Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
TOTAL	

AQA

Free-Standing Mathematics Qualification
Higher Level
June 2014

Algebra and Graphs 4988

Unit 8

Tuesday 13 May 2014 1.30 pm to 2.45 pm

For this paper you must have:
- a clean copy of the Data Sheet (enclosed)
- a calculator
- a ruler.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is enclosed for your use.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 50.
- You are expected to use a calculator where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

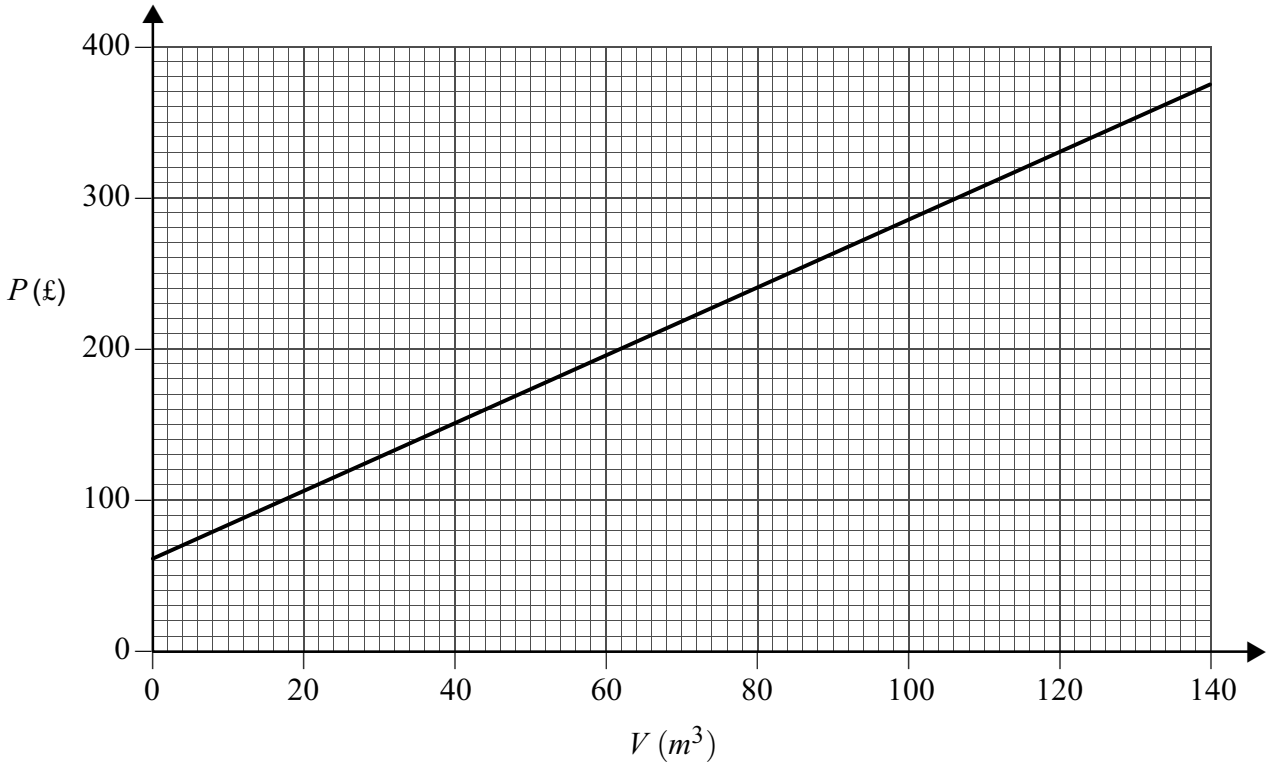
Section A

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Household water bills** *on page 2 of the Data Sheet.*

1 The graph below shows how, when using a water meter, the amount paid, £P, is linked to the volume of water used, V cubic metres.



1 (a) Is the amount paid proportional to the volume of water used?
Use the graph to explain your answer.

[1 mark]

.....

.....

1 (b) (i) What does the intercept on the P-axis represent?

[1 mark]

.....

.....

Answer.....

1 (b) (ii) What is the value of this intercept?

[1 mark]

.....

Answer.....

1 (c) Find the equation connecting P and V.

[2 marks]

.....

.....

.....

.....

Answer.....

1 (d) Mr Smith does not have a water meter in his house.
His annual bill is £357 , regardless of how much water he uses.

1 (d) (i) Draw a line on the graph to illustrate this information.

[1 mark]

.....

1 (d) (ii) What is the equation of this line?

[1 mark]

.....

.....

Answer.....

1 (e) By using the graph, or otherwise, find the minimum number of litres of water used so that using a water meter costs more than £357 .
(1 cubic metre = 1000 litres.)

[2 marks]

.....

.....

.....

Answer.....

9

Turn over for the next question

Section B

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Carbon dioxide emissions** *on page 2 of the Data Sheet.*

2 The table below shows the carbon dioxide emissions, in tonnes, produced by different countries in 2009.

Country	Carbon dioxide emissions (tonnes)
China	7.711×10^9
Cyprus	9.420×10^6
Ireland	4.027×10^7
New Zealand	3.907×10^7
United Kingdom	5.199×10^8
United States of America	5.425×10^9

2 (a) Which of these countries produced the lowest carbon dioxide emissions?

[1 mark]

.....

Answer.....

2 (b) Work out the total carbon dioxide emissions produced by the United Kingdom and Ireland.

Give your answer in standard form correct to two significant figures.

[3 marks]

.....

.....

.....

Answer.....

2 (c) Jan looked at the carbon dioxide emissions in the table and wrote down the equation

$$7.711 \times 10^9 = 5.199 \times 10^8 \times n$$

2 (c) (i) Calculate the value of n. Give your answer correct to two significant figures.

[2 marks]

.....

.....

.....

.....

Answer.....

2 (c) (ii) Use the names of **two** of the countries in the table on page 4 and your answer to part **(c)(i)** to complete the sentence below.

[1 mark]

..... produces ..... times more carbon dioxide

than .....

7

Turn over for the next question

Section C

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Camping at Glastonbury** *on page 3 of the Data Sheet.*

3 A group of students can buy:

3 large tents and 5 small tents for £785

or

4 large tents and 3 small tents for £845 .

3 (a) Each large tent costs £x and each small tent costs £y.
Write down a pair of equations connecting x and y.

[2 marks]

.....

.....

.....

.....

Answers.....

.....

3 (b) Solve the equations to find the cost of **one** large tent and the cost of **one** small tent.

[5 marks]

.....

.....

.....

.....

.....

.....

.....

Answer: One large tent costs £ .....

One small tent costs £.....

3 (c) 5 students can sleep in a large tent and 2 students can sleep in a small tent.

3 (c) (i) What is the maximum number of students that can sleep in 3 large tents and 5 small tents?

[2 marks]

.....

.....

.....

.....

Answer.....

3 (c) (ii) If 3 large tents and 5 small tents are bought for this maximum number of students, calculate the mean cost per student.

[2 marks]

.....

.....

.....

.....

Answer.....

11

Turn over for the next question

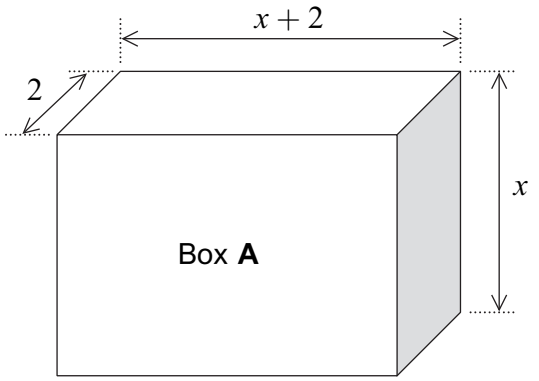
Section D

Answer **all** questions.

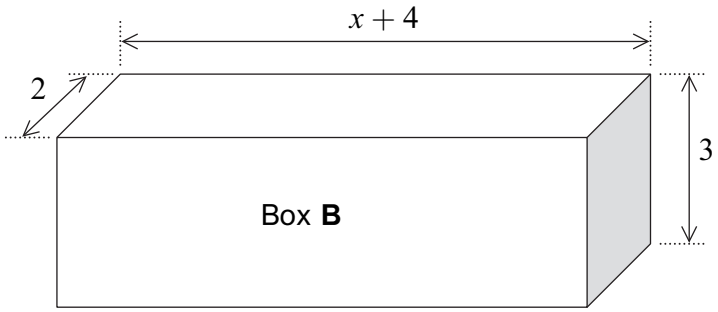
Answer each question in the space provided for that question.

Use **Jewellery boxes** *on page 3 of the Data Sheet.*

4 A manufacturer makes jewellery boxes in two different sizes. The boxes are shown below. All measurements are in centimetres.



Not drawn to scale



Not drawn to scale

4 (a) An expression, in terms of x, for the volume of Box **A** is $2x(x + 2)$.

Expand this expression.

[1 mark]

.....

.....

Answer.....

4 (b) (i) Write an expression, in terms of x, for the volume of Box **B**.

[1 mark]

.....

Answer.....

4 (b) (ii) Expand this expression.

[1 mark]

.....

.....

.....

Answer.....

4 (c) The volume of Box **A** is the same as the volume of Box **B**.

Show that $x^2 - x - 12 = 0$.

[3 marks]

.....

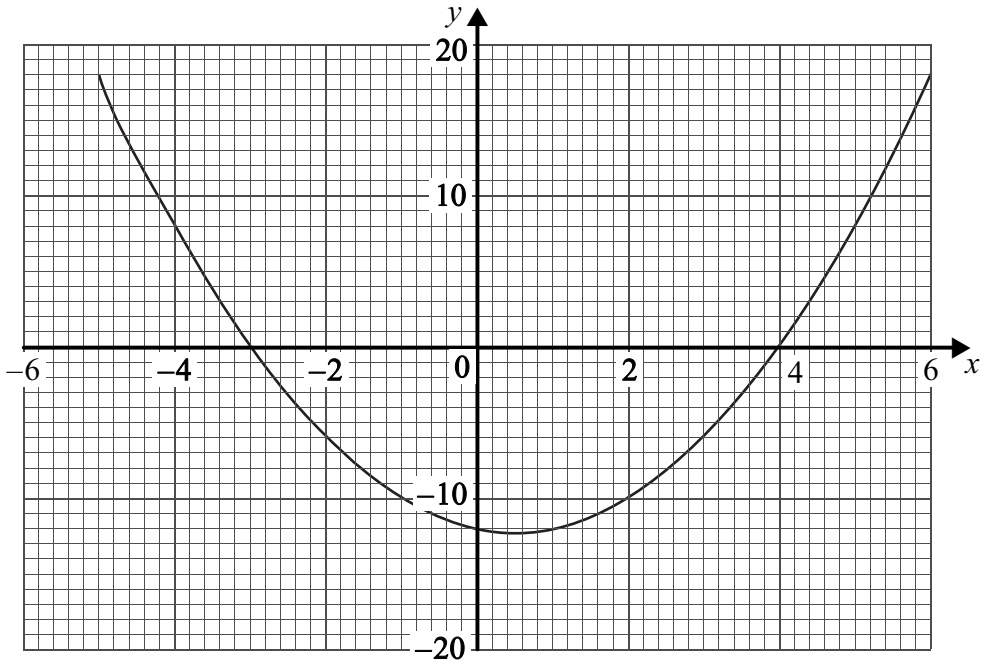
.....

.....

.....

Question 4 continues on the next page

4 (d) The graph of $y = x^2 - x - 12$ for values of x from $x = -5$ to $x = 6$ is drawn below.



Use the graph to solve the equation

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

[2 marks]

.....

.....

.....

Answers $x =$ ..... or $x =$ .....

4 (e) Use your answer to part **(d)** to calculate the volume of Box **A**.

State the **units** of your answer.

[3 marks]

.....

.....

.....

.....

Answer.....

11

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Section E

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Speed cameras** *on page 4 of the Data Sheet.*

5 (a) The speed of a car, in miles per hour, is $2.25v$, where v is the speed of the car in metres per second.

A car passes camera A travelling at 22 metres per second and accelerates at a constant rate of 1.5 metres per second per second.

The car passes camera B 10 seconds after passing camera A.

5 (a) (i) Calculate the speed of the car, in miles per hour, as it passes camera A.

[1 mark]

.....

.....

.....

Answer.....

5 (a) (ii) Using the equation $v = u + at$, calculate the speed of the car, in metres per second, as it passes camera B.

[2 marks]

.....

.....

.....

Answer.....

5 (a) (iii) As the car passes camera B, is it exceeding the motorway speed limit of 70 miles per hour?

[2 marks]

.....

.....

.....

Answer.....

5 (a) (iv) Use the equation $s = ut + \frac{1}{2}at^2$ to calculate the distance, in metres, between camera A and camera B.

[2 marks]

.....

.....

.....

.....

Answer.....

5 (b) Rearrange the formula $v^2 = u^2 + 2as$ to give s in terms of v, u and a.

[2 marks]

.....

.....

.....

.....

Answer.....

5 (c) The distance travelled by the car is given by both $s = \frac{1}{2}(u + v)t$ and $s = ut + \frac{1}{2}at^2$ and so

$$\frac{1}{2}(u + v)t = ut + \frac{1}{2}at^2$$

Simplify this equation to show that

$$v = u + at$$

[3 marks]

.....

.....

.....

.....

.....

12

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED