

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	



Free-Standing Mathematics Qualification  
Higher Level  
June 2015

# Algebra and Graphs

**4988**

## Unit 8

Tuesday 12 May 2015 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.



J U N 1 5 4 9 8 8 0 1

**Section A**

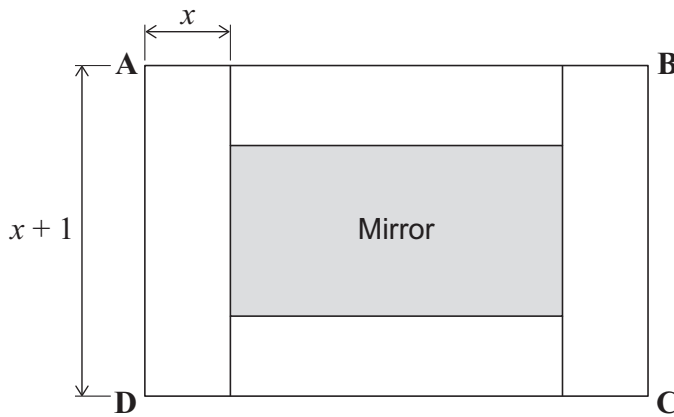
Answer **all** questions.

Answer each question in the space provided for that question.

Use **Bathroom tiles** on page 2 of the Data Sheet.

- 1** The diagram below shows four identical tiles arranged around a mirror to form a rectangle ABCD.

The measurements of one of the tiles are shown.



- 1 (a) (i)** Write an expression, in terms of  $x$ , for the length AB.

Simplify this expression.

**[2 marks]**

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Answer .....

- 1 (a) (ii)** Write an expression, in terms of  $x$ , for the perimeter of rectangle ABCD.

Simplify this expression.

**[2 marks]**

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Answer .....



**1 (b)** The perimeter of rectangle ABCD is 6 metres.

Calculate the value of  $x$ .

**[3 marks]**

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Answer .....

**1 (c) (i)** Using your answer to part (b), calculate the length and width of the **mirror**, shown shaded on the diagram.

**[3 marks]**

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Answer .....length (m) ..... width (m)

**1 (c) (ii)** Calculate the area of the **mirror**.

State the units of your answer.

**[3 marks]**

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Answer .....



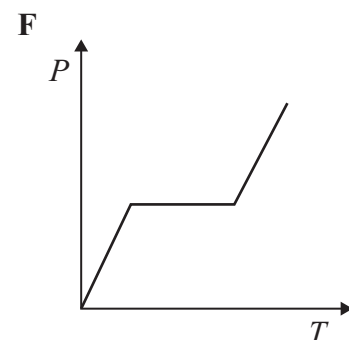
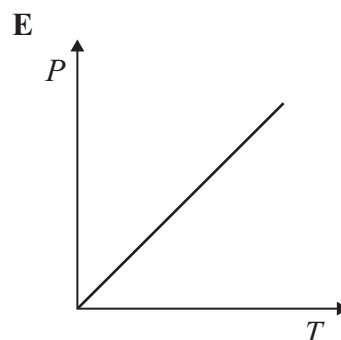
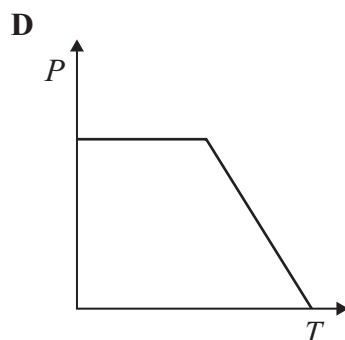
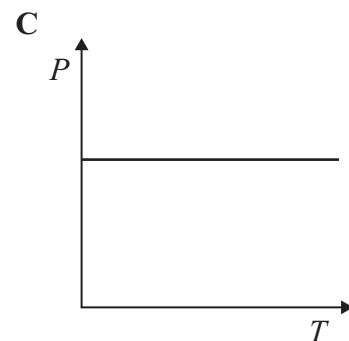
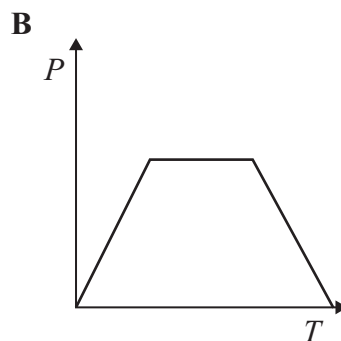
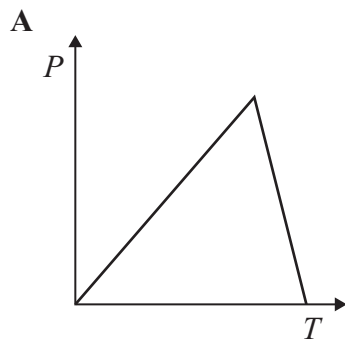
**Section B**Answer **all** questions.

Answer each question in the space provided for that question.

Use **Company profit** on page 2 of the Data Sheet.**2** Companies often use graphs to illustrate the profit they make over a period of time.

The Data Sheet gives an example of a graph and a description of a company's profit over a period of time.

The graphs below show how the profits made by six companies change over a period of time.

The vertical axes represent profit ( $P$ ) and the horizontal axes represent time ( $T$ ).

Complete the table opposite to identify which graph matches each description given in the table.

**[5 marks]**

Description	Graph (A, B, C, D, E or F)
The profit stays constant.	
The profit increases at a constant rate.	
The profit increases at a constant rate, stays the same for a period of time, then decreases at a constant rate.	
The profit increases at a constant rate, then decreases at a constant rate.	
The profit stays the same then decreases at a constant rate.	

**Turn over for the next question**

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**Section C**

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Keeping fish** on page 3 of the Data Sheet.

- 3** Three friends, Ahmed, Brent and Cassie, each have a fish tank where they keep guppies and rainbow fish.

They each follow the same advice regarding the number of gallons of water needed in a tank to keep the fish healthy.

The table below shows the number of fish in each tank and the number of gallons of water needed.

Name	Number of guppies	Number of rainbow fish	Number of gallons of water in tank
Ahmed	3	4	24
Brent	4	6	35
Cassie	5	8	?

Each guppy needs  $x$  gallons of water and each rainbow fish needs  $y$  gallons of water.

- 3 (a)** Write down the information for the number of gallons of water needed for Ahmed's and Brent's fish as a pair of equations.

**[2 marks]**

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Answer .....

Answer .....



**3 (b) (i)** Solve the equations to find the values of  $x$  and  $y$ .

**[4 marks]**

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Answer  $x =$  .....  $y =$  .....

**3 (b) (ii)** Calculate the number of gallons of water needed in Cassie's tank.

**[2 marks]**

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Answer .....

8

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**Section D**

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Heartbeats** on page 4 of the Data Sheet.

**4** Assume that, on average, the human heart beats 100 000 times a day.

Also assume that there are 365.25 days in a year.

**4 (a)** How many times, on average, does the human heart beat in a year?

Give your answer in standard form.

**[3 marks]**

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Answer .....

**4 (b)** Assume that, on average, the human heart beats 3 billion times in a person's lifetime.  
(1 billion = 1 000 000 000)

Estimate the length of a person's lifetime.

Give your answer to the nearest year.

**[3 marks]**

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Answer .....

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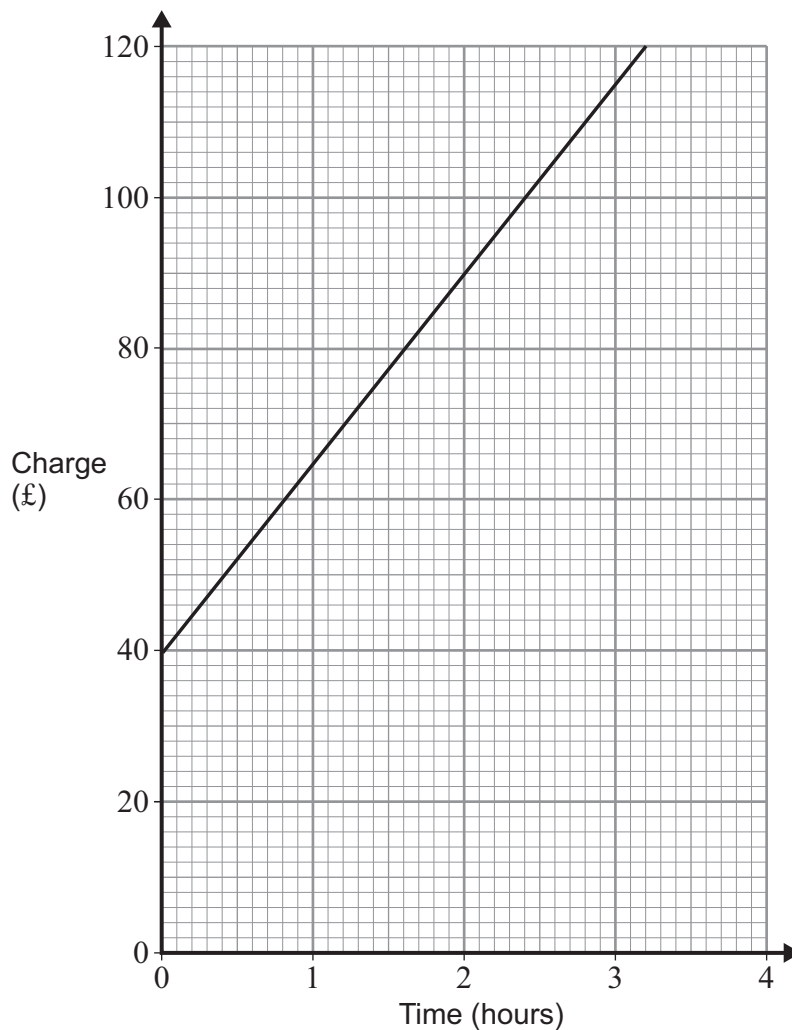


**Section E**Answer **all** questions.

Answer each question in the space provided for that question.

*Use Tradesmen on page 4 of the Data Sheet.*

- 5** The labour charge for a plumber for each job is illustrated in the graph below.



The labour charge is made up of a fixed call-out fee plus an amount for the time the job lasts. This second amount is based on a rate-per-hour.

- 5 (a)** How much is the call-out fee?

**[1 mark]**

Answer .....



**5 (b)** What is the plumber's rate per hour? **[1 mark]**

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Answer .....

**5 (c)** Use your answers to parts **(a)** and **(b)** to write an equation for the total charge, £ $C$ , in terms of the number of hours,  $h$ , the job lasts. **[1 mark]**

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Answer  $C =$  .....

**5 (d)** Use your answer to part **(c)** to calculate how much the plumber would charge for a job lasting  $5\frac{1}{2}$  hours. **[3 marks]**

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Answer .....

**5 (e)** The plumber sends a customer a bill for £252.50 .  
How many hours did the plumber take to complete the work? **[3 marks]**

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Answer .....

**Question 5 continues on the next page**

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**5 (f)** During the first week in May, the plumber completed 4 jobs and the mean charge for each job was £295 .

During the second week in May, the plumber completed 3 jobs and the charges made were £314 , £290 and £428 .

Calculate the mean charge for the 7 jobs.

**[3 marks]**

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Answer .....

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**Section F**

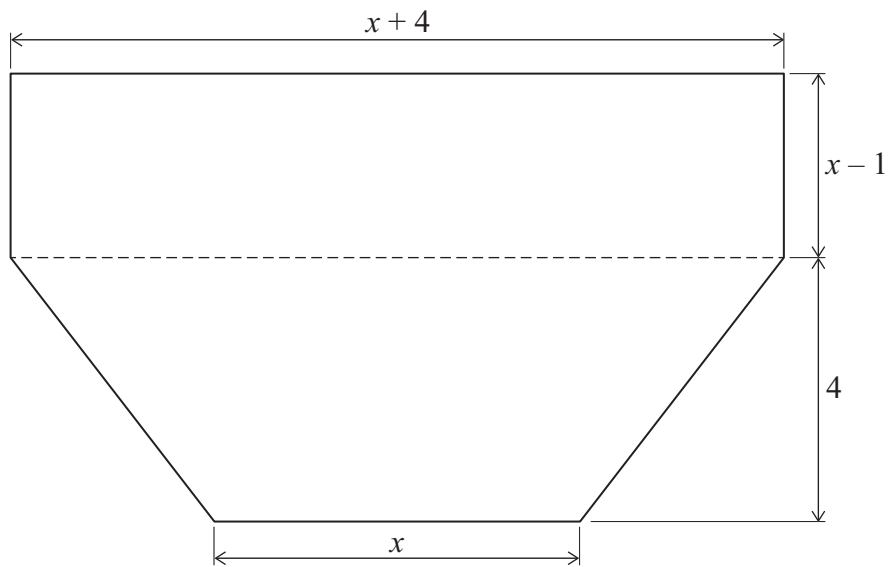
Answer **all** questions.

Answer each question in the space provided for that question.

Use **Patios** on page 5 of the Data Sheet.

- 6** The diagram below shows the plan of a patio. The hexagonal area is made up of a rectangle and a trapezium.

All measurements are in metres.



- 6 (a)** The total area of the patio is 34 square metres.

Use this information to show clearly that

$$x^2 + 7x - 30 = 0$$

**[3 marks]**

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**6 (b)** Solve the equation  $x^2 + 7x - 30 = 0$ , by factorisation or otherwise, to find the value of  $x$ .

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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

**[3 marks]**

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Answer .....

6

**END OF QUESTIONS**



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