

$$\lim_{r \rightarrow -2} \frac{\sqrt{2r^2 + 1} - 3}{r + 2}.$$

- b. Use the result of part a to find an approximation to  $\sqrt{2r^2 + 1}$  for  $r$  values near  $-2$ .
- c. Find an interval containing  $-2$  on which the error in this approximation is less than  $0.001$ .
- d. For  $r = -1.98$ , compare the actual (calculator) value of  $\sqrt{2r^2 + 1}$  with the value given by the approximation.

**T**

16. a. Use graphical or numerical means to find the value of

$$\lim_{t \rightarrow 2} \frac{3^t - 3^2}{t - 2}.$$

- b. Use the result of part a to find an approximation to  $3^t$  for  $t$  values near  $2$ .
- c. Find an interval containing  $2$  on which the error in this approximation is less than  $0.01$ .
- d. For  $t = 2.015$ , compare the actual (calculator) value of  $3^t$  with the value given by the approximation.

**T**

17. a. Use graphical or numerical means to find the value of

$$\lim_{x \rightarrow \pi/4} \frac{\tan x - 1}{x - \pi/4}.$$

- b. Use the result of part a to find an approximation to  $\tan x$  for  $x$  values near  $\pi/4$ .
- c. Find an interval containing  $\pi/4$  on which the error in this approximation is less than  $0.001$ .
- d. For  $x = 0.75$ , compare the actual value of  $\tan x$  with the value given by the approximation.

18. In Fig. 1.60, which is the graph of  $y = x$  and which is the graph of  $y = \sin x$ ? Give reasons for your answer.

19. Let  $h(t) = t/|t|$ .

- a. Evaluate  $\lim_{t \rightarrow 0^+} h(t)$  and  $\lim_{t \rightarrow 0^-} h(t)$ .
- b. What can be said about  $\lim_{t \rightarrow 0} h(t)$ ?
- c. Is  $h(t)$  continuous at  $t = 0$ ? Why or why not?

20. Let  $P(w)$  be the cost of first-class postage for a letter that weighs  $w$  ounces. If  $0 < w < 1$ , then  $P(w) = 34\text{¢}$ . If  $w > 1$ , the cost is  $34\text{¢}$  plus  $22\text{¢}$  for each ounce or fraction of an ounce above  $1$ .

- a. Sketch a graph of the function  $C = P(w)$  for  $0 < w < 5.5$ .
- b. Evaluate  $\lim_{w \rightarrow 2^-} P(w)$  and  $\lim_{w \rightarrow 2^+} P(w)$ .
- c. Tell why  $P(w)$  is discontinuous for  $w = 1, 2, 3, 4, \dots$

21. The graph of a function  $f$  is shown in the accompanying figure.

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

- b. Evaluate  $\lim_{x \rightarrow 0^+} f(x)$  and  $\lim_{x \rightarrow 0^-} f(x)$ .
- c. Evaluate  $\lim_{x \rightarrow 1^+} f(x)$  and  $\lim_{x \rightarrow 1^-} f(x)$ .
- d. For what values of  $x$  between  $-3$  and  $3$  is  $f$  discontinuous?

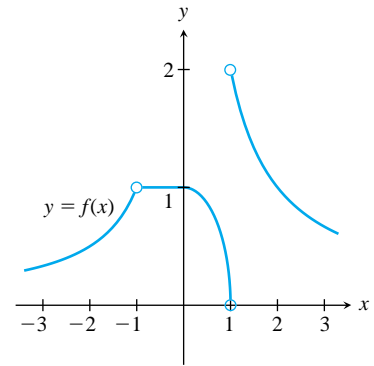


Figure for Exercise 21.

22. The graph of a function  $g$  is shown in the accompanying figure.

- a. Evaluate  $\lim_{x \rightarrow -4^+} g(x)$  and  $\lim_{x \rightarrow -4^-} g(x)$ .
- b. Evaluate  $\lim_{x \rightarrow -2^+} g(x)$  and  $\lim_{x \rightarrow -2^-} g(x)$ .
- c. Evaluate  $\lim_{x \rightarrow 2^+} g(x)$  and  $\lim_{x \rightarrow 2^-} g(x)$ .
- d. For what values of  $x$  between  $-5$  and  $3$  is  $g$  discontinuous?

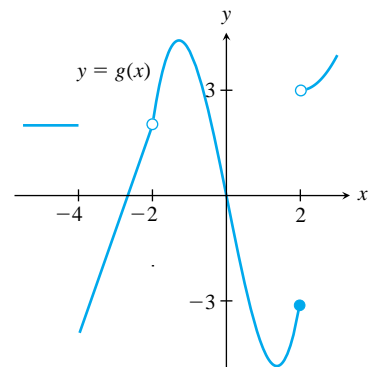


Figure for Exercise 22.

23. Restate the rule for limits and compositions in Section 1.5 in such a way that the conditions on the function  $h$  are expressed in terms of the continuity of  $h$  at  $L$ .

24. a. For  $x \neq 0$  let

$$g(x) = x \sin\left(\frac{1}{x}\right).$$

Show that  $\lim_{x \rightarrow 0} g(x) = 0$ .

- b. For  $x \neq 0$  let