

# Quadratic Equations

Solving Quadratics by Factorising / The Quadratic Formula / Completing the Square  
/ Deciding the Quadratic Method

|                          |             |
|--------------------------|-------------|
| Medium (17 questions)    | /48         |
| Hard (13 questions)      | /52         |
| Very Hard (12 questions) | /57         |
| <b>Total Marks</b>       | <b>/157</b> |

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# Medium Questions

1 Solve  $(x - 2)^2 = 3$

Give your solutions correct to 3 significant figures.

(2 marks)

2 Solve the equation  $3x^2 + 4x - 12 = 0$

Give your solutions correct to 2 decimal places.

(3 marks)

3 Solve  $3x^2 + 6x - 2 = 0$

Give your solutions correct to 2 decimal places.

(3 marks)

4 Solve  $3x^2 - x - 1 = 0$

Give your solutions correct to 2 decimal places.

(3 marks)

5 Solve  $x^2 - 5x + 3 = 0$

Give your solutions correct to 3 significant figures.

(3 marks)

6 Liz is asked to solve the equation  $3x^2 + 8 = 83$

Here is her working.

$$3x^2 + 8 = 83$$

$$3x^2 = 75$$

$$x^2 = 25$$

$$x = 5$$

Explain what is wrong with Liz's answer.

(1 mark)

7 Solve  $x^2 - 21x + 20 = 0$

Show your working clearly.

(3 marks)

8 (a) Factorise  $x^2 + 2x - 24$ .

(2 marks)

(b) Hence solve  $x^2 + 2x - 24 = 0$

(1 mark)

9 The **only** solution to  $x^2 + bx + c = 0$  is  $x = 5$

Work out the values of  $b$  and  $c$ .

$b = \dots\dots\dots$

$c = \dots\dots\dots$

(2 marks)

10 (a) Write  $x(3x - 9) = 4$  in the form  $ax^2 + bx + c = 0$  where  $a$ ,  $b$  and  $c$  are integers.

(1 mark)

(b) Solve  $x(3x - 9) = 4$

Give your answers to 2 decimal places.

(2 marks)

11 Solve  $x^2 - x - 12 = 0$

(3 marks)

12 **Without** expanding any brackets, show how to work out the **exact** solutions of  $9(x + 3)^2 = 4$

Give the solutions.

(3 marks)

13 Solve by factorising.

$$x^2 + 9x + 20 = 0$$

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$

(3 marks)

14 Solve this equation algebraically.

Give your solutions correct to 2 decimal places.

$$3x^2 + 8x - 5 = 0$$

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$

(4 marks)

15 Solve.

$$x^2 - 6x + 15 = 3x - 5$$

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$

(4 marks)

16 Solve.

$$3x^2 = 75$$

$x = \dots\dots\dots$

(2 marks)

17 Solve  $3(5x^2 - 9) = 27$ .

Give your answers as exact values.

(3 marks)

# Hard Questions

1 Solve  $x^2 - 6x - 8 = 0$

Write your answer in the form  $a \pm \sqrt{b}$  where  $a$  and  $b$  are integers.

(3 marks)

- 2 Alison is using the quadratic formula to solve a quadratic equation. She substitutes values into the formula and correctly gets.

$$x = \frac{-7 \pm \sqrt{49 - 32}}{4}$$

Work out the quadratic equation that Alison is solving. Give your answer in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers.

(3 marks)

3 Solve  $3x^2 - 4x - 2 = 0$

Give your solutions correct to 3 significant figures.

(3 marks)

4 Solve  $3x^2 - 5x - 1 = 0$

Give your solutions correct to 3 significant figures.

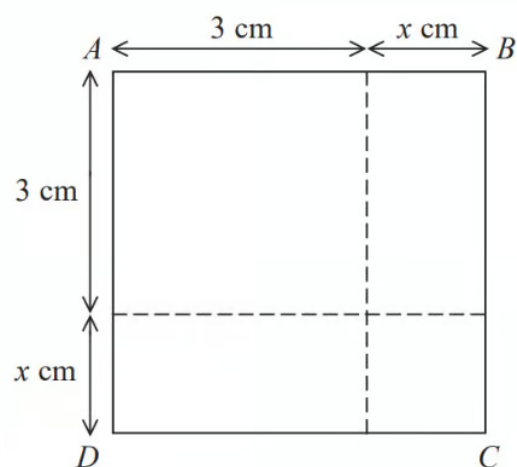
(3 marks)

5 Solve  $2x^2 + 3x - 7 = 0$

Give your solutions correct to 2 decimal places.

(3 marks)

6



The area of square  $ABCD$  is  $10 \text{ cm}^2$ .

Show that  $x^2 + 6x = 1$

(3 marks)

7 Solve  $5x^2 = 10x + 4$

Give your answers to 2 decimal places.

(4 marks)

8 (a)  $2x^2 - 6x + 5$  can be written in the form  $a(x - b)^2 + c$

where  $a$ ,  $b$  and  $c$  are positive numbers.

Work out the values of  $a$ ,  $b$  and  $c$ .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

$c = \dots\dots\dots$

(3 marks)

(b) Using your answer to part (a), or otherwise, solve  $2x^2 - 6x + 5 = 8.5$

(3 marks)

**9 (a)** Here are two pieces of work.

For each one, describe the error made and give the complete correct solution.

Question:

Solve by factorisation.

$$3x^2 - 2x - 5 = 0$$

Solution:

$$(3x + 5)(x - 1) = 0$$

Therefore

$$x = -5/3 \text{ or } x = 1$$

Error: .....

Correct solution:

**(3 marks)**

Question:

Solve, giving your answers correct to 3 significant figures.

$$2x^2 - 8x + 3 = 0$$

Solution:

$$x = -(-8) \pm \frac{\sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

Therefore  $x = 6.42$  or  $x = 9.58$

(b)

Error: .....

Correct solution:

(3 marks)

10 Solve by factorisation.

$$5x^2 + 7x + 2 = 0$$

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$

(3 marks)

11 Solve by factorisation.

$$2x^2 - 19x - 33 = 0$$

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$

**(3 marks)**

**12** i) Write  $x^2 + 4x - 16$  in the form  $(x + a)^2 - b$ .

[3]

ii) Solve the equation  $x^2 + 4x - 16 = 0$ . Give your answers in surd form as simply as possible.

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]

**(7 marks)**

**13** Solve  $4x^2 + 1 = 2x^2 + 4x + 10$ .

Give your answers correct to 3 significant figures.

(5 marks)

# Very Hard Questions

1 Solve  $x^2 = 4(x - 3)^2$

(3 marks)

2 (a) Solve  $2x^2 + 9x - 7 = 0$

Give your solutions correct to 3 significant figures.

(3 marks)

(b) Solve  $\frac{2}{y^2} + \frac{9}{y} - 7 = 0$

Give your solutions correct to 3 significant figures.

(2 marks)

3 Given that

$$2x - 1 : x - 4 = 16x + 1 : 2x - 1$$

find the possible values of  $x$ .

(5 marks)

4 (a) The diagram shows a trapezium.

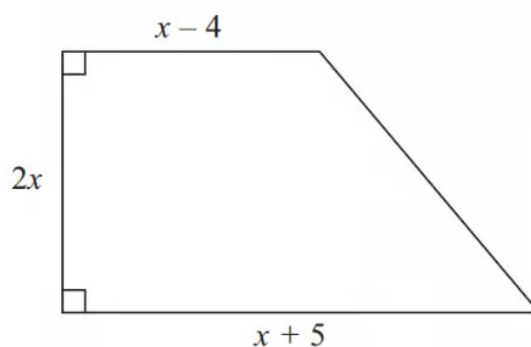


Diagram **NOT**  
accurately drawn

All the measurements are in centimetres.

The area of the trapezium is  $351 \text{ cm}^2$ .

Show that  $2x^2 + x - 351 = 0$

(2 marks)

(b) Work out the value of  $x$ .

(3 marks)

5 Given that

$$x^2 : (3x + 5) = 1 : 2$$

find the possible values of  $x$ .

(4 marks)

6

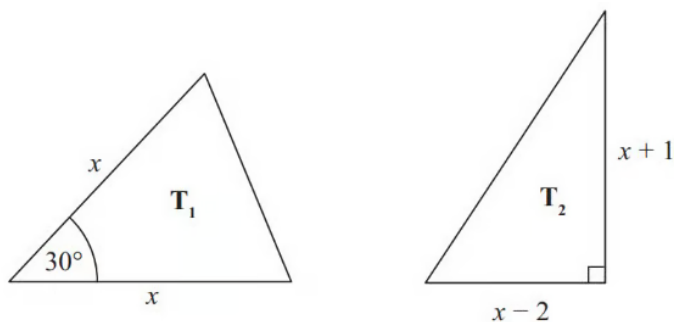


Diagram **NOT**  
accurately drawn

The lengths of the sides are in centimetres.

The area of triangle  $T_1$  is equal to the area of triangle  $T_2$ .

Work out the value of  $x$ , giving your answer in the form  $a + \sqrt{b}$  where  $a$  and  $b$  are integers.

(5 marks)

7 Given that 
$$M = \frac{18^{4n} \times 2^{3(n^2-6n)} \times 3^{2(1-4n)}}{12^2}$$

find the values of  $n$  for which  $M = 2$

(5 marks)

8 (a) The diagram shows a trapezium.

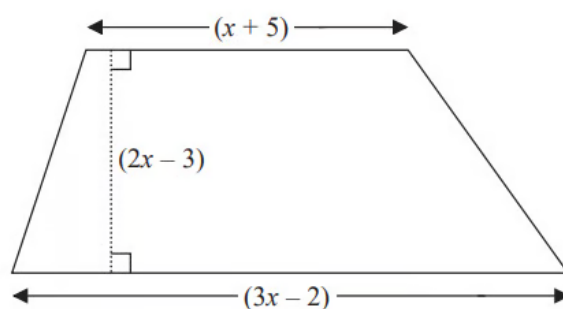


Diagram **NOT**  
accurately drawn

All measurements shown on the diagram are in centimetres.  
The area of the trapezium is  $133 \text{ cm}^2$

Show that  $8x^2 - 6x - 275 = 0$

(3 marks)

(b) Find the value of  $x$ .

Show your working clearly.

(3 marks)

9 (a) Express  $7 - 4x - x^2$  in the form  $p - (x + q)^2$  where  $p$  and  $q$  are constants.

(2 marks)

(b) Use your answer to part (a) to solve the equation  $7 - 4(y + 3) - (y + 3)^2 = 0$

Give your solutions in the form  $e \pm \sqrt{f}$  where  $e$  and  $f$  are integers.

(3 marks)

10 Solve  $\frac{5}{4x+1} = \frac{2x}{x^2+3}$

Give your solutions to 3 significant figures.  
You **must** show your working.

(5 marks)

11  $y = 6x^4 + 7x^2$  and  $x = \sqrt{w+1}$

Find the value of  $w$  when  $y = 10$ .  
Show your working.

$w = \dots\dots\dots$

(6 marks)

12  $6x^2 = 7xy + 20y^2$  where  $x > 0$  and  $y > 0$

Find the ratio  $x:y$

(3 marks)