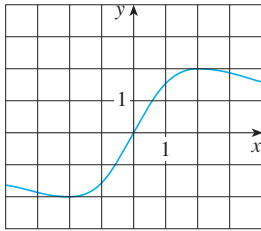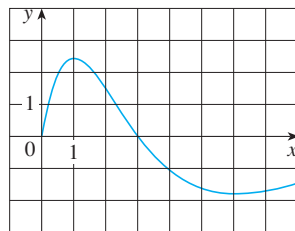## 2.8 Exercises

1–2 Use the given graph to estimate the value of each derivative. Then sketch the graph of f'.
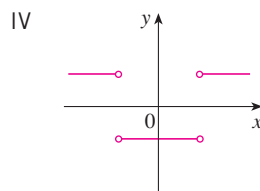
1. (a) $f'(-3)$
(b) $f'(-2)$
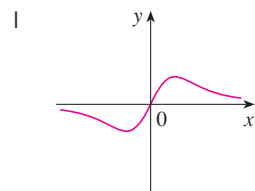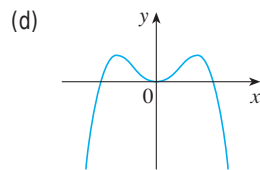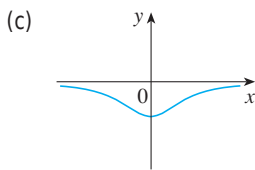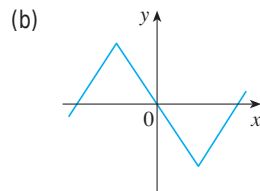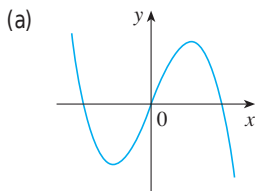(c) $f'(-1)$
(d) $f'(0)$
(e) $f'(1)$
(f) $f'(2)$
(g) $f'(3)$

2. (a) $f'(0)$
(b) $f'(1)$
(c) $f'(2)$
(d) $f'(3)$
(e) $f'(4)$
(f) $f'(5)$
(g) $f'(6)$
(h) $f'(7)$

3. Match the graph of each function in (a)–(d) with the graph of its derivative in I–IV. Give reasons for your choices.

(a)

(b)

(c)

(d)

I

II

III

IV
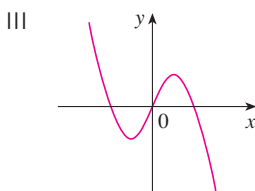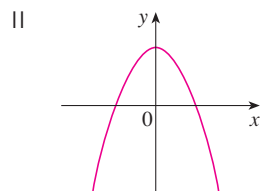
4–11 Trace or copy the graph of the given function f. (Assume that the axes have equal scales.) Then use the method of Example 1 to sketch the graph of f' below it.

4.

5.

6.

7.

8.

9.

10.

11.
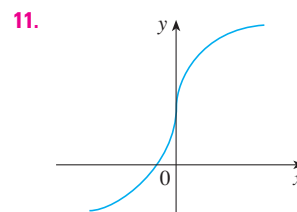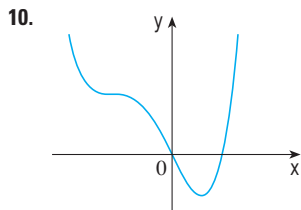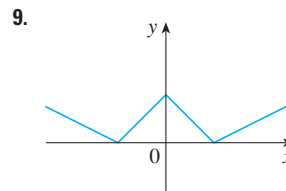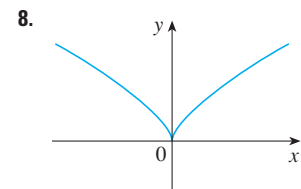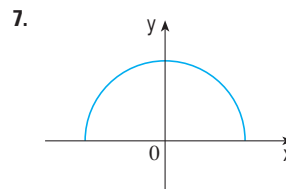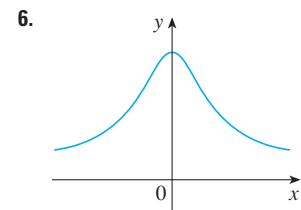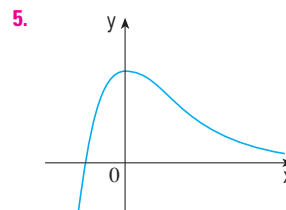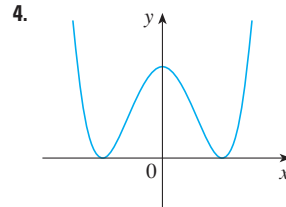
12. Shown is the graph of the population function $P(t)$ for yeast cells in a laboratory culture. Use the method of Example 1 to

P (yeast cells)

500

5   10   15 t (hours)
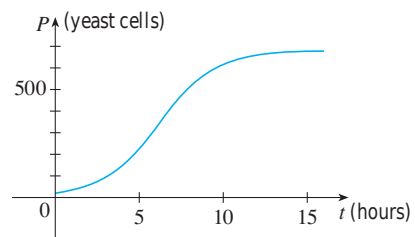
35. The unemployment rate U(t) varies with time. The table (from the Bureau of Labor Statistics) gives the percentage of unemployed in the US labor force from 1999 to 2008.

t	U(t)	t	U(t)
1999	4.2	2004	5.5
2000	4.0	2005	5.1
2001	4.7	2006	4.6
2002	5.8	2007	4.6
2003	6.0	2008	5.8

(a) What is the meaning of U′(t)? What are its units?
(b) Construct a table of estimated values for U′(t).

36. Let P(t) be the percentage of Americans under the age of 18 at time t. The table gives values of this function in census years from 1950 to 2000.

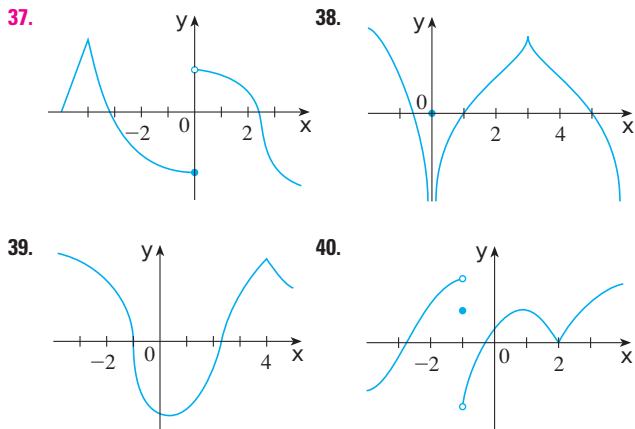| t	P(t)	t	P(t)
1950	31.1	1980	28.0
1960	35.7	1990	25.7
1970	34.0	2000	25.7

(a) What is the meaning of P′(t)? What are its units?
(b) Construct a table of estimated values for P′(t).
(c) Graph P and P′.
(d) How would it be possible to get more accurate values for P′(t)?

37–40 The graph of f is given. State, with reasons, the numbers at which f is not differentiable.

37.

38.

39.

40.

41. Graph the function $f(x) = x + \sqrt{|x|}$. Zoom in repeatedly, first toward the point $(-1, 0)$ and then toward the origin. What is different about the behavior of f in the vicinity of these two points? What do you conclude about the differentiability of f?

42. Zoom in toward the points $(1, 0)$, $(0, 1)$, and $(-1, 0)$ on the graph of the function $g(x) = (x^2 - 1)^{2/3}$. What do you notice? Account for what you see in terms of the differentiability of g.
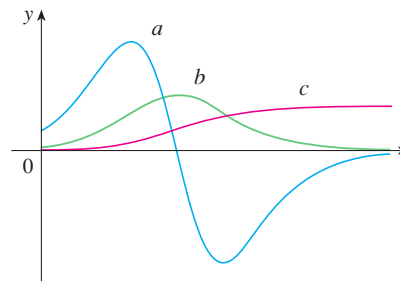
43. The figure shows the graphs of f, f′, and f″. Identify each curve, and explain your choices.
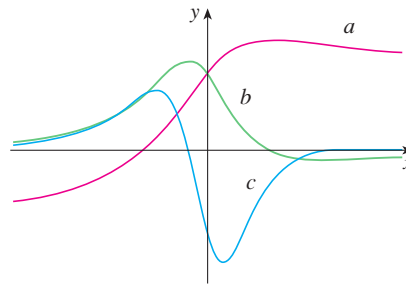
44. The figure shows graphs of f, f′, f″, and f‴. Identify each curve, and explain your choices.
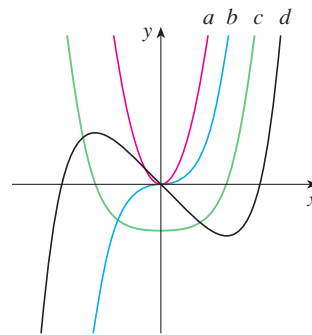
45. The figure shows the graphs of three functions. One is the position function of a car, one is the velocity of the car, and one is its acceleration. Identify each curve, and explain your choices.

46. The figure shows the graphs of four functions. One is the position function of a car, one is the velocity of the car, one is its acceleration, and one is its jerk. Identify each curve, and explain your choices.