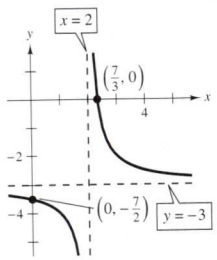
Section 3.6 (page 215)

1. d **2.** c **3.** a **4.** b

5.



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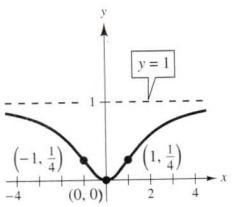

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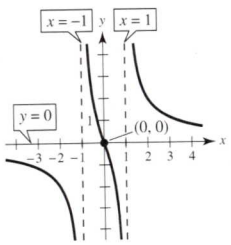

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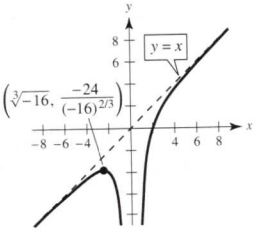

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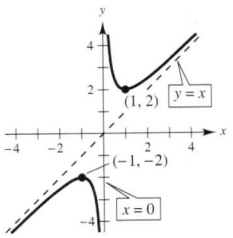

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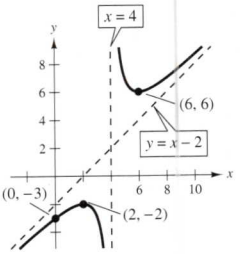

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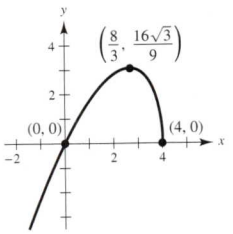

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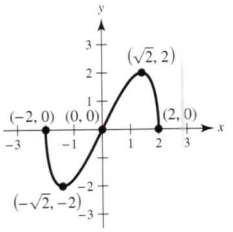

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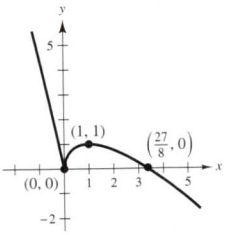

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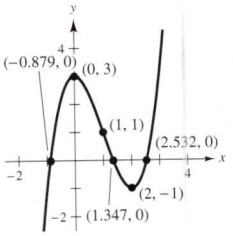

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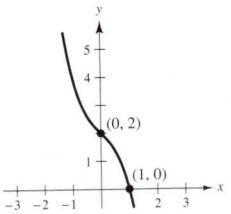

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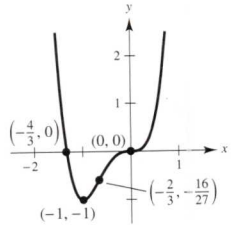

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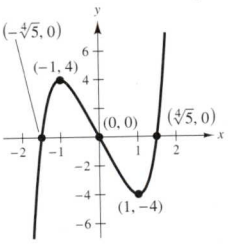

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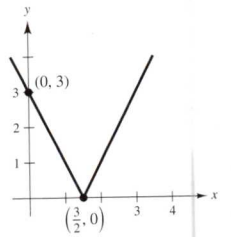

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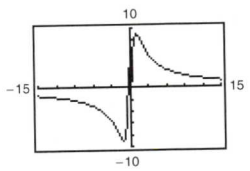
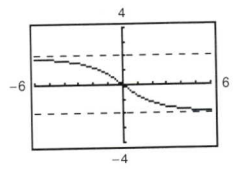


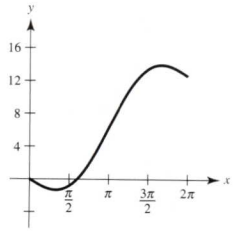
Minimum: $(-1.10, -9.05)$
Maximum: $(1.10, 9.05)$
Points of inflection:
$(-1.84, -7.86), (1.84, 7.86)$
Vertical asymptote: $x = 0$
Horizontal asymptote: $y = 0$

35.

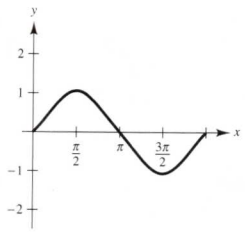


Point of inflection: $(0, 0)$
Horizontal asymptotes: $y = \pm 2$

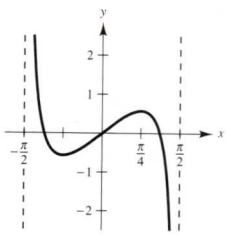
37.



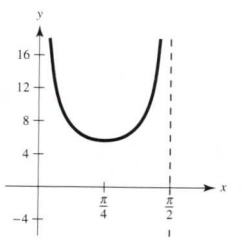
39.



41.



43.



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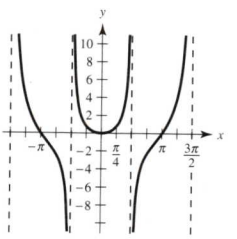
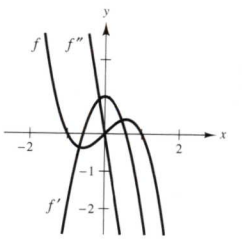


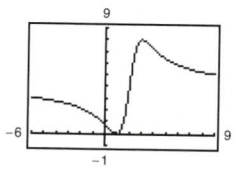
47. f is decreasing on $(2, 8)$ and therefore $f(3) > f(5)$.

49.



The zeros of f' correspond to the points where the graph of f has horizontal tangents. The zero of f'' corresponds to the point where the graph of f' has a horizontal tangent.

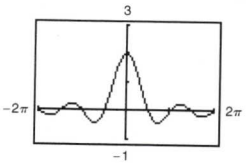
51.



The graph crosses the horizontal asymptote $y = 4$.

The graph of a function f does not cross its vertical asymptote $x = c$ because $f(c)$ does not exist.

53.

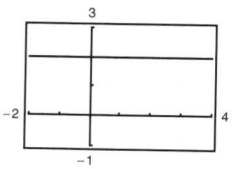


The graph has a hole at $x = 0$.

The graph crosses the horizontal asymptote $y = 0$.

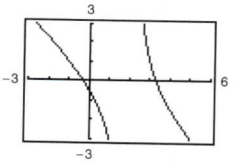
The graph of a function f does not cross its vertical asymptote $x = c$ because $f(c)$ does not exist.

55.



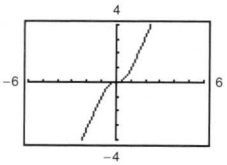
The graph has a hole at $x = 3$. The rational function is not reduced to lowest terms.

57.



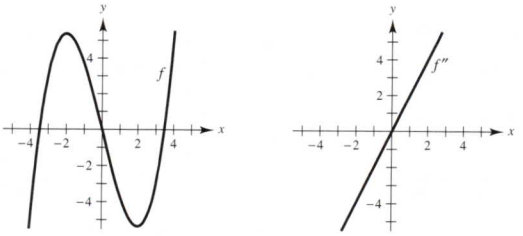
The graph appears to approach the line $y = -x + 1$, which is the slant asymptote.

59.

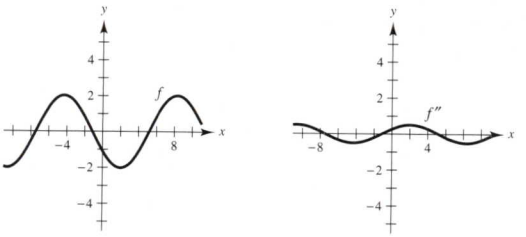


The graph appears to approach the line $y = 2x$, which is the slant asymptote.

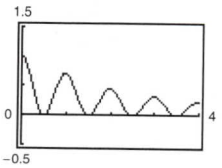
61.



63.



65. (a)



The graph has holes at $x = 0$ and at $x = 4$.

Visually approximated critical numbers: $\frac{1}{2}$, 1, $\frac{3}{2}$, 2, $\frac{5}{2}$, 3, $\frac{7}{2}$

(b) $f'(x) = \dfrac{-x\cos^2(\pi x)}{(x^2+1)^{3/2}} - \dfrac{2\pi\sin(\pi x)\cos(\pi x)}{\sqrt{x^2+1}}$

Approximate critical numbers: $\frac{1}{2}$, 0.97, $\frac{3}{2}$, 1.98, $\frac{5}{2}$, 2.98, $\frac{7}{2}$

The critical numbers where maxima occur appear to be integers in part (a), but by approximating them using f' you can see that they are not integers.

67. Answers will vary. Example: $y = 1/(x - 3)$

69. Answers will vary. Example: $y = (3x^2 - 7x - 5)/(x - 3)$

71. (a) $f'(x) = 0$ for $x = \pm 2$; $f'(x) > 0$ for $(-\infty, -2)$, $(2, \infty)$
$f'(x) < 0$ for $(-2, 2)$

(b) $f''(x) = 0$ for $x = 0$; $f''(x) > 0$ for $(0, \infty)$
$f''(x) < 0$ for $(-\infty, 0)$

(c) $(0, \infty)$

(d) f' is minimum for $x = 0$.
f is decreasing at the greatest rate at $x = 0$.

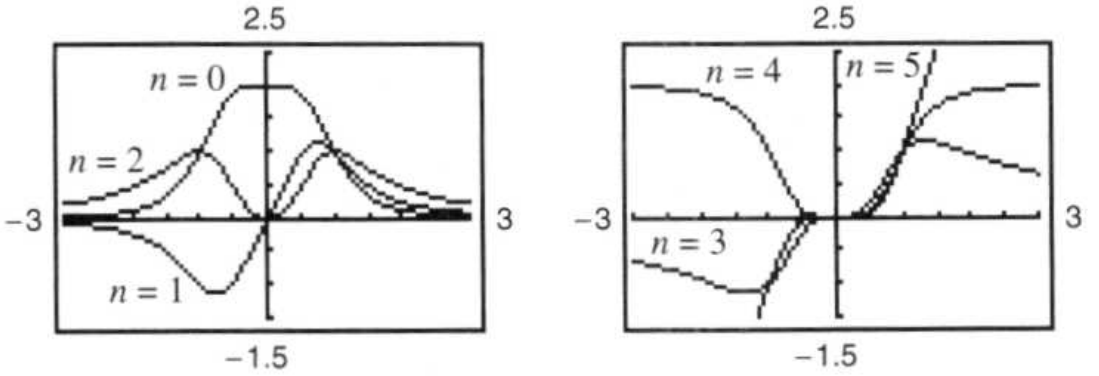
73. Answers will vary. Sample answer: The graph has a vertical asymptote at $x = b$. If a and b are both positive, or both negative, then the graph of f approaches ∞ as x approaches b, and the graph has a minimum at $x = -b$. If a and b have opposite signs, then the graph of f approaches $-\infty$ as x approaches b, and the graph has a maximum at $x = -b$.

75. (a) If n is even, f is symmetric with respect to the y-axis.
If n is odd, f is symmetric with respect to the origin.

(b) $n = 0, 1, 2, 3$ (c) $n = 4$

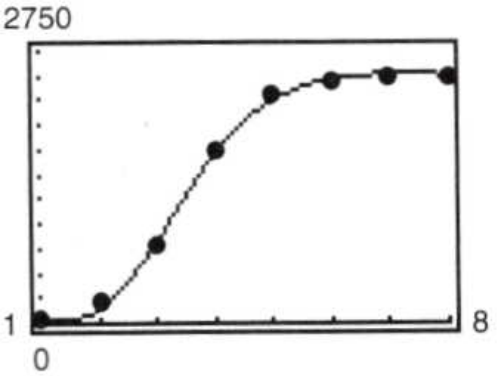
(d) When $n = 5$, the slant asymptote is $y = 2x$.

(e)



n	0	1	2	3	4	5
M	1	2	3	2	1	0
N	2	3	4	5	2	3

77. (a)



(b) 2434

(c) The number of bacteria reaches its maximum early on the seventh day.

(d) The rate of increase in the number of bacteria is greatest in the early part of the third day.

(e) 13,250/7

79. $y = x + 3, y = -x - 3$