Answers to Even-Numbered Exercises

Exercises 4.1

4. critical points: -1, 0,2,
increasing on: $(-1, 0)$ and $(2, \infty)$
decreasing on: $(-\infty, -1)$ and $(0, 2)$
local min at: $x = -1, x = 2$
local max at: $x = 0$

6. critical point: 1
increasing on: $(1, \infty)$
decreasing on: $(0, 1)$
local min: $x = 1$
local max: none

14. critical points: 0
increasing on: $(-2, 0)$
decreasing on: $(0, 2)$
local min: none
local max: $x = 0$

critical points:
increasing on:
decreasing on:
local min:
local max:

26. (a) there's a global max at $t = 10$, and $s'(10) = 0$
(b) positive
(c) negative
(d) false

28. d, final answer

32. (a) $(-\infty, 0)$, $(0, 1)$, and $(2, \infty)$
(b) (1,2)
(c) 0,1,2
(d) $x = 1$
(e) $x = 2$

48. There's a global min at $x = \frac{1}{2}$.

Exercises 4.2

4. (d)

14. (e)

16. (j)

22. concave down on $(-\infty, -2)$
concave up on $(-2, \infty)$
no inflection point

32. concave down on $(-\infty, 0)$
concave up on $(0, \infty)$
inflection point at $x = 0$

40. $x = e^{-1/2}$ is a critical point and local minimum, with $f(e^{-1/2}) = -\frac{1}{2e}$.

42. $x = 0$ is a critical point and local minimum, with $f(0) = 0$, and a local maximum at $x = 2$ with value $f(2) = 4e^{-2}$.

46. (a) global maximum: $t = 2$ (i.e. the 2nd day)
(b) $r(t)$ is increasing, concave up on (0,2), and concave down on (2,4)
inflection point: $t = 2$

48. $x = 0$ is a critical point and local maximum. (Note: $f''(0) = 0$, so the second derivative test is inconclusive.)
$x = 2$ is a critical point and local minimum (using $f''(2) > 0$).

52. (a) global max: 1999
global min: 1940
(b) concave down: 1913 to 1940, and 1940 to 1970
concave up: 1970 to 1999
(c) inflection point: 1970

Exercises 4.3

16. Domain: $x \neq 3/2$

Vertical asymptote: $x = 3/2$

Horizontal asymptote: $y = 1/2$

Local or global extrema: none

Inflection point: none

20. Domain: $-\infty < x < \infty$

Symmetry: about the y-axis

Horizontal asymptote: $y = 1$

Global minimum at $(0, 0)$

Inflection points at

$\left(-\frac{2}{\sqrt{3}}, \frac{1}{4}\right), \left(\frac{2}{\sqrt{3}}, \frac{1}{4}\right)$

Exercises 4.4

2. There is a global maximum at $x = 0$ with maximum value $f(0) = 0$.
There is a global minimum at $x = 2$ with minimum value $f(2) = -16$.

4. There is a global maximum at $x = 1$ with maximum value $f(1) = 5$.
There is a global minimum at $x = -\frac{1}{2}$ with minimum value $f\left(-\frac{1}{2}\right) = \frac{11}{4}$.

6. There is a global maximum at $x = 2$ with maximum value $f(2) = 1/4$.
There is a global minimum at $x = -2$ with minimum value $f(-2) = -1/4$.

8. There is a global maximum at $x = 2$ with maximum value $f(2) = 8$.
There is a global minimum at $x = 1$ with minimum value $f(1) = -9$.

28. There is a global maximum at $x = 0$ with the maximum value $f(0) = -1$.
There is no global minimum.

Exercises 4.5

2. The price of 200 will maximize the revenue.

4. The company should charge \$19.50 per passenger to maximize its revenue.

8. The optimal time for the eggs to be laid is 1.25 weeks after the winter solstice.

12. The dimensions of the printed area are $x = 12$ and $y = 180/12 = 15$.

24. 1000.

28. The distance from A to P is $\sqrt{2}/2$.