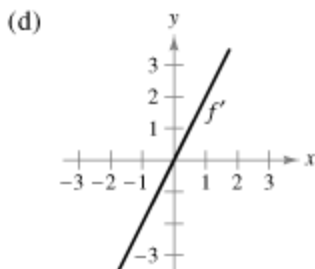
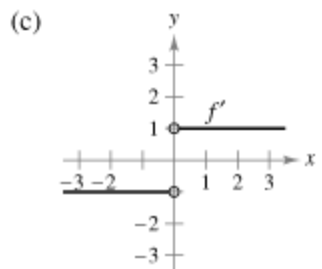
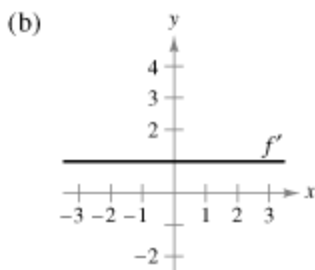
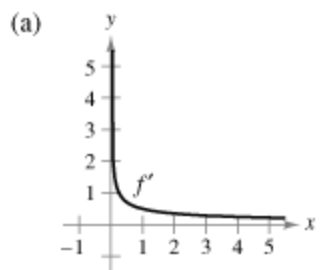
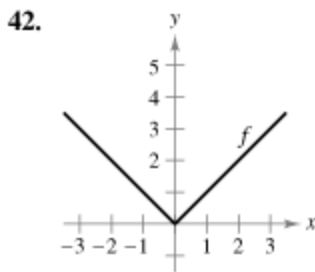
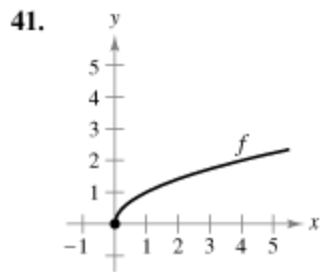
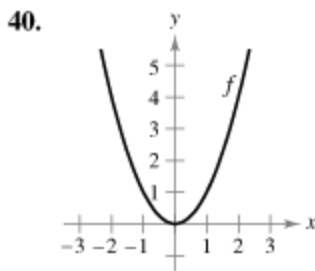
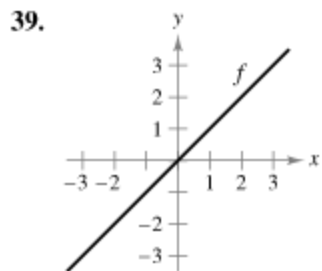


In Exercises 39–42, the graph of f is given. Select the graph of f' .



43. Sketch a graph of a function whose derivative is always negative.
 44. Sketch a graph of a function whose derivative is always positive.
 45. Assume that $f'(c) = 3$. Find $f'(-c)$ if (a) f is an odd function and if (b) f is an even function.
 46. Determine whether the limit yields the derivative of a differentiable function f . Explain.

(a) $\lim_{\Delta x \rightarrow 0} \frac{f(x + 2\Delta x) - f(x)}{2\Delta x}$

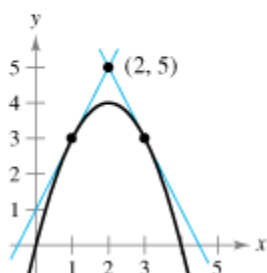
(b) $\lim_{\Delta x \rightarrow 0} \frac{f(x + 2) - f(x)}{\Delta x}$

(c) $\lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x - \Delta x)}{2\Delta x}$

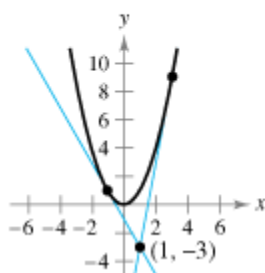
(d) $\lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$

In Exercises 47 and 48, find equations of the two tangent lines to the graph of f that pass through the indicated point.

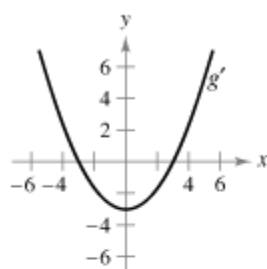
47. $f(x) = 4x - x^2$



48. $f(x) = x^2$



49. **Graphical Reasoning** The figure shows the graph of g' .



- (a) $g'(0) =$
- (b) $g'(3) =$
- (c) What can you conclude about the graph of g knowing that $g'(1) = -\frac{8}{3}$?
- (d) What can you conclude about the graph of g knowing that $g'(-4) = \frac{7}{3}$?
- (e) Is $g(6) - g(4)$ positive or negative? Explain.
- (f) Is it possible to find $g(2)$ from the graph? Explain.

50. **Graphical Reasoning** Use a graphing utility to graph each function and its tangent lines when $x = -1$, $x = 0$, and $x = 1$. Based on the results, determine whether the slope of a tangent line to the graph of a function is always distinct for different values of x .

- (a) $f(x) = x^2$
- (b) $g(x) = x^3$

Graphical, Numerical, and Analytic Analysis In Exercises 51 and 52, use a graphing utility to graph f on the interval $[-2, 2]$. Complete the table by graphically estimating the slopes of the graph at the indicated points. Then evaluate the slopes analytically and compare your results with those obtained graphically.

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
$f(x)$									
$f'(x)$									

51. $f(x) = \frac{1}{4}x^3$

52. $f(x) = \frac{1}{2}x^2$

Graphical Reasoning In Exercises 53 and 54, use a graphing utility to graph the functions f and g in the same viewing window where

$$g(x) = \frac{f(x + 0.01) - f(x)}{0.01}.$$

Label the graphs and describe the relationship between them.

53. $f(x) = 2x - x^2$

54. $f(x) = 3\sqrt{x}$

In Exercises 55 and 56, evaluate $f(2)$ and $f(2.1)$ and use the results to approximate $f'(2)$.

55. $f(x) = x(4 - x)$

56. $f(x) = \frac{1}{4}x^3$

Graphical Reasoning In Exercises 57 and 58, use a graphing utility to graph the function and its derivative in the same viewing window. Label the graphs and describe the relationship between them.

57. $f(x) = \frac{1}{\sqrt{x}}$

58. $f(x) = \frac{x^3}{4} - 3x$

Writing In Exercises 59 and 60, consider the functions f and $S_{\Delta x}$ where

$$S_{\Delta x}(x) = \frac{f(2 + \Delta x) - f(2)}{\Delta x}(x - 2) + f(2).$$

(a) Use a graphing utility to graph f and $S_{\Delta x}$ in the same viewing window for $\Delta x = 1, 0.5,$ and 0.1 .

(b) Give a written description of the graphs of S for the different values of Δx in part (a).

59. $f(x) = 4 - (x - 3)^2$

60. $f(x) = x + \frac{1}{x}$