**Forming and Solving Quadratic Equations**

**Section A – Variables given**

Example

*x*

The diagram shows how a fence has been used to enclose a rectangular sheep pen next to a wall. The length of fence used is 15 m.

* 1. Write an expression for the length of the longer side of the pen, given that each of the shorter sides has length *x*.
  2. Given that the pen has area 27m2, write an equation for *x* and solve it.

1. Find the co-ordinates of the points where the curve  crosses the *x*-axis. (Hint: what is the y value everywhere on the x axis?)
2. An *n-*sided convex polygon has  diagonals. How many sides has a polygon with 135 diagonals.
3. The sum of the squares of two consecutive positive numbers is 145.
   1. If *x* is the smaller of the two *consecutive* numbers, what is the other number?
   2. Show that the sum of the squares of the two numbers can be written as



* 1. Hence find the value of *x.*

1. The height,  metres, of a rocket above the ground after  seconds is given by the equation . When is the rocket 70 m high?

2*x*

*x*

1. The diagram shows part of a garden which consists of a 1∙5 m path around a rectangular pool. This part of the garden is twice as long as it is wide, as shown.
   1. Write an expression for the area of the pool itself.
   2. Given that the pool itself has area 54m2, find *x*.
2. The sum of two numbers is 19. The product of the numbers is 89.



* 1. If one of the numbers is *x*, what is the other?
  2. Form an equation to find the value of *x*. (hint: multiply by four)

**Section B – Define your own variables.**

Example

The height of a triangle is 3 cm more than the width. The triangle’s area is 5 cm2.

* 1. Form an equation to represent this situation.
  2. Find the height of the triangle.

1. The length of a rectangle is 4 cm more than its width. The rectangle’s area is 12 cm2.
   1. Form an equation to represent this situation.
   2. Find the length of the rectangle.
2. The width of a rectangle is 12 cm less than its length. The rectangle has an area of 85 cm2. Write and solve an equation to find the dimensions of the rectangle.
3. The base of a right-angled triangle is 9 cm longer than the height of the triangle. The area of the triangle is 56 cm2.
   1. Define a variable and draw out the triangle, labelling the sides.
   2. Form an equation and hence find the height of the triangle.
   3. Calculate the perimeter of the triangle.
4. Four equal-sized squares together have the same area as a single square, with side length 4cm greater. Find the sizes of the squares.
5. Three consecutive numbers have the property that the square of the largest is 192 less than the sum of the squares of the other two. Find the numbers.
6. A concrete beam used to build a bridge is in the shape of a cuboid. The beam is 2.8 metres longer than it is wide, and is 2.5 metres high. The volume of the beam is 52.7 m3. If the width of the beam is  metres, show that the total surface area () of the beam is given by the equation: .

### Section C – Harder Problems

1. A cylinder has radius *r* and height 11 cm. The surface area of the cylinder is 160 cm2. Find *r*.
2. Sammy spends £10 on some cans of drink. In another shop, she sees that the same cans are each 10p cheaper, and she calculates that she could have bought five more cans for the same money. How many cans did she buy?

20

*x*

9

1. Use similar triangles to find *x*
2. John’s savings increase by the same percentage every year. In 2003, he had £150. In 2005, he had £36 more than in 2004. What amount did he have in 2004?
3. A rectangle has a perimeter of 126 cm. The length of a diagonal of the rectangle is 45 cm. Write and solve an equation to find the length of the rectangle.
4. The diagram shows a solid made up of a hemisphere and a cone. The hemisphere has radius *r* and slant height 13 cm. The total surface area of the solid is 99 cm2. Find *r*.

[Formulae: curved surface area of cylinder: ; surface area of sphere: .]

D

C

A

O

B

1. In the diagram angle BAD = angle BCD. Distance AD = 19 cm,

BO = 5 cm and CO = 12 cm. Find distance AO.

1. For which values of *x* is  greater than 40?

**Forming and Solving Quadratic Equations - Homework**

1. A rectangular field has area 72 and is 6m longer than it is wide.
   1. Define a variable: let x be…
   2. Form an equation using the area of the field.
   3. Solve your equation to find the width of the field.
2. A right angled triangle has base which is 4 cm greater than double its height. Its area is 15.
   1. If x is the height of the triangle, what is the base?
   2. Form an equation using these expressions and solve it to find the height.
3. A right angled triangle has hypotenuse 15cm. One of the other sides has length cm and the other is 3cm longer than this.
   1. Form an equation using Pythagoras’ theorem.
   2. Expand and simplify to show that
   3. Solve this equation to find the value of .
4. A small box is 3 cm tall and 2 cm wider than it is long. The box has a volume of 105. Form and solve an equation to find its length
5. \*Find two positive numbers with a difference of 2 whose product is .

Answers, not in the correct order:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 12 | 3 1/3 | 3 | 6 | 5 |

1. A right angled triangle has hypotenuse 15cm. One of the other two sides is 3cm shorter than the other side. Find the dimensions of the triangle.
2. Find two positive numbers with a difference of 2 whose product is .
3. Two positive whole numbers differ by ten. The square of the larger one is four times the square of the smaller one. Find the two numbers.