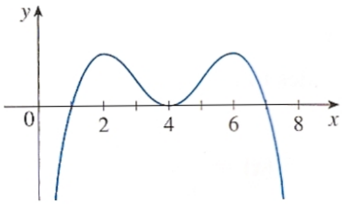
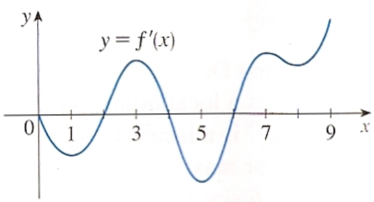
13. In each part state the x-coordinates of the inflection points of f. Give reasons for your answers.
(a) The curve is the graph of f.
(b) The curve is the graph of f'.
(c) The curve is the graph of f''.



14. 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 minimum? Explain.
(c) On what intervals is f concave upward or concave downward? Explain.
(d) What are the x-coordinates of the inflection points of f? Why?



15–20 ▪ Sketch the graph of a function that satisfies all of the given conditions.

15. $f'(x)$ and $f''(x)$ are always negative

16. $f'(x) > 0$ for all $x \neq 1$, vertical asymptote $x = 1$,
$f''(x) > 0$ if $x < 1$ or $x > 3$, $f''(x) < 0$ if $1 < x < 3$

17. $f'(0) = f'(2) = f'(4) = 0$,
$f'(x) > 0$ if $x < 0$ or $2 < x < 4$,
$f'(x) < 0$ if $0 < x < 2$ or $x > 4$,
$f''(x) > 0$ if $1 < x < 3$, $f''(x) < 0$ if $x < 1$ or $x > 3$

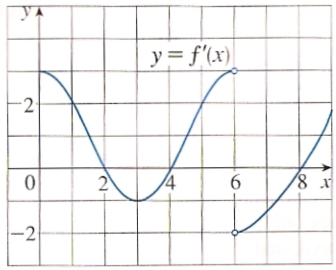
18. $f'(1) = f'(-1) = 0$, $f'(x) < 0$ if $|x| < 1$,
$f'(x) > 0$ if $1 < |x| < 2$, $f'(x) = -1$ if $|x| > 2$,
$f''(x) < 0$ if $-2 < x < 0$, inflection point $(0, 1)$

19. $f'(x) > 0$ if $|x| < 2$, $f'(x) < 0$ if $|x| > 2$,
$f'(-2) = 0$, $\lim_{x \to 2} |f'(x)| = \infty$, $f''(x) > 0$ if $x \neq 2$

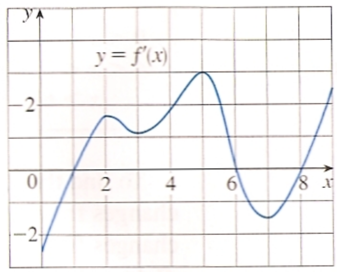
20. $f'(x) > 0$ if $|x| < 2$, $f'(x) < 0$ if $|x| > 2$,
$f'(2) = 0$, $\lim_{x \to \infty} f(x) = 1$, $f(-x) = -f(x)$,
$f''(x) < 0$ if $0 < x < 3$, $f''(x) > 0$ if $x > 3$

21–22 ▪ The graph of the derivative f' of a continuous function f is shown.
(a) On what intervals is f increasing or decreasing?
(b) At what values of x does f have a local maximum or minimum?
(c) On what intervals is f concave upward or downward?
(d) State the x-coordinate(s) of the point(s) of inflection.
(e) Assuming that $f(0) = 0$, sketch a graph of f.

21.



22.



23–34 ▪
(a) Find the intervals of increase or decrease.
(b) Find the local maximum and minimum values.
(c) Find the intervals of concavity and the inflection points.
(d) Use the information from parts (a)–(c) to sketch the graph. Check your work with a graphing device if you have one.

23. $f(x) = 2x^3 - 3x^2 - 12x$ **24.** $f(x) = 2 + 3x - x^3$

25. $f(x) = x^4 - 6x^2$

26. $g(x) = 200 + 8x^3 + x^4$

27. $h(x) = 3x^5 - 5x^3 + 3$ **28.** $h(x) = (x^2 - 1)^3$

29. $A(x) = x\sqrt{x + 3}$ **30.** $B(x) = 3x^{2/3} - x$

31. $C(x) = x^{1/3}(x + 4)$

32. $f(x) = \ln(x^4 + 27)$

33. $f(\theta) = 2\cos\theta - \cos 2\theta$, $0 \leqslant \theta \leqslant 2\pi$

34. $f(t) = t + \cos t$, $-2\pi \leqslant t \leqslant 2\pi$

35–42 ▪
(a) Find the vertical and horizontal asymptotes.
(b) Find the intervals of increase or decrease.
(c) Find the local maximum and minimum values.