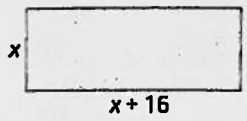
For help with question 3, see Example 2.

3. The length of a rectangle is 16 cm greater than its width. The area is 35 m². Find the dimensions of the rectangle, to the nearest hundredth of a metre.



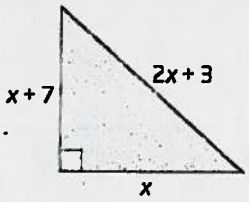
For help with questions 4 and 5, see Example 3.

4. The product of two consecutive numbers is 3306. What are the numbers?

5. Determine two consecutive odd integers whose product is 323.

For help with question 6, see Example 4.

6. The length of one leg of a right triangle is 7 cm more than that of the other leg. The length of the hypotenuse is 3 cm more than double that of the shorter leg. Find the lengths of each of the three sides.



For help with question 7, see Example 5.

7. Use Technology Measurements from the flight path of a tennis ball are recorded.

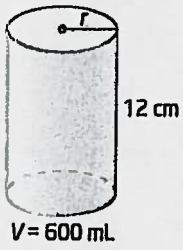
Horizontal Distance (m)	6	8	10	12	14
Height (m)	4.4	4.9	5.0	4.7	4.0

a) Use a graphing calculator or a spreadsheet to create a scatter plot of the data and add a curve of best fit.

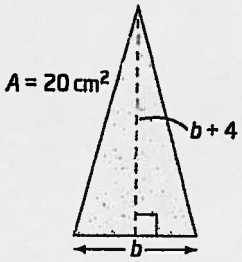
b) Determine the equation of the quadratic relation.

Connect and Apply

8. A cylindrical can with height 12 cm has capacity 600 mL. What is its radius, to the nearest millimetre? [Remember that 1 mL = 1 cm³.]



9. The area of a triangle is 20 cm², and the altitude is 4 cm greater than the base. Find the length of the base, to the nearest millimetre.



10. The sum of the squares of two consecutive integers is 365. Find the integers.

11. A rectangle has perimeter 23 cm. Its area is 33 cm². Determine the dimensions of the rectangle. Include a diagram in your solution.

12. A rectangular construction site is enclosed on three sides using 1200 m of fencing. The remaining side is formed by an existing wall. What dimensions enclose 180 000 m² of land?

13. The three sides of a right triangle are consecutive even integers. What is the length of each side?

14. A ladder is 6 m long. If the height of the top of the ladder must be no greater than 10 times the distance from the base to the wall, how high up a wall can the top of the ladder be placed? Include a diagram in your solution. Round to the nearest millimetre.

15. A science experiment involves launching a small rocket. The following measurements are taken:

    Initial height: 0.61 m
    Initial vertical velocity: 36.85 m/s

    a) Create a quadratic model for the height, in metres, of the rocket after a given number of seconds.

    b) Verify the following results of the experiment:
    Total time in the air: 7.54 s
    Maximum height: 69.89 m

    c) Sketch a graph of this relation and label the key information as in Example 1 of this section.

16. The acceleration due to gravity on Earth is 9.8 m/s^2. A ball is thrown upward at an initial velocity of 15 m/s from a height of 1 m above the ground. Round answers to the nearest tenth.

    a) Write an equation for the height of the ball.

    b) What is the height of the ball after 1 s?

    c) After how many seconds does the ball land?

    d) What is the maximum height of the ball? When does this occur?

    e) Repeat parts a) to d) for a ball thrown on the Moon, where $g = 1.62$ m/s^2.

    f) Repeat parts a) to d) for a ball thrown on Jupiter, where $g = 23.1$ m/s^2.

17. Sherri sells photos of athletes to baseball, basketball, and hockey fans after their games. Her regular price is \$10 per photograph, and she usually sells about 30 photographs. Sherri finds that, for each reduction in price of \$0.50, she can sell an additional two photographs.

    a) Total sales revenue is the product of the number of units sold and the price. Make an algebraic model to represent Sherri's total sales revenue.

    b) At what price will Sherri's revenue be \$150?

    c) At what price will her maximum revenue occur?

    d) At what price will her revenue be \$0?

    e) Graph the relationship between revenue and the number of price reductions. Which features on the graph represent the solutions to parts b), c), and d)?

18. A rectangular picture frame measures 20 cm by 30 cm. A new frame is to be made by increasing each side length by the same amount. The resulting enclosed area is to be 1064 cm^2. Find the dimensions of the new picture frame. Include a diagram in your solution.

19. A rectangular garden measures 15 m by 24 m. A larger garden is to be made by increasing each side length by the same amount. The resulting area is to be 1.5 times the original area. Find the dimensions of the new garden, to the nearest tenth of a metre. Include a diagram in your solution.

20. The length of a rectangular field is 2 m greater than three times its width. The area of the field is 1496 m^2. What are the dimensions of the field?

21. An open-topped box is to be made from a rectangular piece of tin measuring 50 cm by 40 cm by cutting squares of equal size from each corner. The base area is to be 875 cm^2.

a) Draw a diagram representing the information.

b) What is the side length of the squares being removed?

c) What is the volume of the box?

22. A photograph measures 21 cm by 15 cm. A strip of constant width is to be cut from each side of the photo, so the area is reduced to 216 cm^2. Find the width of the cut. Include a diagram in your solution.

23. A photograph measures 20 cm by 16 cm. A strip of constant width is to be cut off the top and one side of the photo, so the area is reduced to 60% of the area of the original photo. Find the width of the cut. Include a diagram in your solution.

24. A rectangular field measures 15 m by 20 m. A rectangular area is to be fenced in by reducing each dimension by the same amount. The fenced-in area will be $\frac{1}{2}$ the original area. What will the dimensions of the fenced-in area be? Include a diagram in your solution.

25. A rotating liquid surface takes on the shape of a parabolic mirror. This is the principle behind the 6 m in diameter reflecting telescope at the University of British Columbia, which uses mercury as a reflecting surface. The vertex is 23 cm below the edges. Find an equation to model the parabolic cross section of the mirror. Note: The mirror must always point straight up for the principle to work.

Go to www.mcgrawhill.ca/links/principles10 and follow the links to learn more about liquid mirror telescopes.

26. Use Technology An automotive magazine tested the stopping distance required by a particular car, starting from various speeds. The data are shown in the table.

Speed (km/h)	Stopping Distance (m)
30	3.6
40	6.2
50	10.0
60	14.1
70	19.6
80	27.8
90	36.5
100	49.3

a) Use technology to create a scatter plot of the data and add a curve of best fit.

b) Determine the equation of the quadratic relation.

c) Extrapolate to determine the stopping distance for a speed of 110 km/h.

d) Determine what approximate speed results in stopping distances of 30 m, 65 m, and 200 m.

e) Comment on the validity of extrapolation for this model.

Extend

27. Determine the number of points of intersection of each pair of parabolas. Justify your answer.

a) $y = x^2 + 2x + 7$
$y = x^2 - 4x - 1$

b) $y = 3x^2 - 12x + 16$
$y = -2x^2 - 4x + 3$

c) $y = x^2 - 6x + 10$
$y = 5x^2 - 30x + 46$

6.5 Solve Problems Using Quadratic Equations, pages 304–315

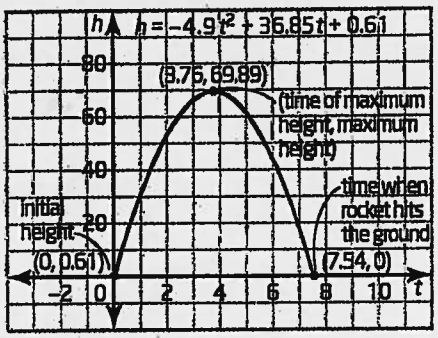
1. a) $h = -4.9t^2 + 45t + 2$ b) 9.23 s
2. a) 124 m b) $2.79 \leq t \leq 7.21$
3. 1.95 m by 17.95 m
4. 57 and 58 or −57 and −58
5. 17 and 19 or −17 and −19
6. 5 cm, 12 cm, and 13 cm
7. a)

b) $y = -0.05x^2 + 0.95x + 0.5$

8. 40 mm
9. 46 mm
10. 13 and 14 or −13 and −14
11. 5.5 cm by 6 cm
12. 300 m by 600 m
13. 6 units, 8 units, and 10 units
14. 5.97 m
15. a) $h = -4.9t^2 + 36.85t + 0.61$

b) Answers may vary. For example: Use a graphing calculator to calculate the total time in the air. When the height is equal to zero, the time is 7.54 s, to the nearest hundredth. Use a graphing calculator to calculate the maximum height of the rocket. When the time is 3.76 s, the height of the rocket is 69.89 m, to the nearest hundredth.

c)



16. a) $h = -4.9t^2 + 15t + 1$ b) 11.1 m c) 3.1 s

d) The maximum height of 12.5 m occurs at 1.5 s.

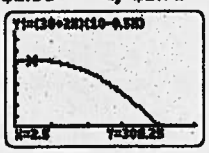
e) $h = -0.81t^2 + 15t + 1$; 15.2 m; 18.6 s; the maximum height of 70.4 m occurs at 9.3 s.

f) $h = -11.55t^2 + 15t + 1$; 4.5 m; 1.4 s; the maximum height of 5.9 m occurs at 0.6 s.

17. a) A model for Sherri's revenue, R, in dollars, is $R = (30 + 2x)(10 - 0.5x)$, where x represents the number of $0.50 price reductions.

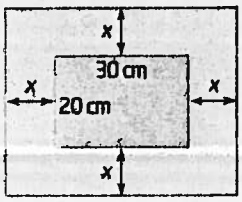
b) $2.50 c) $8.75 d) $0

e)

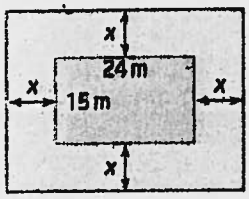


Part b) is represented by the point (15, 150). Part c) is represented by the vertex (2.5, 306.25), which is the maximum point. Part d) is represented by the x-intercept 20.

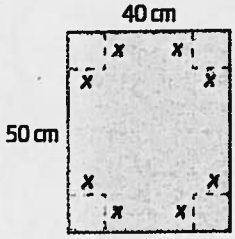
18. 28 cm by 38 cm



19. 28.2 m by 19.2 m



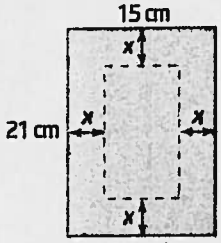
20. 22 m by 68 m
21. a)



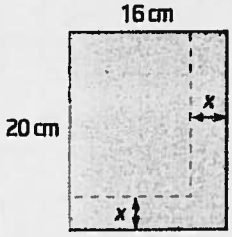
b) 7.5 cm

c) 6562.5 cm³

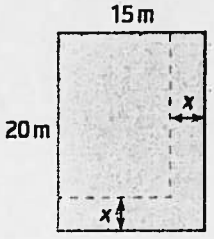
22. 1.5 cm



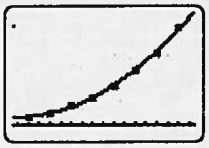
23. 4 cm



24. 10 m by 15 m



25. Answers will vary. For example: $y = \frac{23}{90\,000}x^2 - 23$
26. a)



b) $y = 0.008x^2 - 0.383x + 8.726$

c) 63.4 m

d) 81 km/h, 111 km/h, 180 km/h

e) Answers may vary. For example: The model does not make sense for speeds less than 24.5 km/h because the stopping distances should be less when the car is going slower.