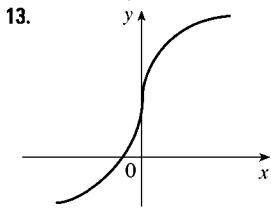


2.9 Exercises



14–16 □ Make a careful sketch of the graph of f and below it sketch the graph of f' in the same manner as in Exercises 5–13. Can you guess a formula for $f'(x)$ from its graph?

14. $f(x) = \sin x$

15. $f(x) = e^x$

16. $f(x) = \ln x$

17. Let $f(x) = x^2$.

- (a) Estimate the values of $f'(0)$, $f'(\frac{1}{2})$, $f'(1)$, and $f'(2)$ by using a graphing device to zoom in on the graph of f .
- (b) Use symmetry to deduce the values of $f'(-\frac{1}{2})$, $f'(-1)$, and $f'(-2)$.
- (c) Use the results from parts (a) and (b) to guess a formula for $f'(x)$.
- (d) Use the definition of a derivative to prove that your guess in part (c) is correct.

18. Let $f(x) = x^3$.

- (a) Estimate the values of $f'(0)$, $f'(\frac{1}{2})$, $f'(1)$, $f'(2)$, and $f'(3)$ by using a graphing device to zoom in on the graph of f .

- 29. (a) If $f(x) = x - (2/x)$, find $f'(x)$.
- (b) Check to see that your answer to part (a) is reasonable by comparing the graphs of f and f' .
- 30. (a) If $f(t) = 6/(1 + t^2)$, find $f'(t)$.
- (b) Check to see that your answer to part (a) is reasonable by comparing the graphs of f and f' .

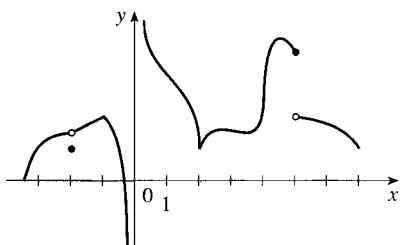
31. The unemployment rate $U(t)$ varies with time. The table (from

the Bureau of Labor Statistics) gives the percentage of unemployed in the U. S. labor force from 1988 to 1997.

t	$U(t)$	t	$U(t)$
1988	5.5	1993	6.9
1989	5.3	1994	6.1
1990	5.6	1995	5.6
1991	6.8	1996	5.4
1992	7.5	1997	4.9

- (a) What is the meaning of $U'(t)$? What are its units?
- (b) Construct a table of values for $U'(t)$.
- 32. Let the smoking rate among high-school seniors at time t be $S(t)$. The table (from the Institute of Social Research, University of Michigan) gives the percentage of seniors who reported that they had smoked one or more cigarettes per day during the past 30 days.

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42. The **left-hand** and **right-hand** derivatives of f at a are defined by

$$f'_-(a) = \lim_{h \rightarrow 0^-} \frac{f(a+h) - f(a)}{h}$$

and

$$f'_+(a) = \lim_{h \rightarrow 0^+} \frac{f(a+h) - f(a)}{h}$$

if these limits exist. Then $f'(a)$ exists if and only if these one-sided derivatives exist and are equal.