Pre-Calculus 11

Roots & Powers

Supplemental Package (Answers)

c) $12t^2 + 13t - 35$

	3t	7
4t	$(4t)(3t) = 12t^2$	$(4t)(7) = 28t$
−5	$(-5)(3t) = -15t$	$(-5)(7) = -35$

6. a) $2p^3 + 3p^2 - 16p + 7$

b) $3e^3 + 6e^2f + 2ef^2 + 4f^3 + 5ef + 10f^2$

c) $-7y^2 + 60yz - 16z^2$

7. a) $(f + 1)(f + 16)$

b) $(c - 2)(c - 11)$

c) $(t + 4)(4t - 7)$

d) $(2r + 5s)^2$

e) $(2x - 5y)(3x - y)$

f) $(h + 5j)(h - 5j)$

8. $6r^3 + 11r^2 + 6r + 1$

9. $8t^2 \pm 25t + 3$; $8t^2 \pm 14t + 3$; $8t^2 \pm 11t + 3$; $8t^2 \pm 10t + 3$

Chapter 4 Roots and Powers, page 202

4.1 Math Lab: Estimating Roots, page 206

1. Answers will vary. For example:

a) $\sqrt{25}$, $\sqrt[3]{19}$, $\sqrt[4]{37}$, $\sqrt[5]{3}$

b) For $\sqrt{25}$, the radicand is 25 and the index is 2.
For $\sqrt[3]{19}$, the radicand is 19 and the index is 3.
For $\sqrt[4]{37}$, the radicand is 37 and the index is 4.
For $\sqrt[5]{3}$, the radicand is 3 and the index is 5.

c) The index tells which root to take.

2. a) 6; 36 = (6)(6)

b) 2; 8 = (2)(2)(2)

c) 10; 1000 = (10)(10)(10)(10)

d) −2; (−2)(−2)(−2)(−2)(−2) = −32

d) $\frac{3}{5}; \left(\frac{3}{5}\right)\left(\frac{3}{5}\right)\left(\frac{3}{5}\right) = \frac{27}{125}$

e) 1.5; (1.5)(1.5) = 2.25

f) 0.5; (0.5)(0.5)(0.5) = 0.125

g) 5; (5)(5)(5)(5) = 625

3. a) 2.8 **b)** 2.1

c) 1.8 **d)** 3.6

e) 2.5 **f)** 2.0

g) 4.4 **h)** 2.7

4. a) The calculator returns an error message; the square of a real number will always be positive.

b) Any non-zero even index

c) i) Any odd index

ii) Any even index

5. a) i) $\sqrt{4}$ **ii)** $\sqrt[3]{8}$

iii) $\sqrt[4]{16}$

b) i) $\sqrt{9}$ **ii)** $\sqrt[3]{27}$

iii) $\sqrt[4]{81}$

c) i) $\sqrt{16}$ **ii)** $\sqrt[3]{64}$

iii) $\sqrt[4]{256}$

d) i) $\sqrt{100}$ **ii)** $\sqrt[3]{1000}$

iii) $\sqrt[4]{10\,000}$

e) i) $\sqrt{0.81}$ **ii)** $\sqrt[3]{0.729}$

iii) $\sqrt[4]{0.6561}$

f) i) $\sqrt{0.04}$ **ii)** $\sqrt[3]{0.008}$

iii) $\sqrt[4]{0.0016}$

6. Answers will vary. For example:

a) $\sqrt[3]{216} = 6$ **b)** $\sqrt[3]{-343} = -7$

c) $\sqrt[4]{\frac{81}{16}} = \frac{3}{2}$ **d)** $\sqrt{17} \doteq 4.1$

4.2 Irrational Numbers, page 211

3. a) Irrational

b) Rational

c) Irrational

d) Rational

e) Irrational

f) Rational

4. a) 7, $\sqrt[3]{27}$

b) −5, 7, $\sqrt[3]{27}$

c) $\frac{4}{3}$, $0.3\overline{4}$, −5, −2.1538, $\sqrt[3]{27}$, 7

d) $\sqrt[4]{9}$

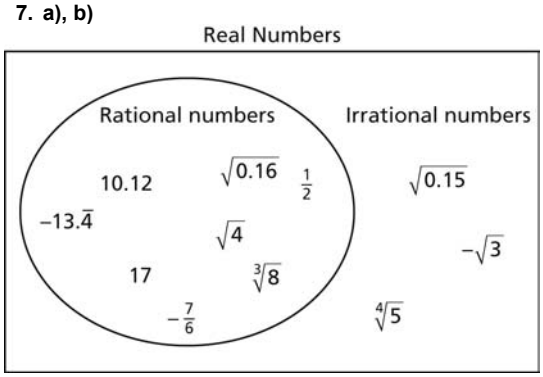
5. a) $\sqrt{49} = 7$; $\sqrt[4]{16} = 2$

b) $\sqrt{21}$ and $\sqrt[3]{36}$ cannot be written as a terminating or repeating decimals.

6. a) Rational

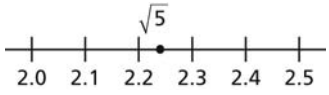
b) Irrational

7. a), b)

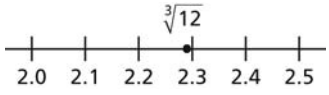


8. The cubes roots of the numbers in parts c and d will be irrational.

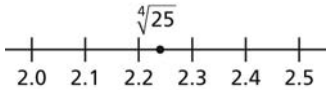
9. a)



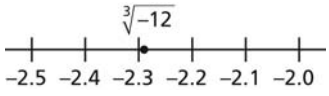
b)



c)



d)



10. a) $\sqrt[3]{400}$, $\sqrt{50}$, $\sqrt[3]{70}$, $\sqrt[4]{100}$

b) $\sqrt{89}$, $\sqrt[3]{150}$, $\sqrt[4]{250}$, $\sqrt[3]{-150}$

11. $\sqrt[3]{98}$, $\sqrt{40}$, $\sqrt[3]{300}$, $\sqrt[3]{500}$, $\sqrt{75}$, $\sqrt{98}$

12. $\frac{-14}{5}$, $\sqrt[3]{-10}$, -2, $\frac{123}{99}$, $\sqrt{4}$;

irrational: $\sqrt[3]{-10}$; rational: $\frac{-14}{5}$, -2, $\frac{123}{99}$, $\sqrt{4}$

13. $\sqrt{5^2+3^2} = \sqrt{34}$, which is an irrational number.

14. a) **i)** True **ii)** True
iii) False **iv)** False
v) True

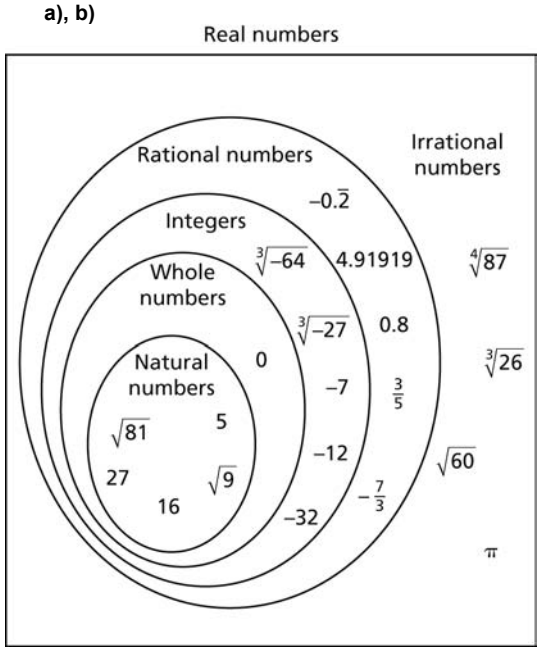
b) **iii)** 0 **iv)** π

15. Answers will vary. For example:

a) **i)** 0.75 **ii)** 0
iii) $\sqrt{7}$

16. Additional numbers may vary. For example:

a), b)

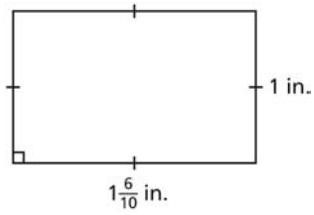


17. Answers may vary. For example:

a) 21 **b)** 125

18. a) 1.6

b)



19. 755:481 is approximately equivalent to 1.6:1, and $\frac{1+\sqrt{5}}{2}$ is approximately 1.6.

20. a) Irrational number

b) Rational number

21. Each prime factor occurs a multiple of n times.

22. Triangles will vary. For example:

a) Side lengths: 3 units, 4 units, 5 units

b) Side lengths: 1 unit, $\sqrt{3}$ units, 2 units

c) Side lengths: 1 unit, $\sqrt{2}$ units, $\sqrt{3}$ units

d) Side lengths: $\sqrt{2}$ units, $\sqrt{3}$ units, $\sqrt{5}$ units

23. a) Yes **b)** No

24. Take rational numbers to the 12th power.

4.3 Mixed and Entire Radicals, page 218

3.

Perfect square	Square root
1	1
4	2
9	3
16	4
25	5
36	6
49	7
64	8
81	9
100	10
121	11
144	12
169	13
196	14
225	15
256	16
289	17
324	18
361	18
400	20

4. a) $2\sqrt{2}$ **b)** $2\sqrt{3}$
c) $4\sqrt{2}$ **d)** $5\sqrt{2}$
e) $3\sqrt{2}$ **f)** $3\sqrt{3}$
g) $4\sqrt{3}$ **h)** $5\sqrt{3}$

5. a) $\sqrt{50}$ **b)** $\sqrt{72}$
c) $\sqrt{98}$ **d)** $\sqrt{128}$
e) $\sqrt{75}$ **f)** $\sqrt{108}$
g) $\sqrt{147}$ **h)** $\sqrt{192}$

6. a)

Perfect cube	Cube root
1	1
8	2
27	3
64	4
125	5
216	6
343	7
512	8
729	9
1000	10

b)

Perfect fourth power	Fourth root
1	1
16	2
81	3
256	4
625	5

9. 25 is a perfect square, but neither 10 nor 5 is a perfect square.

10. a) $3\sqrt{10}$ **b)** Cannot be simplified
c) $6\sqrt{3}$ **d)** $10\sqrt{6}$
e) $3\sqrt{6}$ **f)** Cannot be simplified
g) $2\sqrt{7}$ **h)** Cannot be simplified
i) $4\sqrt{7}$

11. a) $2\sqrt[3]{2}$ **b)** $3\sqrt[3]{3}$
c) $4\sqrt[3]{4}$ **d)** $4\sqrt[3]{2}$
e) Cannot be simplified **f)** $4\sqrt[3]{3}$
g) $3\sqrt[3]{5}$ **h)** Cannot be simplified
i) $5\sqrt[3]{4}$ **j)** $5\sqrt[3]{3}$

12. a) $\sqrt{18}$ **b)** $\sqrt{32}$
c) $\sqrt{180}$ **d)** $\sqrt{150}$
e) $\sqrt{343}$ **f)** $\sqrt[3]{16}$
g) $\sqrt[3]{81}$ **h)** $\sqrt[3]{192}$
i) $\sqrt[3]{250}$ **j)** $\sqrt[3]{72}$

13. a) Yes
b) No

14. $6\sqrt{7}$ ft.

15. $2\sqrt[3]{25}$ cm

16. $12\sqrt{6}$ in.

17. a) $2\sqrt[4]{3}$ **b)** $3\sqrt[4]{5}$
c) $5\sqrt[4]{2}$ **d)** $2\sqrt[4]{11}$

18. a) $\sqrt[4]{3888}$ **b)** $\sqrt[4]{4802}$
c) $\sqrt[5]{972}$ **d)** $\sqrt[5]{3072}$

19. a) $\sqrt{2}$, $\sqrt{3}$, $\sqrt{4}$, $\sqrt{5}$, $\sqrt{6}$, $\sqrt{7}$, $\sqrt{8}$, $\sqrt{9}$, $\sqrt{10}$, $\sqrt{11}$, $\sqrt{12}$, $\sqrt{13}$, $\sqrt{14}$
b) i) The radicands start at 2 and increase by 1 each time.
ii) $\sqrt{51}$
iii) 30

20. $\sqrt[3]{1024}$

21. $4\sqrt{6}$

22. a) $8\sqrt{3}$, $9\sqrt{2}$, $4\sqrt{5}$, $6\sqrt{2}$, $2\sqrt{6}$
b) $8\sqrt{3}$, $6\sqrt{5}$, $4\sqrt{7}$, $2\sqrt{13}$
c) $9\sqrt{2}$, $3\sqrt{17}$, $5\sqrt{6}$, $7\sqrt{3}$, $\sqrt{103}$

23. a) 2, 20, 200;
$\sqrt{4\,000\,000}$, $\sqrt{400\,000\,000}$
b) 3, 30, 300;
$\sqrt{27\,000\,000\,000}$, $\sqrt{27\,000\,000\,000\,000}$
c) $2\sqrt{2}$, $20\sqrt{2}$, $200\sqrt{2}$;
$\sqrt{8\,000\,000}$, $\sqrt{800\,000\,000}$
d) $2\sqrt[3]{3}$, $20\sqrt[3]{3}$, $200\sqrt[3]{3}$;
$\sqrt[3]{24\,000\,000\,000}$, $\sqrt[3]{24\,000\,000\,000\,000}$

24. $4\sqrt{2}$ cm, 32 cm^2; 4 cm, 16 cm^2

25. a) i) 14.142
ii) 141.42
b) i) 2.8284
ii) 4.2426
iii) 5.6568
iv) 7.071

Chapter 4: Checkpoint 1, page 221

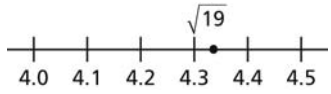
1. a) 9 **b)** –5
c) 4 **d)** 3

2. a) 3.16 **b)** 2.47
c) 1.73 **d)** 1.87

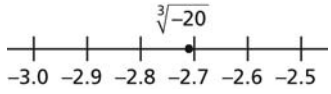
3. Neither

4. a) Irrational **b)** Irrational
c) Irrational **d)** Rational
e) Rational **f)** Irrational

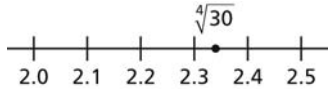
5. a)



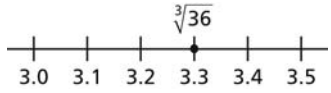
b)



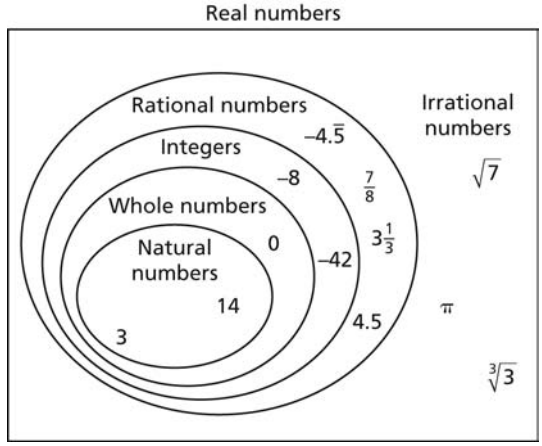
c)



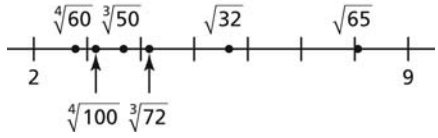
d)



6. a), b) Additional numbers may vary. For example:



7. a)



b) $\sqrt{65}$, $\sqrt{32}$, $\sqrt[3]{72}$, $\sqrt[3]{50}$, $\sqrt[4]{100}$, $\sqrt[4]{60}$

8. Areas of squares may vary. For example:

a)

b)

9. a) $3\sqrt{5}$ **b)** $2\sqrt[3]{12}$

c) Cannot be simplified **d)** $2\sqrt[4]{3}$

e) $2\sqrt[3]{10}$ **f)** Cannot be simplified

11. a) $\sqrt{63}$ **b)** $\sqrt[3]{32}$

c) $\sqrt{147}$ **d)** $\sqrt[4]{192}$

e) $\sqrt[3]{270}$ **f)** $\sqrt{396}$

4.4 Fractional Exponents and Radicals, page 227

3. a) 4 **b)** 6

c) 4 **d)** 2

e) –3 **f)** –10

4. a) 10 **b)** 3

c) 4 **d)** –2

5. a) $\sqrt[3]{36}$ **b)** $\sqrt{48}$

c) $\sqrt[5]{-30}$

6. a) $39^{\frac{1}{2}}$ **b)** $90^{\frac{1}{4}}$

c) $29^{\frac{1}{3}}$ **d)** $100^{\frac{1}{5}}$

7. a) 1 **b)** 2

c) 4 **d)** 8

e) 16 **f)** 32

8. a) $\sqrt[3]{4^2}$, or $\left(\sqrt[3]{4}\right)^2$

b) $\sqrt[5]{(-10)^3}$, or $\left(\sqrt[5]{-10}\right)^3$

c) $\sqrt{2.3^3}$, or $\left(\sqrt{2.3}\right)^3$

9. $\sqrt[3]{350}$ cm, $350^{\frac{1}{3}}$ cm

10. a) $\sqrt[3]{48^2}$, or $\left(\sqrt[3]{48}\right)^2$

b) $\sqrt[3]{(-1.8)^5}$, or $\left(\sqrt[3]{-1.8}\right)^5$

c) $\sqrt{\left(\frac{3}{8}\right)^5}$, or $\left(\sqrt{\frac{3}{8}}\right)^5$

d) $\sqrt[4]{0.75^3}$, or $\left(\sqrt[4]{0.75}\right)^3$

e) $\sqrt[5]{\left(-\frac{5}{9}\right)^2}$, or $\left(\sqrt[5]{-\frac{5}{9}}\right)^2$

f) $\sqrt{1.25^3}$, or $\left(\sqrt{1.25}\right)^3$

11. a) $3.8^{\frac{3}{2}}$, or $3.8^{1.5}$ **b)** $(-1.5)^{\frac{2}{3}}$

c) $\left(\frac{9}{5}\right)^{\frac{5}{4}}$, or $\left(\frac{9}{5}\right)^{1.25}$ **d)** $\left(\frac{3}{8}\right)^{\frac{4}{3}}$

e) $\left(\frac{5}{4}\right)^{\frac{3}{2}}$, or $\left(\frac{5}{4}\right)^{1.5}$ **f)** $(-2.5)^{\frac{3}{5}}$, or $(-2.5)^{0.6}$

12. a) 27 **b)** $\frac{9}{4}$

c) 9 **d)** 0.216

e) 16 **f)** $\frac{8}{125}$

13. a) $4^{\frac{1}{2}}$, $\sqrt{4}$ **b)** $16^{\frac{1}{2}}$, $\sqrt{16}$

c) $100^{\frac{1}{2}}$, $\sqrt{100}$ **d)** $9^{\frac{1}{2}}$, $\sqrt{9}$

e) $25^{\frac{1}{2}}$, $\sqrt{25}$

14. a) $(-1)^{\frac{1}{3}}$, $\sqrt[3]{-1}$ **b)** $8^{\frac{1}{3}}$, $\sqrt[3]{8}$

c) $27^{\frac{1}{3}}$, $\sqrt[3]{27}$ **d)** $(-64)^{\frac{1}{3}}$, $\sqrt[3]{-64}$

e) $64^{\frac{1}{3}}$, $\sqrt[3]{64}$

15. $\left(\frac{1}{4}\right)^{\frac{3}{2}}$, $\sqrt[3]{4}$, $4^{\frac{3}{2}}$, 4^2

16. a) **i)** 64 **ii)** 27

iii) 16 **iv)** 5.9160…

v) 1.331 **vi)** 0.8414…

b) i, ii, iii, v

17. Approximately 76 m

18. 2.744

19. Approximately 1.3 m^2

20. a) Approximately 93%
b) Approximately 81%
c) 5 h

21. Mars; period of Earth: approximately 363.8 Earth days; period of Mars: approximately 688.5 Earth days

22. Karen

4.5 Negative Exponents and Reciprocals, page 233

3. a) $\frac{1}{5^4} = 5^{-4}$ **b)** $\left(-\frac{1}{2}\right)^{-3} = (-2)^3$

c) $\frac{1}{3^{-2}} = 3^2$ **d)** $\frac{1}{4^{-2}} = 4^2$

4. a) 16, $\frac{1}{16}$ **b)** 16, $\frac{1}{16}$

c) 6, $\frac{1}{6}$ **d)** 64, $\frac{1}{64}$

5. $\frac{1}{1024}$

6. a) $\frac{1}{2^3}$

b) $\frac{1}{3^5}$

c) $\frac{1}{(-7)^2}$, or $\frac{1}{7^2}$

7. a) 2^2

b) $\left(\frac{3}{2}\right)^3$

c) $\left(-\frac{5}{6}\right)^4$, or $\left(\frac{5}{6}\right)^4$

8. a) $\frac{1}{9}$ **b)** $\frac{1}{16}$

c) $-\frac{1}{32}$ **d)** 27

e) $\frac{9}{4}$ **f)** 125

9. a) $\frac{1}{2}$ **b)** $\frac{10}{3}$

c) $\frac{1}{3}$ **d)** $-\frac{1}{4}$

e) $\frac{100}{9}$ **f)** $\frac{1}{4}$

g) $\frac{1}{27}$ **h)** 125

10. Answers may vary. For example:

a) 3^{-2}

b) $25^{-\frac{1}{2}}$

c) $\left(\frac{1}{2}\right)^{-2}$

d) $\left(\frac{1}{-27}\right)^{-\frac{1}{3}}$

11. $2651.56

12. $-\frac{3125}{1024}$

13. a) $\frac{1}{81}$ **b)** $\frac{1}{64}$

c) $\frac{1}{4}$ **d)** $\frac{9}{4}$

e) $\frac{8}{27}$ **f)** $\frac{32}{243}$

14. $1266.57

15. Approximately 0.19%

16. 5^{-2}; $\frac{1}{25} > \frac{1}{32}$

17. a) The numbers at the left are divided by 2 each time. The exponents in the powers at the right decrease by 1 each time.

b) $2 = 2^1$; $1 = 2^0$; $\frac{1}{2} = 2^{-1}$; $\frac{1}{4} = 2^{-2}$; $\frac{1}{8} = 2^{-3}$

18. 3^8, or 6561 times as great

19. a) The exponent is positive.
b) The exponent is negative.
c) The exponent is 0.

20. No; if the base is between 0 and 1, the power will be greater than 1. For example: $\left(\frac{1}{2}\right)^{-1} = 2$

21. a) Approximately 2.0×10^{20} N
b) Answers may vary depending on researched values. For example: approximately 1.9×10^{20} N

Chapter 4: Checkpoint 2, page 236

1. a) 2 **b)** 7

c) 16 **d)** $\frac{343}{27}$

e) –32

2. a) i) $\sqrt[3]{35^2}$, or $\left(\sqrt[3]{35}\right)^2$

ii) $\sqrt{32^3}$, or $\left(\sqrt{32}\right)^3$

iii) $\sqrt[5]{(-32)^2}$, or $\left(\sqrt[5]{-32}\right)^2$

iv) $\sqrt{400^3}$, or $\left(\sqrt{400}\right)^3$

v) $\sqrt[3]{-125}$

vi) $\sqrt[3]{\left(\frac{8}{125}\right)^2}$, or $\left(\sqrt[3]{\frac{8}{125}}\right)^2$

b) iii) 4 iv) 8000

v) -5 vi) $\frac{4}{25}$

3. a) $4^{\frac{1}{3}}$

b) $9^{\frac{1}{2}}$, or $9^{0.5}$

c) $18^{\frac{1}{4}}$, or $18^{0.25}$

d) $10^{\frac{3}{2}}$, or $10^{1.5}$

e) $(-10)^{\frac{2}{3}}$

4. Approximately 53 s

5. $\sqrt[3]{3}$, $3^{\frac{2}{3}}$, $\left(\sqrt[3]{3}\right)^4$, $3^{\frac{3}{2}}$, $\left(\sqrt{3}\right)^5$

6. $\sqrt[3]{421\,875}$ mm, $421\,875^{\frac{1}{3}}$ mm, 75 mm

7. a) $\frac{81}{16}$ **b)** 4

c) $\frac{1}{100}$ **d)** 2

e) 100 **f)** 625

8. \$4589.06

4.6 Applying the Exponent Laws, page 241

3. a) x^7 **b)** $\frac{1}{a^3}$

c) b^2 **d)** $\frac{1}{m}$

4. a) 0.5^5 **b)** 0.5^{-1}

c) 0.5^{-1} **d)** 0.5^5

5. a) x^2 **b)** $\frac{1}{x^3}$

c) n **d)** $\frac{1}{a^4}$

6. a) n^6 **b)** $\frac{1}{z^6}$

c) n^{12} **d)** $\frac{1}{c^4}$

7. a) $\left(\frac{3}{5}\right)^{12}$ **b)** $\left(\frac{3}{5}\right)^{-12}$

c) $\left(\frac{3}{5}\right)^{12}$ **d)** $\left(-\frac{3}{5}\right)^{12}$

8. a) $\frac{a^2}{b^2}$ **b)** $\frac{n^6}{m^3}$

c) $\frac{d^8}{c^8}$ **d)** $\frac{4b^2}{25c^2}$

e) a^2b^2 **f)** n^6m^3

g) $\frac{1}{c^{12}d^8}$ **h)** $\frac{x^3}{y^3}$

9. a) x; product of powers law

b) a^{-5}; product of powers law

c) b^3; product of powers law

d) 1; product of powers law

e) $\frac{1}{x^7}$; quotient of powers law

f) s^{10}; quotient of powers law

g) $\frac{1}{b^5}$; quotient of powers law

h) 1; quotient of powers law

10. a) 2.25 **b)** $\frac{9}{16}$

c) 0.36 **d)** 1

e) $\frac{5}{3}$ **f)** $-\frac{3}{8}$

g) $\frac{1000}{343}$ **h)** $\frac{3}{10}$

11. a) x^3y^6 **b)** $\frac{a^4}{4b^4}$

c) $\frac{1}{64m^6n^9}$ **d)** $\frac{16m^8n^{12}}{81}$

12. 10.6 cm

13. 251 ft.^{2}

14. a) $\frac{a^5}{b}$ **b)** $\frac{d^4}{c^2}$

15. a) -32 **b)** $-\frac{1}{8}$

c) $-\frac{1}{32}$ **d)** $\frac{1}{1024}$

16. a) m^2 **b)** $\frac{1}{x^{\frac{5}{4}}}$

c) $-\frac{3b^{\frac{1}{2}}}{a^6}$ **d)** $-\frac{4c^2b^{\frac{1}{6}}}{a^3}$

17. a) $\frac{x^{\frac{5}{2}}}{y^4}$ **b)** $\frac{b}{25a^4}$

19. a) $\frac{m^8}{n^2}$ **b)** $\frac{r^{\frac{1}{2}}}{s^{\frac{5}{4}}}$

20. a) **i)** Dimensions, in millimetres: $\frac{1000}{2^{\frac{7}{4}}}$ by $\frac{1000}{2^{\frac{5}{4}}}$;

297 mm by 420 mm

ii) Dimensions, in millimetres: $\frac{1000}{2^{\frac{9}{4}}}$ by $\frac{1000}{2^{\frac{7}{4}}}$;

210 mm by 297 mm

iii) Dimensions, in millimetres: $\frac{1000}{2^{\frac{11}{4}}}$ by $\frac{1000}{2^{\frac{9}{4}}}$;

149 mm by 210 mm

b) **i)** Dimensions, in millimetres: $\frac{1000}{2^{\frac{9}{4}}}$ by $\frac{1000}{2^{\frac{7}{4}}}$

ii) Dimensions, in millimetres: $\frac{1000}{2^{\frac{11}{4}}}$ by $\frac{1000}{2^{\frac{9}{4}}}$

iii) Dimensions, in millimetres: $\frac{1000}{2^{\frac{13}{4}}}$ by $\frac{1000}{2^{\frac{11}{4}}}$

c) A piece of A4 paper has the same dimensions as a folded piece of A3 paper; a piece of A5 paper has the same dimensions as a folded piece of A4 paper.

21. a) $\frac{a^{16}c^3}{b^7}$ **b)** $\frac{c^{14}}{64a^2b^{10}}$

22. a) $\frac{1}{a^{\frac{10}{9}}}$ **b)** $\frac{1}{a^{\frac{7}{2}}}$

23. For example:

a) $x^1 \cdot x^{\frac{1}{2}}$, $x^{\frac{3}{4}} \cdot x^{\frac{3}{4}}$, $x^2 \cdot x^{-\frac{1}{2}}$

b) $x^2 \div x^{\frac{1}{2}}$, $x^{\frac{5}{2}} \div x^1$, $x^{-1} \div x^{-\frac{5}{2}}$

c) $\left(x^{\frac{1}{2}}\right)^3$, $\left(x^6\right)^{\frac{1}{4}}$, $\left(x^{-\frac{1}{3}}\right)^{-\frac{9}{2}}$

24. $\frac{1}{2}\left(\frac{3}{2}\right)^{\frac{1}{2}}$ cm, or approximately 0.6 cm

Chapter 4: Review, page 246

1. a) 10 **b)** 0.9

c) 2 **d)** $\frac{3}{5}$

2. The index tells which root to take.

3. a) 3.3 **b)** –2.3

c) 2.0

4. a) 25 **b)** 216

c) 2401

5. Neither

6. a) Rational **b)** Rational

c) Rational **d)** Irrational

e) Rational **f)** Rational

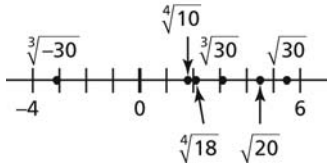
g) Rational **h)** Irrational

i) Irrational

7. Approximately 4.8 cm

8. a) Rational **b)** Irrational

9. $\sqrt[3]{-30}$, $\sqrt[4]{10}$, $\sqrt[4]{18}$, $\sqrt[3]{30}$, $\sqrt{20}$, $\sqrt{30}$



10. 1 s

11. a) $5\sqrt{6}$ **b)** $3\sqrt[3]{5}$

c) $4\sqrt{7}$ **d)** $3\sqrt[4]{2}$

12. a) $\sqrt{180}$ **b)** $\sqrt{126}$

c) $\sqrt[3]{192}$ **d)** $\sqrt[4]{32}$

13. Approximately 1.0 cm

15. $6\sqrt{2}$, $3\sqrt{6}$, $5\sqrt{2}$, $4\sqrt{3}$, $2\sqrt{7}$

17. a) $\sqrt[4]{12}$ **b)** $\sqrt[3]{(-50)^5}$, or $\left(\sqrt[3]{-50}\right)^5$

c) $\sqrt{1.2}$ **d)** $\sqrt[3]{\frac{3}{8}}$

18. a) $1.4^{\frac{1}{2}}$ **b)** $13^{\frac{2}{3}}$

c) $2.5^{\frac{4}{5}}$ **d)** $\left(\frac{2}{5}\right)^{\frac{3}{4}}$

19. a) 2 **b)** 1.2

c) –32 **d)** $\frac{27}{64}$

20. Approximately 35%

21. $\left(\sqrt{5}\right)^3$, $5^{\frac{3}{4}}$, $5^{\frac{2}{3}}$, $\sqrt[3]{5}$, $\sqrt[4]{5}$

22. a) Approximately 7122 Calories/day

b) Approximately 4 Calories/day

23. a) The numbers at the left are divided by 3 each time; the exponents in the powers at the right decrease by 1 each time.

b) $3 = 3^1$; $1 = 3^0$; $\frac{1}{3} = 3^{-1}$; $\frac{1}{9} = 3^{-2}$; $\frac{1}{27} = 3^{-3}$

24. a) $\frac{1}{4}$ **b)** $\frac{27}{8}$

c) $\frac{125}{8}$

25. $908.51

26. 18.0 cm

27. 262 Hz

28. a) $9m^8n^2$ **b)** $\frac{1}{x^4y^6}$

c) $\frac{1}{4ab^3}$ **d)** $\frac{1}{r^{\frac{10}{3}}s^{\frac{2}{3}}}$

29. a) a^2b^5 **b)** $\frac{x^2}{y}$

c) $\frac{1}{a^5}$ **d)** $x^{\frac{3}{2}}y^3$

30. a) $\frac{9}{4}$ **b)** 30.25

c) $\frac{144}{25}$ **d)** 0.4

31. Approximately 6.4 cm

32. a) $s^3t^{\frac{10}{3}}$

b) $\frac{d^9}{64c}$

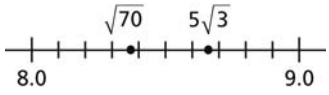
Chapter 4: Practice Test, page 249

1. B

2. A

3. a) $5\sqrt{3}$; $5\sqrt{3} = \sqrt{75}$

b)



4. a) $\frac{4}{3}$ **b)** $\frac{1}{16}$

c) 0.729 **d)** $\frac{1}{4}$

5. $2\sqrt{11}$

6. $\frac{y^5}{x^2}$

7. a) $\frac{1}{p^2q}$ **b)** $\frac{1}{cd^{\frac{1}{3}}}$

8. Approximately 29 L

Cumulative Review Chapters 1–4, page 252

1. 117 m^2

2. 236 $in.^3$

3 a) 5.2 cm **b)** 1 in.

4. 28 ft.

5. 64.2°

6. a) $9\frac{7}{10}$ in. **b)** 4 $in.^2$

7. a) 9; 585

b) 14; 924

c) 3; 3150

d) 2; 4620

8. 8214 $in.^2$

9. a) 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

b) 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000

c) 1, 64, 729

10. a) $3a(5a - 9)$ **b)** $2p(2 + 6p^2 - 3p)$

c) $-2d(4d^3 + 7)$ **d)** $7(3w - 4 + 2w^2)$

e) $2x^2y^2(9x^2 - 2xy + 5y^2)$ **f)** $11np^2(3n^3p + n - 11p^2)$

11. The trinomials that can be represented as a rectangle of algebra tiles can be factored.

a) Can be represented **b)** Cannot be represented

c) Cannot be represented **d)** Can be represented

12. a) $d^2 + 2d - 15$

	d	-3
d	$(d)(d) = d^2$	$(d)(-3) = -3d$
5	$(5)(d) = 5d$	$(5)(-3) = -15$

b) $45 - 14s + s^2$

	9	$-s$
5	$(5)(9) = 45$	$(5)(-s) = -5s$
$-s$	$(-s)(9) = -9s$	$(-s)(-s) = s^2$