

# Edexcel GCSE

## Mathematics (Linear) – 1MA0

# QUADRATIC FORMULA

### Materials required for examination

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser.  
Tracing paper may be used.

### Items included with question papers

Nil



### Instructions

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Use black ink or ball-point pen.

Fill in the boxes at the top of this page with your name, centre number and candidate number.

Answer all questions.

Answer the questions in the spaces provided – there may be more space than you need.

Calculators may be used.

### Information

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The marks for each question are shown in brackets – use this as a guide as to how much time to spend on **each** question.

Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed – you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.

### Advice

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Read each question carefully before you start to answer it.

Keep an eye on the time.

Try to answer every question.

Check your answers if you have time at the end.

1. Solve  $3x^2 + 7x - 13 = 0$   
Give your solutions correct to 2 decimal places.

$$a = 3 \quad b = 7 \quad c = -13$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-7 \pm \sqrt{7^2 - 4 \times 3 \times -13}}{2 \times 3} = \frac{-7 \pm \sqrt{205}}{6}$$

$$= 1.219636844 \quad \text{or} \quad -3.552970177$$

$$x = 1.22 \quad \text{or} \quad x = -3.55$$

(3 marks)

2. Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

$$a = 2 \quad b = 6 \quad c = -95$$

$$x = \frac{-6 \pm \sqrt{36 - (4 \times 2 \times -95)}}{4}$$

$$= \frac{-6 \pm \sqrt{796}}{4}$$

$$= 5.55336799 \quad \text{or} \quad -8.55336799$$

$$x = 5.55 \quad \text{or} \quad x = -8.55$$

(3 marks)

3. Solve  $x^2 + 3x - 5 = 0$   
Give your solutions correct to 4 significant figures.

$$a = 1 \quad b = 3 \quad c = -5$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-3 \pm \sqrt{9 - (4 \times 1 \times -5)}}{2}$$

$$= \frac{-3 \pm \sqrt{29}}{2}$$

$$x = 1.192582404 \text{ or } -4.192582404$$

$$x = 1.193 \text{ or } -4.193$$

(3 marks)

4. Solve this quadratic equation.

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

Give your answers correct to 3 significant figures.

$$a = 1 \quad b = -5 \quad c = -8$$

$$x = \frac{5 \pm \sqrt{25 - (4 \times 1 \times -8)}}{2}$$

$$= \frac{5 \pm \sqrt{57}}{2}$$

$$x = 6.274917218 \text{ or } -1.274917218$$

$$x = 6.27 \text{ or } x = -1.27$$

(3 marks)

5. (a) Solve  $x^2 - 2x - 1 = 0$

Give your solutions correct to 2 decimal places.

$$a = 1 \quad b = -2 \quad c = -1$$

$$x = \frac{2 \pm \sqrt{4 - (4 \times 1 \times -1)}}{2}$$

$$= \frac{2 \pm \sqrt{8}}{2}$$

$$x = 2.414213562 \text{ or } -0.4142135624$$

$$\underline{x = 2.41 \text{ or } -0.41}$$

(3)

(b) Write down the solutions, correct to 2 decimal places, of  $3x^2 - 6x - 3 = 0$

$$3(x^2 - 2x - 1) = 0$$

so

$$\underline{x = 2.41 \text{ or } -0.41}$$

(2)

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(5 marks)

6. (a) Solve  $x^2 + x + 11 = 14$   
Give your solutions correct to 3 significant figures.

$$\begin{aligned}
 x^2 + x + 11 - 14 &= 0 \\
 x^2 + x - 3 &= 0 \\
 a=1 \quad b=1 \quad c=-3 \\
 x &= \frac{-1 \pm \sqrt{1 - (4 \times 1 \times -3)}}{2} \\
 &= \frac{-1 \pm \sqrt{13}}{2} \\
 x &= 1.302775638 \quad \text{or} \quad -2.302775638
 \end{aligned}$$

$$x = 1.30 \text{ or } -2.30$$

(3)

$$y = x^2 + x + 11$$

The value of  $y$  is a prime number when  $x = 0, 1, 2$  and  $3$

The following statement is **not** true.

' $y = x^2 + x + 11$  is **always** a prime number when  $x$  is an integer'

- (b) Show that the statement is not true.

$$\begin{aligned}
 \text{when } x = 10 \quad y &= 10^2 + 10 + 11 \\
 y &= 121 \quad \text{this is not a prime} \\
 &\quad \text{number as } 11^2 = 121
 \end{aligned}$$

(2)

(5 marks)

7. The diagram below shows a 6-sided shape.  
All the corners are right angles.  
All the measurements are given in centimetres.

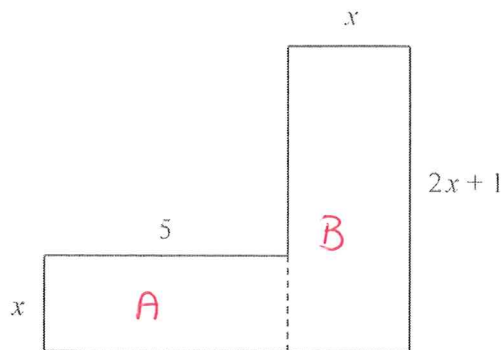


Diagram **NOT** accurately drawn

The area of the shape is  $95 \text{ cm}^2$ .

- (a) Show that  $2x^2 + 6x - 95 = 0$

$$a = 2 \quad b = 6 \quad c = -95$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\begin{aligned} \text{Area A} &= 5x \\ \text{Area B} &= x(2x+1) \\ &= 2x^2 + x \end{aligned}$$

$$\text{TOTAL AREA} = 5x + 2x^2 + x$$

$$\text{SO } 2x^2 + 5x + x = 95$$

$$\therefore 2x^2 + 6x - 95 = 0$$

(3)

- (b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

$$x = \frac{-6 \pm \sqrt{36 - 4(2x - 95)}}{4}$$

$$= \frac{-6 \pm \sqrt{796}}{4}$$

$$= 5.55336799 \quad \text{or} \quad -8.55336799$$

$$x = 5.55 \dots \dots \dots \quad \text{or} \quad x = -8.55 \dots \dots \dots$$

(3)

(6 marks)

8. The diagram below shows a 6-sided shape.  
 All the corners are right angles.  
 All measurements are given in centimetres.

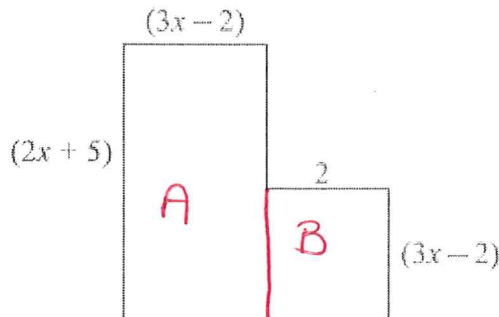


Diagram NOT accurately drawn

The area of the shape is  $25 \text{ cm}^2$ .

- (a) Show that  $6x^2 + 17x - 39 = 0$

$$\begin{aligned} \text{Area A} &= (2x+5)(3x-2) \\ &= 6x^2 - 4x + 15x - 10 \\ &= 6x^2 + 11x - 10 \end{aligned}$$

$$\begin{aligned} \text{Area B} &= 2(3x-2) \\ &= 6x - 4 \end{aligned}$$

$$\begin{aligned} \text{TOTAL AREA} &= 6x^2 + 11x - 10 + 6x - 4 \\ &= 6x^2 + 17x - 14 \end{aligned}$$

$$\text{SO } 6x^2 + 17x - 14 = 25$$

$$6x^2 + 17x - 39 = 0 \quad (3)$$

- (b) (i) Solve the equation

$$6x^2 + 17x - 39 = 0$$

$$a=6 \quad b=17 \quad c=-39$$

$$x = \frac{-17 \pm \sqrt{17^2 - 4(6)(-39)}}{12}$$

$$x = 1.5 \quad \text{or} \quad x = -4.3$$

$x = \dots\dots\dots$  OR  $x = \dots\dots\dots$

- (ii) Hence work out the length of the longest side of the shape.

$$(2 \times 1.5) + 5 = 8$$

$\dots\dots\dots 8 \dots\dots\dots \text{cm}$

(4)

(7 marks)

9. The diagram shows a 6-sided shape.  
 All the corners are right angles.  
 All the measurements are given in centimetres.

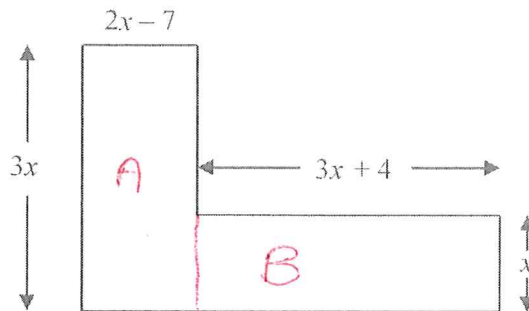


Diagram NOT accurately drawn

The area of the shape is  $85 \text{ cm}^2$ .

- (a) Show that  $9x^2 - 17x - 85 = 0$

$$A = 3x(2x-7) = 6x^2 - 21x$$

$$B = x(3x+4) = 3x^2 + 4x$$

$$6x^2 - 21x + 3x^2 + 4x = 85$$

$$9x^2 - 17x - 85 = 0$$

(3)

- (b) (i) Solve  $9x^2 - 17x - 85 = 0$

Give your solutions correct to 3 significant figures.

$$a=9 \quad b=-17 \quad c=-85$$

$$x = \frac{17 \pm \sqrt{17^2 - 4(9)(-85)}}{18}$$

$$x = 4.159474732 \quad \text{or} \quad x = -2.270585844$$

$$x = 4.16 \dots \quad \text{or} \quad x = -2.27 \dots$$

- (ii) Hence, work out the length of the shortest side of the 6-sided shape.

$$2x-7$$

$$\dots 1.38 \dots \text{ cm}$$

(4)

(7 marks)