In Exercises 39–46, sketch a graph of the function over the indicated interval. Use a graphing utility to verify your graph.

Function	*Interval*
39. $y = \sin x - \frac{1}{18}\sin 3x$	$0 \le x \le 2\pi$
40. $y = \cos x - \frac{1}{2}\cos 2x$	$0 \le x \le 2\pi$
41. $y = 2x - \tan x$	$-\frac{\pi}{2} < x < \frac{\pi}{2}$
42. $y = 2(x - 2) + \cot x$	$0 < x < \pi$
43. $y = 2(\csc x + \sec x)$	$0 < x < \frac{\pi}{2}$
44. $y = \sec^2\left(\frac{\pi x}{8}\right) - 2\tan\left(\frac{\pi x}{8}\right) - 1$	$-3 < x < 3$
45. $g(x) = x \tan x$	$-\frac{3\pi}{2} < x < \frac{3\pi}{2}$
46. $g(x) = x \cot x$	$-2\pi < x < 2\pi$

In Exercises 47–50, use a computer algebra system to analyze and graph the function. Identify any relative extrema, points of inflection, and asymptotes.

47. $f(x) = \dfrac{20x}{x^2 + 1} - \dfrac{1}{x}$

48. $f(x) = 5\left(\dfrac{1}{x - 4} - \dfrac{1}{x + 2}\right)$

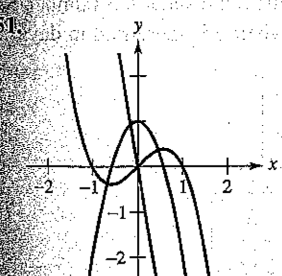
49. $f(x) = \dfrac{x}{\sqrt{x^2 + 7}}$

50. $f(x) = \dfrac{4x}{\sqrt{x^2 + 15}}$

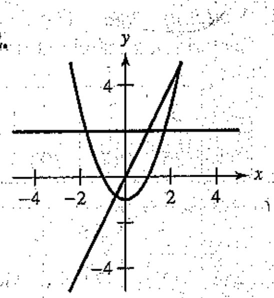
Getting at the Concept

In Exercises 51 and 52, the graphs of f, f', and f'' are shown on the same set of coordinate axes. Which is which? To print an enlarged copy of the graph, go to the website *www.mathgraphs.com*.

51.

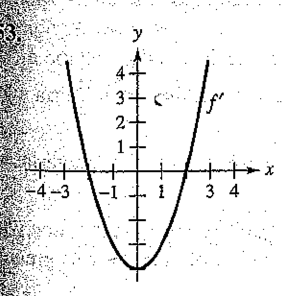


52.

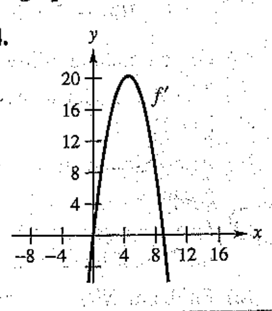


In Exercises 53–56, use the graph of f' to sketch a graph of f and the graph of f''. To print an enlarged copy of the graph, go to the website *www.mathgraphs.com*.

53.

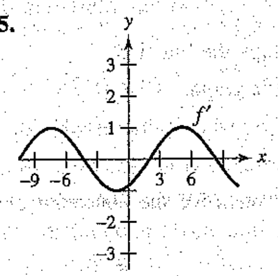


54.

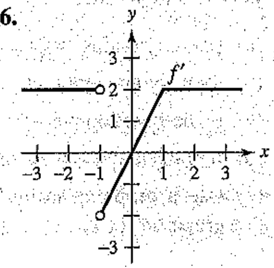


Getting at the Concept *(continued)*

55.



56.



(Submitted by Bill Fox, Moberly Area Community College, Moberly, MO)

57. Suppose $f'(t) < 0$ for all t in the interval $(2, 8)$. Explain why $f(3) > f(5)$.

58. Suppose $f(0) = 3$ and $2 \le f'(x) \le 4$ for all x in the interval $[-5, 5]$. Determine the greatest and least possible values of $f(2)$.

In Exercises 59 and 60, use a graphing utility to graph the function. Use the graph to determine whether it is possible for the graph of a function to cross its horizontal asymptote. Do you think it is possible for the graph of a function to cross its vertical asymptote? Why or why not?

59. $f(x) = \dfrac{4(x - 1)^2}{x^2 - 4x + 5}$

60. $g(x) = \dfrac{3x^4 - 5x + 3}{x^4 + 1}$

Writing **In Exercises 61 and 62, use a graphing utility to graph the function. Explain why there is no vertical asymptote when a superficial examination of the function may indicate that there should be one.**

61. $h(x) = \dfrac{6 - 2x}{3 - x}$

62. $g(x) = \dfrac{x^2 + x - 2}{x - 1}$

Writing **In Exercises 63 and 64, use a graphing utility to graph the function and determine the slant asymptote of the graph. Zoom out repeatedly and describe how the graph on the display appears to change. Why does this occur?**

63. $f(x) = -\dfrac{x^2 - 3x - 1}{x - 2}$

64. $g(x) = \dfrac{2x^2 - 8x - 15}{x - 5}$

65. ***Graphical Reasoning*** Consider the function

$$f(x) = \frac{\cos^2 \pi x}{\sqrt{x^2 + 1}}, \quad 0 < x < 4.$$

(a) Use a computer algebra system to graph the function and use the graph to visually approximate the critical numbers.

(b) Use a computer algebra system to find f' and approximate the critical numbers. Are the results the same as the visual approximation in part (a)? Explain.