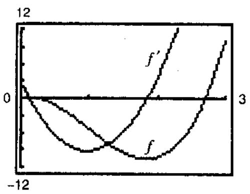
63. 

(0.11, 0.14), (1.84, −10.49)

65. False. Let $f(x) = x$ and $g(x) = x + 1$.

SECTION 2.3 *(page 116)*

Prerequisite Review

1. 3 **2.** −7 **3.** $y' = 8x - 2$

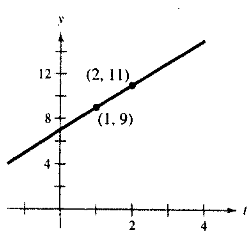
4. $y' = -9t^2 + 4t$ **5.** $s' = -32t + 24$

6. $y' = -32x + 54$ **7.** $A' = -\frac{3}{5}r^2 + \frac{3}{5}r + \frac{1}{2}$

8. $y' = 2x^2 - 4x + 7$ **9.** $y' = 12 - \dfrac{x}{2500}$

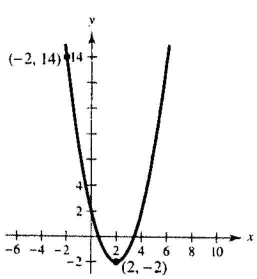
10. $y' = 74 - \dfrac{3x^2}{10,000}$

1. (a) \$11 billion per year (b) \$7 billion per year
(c) \$6 billion per year (d) \$16 billion per year
(e) \$9.5 billion per year (f) \$10.4 billion per year

3. 

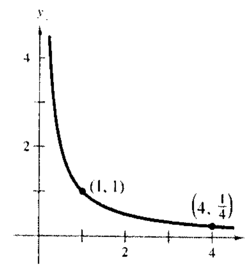
Average rate: 2

Instantaneous rates: $f'(1) = 2, f'(2) = 2$

5. 

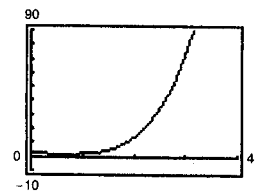
Average rate: −4

Instantaneous rates: $h'(-2) = -8, h'(2) = 0$

7. 

Average rate: $-\frac{1}{4}$

Instantaneous rates: $f'(1) = -1, f'(4) = -\frac{1}{16}$

9. 

Average rate: 36

Instantaneous rates: $g'(1) = 2, g'(3) = 102$

11. (a) −500

The number of visitors to the park is decreasing at an average rate of 500 hundred thousand people per month from September to December.

(b) Answers will vary. The instantaneous rate of change at $t = 8$ is approximately 0.

13. (a) Average rate: $\frac{11}{27}$

Instantaneous rates: $E'(0) = \frac{1}{3}, E'(1) = \frac{4}{9}$

(b) Average rate: $\frac{11}{27}$

Instantaneous rates: $E'(1) = \frac{4}{9}, E'(2) = \frac{1}{3}$

(c) Average rate: $\frac{5}{27}$

Instantaneous rates: $E'(2) = \frac{1}{3}, E'(3) = 0$

(d) Average rate: $-\frac{7}{27}$

Instantaneous rates: $E'(3) = 0, E'(4) = -\frac{5}{9}$

15. (a) −80 feet per second

(b) $s'(2) = -64$ feet per second,
$s'(3) = -96$ feet per second

(c) $\dfrac{\sqrt{555}}{4} \approx 5.89$ seconds

(d) $-8\sqrt{555} \approx -188.5$ feet per second

17. 1.47 dollars **19.** $470 - 0.5x$ dollars, $0 \le x \le 940$

21. $50 - x$ dollars **23.** $-18x^2 + 16x + 200$ dollars

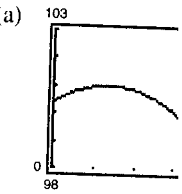
25. $-4x + 72$ dollars **27.** $-0.0005x + 12.2$ dollars

29. (a) \$0.58 (b) \$0.60

(c) The results are nearly the same.

31. (a) \$4.95 (b) \$

(c) The results are

33. (a) 

(b) For $t < 4$, inc
when fever is g

(c) $T(0) = 100.4$
$T(4) = 101$
$T(8) = 100.4$
$T(12) = 98.6$

(d) $T'(t) = -0.075$.
The rate of chan

(e) $T'(0) = 0.3$
$T'(4) = 0$
$T'(8) = -0.3$
$T'(12) = -0.6$

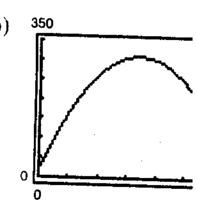
35. (a) $R = 5x - 0.001$.

(b) $P = -0.001x^2 +$

(c)

x	600
dR/dx	3.8
dP/dx	2.3
P	1705

37. (a) $P = -0.0025x^2$

(b) 

When $x = 200$, sl
When $x = 400$, sl

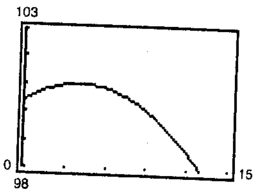
(c) $P'(200) = 0.7$
$P'(400) = -0.3$

39. (a) $P = -\dfrac{1}{6000}x^2 +$

31. (a) \$4.95 (b) \$5.00

(c) The results are nearly the same.

33. (a)



(b) For $t < 4$, increasing; for $t > 4$, decreasing; shows when fever is going up and down.

(c) $T(0) = 100.4$

$T(4) = 101$

$T(8) = 100.4$

$T(12) = 98.6$

(d) $T'(t) = -0.075t + 0.3$

The rate of change of temperature

(e) $T'(0) = 0.3$

$T'(4) = 0$

$T'(8) = -0.3$

$T'(12) = -0.6$

35. (a) $R = 5x - 0.001x^2$

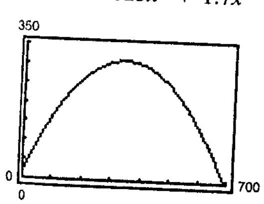
(b) $P = -0.001x^2 + 3.5x - 35$

(c)

x	600	1200	1800	2400	3000
dR/dx	3.8	2.6	1.4	0.2	−1
dP/dx	2.3	1.1	−0.1	−1.3	−2.5
P	1705	2725	3025	2605	1465

37. (a) $P = -0.0025x^2 + 1.7x - 20$

(b)



When $x = 200$, slope is positive.

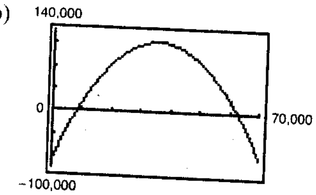
When $x = 400$, slope is negative.

(c) $P'(200) = 0.7$

$P'(400) = -0.3$

39. (a) $P = -\dfrac{1}{6000}x^2 + 11.8x - 85{,}000$

(b)



When $x = 18{,}000$, slope is positive.

When $x = 36{,}000$, slope is negative.

(c) $P'(18{,}000) = 5.8$ dollars

$P'(36{,}000) = -0.2$ dollars

41. (a) \$0.33 per unit (b) \$0.13 per unit

(c) \$0 per unit (d) \$−0.08 per unit

$p'(2500) = 0$ indicates that $x = 2500$ is the optimal value of x. So, $p = \dfrac{50}{\sqrt{x}} = \dfrac{50}{\sqrt{2500}} = \$1.00$.

43. (a) $\approx$ 4.7 miles per year

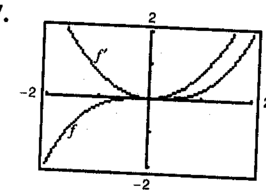
(b) $\approx$ 3.5 miles per year

(c) $\approx$ 3.85 miles per year

45. (a) The rate of change of the number of gallons of gasoline sold when the price is \$1.479 per gallon.

(b) In general, the rate of change when $p = 1.479$ should be negative.

47.



f has a horizontal tangent at $x = 0$.

49. The population in each phase is increasing. During the acceleration phase the population's growth is the greatest, so the slopes of the tangent lines are greater than the slopes of the tangent lines during the lag phase and the deceleration phase. Possible reasons for the changing rates could be seasonal growth and food supplies.

SECTION 2.4 *(page 128)*

Prerequisite Review

1. $2(3x^2 + 7x + 1)$ **2.** $4x^2(6 - 5x^2)$

3. $8x^2(x^2 + 2)^3 + (x^2 + 4)$

4. $(2x)(2x + 1)[2x + (2x + 1)^3]$

5. $\dfrac{23}{(2x + 7)^2}$ **6.** $-\dfrac{x^2 + 8x + 4}{(x^2 - 4)^2}$