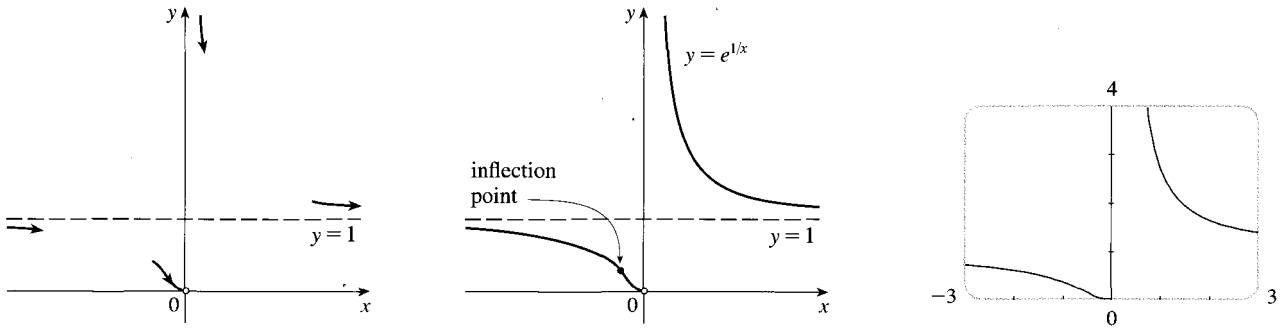
To sketch the graph of f we first draw the horizontal asymptote $y = 1$ (as a dashed line), together with the parts of the curve near the asymptotes in a preliminary sketch [Figure 13(a)]. These parts reflect the information concerning limits and the fact that f is decreasing on both $(-\infty, 0)$ and $(0, \infty)$. Notice that we have indicated that $f(x) \to 0$ as $x \to 0^-$ even though $f(0)$ does not exist. In Figure 13(b) we finish the sketch by incorporating the information concerning concavity and the inflection point. In Figure 13(c) we check our work with a graphing device.

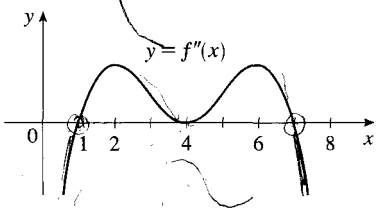


(a) Preliminary sketch (b) Finished sketch (c) Computer confirmation

FIGURE 13

4.3 Exercises

7. The graph of the second derivative f'' of a function f is shown. State the x-coordinates of the inflection points of f. Give reasons for your answers.



8. The graph of the first derivative f' of a function f is shown.
(a) On what intervals is f increasing? Explain.
(b) At what values of x does f have a local maximum or mini-

13. $f(x) = x^6 + 192x + 17$

14. $f(x) = \dfrac{x}{(1 + x)^2}$

15. $f(x) = x - 2 \sin x, \quad 0 < x < 3\pi$

16. $f(x) = 2 \sin x + \sin^2 x, \quad 0 \leq x \leq 2\pi$

17. $f(x) = xe^x$

18. $f(x) = x^2 e^x$

19. $f(x) = (\ln x)/\sqrt{x}$

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

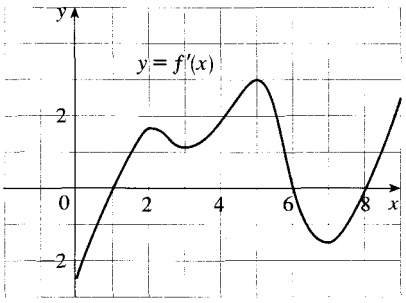
21–23 □ Find the local maximum and minimum values of f using both the First and Second Derivative Tests. Which method do you prefer?

21. $f(x) = x^5 - 5x + 3$

22. $f(x) = \dfrac{x}{x^2 + 4}$

23. $f(x) = x + \sqrt{1 - \ldots}$

30.



31–42 □

(a) Find the intervals of increase or decrease.

(b) Find the local maximum and minimum values

53–54 □

(a) Use a graph of f to give a rough estimate of the intervals of concavity and the coordinates of the points of inflection.

(b) Use a graph of f'' to give better estimates.

53. $f(x) = 3x^5 - 40x^3 + 30x^2$

54. $f(x) = 2\cos x + \sin 2x, \quad 0 \leq x \leq 2\pi$

55–56 □ Estimate the intervals of concavity to one decimal place by using a computer algebra system to compute and graph f''.

55. $f(x) = \dfrac{x^3 - 10x + 5}{\sqrt{x^2 + 4}}$

56. $f(x) = \dfrac{(x + 1)^3(x^2 + 5)}{(x^3 + 1)(x^2 + 4)}$