

Quadratic equations

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class

Teacher

Time allowed: 125 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 14): you must not use a calculator.
- **Section B** (questions 15 to 26): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 110.

Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

For teacher's use

Q	Mark	Q	Mark
1		14	
2		15	
3		16	
4		17	
5		18	
6		19	
7		20	
8		21	
9		22	
10		23	
11		24	
12		25	
13		26	
TOTAL			

Section A**You must not use a calculator**Do not
write
outside
the box

- 1** Expand and simplify $(x + 7)(x - 3)$

Answer _____
[2 marks]

- 2** (a) Factorise $x^2 - 11x + 24$

Answer _____
[2 marks]

- (b) Hence, or otherwise, solve $x^2 - 11x + 24 = 0$

Answer _____
[1 mark]

- 3** (a) Factorise $x^2 - 81$

Answer _____

[1 mark]

- (b) Use your answer to part (a) to work out 109×91

Answer _____

[2 marks]

- 4** Jade tries to solve $x^2 + 3x = 28$
Here is her working.

$$\begin{aligned}x(x + 3) &= 28 \\x &= 28 \text{ or } x + 3 = 28 \\x &= 28 \text{ or } x = 25\end{aligned}$$

- (a) Explain the mistake Jade has made.

[1 mark]

- (b) Solve $x^2 + 3x = 28$

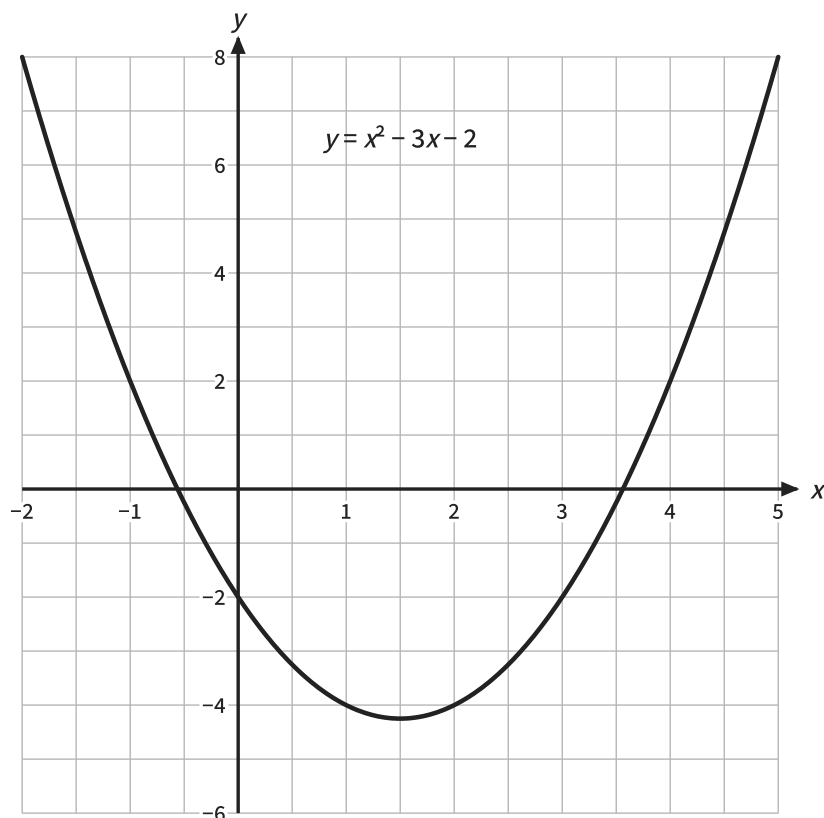
Answer _____

[3 marks]

5

Here is the graph of $y = x^2 - 3x - 2$

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outside
the box



- (a) Write down the coordinates of the point where the graph crosses the y -axis.

Answer _____

[1 mark]

- (b) Use the graph to estimate the solutions of $x^2 - 3x - 2 = 0$

Answer _____

[2 marks]

- (c) Explain how the graph shows that the equation $x^2 - 3x - 2 = -5$ has no solutions.

[1 mark]

- 6** A rectangular rug has width x metres.
Its length is 3 metres more than its width.
The area of the rug is 10 m^2

(a) Show that $x^2 + 3x - 10 = 0$

[2 marks]

(b) Work out the length of the rug.

Answer _____ m

[3 marks]

- 7** The equation $x^2 + bx + c = 0$ has solutions $x = -3$ and $x = 7$

Work out the value of b and the value of c .

Answer _____

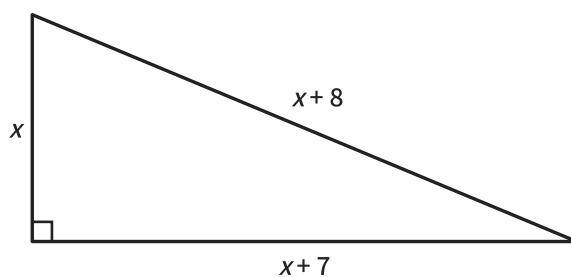
[3 marks]

- 8** Solve $3x^2 = 8 - 10x$

Answer _____

[3 marks]

- 9** Here is a right-angled triangle.
All lengths are in centimetres.



Not drawn accurately

Work out the perimeter of the triangle.
You must show your working.

Answer _____ cm

[4 marks]

- 10** The graph of $y = x^2 + px + q$ has a turning point at $(4, -11)$

Work out the value of p and the value of q .

Answer _____

[3 marks]

Do not
write
outside
the box

- 11** Solve $x^2 - 4x - 14 = 0$
Give your answers in the form $a \pm b\sqrt{2}$ where a and b are integers.

Answer _____

[4 marks]

- 12** Ravi says,
“The equation $x^2 - 6x + 11 = 0$ has no solutions.”
By completing the square, show that Ravi is correct.

[3 marks]

- 13** (a) Write $2x^2 + 12x + 5$ in the form $a(x + b)^2 + c$

Answer _____

[3 marks]

- (b) Write down the equation of the line of symmetry of the graph of $y = 2x^2 + 12x + 5$

Answer _____

[1 mark]

14

A circle has equation $x^2 + y^2 = 10$

A straight line has equation $x + 3y = 10$

- (a) Prove algebraically that the line is a tangent to the circle.

[4 marks]

- (b) Write down the coordinates of the point where the line touches the circle.

Answer _____

[1 mark]

Section B**You may use a calculator**Do not
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the box

- 15** Solve $3x^2 - 5x - 4 = 0$
Give your answers to 2 decimal places.

Answer _____

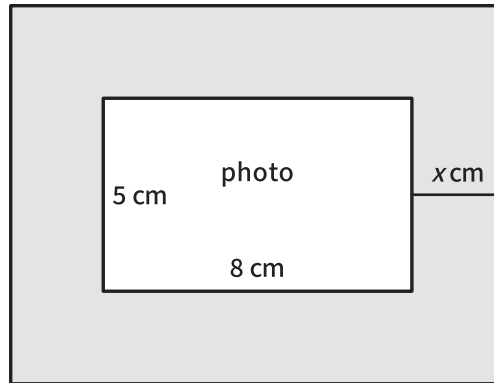
[3 marks]

16

A photo is 8 cm long and 5 cm wide.

It is mounted on a rectangular card so that there is a border of width x cm all the way round the photo.

The area of the card is 60 cm^2



Not drawn accurately

- (a) Show that $2x^2 + 13x - 10 = 0$

[3 marks]

- (b) Work out the value of x .
Give your answer to 3 significant figures.

Answer _____ cm

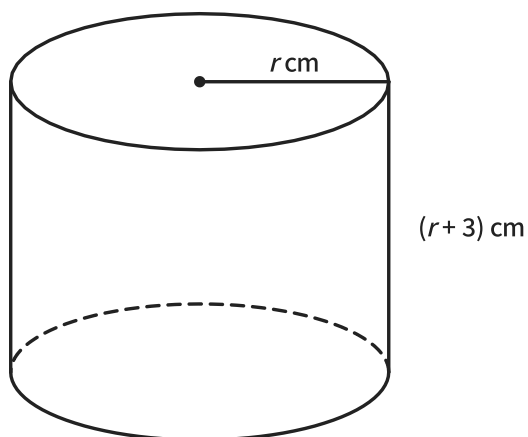
[3 marks]

17

A closed cylinder has radius r cm.

The height of the cylinder is 3 cm more than its radius.

The total surface area of the cylinder is 500 cm^2



Not drawn accurately

Work out the value of r .

Give your answer to 3 significant figures.

Answer _____ cm

[5 marks]

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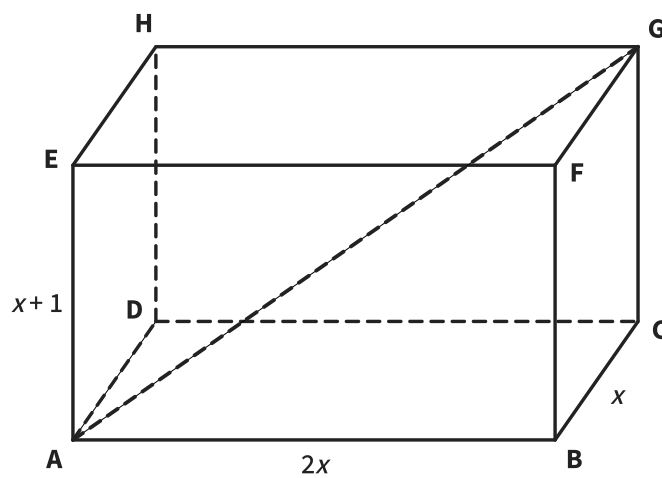
18

ABCDEFGH is a cuboid.

The length of the cuboid is twice its width.

The height of the cuboid is 1 cm more than its width.

The diagonal AG is 18 cm long.



Not drawn accurately

Work out the volume of the cuboid.

Give your answer to 3 significant figures.

Answer _____ cm^3

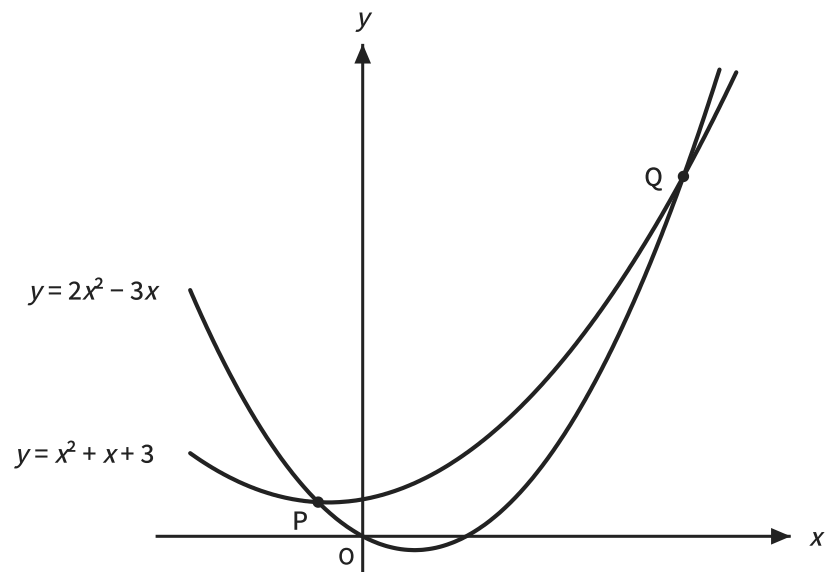
[6 marks]

Do not
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19

The diagram shows a sketch of the curves $y = 2x^2 - 3x$ and $y = x^2 + x + 3$. The curves meet at the points P and Q.

Do not
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outside
the box



Work out the coordinates of P and Q.
Give your answers to 2 decimal places.

Answer _____

[5 marks]

20

The n th term of sequence **A** is $2n^2 - 5n + 3$

The n th term of sequence **B** is $60n + 100$

The first few terms of sequence **B** are bigger than the matching terms of sequence **A**.

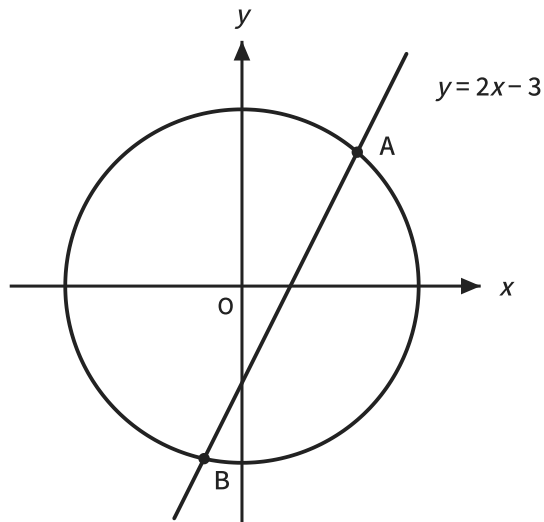
Work out the smallest value of n for which the n th term of **A** is bigger than the n th term of **B**.

You must show your working.

Answer _____

[4 marks]

- 21** The line $y = 2x - 3$ meets the circle $x^2 + y^2 = 30$ at the points A and B.



Work out the length of AB.
Give your answer to 3 significant figures.

Answer _____

[5 marks]

Do not
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the box

22

A farm shop sells cherries.

When the price is $\pounds p$ per kilogram, the shop takes $\pounds T$ in a day from selling cherries, where $T = p(150 - 20p)$

- (a) By completing the square, or otherwise, work out the greatest amount the shop can take in a day.

Answer $\pounds$ _____

[2 marks]

- (b) The shop wants to take at least $\pounds 275$ a day.
The price must be a whole number of pence.
Work out the lowest price and the highest price the shop can charge.

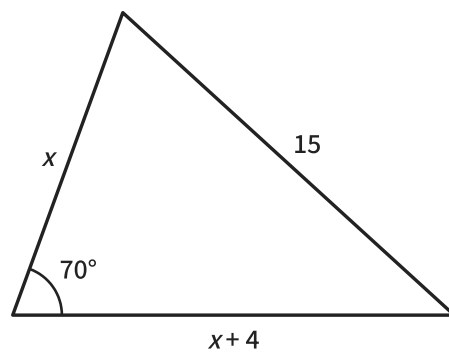
Lowest $\pounds$ _____ Highest $\pounds$ _____

[4 marks]

23

Here is a triangle.
All lengths are in centimetres.

Do not
write
outside
the box



Not drawn accurately

- (a) Work out the value of x .
Give your answer to 3 significant figures.

Answer _____

[4 marks]

- (b) Work out the area of the triangle.
Give your answer to 3 significant figures.

Answer _____ cm^2

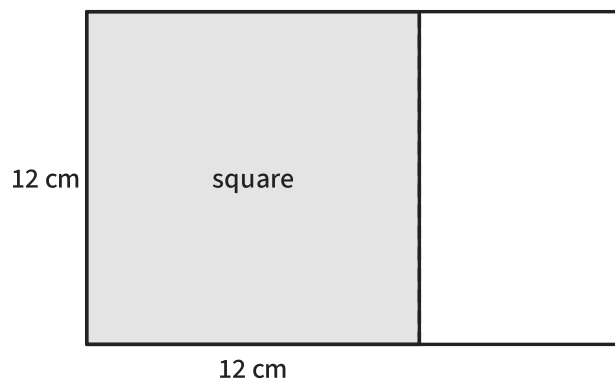
[2 marks]

24

A rectangular tile is 12 cm wide.

A square of side 12 cm is cut from one end of the tile, as shown.

The rectangle that is left is mathematically similar to the whole tile.



Not drawn accurately

Work out the length of the whole tile.

Give your answer to 3 significant figures.

Answer _____ cm

[4 marks]

Do not
write
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25

Nadia puts £2000 into a savings account.

The account pays $r\%$ compound interest each year.

At the end of the first year, after the interest is added, Nadia pays in another £500

At the end of the second year, after the interest is added, there is £2700 in the account.

- (a) Show that $20m^2 + 5m - 27 = 0$ where $m = 1 + \frac{r}{100}$

[2 marks]

- (b) Work out the value of r .
Give your answer to 2 decimal places.

Answer _____

[3 marks]**26**

A garden designer changes the size of a rectangular lawn.

She increases the length of the lawn by $p\%$

She decreases the width of the lawn by $2p\%$

The area of the lawn decreases by 10%

Work out the value of p .

Give your answer to 3 significant figures.

Answer _____

[5 marks]**END OF QUESTIONS**