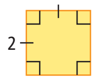
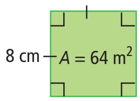
Chapter 3

3.1 Squares and Square Roots, pages 85–87

5. a) $4 = 2 \times 2$ **b)** Yes, the prime factor, 2, appears an even number of times. **c)**



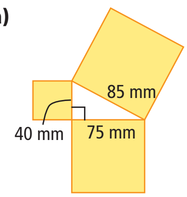
6. a) $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$ **b)** Yes, 64 is a perfect square. The prime factor, 2, appears an even number of times. **c)**



7. a) $42 = 2 \times 3 \times 7$; 42 is not a perfect square.
b) $169 = 13 \times 13$; 169 is a perfect square.
c) $256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$; 256 is a perfect square.
8. a) $144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$; 144 is a perfect square.
b) $60 = 2 \times 2 \times 3 \times 5$; 60 is not a perfect square.
c) $40 = 2 \times 2 \times 2 \times 5$; 40 is not a perfect square.
9. a) 100 square units **b)** 256 square units
10. a) 400 square units **b)** 289 square units
11. a) 81 **b)** 121
12. a) 9 **b)** 324
13. 7 mm
14. 30 cm
15. a) 7 **b)** 8 **c)** 25
16. a) 3 **b)** 5 **c)** 40
17. $54 = 2 \times 3 \times 3 \times 3$; No, 54 is not a perfect square because it has an odd number of factors of 2 and 3.
18. 196 m^2
19. 1360 m
20. a) 36 m^2 **b)** 6 m
21. a) 56 m^2 **b)** Answers may vary. Example: 7 m by 8 m is one set of dimensions for the patio. **c)** No, it is not possible to make a patio with the same area that is a square since 56 is not a perfect square.
22. a) 630 m by 630 m **b)** 395 641 m^2 **c)** 622 m by 622 m *or* 623 m by 623 m *or* 624 m by 624 m *or* 625 m by 625 m *or* 626 m by 626 m *or* 627 m by 627 m.
23. 20 m
24. a) 10, 15, 21 **b)** The sum of any two consecutive triangular numbers is a perfect square.
25. a) 12 cm **b)** 1296 cm^2 **c)** 9 times **d)** 3 times **e)** To find the number of times the side length is enlarged, calculate the square root of the times that the area has been enlarged.
26. a) perfect squares: 100 and 10 000 **b)** $\sqrt{100} = 10$ and $\sqrt{10\,000} = 100$ **c)** Answers may vary. Example: The number 1000 is not a perfect square. The prime factorization of 1000 is $2 \times 2 \times 2 \times 5 \times 5 \times 5$. There is an odd number of factors of 2 and 5.
d) Any power of 10 with an even number of trailing zeros will be a perfect square.
e) No, 1 000 000 000 is not a perfect a square because it has an odd number of trailing zeros.
27. a) $\sqrt{6400} = 80$, $\sqrt{640\,000} = 800$, $\sqrt{64\,000\,000} = 8000$ **b)** Take the square root of 64 and then "add" half the number of trailing zeros from the original number.
c) There is an odd number of trailing zeros.
d) 800 000; Calculate the square root of 64, which is 8. Then count the number of trailing zeros, which is 10. Take half of that number of trailing zeros, which is 5, and attach that many zeros to 8.

3.2 Exploring the Pythagorean Relationship, pages 92–94

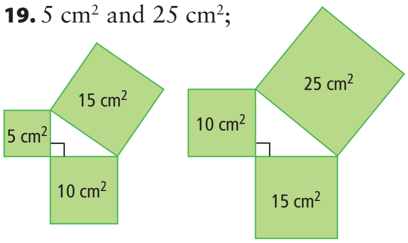
4. 900 mm^2; 1600 mm^2; 2500 mm^2
5. a)



b) 1600 mm^2; 5625 mm^2; 7225 mm^2
c) $1600 + 5625 = 7225$

6. a) $25 + 144 = 169$ **b)** 5 cm; 12 cm; 13 cm
c) The sum of the areas of the two smaller squares is equal to the area of the largest square: $5^2 + 12^2 = 13^2$.
7. a) 81 cm^2; 144 cm^2; 225 cm^2 **b)** $81 + 144 = 225$ **c)** The sum of the areas of the two smaller squares is equal to the area of the largest square: $9^2 + 12^2 = 15^2$.
8. No, the triangle is not a right triangle. The sum of the areas of the smaller squares is not equal to the area of the largest square: $20^2 + 40^2 \neq 50^2$
9. a) 4 cm^2; 9 cm^2; 16 cm^2 **b)** No, the triangle is not a right triangle. The sum of the areas of the smaller squares is not equal to the area of the largest square: $2^2 + 3^2 \neq 4^2$.
10. Yes, the triangle is a right triangle. The sum of the areas of the two smaller squares is equal to the area of the largest square: $120^2 + 160^2 = 200^2$.
11. Answers may vary. Example: No, the triangle is not a right triangle. The sum of areas of the squares of the two shorter sides does not equal the area of the square of the longest side, the hypotenuse. $5^2 = 25$, $6^2 = 36$, and $8^2 = 64$; $25 + 36 \neq 64$.
12. a) 52 cm^2 **b)** 676 mm^2 **c)** 65 cm^2 **d)** 24 cm^2
13. No, the garden is not a right triangle. The sum of the areas of the smaller squares is not equal to the area of the largest square: $4800 + 4800 \neq 9800$.

14. Triangle A is a right triangle: $9^2 + 12^2 = 15^2$.
Triangle B is not a right triangle: $7^2 + 8^2 \neq 11^2$.
Triangle C is a right triangle: $7^2 + 24^2 = 25^2$.
Triangle D is a right triangle: $16^2 + 30^2 = 34^2$.
Triangle E is not a right triangle: $10^2 + 11^2 \neq 14^2$.
15. No, the angle is not a right angle. The diagonal would have to be 10 m for the angle to be right angled.
$6^2 + 8^2 = 100; \sqrt{100} = 10$
16. Answers may vary. Example: Baldeep should ensure that the sum of the areas of the squares for the width and the length of the rectangle equals the area of the square that can be drawn on the diagonal of the rectangle: $144 + 400 = 544$.
17. a) 1225 cm^2 **b)** 169 mm^2
18. a) 28 m^2 **b)** 16 m^2
19. 5 cm^2 and 25 cm^2;



20. Answers may vary. Example: The sum of the areas of the two smaller semicircles is equal to the area of the semicircle attached to the hypotenuse of the triangle.
21. a) 6, 8, and 10 form a Pythagorean triple: $6^2 + 8^2 = 10^2$. **b)** Answers may vary. Example: Multiply each number by 10: $60^2 + 80^2 = 100^2$. The results form a Pythagorean triple. **c)** No, there is no natural number that does not make a Pythagorean triple when 3, 4, and 5 are multiplied by it.

3.3 Estimating Square Roots, pages 99–100

4. Answers may vary for the estimates. **a)** 8.5 **b)** 10.1 **c)** 7.4
5. Answers may vary for the estimates. **a)** 3.7 **b)** 9.3 **c)** 11.7
6. Answers may vary. Example: 90
7. Answers may vary. Example: 130
8. 5, 6, 7, and 8
9. 17, 18, 19, 20, 21, 22, 23, 24
10. Answer may vary. Example: 5.2 m
11. a) Answers may vary. Example: 4.5 cm **b)** 4.5 cm
12. a) Answers may vary. Example: An estimate is 3.2 m. **b)** 3.3 m **c)** Yes, the rug will fit since its side length, 3.3 m, is smaller than the shorter side of the room.
13. a) 10.7 m **b)** Answers may vary. Example: 10 m or 11 m **c)** 100 m^2 or 121 m^2 **d)** She will choose the 121 m^2 dance floor since it is much closer to her desired size.
14. a) 60 **b)** No, there is only one answer. The number must be between 49 and 64. The only multiple of 12 in this range is 60.
15. $\sqrt{27}$, 5.8, 6.3, $\sqrt{46}$, 7
16. a) 27 m^2 **b)** Answers may vary. Example: The fitness centre should order dimensions of 5.1 m by 5.1 m so that the area does not exceed 75% of the space available.
17. a) 324 cm^2 **b)** 1296 cm^2 **c)** 36 cm by 36 cm
18. a) 3 **b)** Answers may vary. Example: 1.7 **c)** 1.73 **d)** Answers may vary. Example: 0.03
19. Answers may vary. Example: A reasonable estimate for the square root of 160 100 is 400. $16 \times 10\,000 = 160\,000$. The square root of 16 is 4. The square root of 10 000 is 100. The square root of 160 100 is approximately $4 \times 100 = 400$.
20. 14
21. 106 500 and 106 800

3.4 Using the Pythagorean Relationship, pages 104–105

3. a) 20 cm **b)** 34 m
4. a) 9.2 cm **b)** 13.6 cm
5. a) 36 cm^2; 64 cm^2 **b)** 100 cm^2 **c)** 10 cm
6. a) 24 cm **b)** 10 cm
7. a) 7.5 mm **b)** 10.2 mm
8. 206 cm
9. 13.4 m
10. 38.2 m
11. 72.2 cm
12. 8.6 cm
13. 12 mm
14. $b = 4$ m; $c = 7.2$ m
15. 4.5 cm
16. 14.8 mm

3.5 Applying the Pythagorean Relationship, pages 110–111

3. a) 420 m **b)** 323 m **c)** Maria walked further by 97 m.
4. 9.8 m
5. Yes, these dimensions could form a rectangle. Square both sides of the rectangle and then sum the values: $9^2 + 22^2 = 565$. Calculate the square root of 565, which is 23.8 cm. This length is equal to the length of the diagonal.
6. No, there is not a right angle at first base because $27^2 + 27^2 = 38.2^2$. Since the distance between home plate and second base is 37.1 m and not 38.2 m, the triangle is not a right triangle.
7. 12.6 cm
8. Answers may vary. Example: Shahriar is correct. The diagonal is 39.1 cm when calculated with the Pythagorean relationship, which is smaller than the advertised 42 cm diagonal.
9. a) 4.2 cm **b)** 34 cm
10. Yes, she will have enough room. The diagonal of the mat is $\sqrt{12^2 + 12^2} \approx 17.0$ m, according to the Pythagorean relationship. The gymnast requires 16 m for the tumbling run and she will have one metre to spare.
11. maximum of 291.7 cm, minimum of 279.1 cm
12. a) 9.65 m **b)** \$19.30
13. 235 km
14. 15.6 mm

Chapter Review, pages 112–113

1. square root **2.** perfect square
3. hypotenuse **4.** Pythagorean relationship
5. prime factorization
6. a) 36 **b)** 121 **c)** 625
7. a) 7 **b)** 16 **c)** 10 000
8. No, the fabric has an area of 4×4 or 16 m^2. Lisa needs 17 m^2.
9. a) No, the triangle is not a right triangle. The sum of the two smaller squares is 16 cm^2 + 16 cm^2 = 32 cm^2. This does not equal the area of the largest square, which is 36 cm^2. **b)** 4 cm; 4 cm; 6 cm
10. Yes, the triangle is a right triangle since the sum of the squares of the two smaller sides is $225 + 1296 = 1521$, which is equal to the square of the largest side.
11. Triangles A, C, and D are right triangles.
12. a) Answer may vary. Example: 30 cm^2 **b)** 5 cm, 6 cm
c) Answer may vary. Example: 5.5 cm
d) Answer may vary. Example: 5.5 cm
13. a) 3.2 **b)** $\sqrt{6}$ is closer to 2 than 3 because 6 is closer to 4 (2^2) than 9 (3^2). **c)** When 3.61 is squared the result is 13.0321, which is closest to 13.
14. a) $d = 13$ m **b)** $v = 12$ cm
15. a) 5.4 cm; 6.7 cm **b)** 15.7 cm
16. No, the ladder will not reach the window. The length the ladder needs to reach is greater than 4 m: $1^2 + 3.9^2 \approx 4.03^2$.
17. 99.0 cm