b) $(x - y)(x + y)(x^4 + x^2y^2 + y^4)$
c) Both methods produce factors of $(x - y)$ and $(x + y)$; however, the other factors are different. Since the two factorizations must be equal to each other, this means that $(x^4 + x^2y^2 + y^4)$ must be equal to $(x^2 + xy + y^2)(x^2 - xy + y^2)$.

Chapter Self-Test, p. 186

1. a) $f(x) = a_nx^n + a_{n-1}x^{n-1} + \ldots + a_1x + a_0$, where $a_0, a_1, \ldots, a_n$ are real numbers and n is a whole number. The degree of the function is n; the leading coefficient is a_n.
b) $n - 1$
c) n
d) odd degree function
e) even degree function with a negative leading coefficient

2. $y = (x + 4)(x + 2)(x - 2)$

3. a) $(x - 9)(x + 8)(2x - 1)$
b) $(3x - 4)(3x^2 + 9x + 79)$

4. more zeros

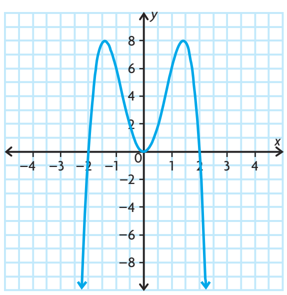
5. $-5 < x < -3$; $x > 1$

6. yes

7. a) $y = 5(2(x - 2))^3 + 4$
b) (2.5, 9)

8. $x + 5$

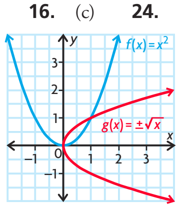
9. $a = -2$; zeros at 0, -2, and 2.



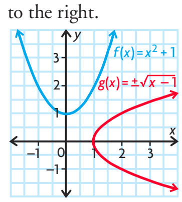
Cumulative Review Chapters 1–3, pp. 188–191

1.	(b)	**9.**	(c)	**17.**	(a)	**25.**	(c)
2.	(a)	**10.**	(d)	**18.**	(d)	**26.**	(c)
3.	(c)	**11.**	(a)	**19.**	(b)	**27.**	(d)
4.	(b)	**12.**	(a)	**20.**	(c)	**28.**	(b)
5.	(b)	**13.**	(c)	**21.**	(b)	**29.**	(c)
6.	(d)	**14.**	(d)	**22.**	(b)	**30.**	(c)
7.	(d)	**15.**	(c)	**23.**	(b)	**31.**	(c)
8.	(a)	**16.**	(c)	**24.**	(a)		

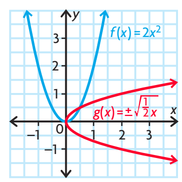
32. a)



b) Answers may vary. For example, vertical translation up produces horizontal translation of the inverse to the right.



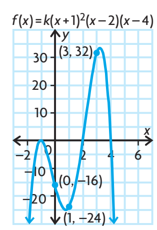
Vertical stretch produces horizontal stretch of inverse.



c) Answers may vary. For example, if the vertex of the inverse is (a, b), restrict the value of y to either $y \geq b$ or $y \leq b$.

33. Answers may vary. For example, average rates of change vary between -2 and 4, depending on the interval; instantaneous rates of change are 9 at $(0, 1)$, 0 at $(1, 5)$, -3 at $(2, 3)$, 0 at $(3, 1)$, 9 at $(4, 5)$; instantaneous rate of change is 0 at maximum $(1, 5)$ and at minimum $(3, 1)$.

34. a) $f(x) = -2(x + 1)^2(x - 2)(x - 4)$
b) $p = 32$
c) As $x \rightarrow \pm\infty$, $f(x) \rightarrow -\infty$; zeros: -1, 2, and 4
d) -16
e)



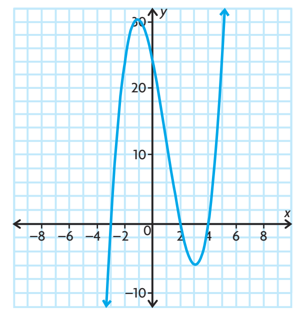
Chapter 4

Getting Started, pp. 194–195

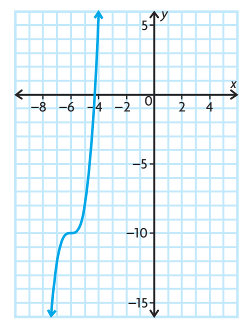
1. a) 3   c) 1
b) 5   d) $\frac{64}{11}$

2. a) $x(x + 6)(x - 5)$
b) $(x - 4)(x^2 + 4x + 16)$
c) $3x(2x + 3)(4x^2 - 6x + 9)$
d) $(x + 3)(x - 3)(2x + 7)$

3. a)



b)



4. 2 and 5

5. a) 3 and -3 c) $-\frac{2}{3}$ and $\frac{5}{2}$
b) -10 and 2   d) 0.3452 and -4.345

6. a) (3, 7); Answers may vary. For example, the change in distance over time from $t = 3$ to $t = 7$ is greater than at other intervals of time.
b) $\frac{1}{3}$ m/s; $\frac{3}{4}$ m/s
c) Answers may vary. For example, away; Erika's displacement, or distance from the sensor, is increasing.

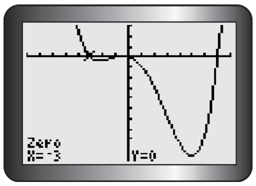
7. a) 2 s
b) 4.75 m/s
c) -10.245 m/s

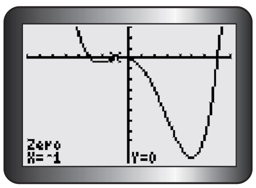
8. a) Disagree; You could use the quadratic formula to solve $y = x^3 + 4x^2 + 3x$ because it equals $x(x^2 + 4x + 3)$.
b) Disagree; $y = (x + 3)^2(x - 2)$ is a cubic equation that will have two roots.
c) Disagree; The equation $y = x^3$ will only pass through two quadrants.
d) Agree; All polynomials are continuous and all polynomials have a y-intercept.
e) Disagree; $f(-3) = 9$
f) Agree; The instantaneous rates of change will tell you whether the graph is increasing, decreasing, or not changing at those points.

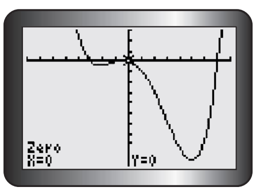
Lesson 4.1, pp. 204–206

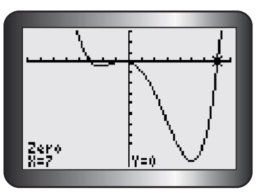
1. a) 0, 1, -2, 2   d) -6, $\frac{5}{2}$
b) $-\frac{3}{2}$, $\frac{5}{4}$, -7 e) 0, -3, 3
c) 3, -5, 4   f) -5, -2, 6

2. a) $0, -3, 3$
   b) ± 3
   c) $0, 2, -2, -\frac{5}{3}$
   d) $0, \frac{2}{5}, 3$
   e) $-3\sqrt[3]{3}$
   f) $0, \pm 2\sqrt{6}$
3. a) $6, -1, \frac{7}{2}$
   b) $2x^3 - 17x^2 + 23x + 42 = 0$ or $(x - 6)(x + 1)(2x - 7)$
4. Algebraically:
   $x = -1, -3, 7, 0$
   Graphically:

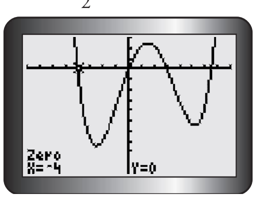


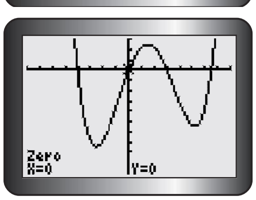


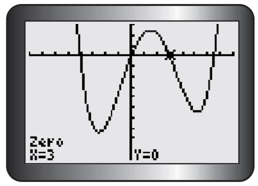


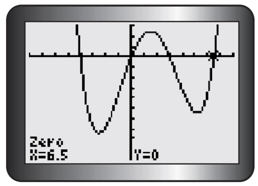


5. $0, 3, -4, \frac{13}{2}$

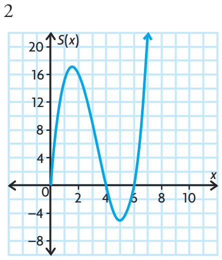




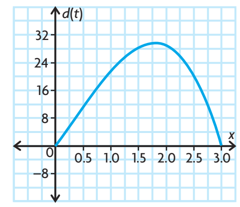




6. a) $0, 2, -5$
   b) $-1, 17$
   c) 2
   d) $0, -2, -5, 5$
   e) $0, -3, 4$
   f) -1
7. a) $-3, 6, 5$
   b) $1, -2, -3, -5$
   c) $-1, \frac{1}{2}, 3$
   d) $-1, \frac{3}{2}, -2$
   e) $2, -4, \frac{1}{2}, \frac{5}{2}$
   f) $\frac{1}{2}, \frac{5}{3}, \frac{3}{2}$
8. a) $-3, 1, 2$
   b) $-2, -1.24, 1, 7.24$
   c) $-2, 1$
   d) $-3, 0, 2$
   e) $-0.86, 1.8, 2.33$
   f) $-2.71, -0.16$
9. a) $3, -2, 5$
   b) $0, 2, \frac{4}{3}$
   c) $2, -2, -\frac{1}{3}, \frac{5}{2}$
   d) $0, 3$
10. 3, 4.92; either 3 cm by 3 cm or 4.92 cm by 4.92 cm.
11. a) 4 and 6
    b) 5
    c) 2
    d)



This is not a good model to represent Maya's score because the graph is shown for real numbers, but the number of games can only be a whole number.
12. 22.59 s
13. a) $d(t) = -3t(t + 2)(t - 3)$
    b) 3 h after departure
    c) -2, because time cannot be negative
    d)



    e) 1.8 h after departure
14. a) $0 \leq t \leq 5$
    b) Answers may vary. For example, because the function involves decimals, graphing technology would be the better strategy for answering the question.
    c) 0.25 L
15. All powers are even, which means every term is positive for all real numbers. Thus, the polynomial is always positive.
16. For $x = 1$, the left side is -48.
    For $x = -1$, the left side is -12.
17. a) Answers may vary. For example, $x^3 + x^2 - x - 1 = 0$; $F(1) = 0$, so it is simple to solve using the factor theorem.
    b) Answers may vary. For example, $x^2 - 2x = 0$; The common factor, x, can be factored out to solve the equation.
    c) Answers may vary. For example, $x^3 - 2x^2 - 9x + 18$; An x can be factored out of the first two terms and a -2 out of the second two terms leaving you with the factors $(x - 2)(x^2 - 9)$.
    d) Answers may vary. For example, $10x^2 - 7x + 1 = 0$; The roots are fractional, which makes using the quadratic formula the most sensible approach.
    e) $x^3 - 8 = 0$; This is the difference of two cubes.
    f) $0.856x^3 - 2.74x^2 + 0.125x - 2.89 = 0$; The presence of decimals makes using graphing technology the most sensible strategy.
18. a) $0 = x^4 + 10$. x^4 is non-negative for all real x, so $x^4 + 10$ is always positive.
    b) A degree 5 polynomial function $y = f(x)$ has opposite end behaviour, so somewhere in the middle it must cross the x-axis. This means its corresponding equation $0 = f(x)$ will have at least one real root.
19. $y = x^5 + x + 1$; By the factor theorem, the only possible rational zeros are 1 and -1. Neither works. Because the degree is odd, the polynomial has opposite end behaviour, and hence must have at least one zero, which must be irrational.

Lesson 4.2, pp. 213–215

1. **a)** $x \leq 4$; $\{x \in \mathbf{R} \mid x \leq 4\}$
b) $x < 7$; $\{x \in \mathbf{R} \mid x < 7\}$
c) $x < -5$; $\{x \in \mathbf{R} \mid x < 5\}$
d) $x \geq -3$; $\{x \in \mathbf{R} \mid x \geq -3\}$
e) $x > -10$; $\{x \in \mathbf{R} \mid x > -10\}$
f) $x \geq 7$; $\{x \in \mathbf{R} \mid x \geq 7\}$

2. **a)** $x \in [-3, \infty)$
b) $x \in \left(-\infty, -\frac{2}{3}\right)$
c) $x \in [18, \infty)$
d) $x \in [1, \infty)$
e) $x \in (-\infty, 0)$
f) $x \in [-10, \infty)$

3. $-1 \leq x < 6$

4. **a)** yes **c)** no **e)** yes
b) no **d)** no **f)** no

5. **a)** $x \leq 7$ **c)** $x < -10$ **e)** $x < 6$
b) $x < 0$ **d)** $x \geq 5$ **f)** $x \geq \frac{7}{5}$

6. **a)** yes **c)** no **e)** yes
b) yes **d)** no **f)** no

7. **a)** $-6 < x < 2$
b) $4 < x < 8$
c) $-4 \leq x \leq 10$
d) $-7 \leq x \leq -4$
e) $7 < x < 9$
f) $-3 \leq x \leq -\frac{1}{2}$

8. **a)** Answers may vary. For example, $3x + 1 > 9 + x$
b) Answers may vary. For example, $3x + 1 \leq 4 + x$

9. **a)** $\{x \in \mathbf{R} \mid -6 \leq x \leq 4\}$
b) $-13 \leq 2x - 1 \leq 7$

10. Attempting to solve $x - 3 < 3 - x < x - 5$ yields $3 > x > 4$, which has no solution. Solving $x - 3 > 3 - x > x - 5$ yields $3 < x < 4$.

11. **a)** $\frac{1}{2}x + 1 < 3$
b) $x < 4$
c) $\frac{1}{2}x + 1 < 3$

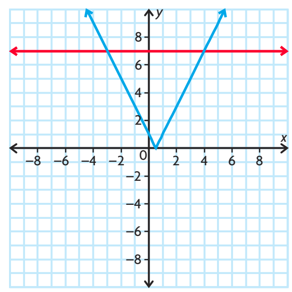
$$\frac{1}{2}x < 2$$
$$x < 4$$

12. **a)** $18 \leq \frac{5}{9}(F - 32) \leq 22$
b) $64.4 \leq F \leq 71.6$

13. 18 min

14. **a)** $\frac{9}{5}C + 32 = F$
b) $C > -40$

15. **a)**



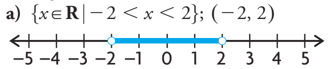
b) $-3 < x < 4$

16. The solution will always have an upper and lower bound due to the manner in which the inequality is solved. The only exception to this is when there is no solution set.

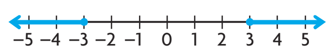
17. **a)** Isolating x is very hard.
b) A graphical approach as described in the lesson yields a solution of $x > 2.75$ (rounded to two places).

18. **a)** Maintained
b) Maintained if both positive; switched if both negative; varies if one positive and one negative.
c) Maintained
d) Switched
e) Switched unless one is positive and the other is negative, in which case it is maintained. (If either side is zero, it becomes undefined.)
f) Maintained, except that $<$ and $>$ become $\leq$ and $\geq$, respectively.
g) Maintained, but it is undefined for negative numbers.

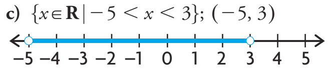
19. **a)** $\{x \in \mathbf{R} \mid -2 < x < 2\}$; $(-2, 2)$



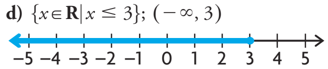
b) $\{x \in \mathbf{R} \mid -3 \leq x \geq 3\}$; $(-\infty, -3)$ or $(3, \infty)$



c) $\{x \in \mathbf{R} \mid -5 < x < 3\}$; $(-5, 3)$



d) $\{x \in \mathbf{R} \mid x \leq 3\}$; $(-\infty, 3)$



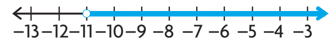
Mid-Chapter Review, p. 218

1. **a)** $0, \frac{5}{2}, 4$ **d)** $-4, 6, 5, -5$
b) -2 **e)** $0, -2, -9$
c) $1, -2, 5$ **f)** $3, -3, 2, -2$

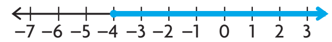
2. **a)** $h(t) = -5t^2 + 3t + 24.55$
b) 24.55 m
c) 2.5 s after jumping
d) $t > 2.5$ s; Jude is below sea level (in the water)

3. either 10 cm by 10 cm or 1.34 cm by 1.34 cm

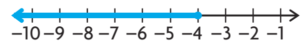
4. **a)** $x > -11$



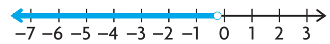
b) $x \geq -4$



c) $x \leq -4$



d) $x < -\frac{1}{3}$



5. $x \in [-2, 6)$

6. **a)** Answers may vary. For example, $2x + 1 > 15$
b) Answers may vary. For example, $4x - 1 < -33$
c) Answers may vary. For example, $-3 \leq 2x - 1 \leq 13$
d) Answers may vary. For example, $x - 2 \leq 3x - 8$

7. **a)** $f(x) = -x + 1$; $g(x) = 2x - 5$
b) $x > 2$
c)

$$f(x) < g(x)$$
$$-x + 1 < 2x - 5$$
$$-3x < -6$$
$$x > 2$$

8. **a)** $N(t) = 20 + 0.02t$; $M(t) = 15 + 0.03t$
b) $20 + 0.02t > 15 + 0.03t$
c) $0 \leq t < 500$
d) Negative time has no meaning.

Lesson 4.3, pp. 225–228

1. **a)** $-2 \leq x \leq -1$ or $x \geq 3$
b) $-3 < x < 2$ or $x > 4$
c) $x < -\frac{2}{5}$ or $\frac{3}{4} < x < 3$
d) $-\frac{1}{4} \leq x \leq \frac{5}{2}$ or $x \geq 5$

2. **a)** $(-\infty, -5]$, $[-2, 0]$, and $[3, \infty)$
b) $x = 1$
c) $[-7, -3]$ and $[0, 4]$
d) $(-\infty, -4]$ and $[2, 7]$

3. $-1 < x < 2$ or $x > 3$

4. $-1.14 < x < 3$ and $x > 6.14$

5. **a)** $(-1, 2)$, $(4, \infty)$
b) $(-2, 2)$, $(2, \infty)$
c) $(-\infty, -2)$, $(0, 1)$
d) $(-\infty, 2)$, $(2, \infty)$

6. **a)** $x < -1$ or $x > 1$
b) $-3 < x < 4$
c) $x \leq -\frac{1}{2}$ or $x \geq 5$
d) $-7 < x < 0$ or $x > 2$
e) $-\frac{3}{2} < x < 3$ or $x > 3$
f) $-4 \leq x \leq \frac{3}{2}$

Answers

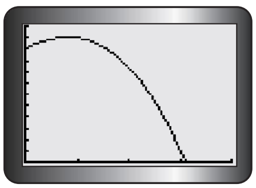
7. **a)** $x \le -1$ or $x \ge 7$
b) $0 < x < 2$
c) $x \le -3$ or $-2 \le x \le 1$
d) $x < -2$, $-1 < x < 1$ or $x > 2$
e) $x \le -1$ or $0 \le x \le 3$
f) $-1 < x < -\frac{1}{2}$ or $x > 2$

8. $(-1, 1)$ and $(2, \infty)$

9. **a)** $x^3 + 11x^2 + 18x = 0$
b) Any values of x for which the graph of the corresponding function is above the x-axis ($y = 0$) are solutions to the original inequality.
c) $-9 < x < -2$ or $x > 0$

10. $f(x) = -3(x + 2)(x - 1)(x - 3)^2$

11. **a)**



b) $0 < v < 154.77$ °C
c) 133.78 °C to 139.56 °C

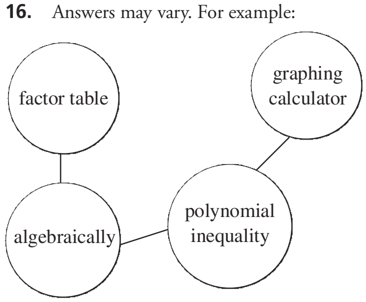
12. **a)** 14 m **b)** 3.3 s **c)** $0.3 < t < 2.1$ **d)** 1.8 s

13. $V(x) = x(50 - 2x)(30 - 2x)$; $5 < x < 7.19$

14. **a)** Since all the powers are even and the coefficients are positive, the polynomial on the left is always positive.
b) Since all the powers are even and all the coefficients are negative (once all terms are brought to the left), the polynomial on the left is always negative.

15. You cannot divide by a variable expression because you do not know whether it is positive, negative, or zero.
The correct solution is $x < -1$ or $x > 4$.

16. Answers may vary. For example:



17. **a)** $-4 < x < -3$ or $-2 < x < 3$
b) $-1 < x < 0$ or $x > 5$

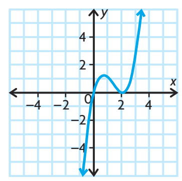
18. $x < -1$ or $x > 2$

Lesson 4.4, pp. 235–237

1. **a)** positive on (0, 1), (4, 7), (10, 15.5), (19, 20); negative on (1, 4), (7, 10), (15.5, 19); zero at $x = 1, 4, 7, 10,$ 15.5, and 19
b) A positive slope means the cyclist's elevation is increasing, a negative slope means it is decreasing, and a zero slope means the cyclist's elevation is transitioning from increasing to decreasing or vice versa.

2. **a)** **i)** 6 **ii)** 12 **iii)** 18
b) about 12
c) The graph is increasing on (2, 6).
d) -6
e) about -6

3. **a)** about 0
b) It indicates that $x = 2$ is a turning point in the graph.
c)

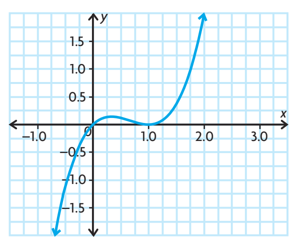


4. **a)** 3
b) Answers may vary. For example, $x = 4.5, 3$.

5. **a)** 3 **b)** 17 **c)** $-\frac{1}{10}$ **d)** -7 **e)** $\frac{28}{3}$ **f)** 0

6. **a)** 3 **b)** about 14 **c)** about $-\frac{1}{9}$ **d)** about -6 **e)** about 5.5 **f)** 0

7.



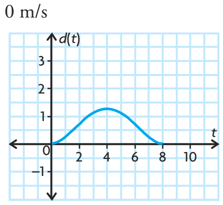
Rate of change is positive on $\left(-\infty, \frac{1}{3}\right)$ and $(1, \infty)$, negative on $\left(\frac{1}{3}, 1\right)$, and zero at $x = \frac{1}{3}$ and 1.

8. **a)** -55 m/s
b) about -20 m/s

9. **a)** about 2
b) -2
c) $y = 2x - 4$

10. **a)** about 10 m/s
b) about -50 m/s
c) 0 m/s

11. **a)**



The rate is positive for $t \in (0, 4)$, negative for $t \in (4, 8)$, and zero at $t = 0$, 4 and 8.
b) When the rate of change is zero, the boat stops.
c) When the rate of change is negative, the boat is headed back to the dock.

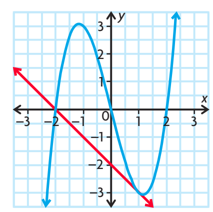
12. At $(-3, 0)$, instantaneous rate $\doteq -96$; at (1, 0), instantaneous rate $\doteq 0$; at (3, 0), instantaneous rate $\doteq 24$; at $(-1, 0)$, instantaneous rate $\doteq 24$

13. **a)** about 5 **b)** $2x + 3 + h$ **c)** $2x + 3$ **d)** $2(1) + 3 = 5$

14. When the instantaneous rate of change is zero, the function potentially has a local maximum or a local minimum. If the rate is positive to the left and negative to the right, it has a local maximum. If the rate is negative to the left and positive to the right, it has a local minimum.

15. **a)** Rate of change and $f(5)$ are both approximately 148.4.
b) Answers may vary. For example, the instantaneous rate of change at $x = 1$ is 2.7; at $x = 3$, it is 20.1; and at $x = 4$, it is 54.6.
c) The instantaneous rate of change of e^x for any value of x is e^x.

16. **a)** about -1
b) $y = -x - 2$
c) $(-2, 0)$



17. $x = -0.53, 2.53$

Chapter Review, pp. 240–241

1. **a)** ± 3 **b)** $\frac{1}{2}, -2$ **c)** $0, -2, 1$ **d)** $\pm 1, 2$

2. $0, 2, \frac{2}{3}, \frac{4}{5}$

3. **a)** $f(x) = (x - 1)(x - 2)(x + 1)(x + 2)$ or $f(x) = x^4 - 5x^2 + 4$
b) 48, 3.10

4. 2 cm by 2 cm or 7.4 cm by 7.4 cm

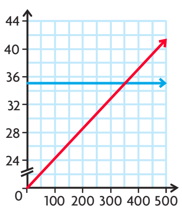
5. **a)** The given information states that the model is valid between 1985 and 1995, so it can be used for 1993, but not 2005.
b) Set $C(t) = 1500$ (since the units are in thousands) and solve using a graphing calculator.
c) Sales reach 1.5 million in the 8th year after 1985, so in 1993.

6. **a)** Answers may vary. For example, $2x + 1 > 17$
b) Answers may vary. For example, $3x - 4 \geq -16$
c) Answers may vary. For example, $2x + 3 \leq -21$
d) Answers may vary. For example, $-19 < 2x - 1 < -3$

7. **a)** $x \in \left(\frac{25}{2}, \infty\right)$
b) $x \in \left[-\frac{23}{8}, \infty\right)$
c) $x \in (-\infty, 2)$
d) $x \in (-\infty, 3]$

8. **a)** $\{x \in \mathbf{R} \mid -2 < x < 4\}$
b) $\{x \in \mathbf{R} \mid -1 \leq x \leq 0\}$
c) $\{x \in \mathbf{R} \mid -3 \leq x \leq 5\}$
d) $\{x \in \mathbf{R} \mid -6 < x < -2\}$

9. **a)** The second plan is better if one calls more than 350 min per month.
b)



10. **a)** $-1 < x < 2$
b) $x \leq -\frac{3}{2}$ or $x \geq 5$
c) $x < -\frac{5}{2}$ or $1 < x < 7$
d) $x \leq -4$ or $1 \leq x \leq 5$

11. negative when $x \in (0, 5)$, positive when $x \in (-\infty, -2), (-2, 0), (5, \infty)$

12. $x \leq -3.81$

13. between January 1993 and March 1994 and between October 1995 and October 1996

14. **a)** average $= 7$, instantaneous $\doteq 8$
b) average $= 13$, instantaneous $\doteq 15$
c) average $= 129$, instantaneous $\doteq 145$
d) average $= -464$, instantaneous $\doteq -485$

15. positive when $-1 < x < 1$, negative when $x < -1$ or $x > 1$, and zero at $x = -1, 1$

16. **a)** $t \doteq 2.2$ s
b) -11 m/s
c) about -22 m/s

17. **a)** about 57.002
b) about 56.998
c) Both approximate the instantaneous rate of change at $x = 3$.

18. **a)** male:
$f(x) = 0.001x^3 - 0.162x^2 + 3.394x + 72.365$;
female:
$g(x) = 0.0002x^3 - 0.026x^2 + 1.801x + 14.369$
b) More females than males will have lung cancer in 2006.

c) The rate was changing faster for females, on average. Looking only at 1975 and 2000, the incidence among males increased only 5.5 per 100 000, while the incidence among females increased by 31.7.
d) Between 1995 and 2000, the incidence among males decreased by 6.1 while the incidence among females increased by 5.6. Since 1998 is about halfway between 1995 and 2000, an estimate for the instantaneous rate of change in 1998 is the average rate of change from 1995 to 2000. The two rates of change are about the same in magnitude, but the rate for females is positive, while the rate for males is negative.

Chapter Self-Test, p. 242

1. $1, \frac{3}{2}, -2$

2. **a)** positive when $x < -2$ and $0 < x < 2$, negative when $-2 < x < 0$ and $x > 2$, and zero at $-2, 0, 2$
b) positive when $-1 < x < 1$, negative when $x < -1$ or $1 < x$, and zero at $x = -1, 1$
c) -1

3. **a)** Cost with card: $50 + 5n$;
Cost without card: $12n$
b) at least 8 pizzas

4. **a)** $x < \frac{1}{2}$
b) $-2 \leq x \leq 1$
c) $-2 < x < -1$ or $x > 5$
d) $x \geq -3$

5. **a)** 15 m
b) 4.6 s
c) -3 m/s

6. **a)** about 5 **b)** $(1, 3)$ **c)** $y = 5x - 2$

7. Since all the exponents are even and all the coefficients are positive, all values of the function are positive and greater than or equal to 4 for all real numbers x.

8. **a)** $\{x \in \mathbf{R} \mid -2 \leq x \leq 7\}$
b) $-2 < x < 7$

9. 2 cm by 2 cm by 15 cm

Chapter 5

Getting Started, pp. 246–247

1. **a)** $(x - 5)(x + 2)$
b) $3(x + 5)(x - 1)$
c) $(4x - 7)(4x + 7)$
d) $(3x - 2)(3x - 2)$
e) $(a - 3)(3a + 10)$
f) $(2x + 3y)(3x - 7y)$

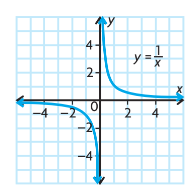
2. **a)** $3 - 2s$
b) $\frac{n^3}{3m}$, $m, n \neq 0$
c) $3x^2 - 4x - 1$, $x \neq 0$
d) $\frac{1}{5x - 2}$, $x \neq \frac{2}{5}$
e) $-\frac{x + 6}{3 + x}$, $x \neq -3, 3$
f) $\frac{a - b}{a - 3b}$, $a \neq -5b, \frac{3b}{2}$

3. **a)** $\frac{7}{15}$
b) $\frac{6}{x}$, $x \neq 0$
c) $\frac{-4x^2 + 20x - 6}{x - 3}$, $x \neq -2, 3$
d) $\frac{x^3 + 2x - 8x}{x^2 - 1}$, $x \neq -1, 0, 1, 3$

4. **a)** $1\frac{11}{21}$
b) $\frac{19x}{12}$
c) $\frac{4 + x}{x^2}$, $x \neq 0$
d) $\frac{3x - 6}{x^2 - 3x}$, $x \neq 0, 3$
e) $\frac{2x + 10 + y}{x^2 - 25}$, $x \neq 5, -5$
f) $\frac{-2a + 50}{(a + 3)(a - 5)(a + 3)}$, $x \neq -3, 4, 5$

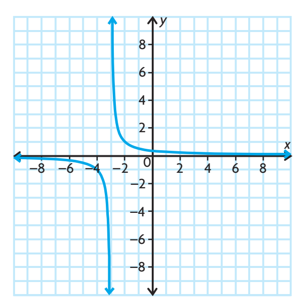
5. **a)** $x = 6$
b) $x = 2$
c) $x = 3$
d) $x = \frac{-12}{7}$

6.



vertical: $x = 0$; horizontal: $y = 0$;
$D = \{x \in \mathbf{R} \mid x \neq 0\}$;
$R = \{y \in \mathbf{R} \mid y \neq 0\}$

7. **a)** translated three units to the left



Answers