In Exercises 1–10, find the limit by direct substitution if it exists.

1. $\lim_{x \to -1} x(x-1)^2$

2. $\lim_{x \to 3} (x-1)^{12}$

3. $\lim_{x \to 2} (x^3 - 2x + 3)$

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

5. $\lim_{x \to 2} \sqrt{x+5}$

6. $\lim_{x \to -2} (x-4)^{2/3}$

7. $\lim_{x \to 0} (e^x \sin x)$

8. $\lim_{x \to \pi} \ln\left(\sin \frac{x}{2}\right)$

9. $\lim_{x \to a} (x^2 - 2)$

10. $\lim_{x \to a} \frac{x^2 - 1}{x^2 + 1}$

In Exercises 11–18, **(a)** explain why you cannot use substitution to find the limit and **(b)** find the limit algebraically if it exists.

11. $\lim_{x \to -3} \frac{x^2 + 7x + 12}{x^2 - 9}$

12. $\lim_{x \to 3} \frac{x^2 - 9}{x^2 + 2x - 15}$

13. $\lim_{x \to -1} \frac{x^3 + 1}{x + 1}$

14. $\lim_{x \to 2} \frac{x^3 - 2x^2 + x - 2}{x - 2}$

15. $\lim_{x \to -2} \frac{x^2 - 4}{x + 2}$

16. $\lim_{x \to -2} \frac{|x^2 - 4|}{x + 2}$

17. $\lim_{x \to 0} \sqrt{x - 3}$

18. $\lim_{x \to 0} \frac{x - 2}{x^2}$

In Exercises 19–22, use the fact that $\lim_{x \to 0} \frac{\sin x}{x} = 1$, along with the limit properties, to find the following limits.

19. $\lim_{x \to 0} \frac{\sin x}{2x^2 - x}$

20. $\lim_{x \to 0} \frac{\sin 3x}{x}$

21. $\lim_{x \to 0} \frac{\sin^2 x}{x}$

22. $\lim_{x \to 0} \frac{x + \sin x}{2x}$

In Exercises 23–26, find the limits.

23. $\lim_{x \to 0} \dfrac{e^x - \sqrt{x}}{\log_4(x + 2)}$

24. $\lim_{x \to 0} \dfrac{3\sin x - 4\cos x}{5\sin x + \cos x}$

25. $\lim_{x \to \pi/2} \dfrac{\ln(2x)}{\sin^2 x}$

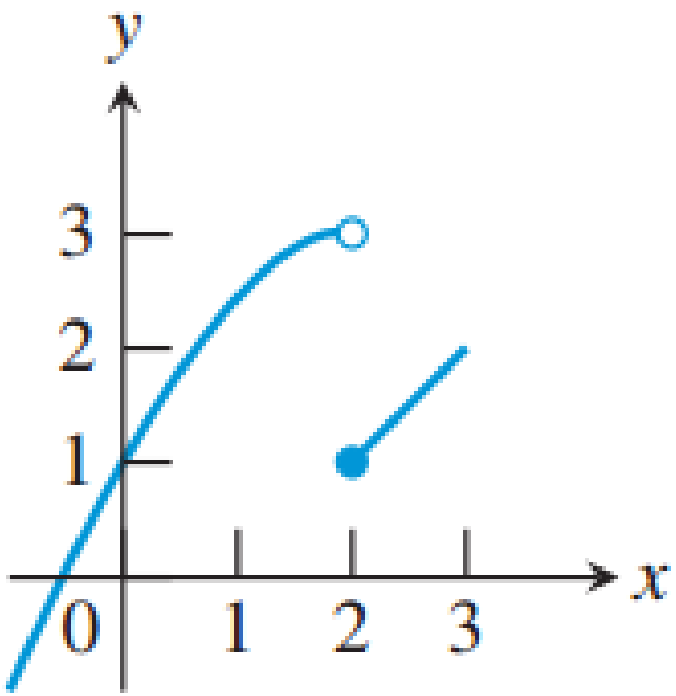
26. $\lim_{x \to 27} \dfrac{\sqrt{x + 9}}{\log_3 x}$

In Exercises 27–30, use the given graph to find the limits or to explain why the limits do not exist.

27. (a) $\lim_{x \to 2^-} f(x)$

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

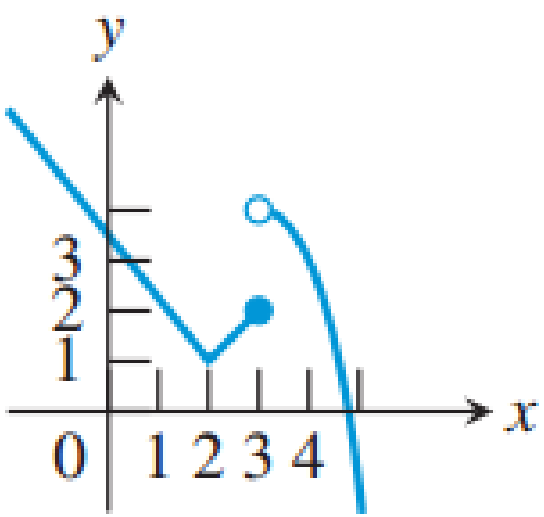
(c) $\lim_{x \to 2} f(x)$



28. **(a)** $\lim_{x \to 3^-} f(x)$

(b) $\lim_{x \to 3^+} f(x)$

(c) $\lim_{x \to 3} f(x)$



29. **(a)** $\lim_{x \to 3^-} f(x)$

(b) $\lim_{x \to 3^+} f(x)$

(c) $\lim_{x \to 3} f(x)$