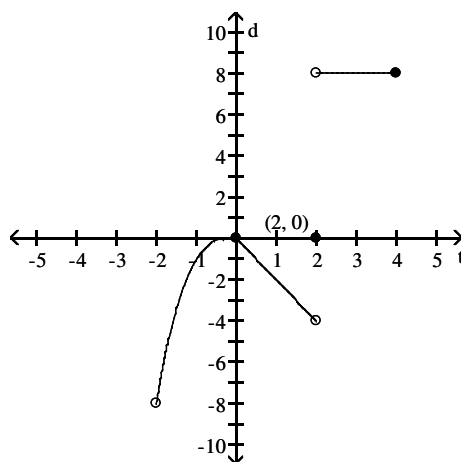
A) Yes

B) No

175) Is  $f$  continuous at  $x = 4$ ?

175) \_\_\_\_\_

$$f(x) = \begin{cases} x^3, & -2 < x \leq 0 \\ -2x, & 0 \leq x < 2 \\ 8, & 2 < x \leq 4 \\ 0, & x = 2 \end{cases}$$



A) No

B) Yes

Find the intervals on which the function is continuous.

176)  $y = \frac{1}{x+5} - 3x$

176) \_\_\_\_\_

A) discontinuous only when  $x = -8$

B) discontinuous only when  $x = 5$

C) discontinuous only when  $x = -5$

D) continuous everywhere

177)  $y = \frac{1}{(x+3)^2 + 6}$

177) \_\_\_\_\_

A) discontinuous only when  $x = 15$

B) discontinuous only when  $x = -24$

C) discontinuous only when  $x = -3$

D) continuous everywhere

178)  $y = \frac{x+3}{x^2 - 10x + 21}$

178) \_\_\_\_\_

A) discontinuous only when  $x = 3$  or  $x = 7$

B) discontinuous only when  $x = -3$  or  $x = 7$

C) discontinuous only when  $x = 3$

D) discontinuous only when  $x = -7$  or  $x = 3$

179)  $y = \frac{3}{x^2 - 25}$

179) \_\_\_\_\_

A) discontinuous only when  $x = -5$  or  $x = 5$

B) discontinuous only when  $x = -25$  or  $x = 25$

C) discontinuous only when  $x = 25$

D) discontinuous only when  $x = -5$

180)  $y = \frac{5}{|x| + 1} - \frac{x^2}{3}$

180) \_\_\_\_\_

A) discontinuous only when  $x = -3$  or  $x = -1$

B) discontinuous only when  $x = -1$

C) continuous everywhere

D) discontinuous only when  $x = -4$

$$181) y = \frac{\sin(3\theta)}{5\theta}$$

181) \_\_\_\_\_

A) discontinuous only when  $\theta = 0$

B) discontinuous only when  $\theta = \pi$

C) discontinuous only when  $\theta = \frac{\pi}{2}$

D) continuous everywhere

$$182) y = \frac{4 \cos \theta}{\theta + 1}$$

182) \_\_\_\_\_

A) discontinuous only when  $\theta = -1$

B) continuous everywhere

C) discontinuous only when  $\theta = 1$

D) discontinuous only when  $\theta = \frac{\pi}{2}$

$$183) y = \sqrt{7x + 6}$$

183) \_\_\_\_\_

A) continuous on the interval  $\left[\frac{6}{7}, \infty\right)$

B) continuous on the interval  $\left[-\frac{6}{7}, \infty\right)$

C) continuous on the interval  $\left[-\frac{6}{7}, \infty\right]$

D) continuous on the interval  $\left[-\infty, -\frac{6}{7}\right]$

$$184) y = \sqrt[4]{7x - 1}$$

184) \_\_\_\_\_

A) continuous on the interval  $\left[\frac{1}{7}, \infty\right)$

B) continuous on the interval  $\left[\frac{1}{7}, \infty\right)$

C) continuous on the interval  $\left[-\infty, \frac{1}{7}\right]$

D) continuous on the interval  $\left[-\frac{1}{7}, \infty\right)$

$$185) y = \sqrt{x^2 - 2}$$

185) \_\_\_\_\_

A) continuous on the interval  $[-\sqrt{2}, \sqrt{2}]$

B) continuous on the intervals  $(-\infty, -\sqrt{2}]$  and  $[\sqrt{2}, \infty)$

C) continuous everywhere

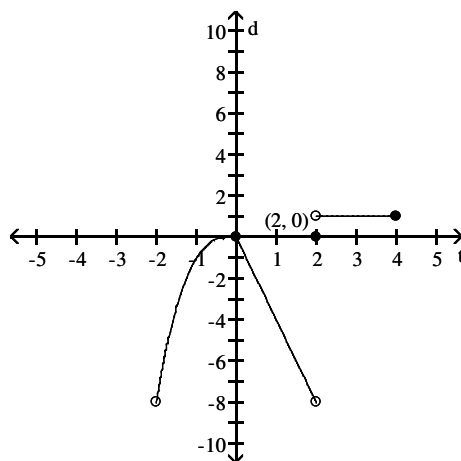
D) continuous on the interval  $[\sqrt{2}, \infty)$

Provide an appropriate response.

186) Is  $f$  continuous on  $(-2, 4]$ ?

186) \_\_\_\_\_

$$f(x) = \begin{cases} x^3, & -2 < x \leq 0 \\ -4x, & 0 \leq x < 2 \\ 1, & 2 < x \leq 4 \\ 0, & x = 2 \end{cases}$$



A) Yes

B) No

Find the limit, if it exists.

187)  $\lim_{x \rightarrow -3} (x^2 - 16 + \sqrt[3]{x^2 - 36})$

187) \_\_\_\_\_

A) -4

B) 4

C) -10

D) Does not exist

188)  $\lim_{x \rightarrow -2} \sqrt{x^2 + 14x + 49}$

188) \_\_\_\_\_

A) 81

B)  $\pm 9$

C) 9

D) Does not exist

189)  $\lim_{x \rightarrow 1} \sqrt{x - 9}$

189) \_\_\_\_\_

A) 2.82842712

B) 0

C) -2.8284271

D) Does not exist

190)  $\lim_{x \rightarrow 14} \sqrt{x^2 - 9}$

190) \_\_\_\_\_

A)  $\pm\sqrt{187}$

B) 93.5

C)  $\sqrt{187}$

D) Does not exist

191)  $\lim_{x \rightarrow -9^-} \sqrt{x^2 - 81}$

191) \_\_\_\_\_

A) 0

B) 4.5

C)  $9\sqrt{3}$

D) Does not exist

192)  $\lim_{x \rightarrow 7^+} \frac{5\sqrt{(x-7)^3}}{x-7}$

192) \_\_\_\_\_

A) 0

B) 5

C)  $5\sqrt{7}$

D) Does not exist

193)  $\lim_{t \rightarrow 1^+} \frac{\sqrt{(t+25)(t-1)^2}}{11t-11}$

193) \_\_\_\_\_

A)  $\frac{1}{11}$

B)  $\frac{\sqrt{26}}{11}$

C) 0

D) Does not exist

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

**Provide an appropriate response.**

194) Use the Intermediate Value Theorem to prove that  $8x^3 + 6x^2 - 9x + 4 = 0$  has a solution between  $-2$  and  $-1$ . 194) \_\_\_\_\_

195) Use the Intermediate Value Theorem to prove that  $-2x^4 + 6x^3 + 5x - 2 = 0$  has a solution between  $3$  and  $4$ . 195) \_\_\_\_\_

196) Use the Intermediate Value Theorem to prove that  $x(x - 2)^2 = 2$  has a solution between  $1$  and  $3$ . 196) \_\_\_\_\_

197) Use the Intermediate Value Theorem to prove that  $3 \sin x = x$  has a solution between  $\frac{\pi}{2}$  and  $\pi$ . 197) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Find numbers  $a$  and  $b$ , or  $k$ , so that  $f$  is continuous at every point.**

198) 198) \_\_\_\_\_

$$f(x) = \begin{cases} -2, & x < -5 \\ ax + b, & -5 \leq x \leq -3 \\ 2, & x > -3 \end{cases}$$

A)  $a = -2, b = 2$

B)  $a = 2, b = -4$

C)  $a = 2, b = 8$

D) Impossible

199) 199) \_\_\_\_\_

$$f(x) = \begin{cases} x^2, & x < -5 \\ ax + b, & -5 \leq x \leq -4 \\ x + 20, & x > -4 \end{cases}$$

A)  $a = -9, b = -20$

B)  $a = 9, b = -20$

C)  $a = -9, b = 20$

D) Impossible

200) 200) \_\_\_\_\_

$$f(x) = \begin{cases} 7x + 10, & \text{if } x < -5 \\ kx + 6, & \text{if } x \geq -5 \end{cases}$$

A)  $k = -\frac{6}{5}$

B)  $k = \frac{6}{5}$

C)  $k = 11$

D)  $k = \frac{31}{5}$

201) 201) \_\_\_\_\_

$$f(x) = \begin{cases} x^2, & \text{if } x \leq 4 \\ x + k, & \text{if } x > 4 \end{cases}$$

A)  $k = -4$

B)  $k = 12$

C)  $k = 20$

D) Impossible

202)

202) \_\_\_\_\_

$$f(x) = \begin{cases} x^2, & \text{if } x \leq 4 \\ kx, & \text{if } x > 4 \end{cases}$$

A)  $k = 4$

B)  $k = \frac{1}{4}$

C)  $k = 16$

D) Impossible

**Solve the problem.**203) Select the correct statement for the definition of the limit:  $\lim_{x \rightarrow x_0} f(x) = L$ 

203) \_\_\_\_\_

means that \_\_\_\_\_

A) if given a number  $\varepsilon > 0$ , there exists a number  $\delta > 0$ , such that for all  $x$ ,  
 $0 < |x - x_0| < \delta$  implies  $|f(x) - L| > \varepsilon$ .B) if given any number  $\varepsilon > 0$ , there exists a number  $\delta > 0$ , such that for all  $x$ ,  
 $0 < |x - x_0| < \varepsilon$  implies  $|f(x) - L| > \delta$ .C) if given any number  $\varepsilon > 0$ , there exists a number  $\delta > 0$ , such that for all  $x$ ,  
 $0 < |x - x_0| < \varepsilon$  implies  $|f(x) - L| < \delta$ .D) if given any number  $\varepsilon > 0$ , there exists a number  $\delta > 0$ , such that for all  $x$ ,  
 $0 < |x - x_0| < \delta$  implies  $|f(x) - L| < \varepsilon$ .

204) Identify the incorrect statements about limits.

204) \_\_\_\_\_

I. The number  $L$  is the limit of  $f(x)$  as  $x$  approaches  $x_0$  if  $f(x)$  gets closer to  $L$  as  $x$  approaches  $x_0$ .II. The number  $L$  is the limit of  $f(x)$  as  $x$  approaches  $x_0$  if, for any  $\varepsilon > 0$ , there corresponds a  $\delta > 0$  such that  $|f(x) - L| < \varepsilon$  whenever  $0 < |x - x_0| < \delta$ .III. The number  $L$  is the limit of  $f(x)$  as  $x$  approaches  $x_0$  if, given any  $\varepsilon > 0$ , there exists a value of  $x$  for which  $|f(x) - L| < \varepsilon$ .

A) I and II

B) II and III

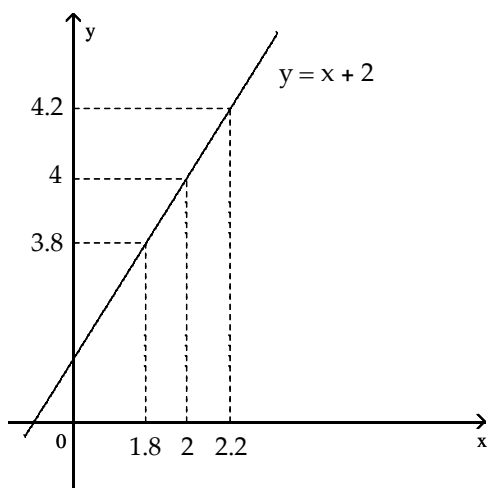
C) I and III

D) I, II, and III

Use the graph to find a  $\delta > 0$  such that for all  $x$ ,  $0 < |x - x_0| < \delta \Rightarrow |f(x) - L| < \varepsilon$ .

205)

205) \_\_\_\_\_



$f(x) = x + 2$

$x_0 = 2$

$L = 4$

$\varepsilon = 0.2$

NOT TO SCALE

A) 0.1

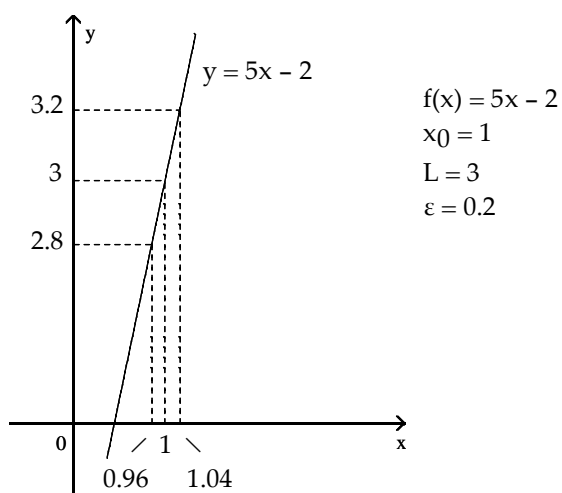
B) 2

C) 0.4

D) 0.2

206)

206) \_\_\_\_\_



NOT TO SCALE

A) 2

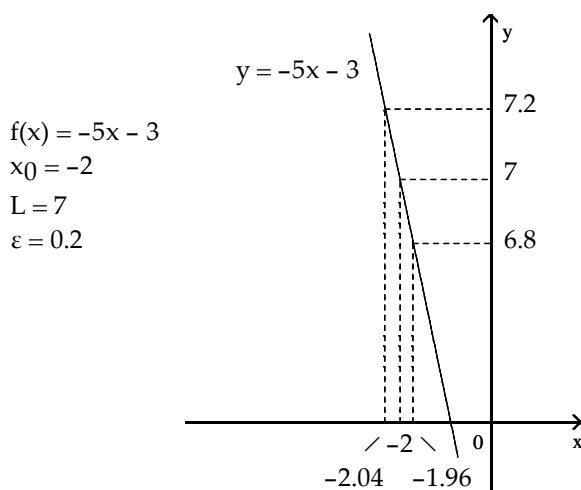
B) 0.04

C) 0.4

D) 0.08

207)

207) \_\_\_\_\_



NOT TO SCALE

A) -0.04

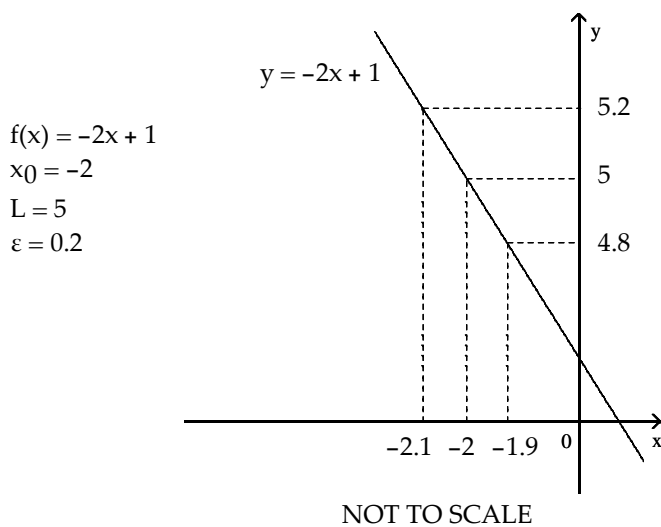
B) 0.4

C) 0.04

D) 15

208)

208) \_\_\_\_\_



A) 7

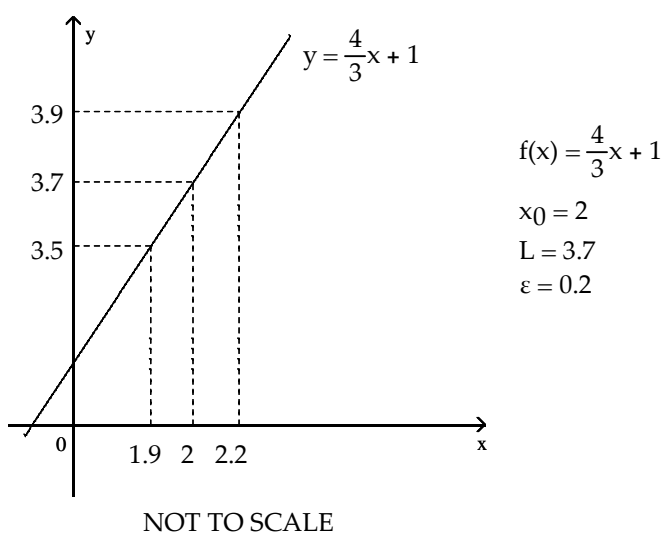
B) 0.1

C) 0.2

D) -0.1

209)

209) \_\_\_\_\_



A) 0.1

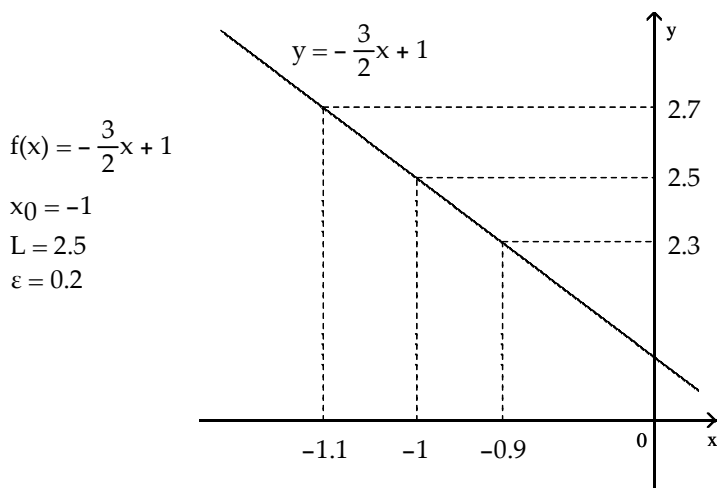
B) -0.3

C) 0.3

D) 1.7

210)

210) \_\_\_\_\_



NOT TO SCALE

A) 3.5

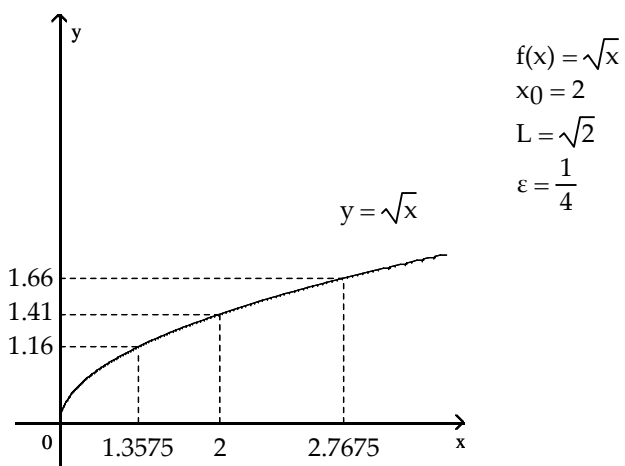
B) 0.1

C) 0.2

D) -0.2

211)

211) \_\_\_\_\_



NOT TO SCALE

A) -0.59

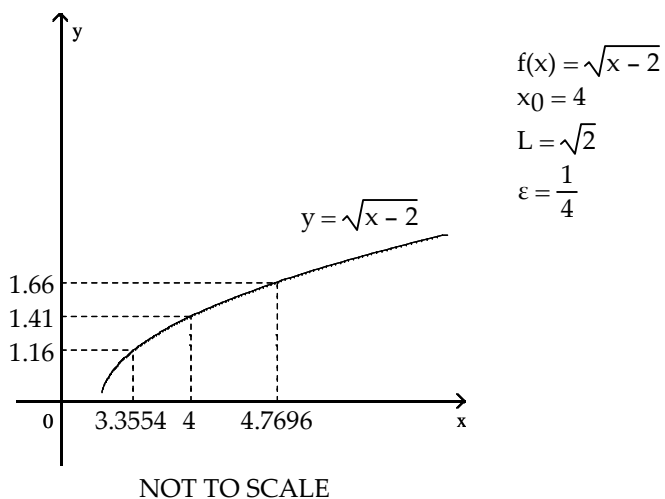
B) 1.41

C) 0.7675

D) 0.6425

212)

212) \_\_\_\_\_



A) 2.59

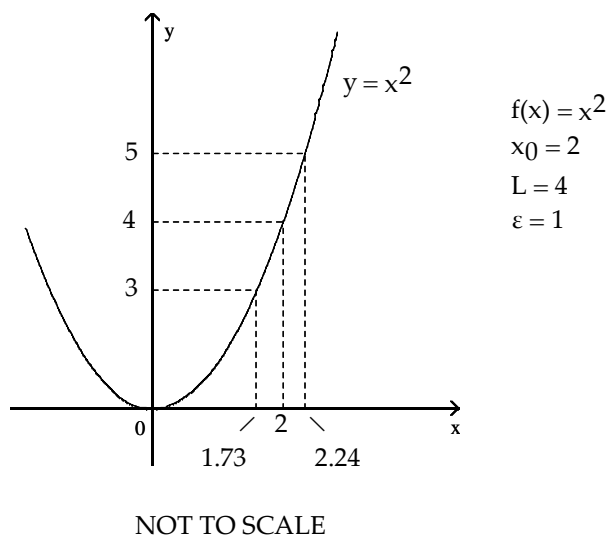
B) 1.4142

C) 0.7696

D) 0.6446

213)

213) \_\_\_\_\_



A) 2

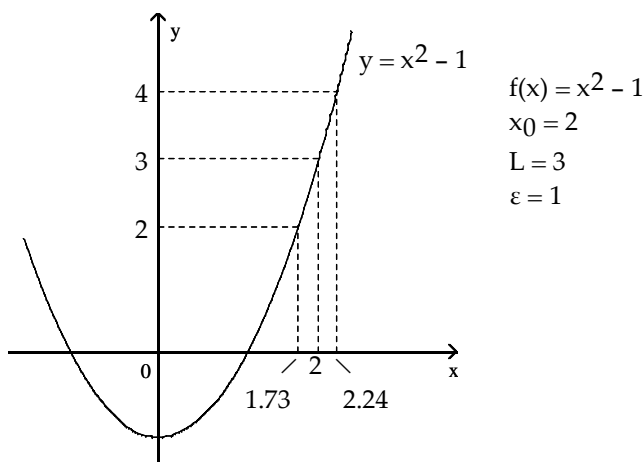
B) 0.51

C) 0.24

D) 0.27

214)

214) \_\_\_\_\_



NOT TO SCALE

A) 1

B) 0.51

C) 0.27

D) 0.24

A function  $f(x)$ , a point  $x_0$ , the limit of  $f(x)$  as  $x$  approaches  $x_0$ , and a positive number  $\epsilon$  is given. Find a number  $\delta > 0$  such that for all  $x$ ,  $0 < |x - x_0| < \delta \Rightarrow |f(x) - L| < \epsilon$ .

215)  $f(x) = 2x + 2$ ,  $L = 10$ ,  $x_0 = 4$ , and  $\epsilon = 0.01$ 

215) \_\_\_\_\_

A) 0.005

B) 0.0025

C) 0.025

D) 0.01

216)  $f(x) = 3x - 1$ ,  $L = 5$ ,  $x_0 = 2$ , and  $\epsilon = 0.01$ 

216) \_\_\_\_\_

A) 0.003333

B) 0.001667

C) 0.005

D) 0.006667

217)  $f(x) = -4x + 2$ ,  $L = -2$ ,  $x_0 = 1$ , and  $\epsilon = 0.01$ 

217) \_\_\_\_\_

A) 0.0025

B) -0.01

C) 0.01

D) 0.005

218)  $f(x) = -5x - 2$ ,  $L = -17$ ,  $x_0 = 3$ , and  $\epsilon = 0.01$ 

218) \_\_\_\_\_

A) 0.004

B) 0.001

C) -0.003333

D) 0.002

219)  $f(x) = 5x^2$ ,  $L = 20$ ,  $x_0 = 2$ , and  $\epsilon = 0.2$ 

219) \_\_\_\_\_

A) 0.00998

B) 2.00998

C) 1.98997

D) 0.01003

**SHORT ANSWER.** Write the word or phrase that best completes each statement or answers the question.

**Prove the limit statement**

220)  $\lim_{x \rightarrow 6} (2x - 1) = 11$ 

220) \_\_\_\_\_

221)  $\lim_{x \rightarrow 3} \frac{x^2 - 9}{x - 3} = 6$ 

221) \_\_\_\_\_

222)  $\lim_{x \rightarrow 4} \frac{5x^2 - 19x - 4}{x - 4} = 21$ 

222) \_\_\_\_\_

$$223) \lim_{x \rightarrow 3} \frac{1}{x} = \frac{1}{3}$$

223) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Use the precise definition of a limit to prove the limit. Specify a relationship between  $\varepsilon$  and  $\delta$  that guarantees the limit exists.**

$$224) \lim_{x \rightarrow 2} x^4 = 16$$

224) \_\_\_\_\_

A)  $\delta = \min \left\{ 1, \frac{\varepsilon}{65} \right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 2| < \delta$ . Then  $|x^4 - 16| = |x^2 + 4| |x + 2| |x - 2| <$

$(13)(5) \frac{\varepsilon}{65} = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $|x^4 - 16| < \varepsilon$  whenever  $0 < |x - 2| < \delta$ , provided  $0 < \delta \leq \frac{\varepsilon}{65}$ .

Therefore,  $\lim_{x \rightarrow 2} x^4 = 16$ .

B)  $\delta = \min \left\{ 1, \frac{\varepsilon}{32} \right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 2| < \delta$ . Then  $|x^4 - 16| = |x^2 + 4| |x + 2| |x - 2| <$

$(8)(4) \frac{\varepsilon}{32} = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $|x^4 - 16| < \varepsilon$  whenever  $0 < |x - 2| < \delta$ , provided  $0 < \delta \leq \frac{\varepsilon}{32}$ .

Therefore,  $\lim_{x \rightarrow 2} x^4 = 16$ .

C)  $\delta = \min \left\{ 1, \frac{\varepsilon}{32} \right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 2| < \delta$ . Then  $|x^4 - 16| = |x^2 + 4| |x + 2| |x - 2| =$

$(8)(4) \frac{\varepsilon}{32} = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $|x^4 - 16| = \varepsilon$  whenever  $0 < |x - 2| < \delta$ , provided  $0 < \delta \leq \frac{\varepsilon}{32}$ .

Therefore,  $\lim_{x \rightarrow 2} x^4 = 16$ .

D)  $\delta = \min \left\{ 1, \frac{\varepsilon}{65} \right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 2| < \delta$ . Then  $|x^4 - 16| = |x^2 + 4| |x + 2| |x - 2| =$

$(13)(5) \frac{\varepsilon}{65} = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $|x^4 - 16| = \varepsilon$  whenever  $0 < |x - 2| < \delta$ , provided  $0 < \delta \leq \frac{\varepsilon}{65}$ .

Therefore,  $\lim_{x \rightarrow 2} x^4 = 16$ .

225)  $\lim_{x \rightarrow 3} \frac{1}{x^2} = \frac{1}{9}$

225) \_\_\_\_\_

A)  $\delta = \min\left\{1, \frac{36\varepsilon}{7}\right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 3| < \delta$ . Then  $\left|\frac{1}{x^2} - \frac{1}{9}\right| = \frac{|-1||x+3||x-3|}{|9x^2|} = \frac{7}{36} \left(\frac{36\varepsilon}{7}\right) = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $\left|\frac{1}{x^2} - \frac{1}{9}\right| = \varepsilon$  whenever  $0 < |x - 3| < \delta$ , provided  $0 < \delta \leq \frac{36\varepsilon}{7}$ .

Therefore,  $\lim_{x \rightarrow 3} \frac{1}{x^2} = \frac{1}{9}$ .

B)  $\delta = \min\left\{1, \frac{36\varepsilon}{7}\right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 3| < \delta$ . Then  $\left|\frac{1}{x^2} - \frac{1}{9}\right| = \frac{|-1||x+3||x-3|}{|9x^2|} < \frac{7}{36} \left(\frac{36\varepsilon}{7}\right) = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $\left|\frac{1}{x^2} - \frac{1}{9}\right| < \varepsilon$  whenever  $0 < |x - 3| < \delta$ , provided  $0 < \delta \leq \frac{36\varepsilon}{7}$ .

Therefore,  $\lim_{x \rightarrow 3} \frac{1}{x^2} = \frac{1}{9}$ .

C)  $\delta = \min\left\{1, \frac{144\varepsilon}{7}\right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 3| < \delta$ . Then  $\left|\frac{1}{x^2} - \frac{1}{9}\right| = \frac{|-1||x+3||x-3|}{|9x^2|} = \frac{7}{144} \left(\frac{144\varepsilon}{7}\right) = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $\left|\frac{1}{x^2} - \frac{1}{9}\right| < \varepsilon$  whenever  $0 < |x - 3| < \delta$ , provided  $0 < \delta \leq \frac{144\varepsilon}{7}$ .

Therefore,  $\lim_{x \rightarrow 3} \frac{1}{x^2} = \frac{1}{9}$ .

D)  $\delta = \min\left\{1, \frac{144\varepsilon}{7}\right\}$ ; Let  $\varepsilon > 0$  and assume  $0 < |x - 3| < \delta$ . Then  $\left|\frac{1}{x^2} - \frac{1}{9}\right| = \frac{|-1||x+3||x-3|}{|9x^2|} < \frac{7}{144} \left(\frac{144\varepsilon}{7}\right) = \varepsilon$ . That is, for any  $\varepsilon > 0$ ,  $\left|\frac{1}{x^2} - \frac{1}{9}\right| < \varepsilon$  whenever  $0 < |x - 3| < \delta$ , provided  $0 < \delta \leq \frac{144\varepsilon}{7}$ .

Therefore,  $\lim_{x \rightarrow 3} \frac{1}{x^2} = \frac{1}{9}$ .

## Answer Key

Testname: UNTITLED25

- 1) A
- 2) A
- 3) C
- 4) C
- 5) A
- 6) A
- 7) B
- 8) C
- 9) A
- 10) B
- 11) C
- 12) B
- 13) C
- 14) C
- 15) B
- 16) A
- 17) D
- 18) C
- 19) C
- 20) B
- 21) D
- 22) B
- 23) A
- 24) B
- 25) A
- 26) A
- 27) D
- 28) A
- 29) C
- 30) B
- 31) A
- 32) C
- 33) D
- 34) B
- 35) D
- 36) D
- 37) B
- 38) D
- 39) C

40) Answers may vary. One possibility:  $\lim_{x \rightarrow 0} 1 - \frac{x^2}{6} = \lim_{x \rightarrow 0} 1 = 1$ . According to the squeeze theorem, the function

$\frac{x \sin(x)}{2 - 2 \cos(x)}$ , which is squeezed between  $1 - \frac{x^2}{6}$  and 1, must also approach 1 as  $x$  approaches 0. Thus,

$$\lim_{x \rightarrow 0} \frac{x \sin(x)}{2 - 2 \cos(x)} = 1.$$

- 41) D
- 42) D
- 43) D

## Answer Key

Testname: UNTITLED25

- 44) A
- 45) C
- 46) A
- 47) C
- 48) B
- 49) A
- 50) A
- 51) C
- 52) B
- 53) C
- 54) C
- 55) D
- 56) D
- 57) B
- 58) C
- 59) D
- 60) B
- 61) C
- 62) B
- 63) B
- 64) D
- 65) B
- 66) B
- 67) B
- 68) C
- 69) D
- 70) C
- 71) B
- 72) D
- 73) D
- 74) B
- 75) B
- 76) A
- 77) C
- 78) B
- 79) B
- 80) D
- 81) B
- 82) C
- 83) D
- 84) B
- 85) C
- 86) A
- 87) B
- 88) B
- 89) B
- 90) C
- 91) B
- 92) A
- 93) C

## Answer Key

Testname: UNTITLED25

- 94) D
- 95) B
- 96) B
- 97) C
- 98) C
- 99) B
- 100) D
- 101) A
- 102) B
- 103) C
- 104) D
- 105) A
- 106) A
- 107) D
- 108) D
- 109) D
- 110) C
- 111) D
- 112) C
- 113) B
- 114) C
- 115) C
- 116) C
- 117) B
- 118) B
- 119) D
- 120) B
- 121) B
- 122) B
- 123) B
- 124) C
- 125) A
- 126) D
- 127) A
- 128) D
- 129) B
- 130) D
- 131) C
- 132) A
- 133) D
- 134) A
- 135) C
- 136) C
- 137) B
- 138) D
- 139) B
- 140) C
- 141) D
- 142) A
- 143) B

# Answer Key

Testname: UNTITLED25

144) B

145) C

146) B

147) D

148) B

149) C

150) D

151) C

152) C

153) A

154) D

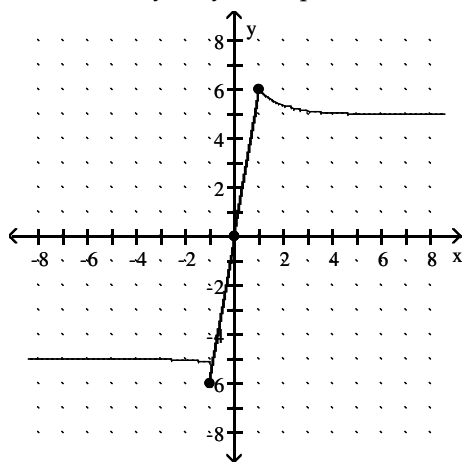
155) B

156) B

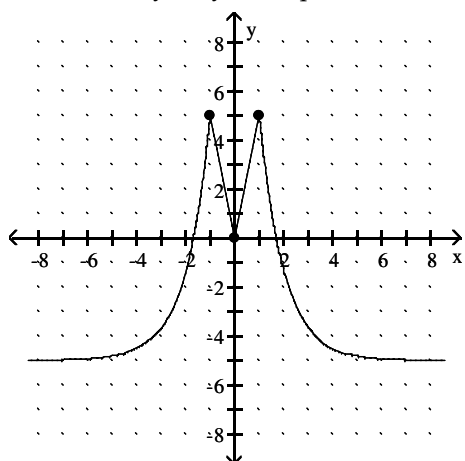
157) C

158) B

159) Answers may vary. One possible answer:



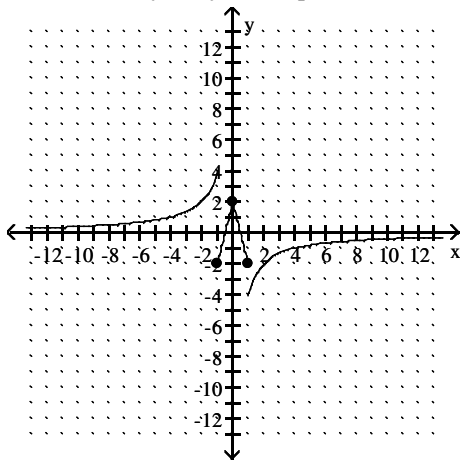
160) Answers may vary. One possible answer:



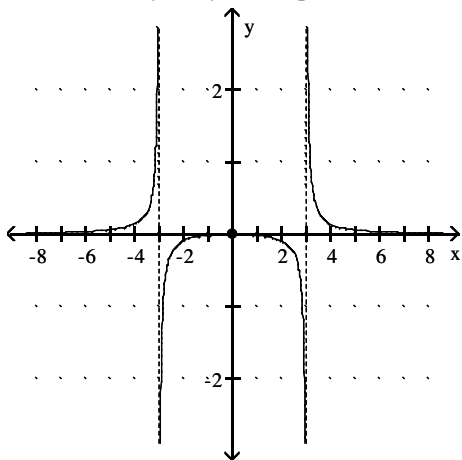
# Answer Key

Testname: UNTITLED25

161) Answers may vary. One possible answer:



162) Answers may vary. One possible answer:



- 163) B
- 164) B
- 165) A
- 166) C
- 167) A
- 168) A
- 169) C
- 170) C
- 171) A
- 172) B
- 173) A
- 174) A
- 175) B
- 176) C
- 177) D
- 178) A
- 179) A
- 180) C
- 181) A
- 182) A
- 183) B

## Answer Key

Testname: UNTITLED25

184) A

185) B

186) B

187) C

188) C

189) D

190) C

191) A

192) A

193) B

194) Let  $f(x) = 8x^3 + 6x^2 - 9x + 4$  and let  $y_0 = 0$ .  $f(-2) = -18$  and  $f(-1) = 11$ . Since  $f$  is continuous on  $[-2, -1]$  and since  $y_0 = 0$  is between  $f(-2)$  and  $f(-1)$ , by the Intermediate Value Theorem, there exists a  $c$  in the interval  $(-2, -1)$  with the property that  $f(c) = 0$ . Such a  $c$  is a solution to the equation  $8x^3 + 6x^2 - 9x + 4 = 0$ .

195) Let  $f(x) = -2x^4 + 6x^3 + 5x - 2$  and let  $y_0 = 0$ .  $f(3) = 13$  and  $f(4) = -110$ . Since  $f$  is continuous on  $[3, 4]$  and since  $y_0 = 0$  is between  $f(3)$  and  $f(4)$ , by the Intermediate Value Theorem, there exists a  $c$  in the interval  $(3, 4)$  with the property that  $f(c) = 0$ . Such a  $c$  is a solution to the equation  $-2x^4 + 6x^3 + 5x - 2 = 0$ .

196) Let  $f(x) = x(x - 2)^2$  and let  $y_0 = 2$ .  $f(1) = 1$  and  $f(3) = 3$ . Since  $f$  is continuous on  $[1, 3]$  and since  $y_0 = 2$  is between  $f(1)$  and  $f(3)$ , by the Intermediate Value Theorem, there exists a  $c$  in the interval  $(1, 3)$  with the property that  $f(c) = 2$ . Such a  $c$  is a solution to the equation  $x(x - 2)^2 = 2$ .

197) Let  $f(x) = \frac{\sin x}{x}$  and let  $y_0 = \frac{1}{3}$ .  $f\left(\frac{\pi}{2}\right) \approx 0.6366$  and  $f(\pi) = 0$ . Since  $f$  is continuous on  $\left[\frac{\pi}{2}, \pi\right]$  and since  $y_0 = \frac{1}{3}$  is between  $f\left(\frac{\pi}{2}\right)$  and  $f(\pi)$ , by the Intermediate Value Theorem, there exists a  $c$  in the interval  $\left(\frac{\pi}{2}, \pi\right)$  with the property that  $f(c) = \frac{1}{3}$ .

Such a  $c$  is a solution to the equation  $3 \sin x = x$ .

198) C

199) A

200) D

201) B

202) A

203) D

204) C

205) D

206) B

207) C

208) B

209) A

210) B

211) D

212) D

213) C

214) D

215) A

216) A

217) A

218) D

219) A

# Answer Key

Testname: UNTITLED25

220)

Let  $\varepsilon > 0$  be given. Choose  $\delta = \varepsilon/2$ . Then  $0 < |x - 6| < \delta$  implies that

$$\begin{aligned} |(2x - 1) - 11| &= |2x - 12| \\ &= |2(x - 6)| \\ &= 2|x - 6| < 2\delta = \varepsilon \end{aligned}$$

Thus,  $0 < |x - 6| < \delta$  implies that  $|(2x - 1) - 11| < \varepsilon$

221) Let  $\varepsilon > 0$  be given. Choose  $\delta = \varepsilon$ . Then  $0 < |x - 3| < \delta$  implies that

$$\begin{aligned} \left| \frac{x^2 - 9}{x - 3} - 6 \right| &= \left| \frac{(x - 3)(x + 3)}{x - 3} - 6 \right| \\ &= |(x + 3) - 6| \quad \text{for } x \neq 3 \\ &= |x - 3| < \delta = \varepsilon \end{aligned}$$

Thus,  $0 < |x - 3| < \delta$  implies that  $\left| \frac{x^2 - 9}{x - 3} - 6 \right| < \varepsilon$

222) Let  $\varepsilon > 0$  be given. Choose  $\delta = \varepsilon/5$ . Then  $0 < |x - 4| < \delta$  implies that

$$\begin{aligned} \left| \frac{5x^2 - 19x - 4}{x - 4} - 21 \right| &= \left| \frac{(x - 4)(5x + 1)}{x - 4} - 21 \right| \\ &= |(5x + 1) - 21| \quad \text{for } x \neq 4 \\ &= |5x - 20| \\ &= |5(x - 4)| \\ &= 5|x - 4| < 5\delta = \varepsilon \end{aligned}$$

Thus,  $0 < |x - 4| < \delta$  implies that  $\left| \frac{5x^2 - 19x - 4}{x - 4} - 21 \right| < \varepsilon$

223) Let  $\varepsilon > 0$  be given. Choose  $\delta = \min\{3/2, 9\varepsilon/2\}$ . Then  $0 < |x - 3| < \delta$  implies that

$$\begin{aligned} \left| \frac{1}{x} - \frac{1}{3} \right| &= \left| \frac{3 - x}{3x} \right| \\ &= \frac{1}{|x|} \cdot \frac{1}{3} \cdot |x - 3| \\ &< \frac{1}{3/2} \cdot \frac{1}{3} \cdot \frac{9\varepsilon}{2} = \varepsilon \end{aligned}$$

Thus,  $0 < |x - 3| < \delta$  implies that  $\left| \frac{1}{x} - \frac{1}{3} \right| < \varepsilon$

224) A

225) B