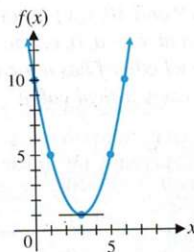
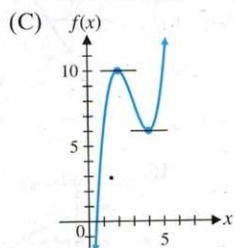


Answers to Matched Problems

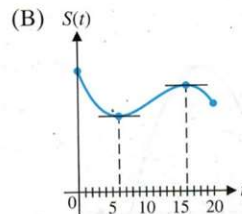
1. (A) Horizontal tangent line at $x = 3$. (C)
 (B) Decreasing on $(-\infty, 3)$;
 increasing on $(3, \infty)$



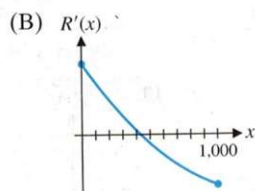
2. Partition number: $x = 0$; critical value: $x = 0$; decreasing for all x
 3. Partition number: $x = -1$; critical value: $x = -1$; increasing for all x
 4. Partition number: $x = 0$; no critical values; decreasing on $(-\infty, 0)$ and $(0, \infty)$
 5. Partition number: $x = 5$; critical value: $x = 5$; increasing on $(0, 5)$; decreasing on $(5, \infty)$
 6. Increasing on $(-3, 1)$; decreasing on $(-\infty, -3)$ and $(1, \infty)$; local maximum at $x = 1$;
 local minimum at $x = -3$
 7. (A) Critical values: $x = 2, x = 4$
 (B) Local maximum at $x = 2$;
 local minimum at $x = 4$



8. (A) The U.S. share of the world market decreases for 6 years to a local minimum, increases for the next 10 years to a local maximum, and then decreases for the final 4 years.

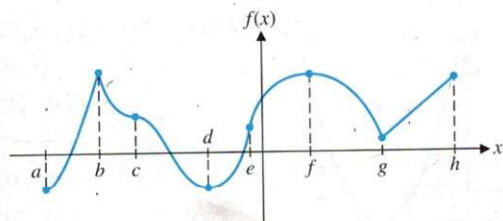


9. (A) The marginal revenue is positive on $(0, 450)$, 0 at $x = 450$, and negative on $(450, 1,000)$.



Exercise 12-1

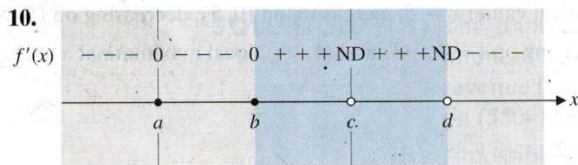
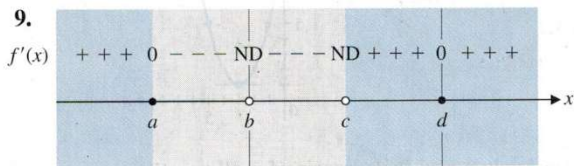
A Problems 1–8 refer to the following graph of $y = f(x)$:



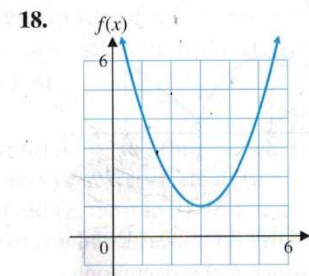
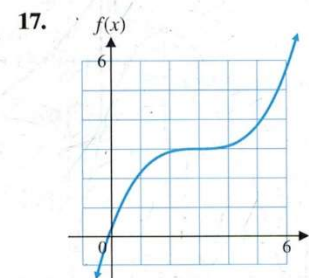
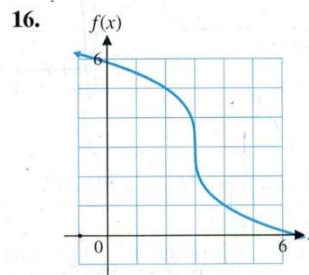
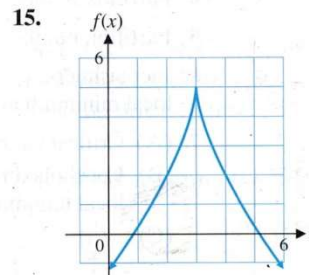
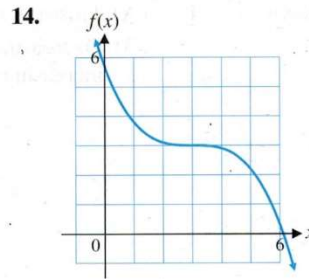
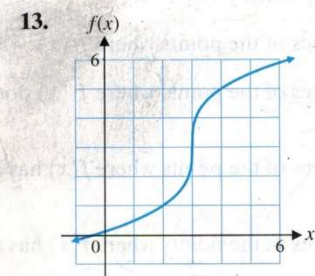
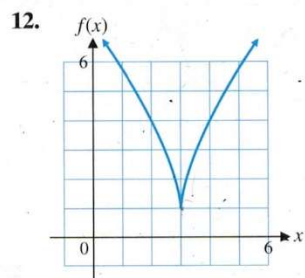
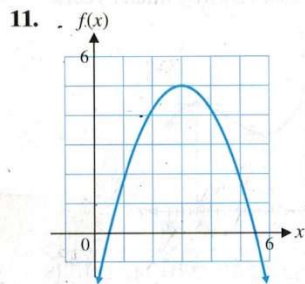
- Identify the intervals on which $f(x)$ is increasing.
- Identify the intervals on which $f(x)$ is decreasing.

- Identify the intervals on which $f'(x) < 0$.
- Identify the intervals on which $f'(x) > 0$.
- Identify the x coordinates of the points where $f'(x) = 0$.
- Identify the x coordinates of the points where $f'(x)$ does not exist.
- Identify the x coordinates of the points where $f(x)$ has a local maximum.
- Identify the x coordinates of the points where $f(x)$ has a local minimum.

In Problems 9 and 10, $f(x)$ is continuous on $(-\infty, \infty)$ and has critical values at $x = a, b, c,$ and d . Use the sign chart for $f'(x)$ to determine whether f has a local maximum, a local minimum, or neither at each critical value.



In Problems 11–18, match the graph of f with one of the sign charts a–h in the figure.



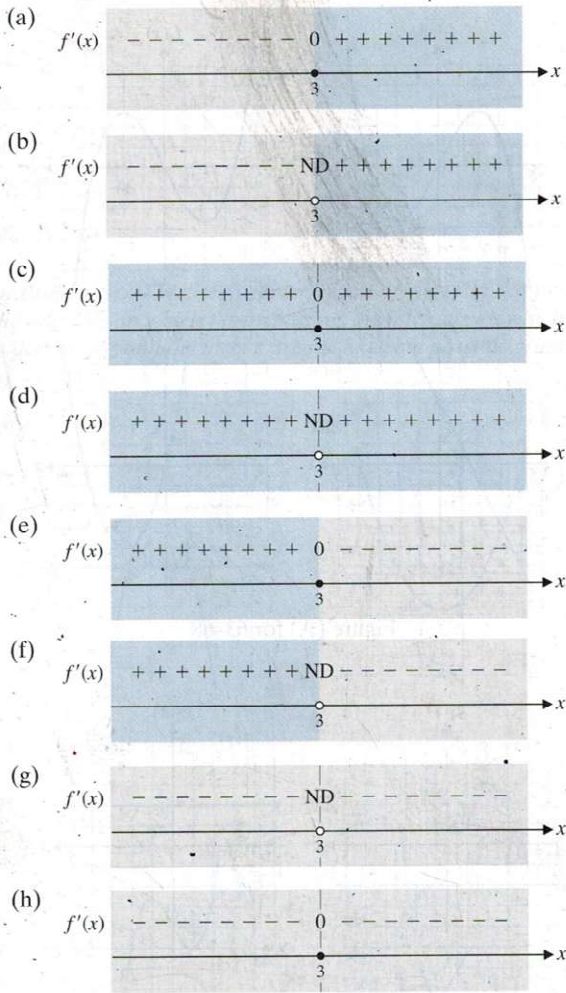


Figure for 11-18

In Problems 19-36, find the intervals on which $f(x)$ is increasing, the intervals on which $f(x)$ is decreasing, and the local extrema.

19. $f(x) = 2x^2 - 4x$
20. $f(x) = -3x^2 - 12x$
21. $f(x) = -2x^2 - 16x - 25$
22. $f(x) = -3x^2 + 12x - 5$
23. $f(x) = x^3 + 4x - 5$
24. $f(x) = -x^3 - 4x + 8$
25. $f(x) = 2x^3 - 3x^2 - 36x$
26. $f(x) = -2x^3 + 3x^2 + 120x$
27. $f(x) = 3x^4 - 4x^3 + 5$
28. $f(x) = x^4 + 2x^3 + 5$
29. $f(x) = (x - 1)e^{-x}$
30. $f(x) = x \ln x - x$
31. $f(x) = 4x^{1/3} - x^{2/3}$
32. $f(x) = (x^2 - 9)^{2/3}$
33. $f(x) = 2x - x \ln x$
34. $f(x) = (x + 2)e^x$

35. $f(x) = (x^2 - 3x - 4)^{4/3}$

36. $f(x) = x^{4/3} - 7x^{1/3}$



In Problems 37-46, use a graphing calculator to approximate the critical values of $f(x)$ to two decimal places. Find the intervals on which $f(x)$ is increasing, the intervals on which $f(x)$ is decreasing, and the local extrema.

37. $f(x) = x^4 + x^2 + x$

38. $f(x) = x^4 + x^2 - 9x$

39. $f(x) = x^4 - 4x^3 + 9x$

40. $f(x) = x^4 + 5x^3 - 15x$

41. $f(x) = x \ln x - (x - 2)^3$

42. $f(x) = 3x - x^{1/3} - x^{4/3}$

43. $f(x) = e^x - 2x^2$

44. $f(x) = e^{-x} - 3x^2$

45. $f(x) = x^{1/3} + x^{4/3} - 2x$

46. $f(x) = \frac{\ln x}{x} - 5x + x^2$

In Problems 47-54, find the intervals on which $f(x)$ is increasing and the intervals on which $f(x)$ is decreasing. Then sketch the graph. Add horizontal tangent lines.

47. $f(x) = 4 + 8x - x^2$

48. $f(x) = 2x^2 - 8x + 9$

49. $f(x) = x^3 - 3x + 1$

50. $f(x) = x^3 - 12x + 2$

51. $f(x) = 10 - 12x + 6x^2 - x^3$

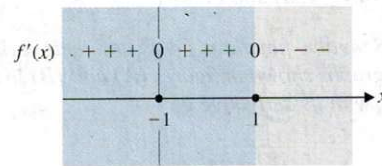
52. $f(x) = x^3 + 3x^2 + 3x$

53. $f(x) = x^4 - 18x^2$

54. $f(x) = -x^4 + 50x^2$

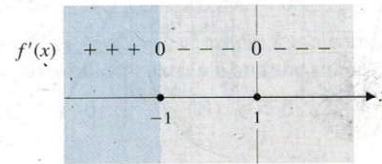
In Problems 55-62, $f(x)$ is continuous on $(-\infty, \infty)$. Use the given information to sketch the graph of f .

55.



x	-2	-1	0	1	2
$f(x)$	-1	1	2	3	-1

56.



x	-2	-1	0	1	2
$f(x)$	1	3	2	1	-1