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	

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Use of Mathematics UOM4/1

Applying Mathematics Paper 1

Friday 6 June 2014 1.30 pm to 2.30 pm

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

Time allowed
- 1 hour

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.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- 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 30.

Advice
- You do not necessarily need to use all the space provided.

Do not write outside the box

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Bounciness** *on the Data Sheet.*

1 (a) For a tennis ball, assume that the bounce height is a fraction, k, of the drop height.

Find the values between which k can lie if it complies with the regulations of the International Tennis Federation.

[3 marks]

(b) What does your answer to part **(a)** tell you about the tennis ball used in the experiments summarised in **Table 1**, printed on page 2 of the Data Sheet?

[1 mark]

QUESTION PART REFERENCE

Answer space for question 1

Do not write outside the box

QUESTION PART REFERENCE

Answer space for question 1

Do not write outside the box

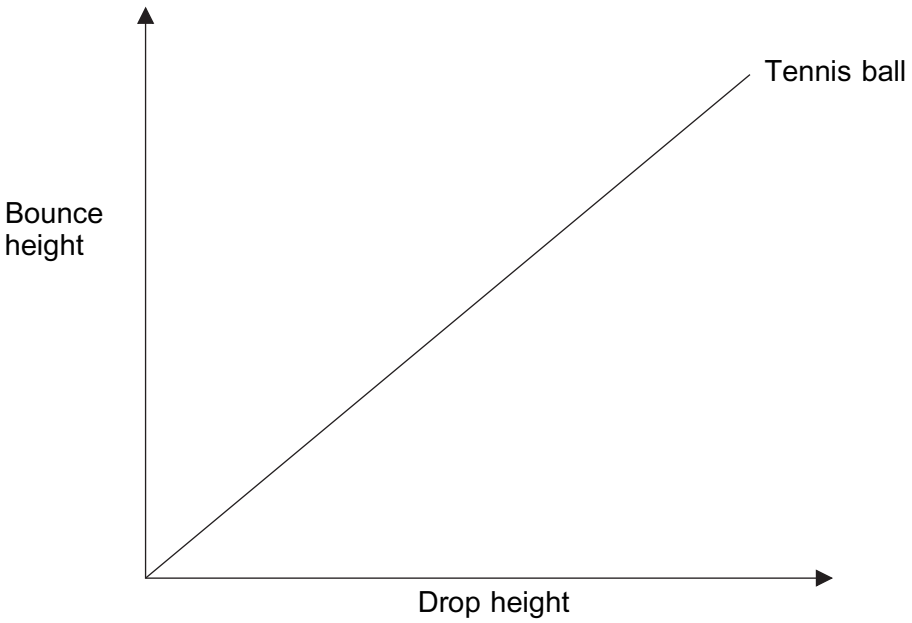
2 The graph below shows how the bounce height would be related to the drop height for the tennis ball used in the experiments described in the article printed on the Data Sheet.

Add two lines that indicate the same for the soccer ball and the basketball.
You must indicate clearly which line represents which ball.

[2 marks]

QUESTION PART REFERENCE

Answer space for question 2



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QUESTION PART REFERENCE

Answer space for question 2

Do not write outside the box

3 For the soccer ball used in the experiment, referred to in the article printed on the Data Sheet, find the heights of successive bounces correct to the nearest centimetre to complete the table below.

[2 marks]

QUESTION PART REFERENCE

Answer space for question 3

Bounce number	Height (metres)
0	1.50
1	
2	
3	
4	

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QUESTION PART REFERENCE

Answer space for question 3

Do not write outside the box

4 A table tennis ball has a value of $k = 0.8$, where k is the bounce height divided by the drop height. This table tennis ball is dropped from a height of 2 metres so that the height of the nth bounce is given by $h_n = 0.8^n \times 2$.

For this ball, find:

(a) the height of the 10th bounce;

[2 marks]

(b) after how many bounces the bounce height of the ball will be less than 0.1 metres.

[4 marks]

QUESTION PART REFERENCE

Answer space for question 4

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QUESTION PART REFERENCE

Answer space for question 4

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5 (a) When a ball is dropped from a height, h_0, its speed just before impact, v_0, with the ground is given by $v_0 = \sqrt{2gh_0}$ and its speed just after impact, v_1, is given by $v_1 = \sqrt{2gh_1}$.

Use these equations to show that the coefficient of restitution $= \sqrt{k}$.

[2 marks]

(b) On the axes opposite, sketch a graph showing how v_1 varies with h_1.

[2 marks]

(c) Complete the table opposite, giving the coefficient of restitution of the balls in **Table 1** printed on page 2 of the Data Sheet.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 5

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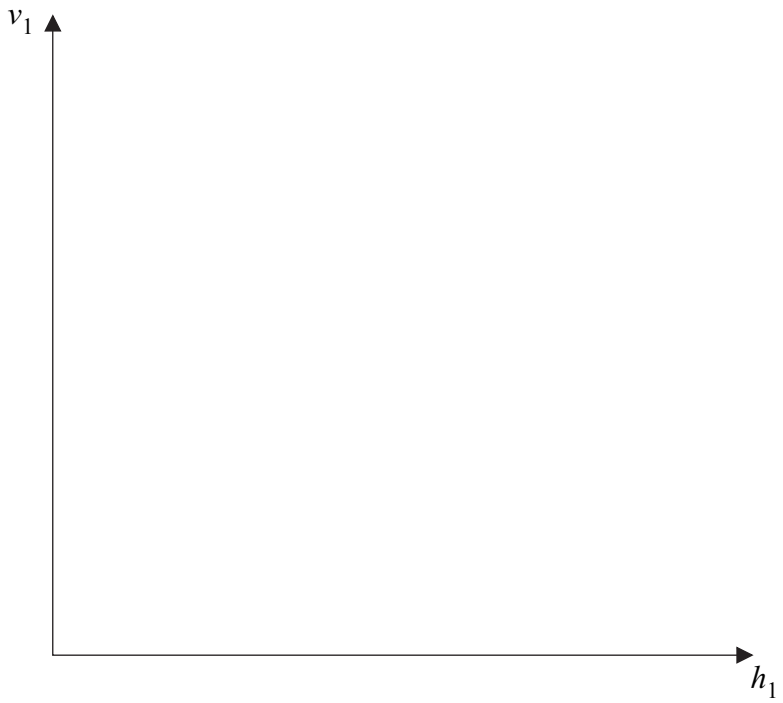
QUESTION PART REFERENCE

Answer space for question 5



Ball	Coefficient of restitution
Soccer	0.632
Tennis	0.707
Golf	
Baseball	
Basketball	

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6 (a) A soccer ball with coefficient of restitution of 0.6 is dropped from a height of 1 metre.

Find the time after the ball is dropped until it hits the ground for the fourth time.

[4 marks]

(b) Use the formula $T = \sqrt{\frac{2h_0}{g}}\left(\frac{1+\sqrt{k}}{1-\sqrt{k}}\right)$ to find the total time that the soccer ball bounces.

[2 marks]

(c) Another ball is dropped from a height of 1 metre. It takes 2.5 seconds to stop bouncing. By finding the value of k for this ball, correct to two decimal places, or the coefficient of restitution, decide which type of ball from those given in **Table 1** of the article printed on the Data Sheet it is likely to be.

[3 marks]

QUESTION PART REFERENCE

Answer space for question 6

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QUESTION PART REFERENCE

Answer space for question 6

END OF QUESTIONS

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