

In each of Exercises 1–14, assume that all of the significant features of the indicated function, including its end behavior, can be correctly surmised from the graph shown in the figure.

1. For the function f graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 3^-} f(x)$ (b) $\lim_{x \rightarrow 3^+} f(x)$ (c) $\lim_{x \rightarrow 3} f(x)$
 (d) $f(3)$ (e) $\lim_{x \rightarrow -\infty} f(x)$ (f) $\lim_{x \rightarrow +\infty} f(x)$.

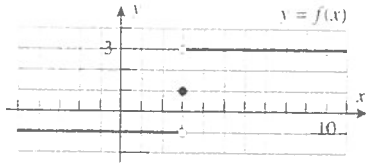


Figure Ex-1

2. For the function f graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 2^-} f(x)$ (b) $\lim_{x \rightarrow 2^+} f(x)$ (c) $\lim_{x \rightarrow 2} f(x)$
 (d) $f(2)$ (e) $\lim_{x \rightarrow -\infty} f(x)$ (f) $\lim_{x \rightarrow +\infty} f(x)$.

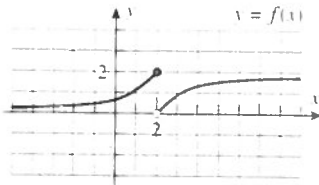


Figure Ex-2

5. For the function F graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow -2^-} F(x)$ (b) $\lim_{x \rightarrow -2^+} F(x)$ (c) $\lim_{x \rightarrow -2} F(x)$
 (d) $F(-2)$ (e) $\lim_{x \rightarrow -\infty} F(x)$ (f) $\lim_{x \rightarrow +\infty} F(x)$.

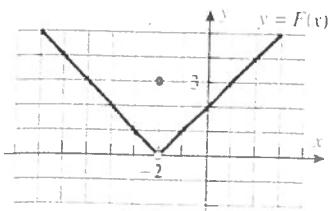


Figure Ex-5

6. For the function F graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 3^-} F(x)$ (b) $\lim_{x \rightarrow 3^+} F(x)$ (c) $\lim_{x \rightarrow 3} F(x)$
 (d) $F(3)$ (e) $\lim_{x \rightarrow -\infty} F(x)$ (f) $\lim_{x \rightarrow +\infty} F(x)$.

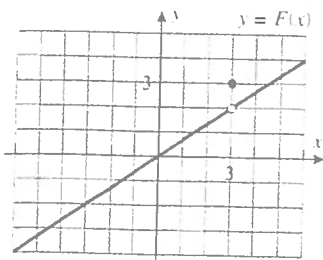


Figure Ex-6

3. For the function g graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 4^-} g(x)$ (b) $\lim_{x \rightarrow 4^+} g(x)$ (c) $\lim_{x \rightarrow 4} g(x)$
 (d) $g(4)$ (e) $\lim_{x \rightarrow -\infty} g(x)$ (f) $\lim_{x \rightarrow +\infty} g(x)$.

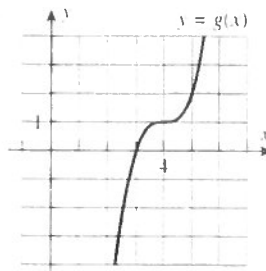


Figure Ex-3

4. For the function g graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 0^-} g(x)$ (b) $\lim_{x \rightarrow 0^+} g(x)$ (c) $\lim_{x \rightarrow 0} g(x)$
 (d) $g(0)$ (e) $\lim_{x \rightarrow -\infty} g(x)$ (f) $\lim_{x \rightarrow +\infty} g(x)$.

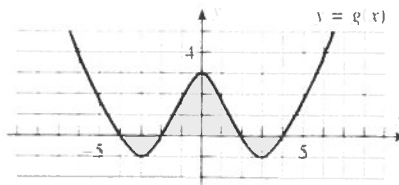


Figure Ex-4

7. For the function ϕ graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow -2^-} \phi(x)$ (b) $\lim_{x \rightarrow -2^+} \phi(x)$ (c) $\lim_{x \rightarrow -2} \phi(x)$
 (d) $\phi(-2)$ (e) $\lim_{x \rightarrow -\infty} \phi(x)$ (f) $\lim_{x \rightarrow +\infty} \phi(x)$.

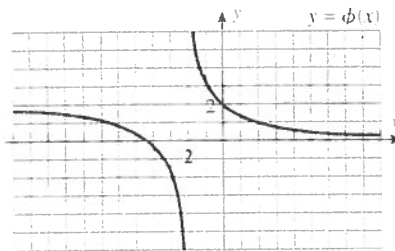


Figure Ex-7

8. For the function ϕ graphed in the accompanying figure, find
 (a) $\lim_{x \rightarrow 4^-} \phi(x)$ (b) $\lim_{x \rightarrow 4^+} \phi(x)$ (c) $\lim_{x \rightarrow 4} \phi(x)$
 (d) $\phi(4)$ (e) $\lim_{x \rightarrow -\infty} \phi(x)$ (f) $\lim_{x \rightarrow +\infty} \phi(x)$.

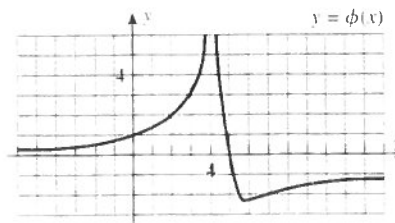


Figure Ex-8

9. For the function f graphed in the accompanying figure, find

- (a) $\lim_{x \rightarrow 3^-} f(x)$ (b) $\lim_{x \rightarrow 3^+} f(x)$ (c) $\lim_{x \rightarrow 3} f(x)$
 (d) $f(3)$ (e) $\lim_{x \rightarrow -\infty} f(x)$ (f) $\lim_{x \rightarrow +\infty} f(x)$.

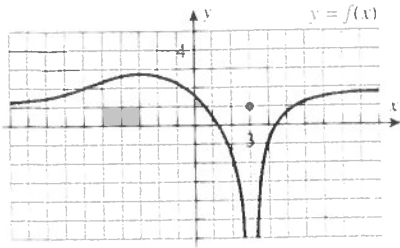


Figure Ex-9

10. For the function f graphed in the accompanying figure, find

- (a) $\lim_{x \rightarrow 0^-} f(x)$ (b) $\lim_{x \rightarrow 0^+} f(x)$ (c) $\lim_{x \rightarrow 0} f(x)$
 (d) $f(0)$ (e) $\lim_{x \rightarrow -\infty} f(x)$ (f) $\lim_{x \rightarrow +\infty} f(x)$.

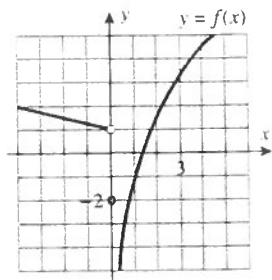


Figure Ex-10

13. Consider the function g graphed in the accompanying figure. For what values of x_0 does $\lim_{x \rightarrow x_0} g(x)$ exist?

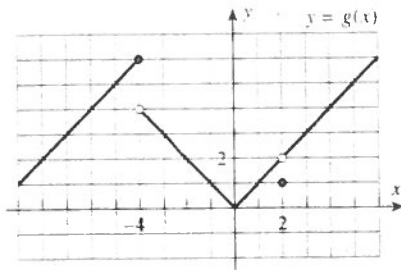


Figure Ex-13

14. Consider the function f graphed in the accompanying figure. For what values of x_0 does $\lim_{x \rightarrow x_0} f(x)$ exist?

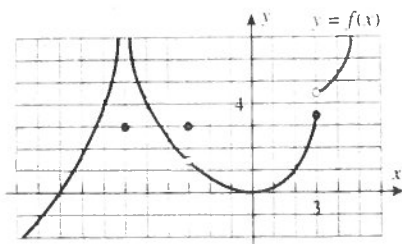


Figure Ex-14

11. For the function G graphed in the accompanying figure, find

- (a) $\lim_{x \rightarrow 0^-} G(x)$ (b) $\lim_{x \rightarrow 0^+} G(x)$ (c) $\lim_{x \rightarrow 0} G(x)$
 (d) $G(0)$ (e) $\lim_{x \rightarrow -\infty} G(x)$ (f) $\lim_{x \rightarrow +\infty} G(x)$.

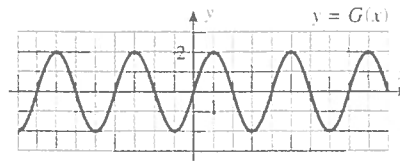


Figure Ex-11

12. For the function G graphed in the accompanying figure, find

- (a) $\lim_{x \rightarrow 0^-} G(x)$ (b) $\lim_{x \rightarrow 0^+} G(x)$ (c) $\lim_{x \rightarrow 0} G(x)$
 (d) $G(0)$ (e) $\lim_{x \rightarrow -\infty} G(x)$ (f) $\lim_{x \rightarrow +\infty} G(x)$.

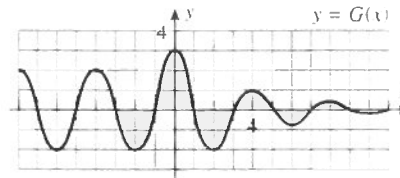


Figure Ex-12

33. Let

$$f(x) = \begin{cases} x - 1, & x \leq 3 \\ 3x - 7, & x > 3 \end{cases}$$

Find

- (a) $\lim_{x \rightarrow 3^-} f(x)$ (b) $\lim_{x \rightarrow 3^+} f(x)$ (c) $\lim_{x \rightarrow 3} f(x)$.

34. Let

$$g(t) = \begin{cases} t^2, & t \geq 0 \\ t - 2, & t < 0 \end{cases}$$

Find

- (a) $\lim_{t \rightarrow 0^-} g(t)$ (b) $\lim_{t \rightarrow 0^+} g(t)$ (c) $\lim_{t \rightarrow 0} g(t)$.

35. Let $f(x) = \frac{x^3 - 1}{x - 1}$.

- (a) Find $\lim_{x \rightarrow 1} f(x)$.
 (b) Sketch the graph of $y = f(x)$.

36. Let

$$f(x) = \begin{cases} \frac{x^2 - 9}{x + 3}, & x \neq -3 \\ k, & x = -3 \end{cases}$$

- (a) Find k so that $f(-3) = \lim_{x \rightarrow -3} f(x)$.
 (b) With k assigned the value $\lim_{x \rightarrow -3} f(x)$, show that $f(x)$ can be expressed as a polynomial.

Responses 425 - #4.

- 1 a) -1
 b) 3
 c) ~~A~~
 d) 1
 e) -1
 f) 3

- 2 a) 2
 b) 0
 c) ~~A~~
 d) 2
 e) 0^+
 f) 2^-

- 3 a) 1
 b) 1
 c) 1
 d) 1
 e) ~~-∞~~
 f) ~~+∞~~

- 4 a) ~~3~~
 b) ~~3~~
 c) ~~3~~
 d) ~~3~~
 e) ~~+∞~~
 f) ~~+∞~~

- 5 a) 0
 b) 0
 c) 0
 d) 3
 e) ~~+∞~~
 f) ~~+∞~~

- 6 a) 2
 b) 2
 c) 2
 d) 3
 e) ~~-∞~~
 f) ~~+∞~~

- 7 a) ~~-∞~~
 b) ~~+∞~~
 c) ~~A~~
 d) ~~A~~
 e) 2^-
 f) 0^+

- 8 a) ~~+∞~~
 b) ~~+∞~~
 c) ~~+∞~~
 d) ~~A~~
 e) 0^+
 f) -1^-

- 9 a) ~~-∞~~
 b) ~~-∞~~
 c) ~~-∞~~
 d) 1
 e) 1
 f) 2^-

- 10 a) 1
 b) ~~-∞~~
 c) ~~A~~
 d) ~~-∞~~
 e) ~~+∞~~
 f) ~~+∞~~

- 11 a) 0
 b) 0
 c) 0
 d) 0
 e) ~~A~~
 f) ~~A~~

- 12 a) 3
 b) 3
 c) 3
 d) 3
 e) ~~A~~
 f) 0

13) $x \neq -4$

14) $x \neq -6$
 $x \neq 3$

33 a) 2
 b) 2
 c) 2

34 a) -2
 b) 0
 c) ~~A~~

35 a) 3