OCR
Oxford Cambridge and RSA

H

Wednesday 2 November 2016 – Morning

GCSE MATHEMATICS A

A502/02 Unit B (Higher Tier)

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Geometrical instruments
- Tracing paper (optional)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

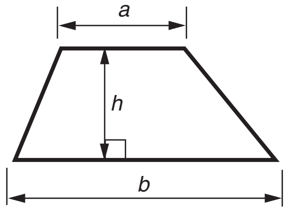
INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Your quality of written communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is **60**.
- This document consists of **16** pages. Any blank pages are indicated.

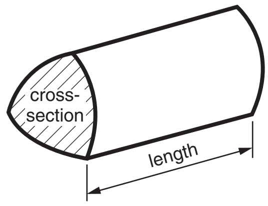
WARNING
No calculator can be used for this paper

Formulae Sheet: Higher Tier

Area of trapezium = $\frac{1}{2}(a + b)h$



Volume of prism = (area of cross-section) × length

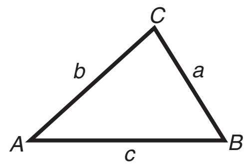


In any triangle *ABC*

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

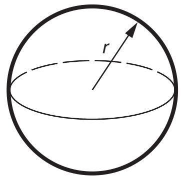
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$



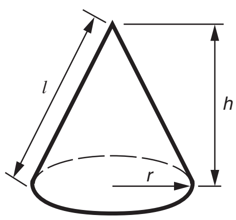
Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$



Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$



The Quadratic Equation

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

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

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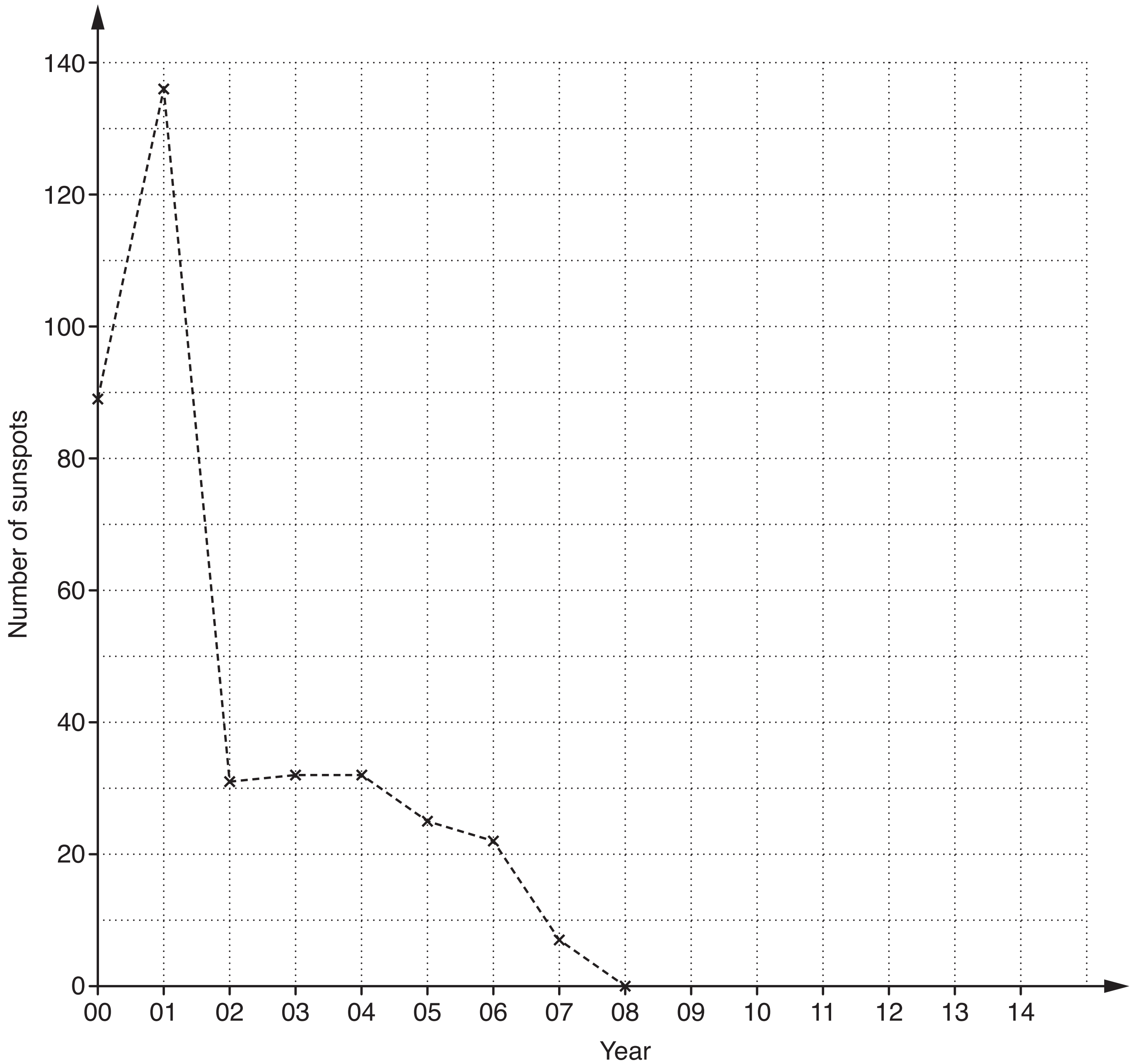
Answer **all** the questions.

1 **(a)** This table gives the number of sunspots observed on 1st January each year from 2000 (recorded as 00) to 2014 (recorded as 14).

Year	00	01	02	03	04	05	06	07	08
Number of sunspots	89	136	31	32	32	25	22	7	0

Year	09	10	11	12	13	14
Number of sunspots	12	33	44	65	87	74

(i) Plot the last 6 values and complete the time series graph.



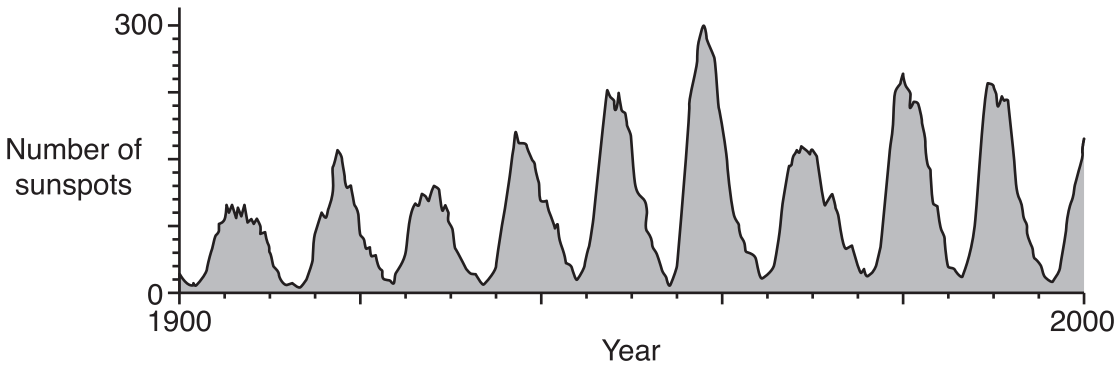
[2]

(ii) Describe the trend in the number of sunspots between 2000 and 2014.

____

____ **[1]**

(b) This time series graph shows the number of sunspots each year during the last century.



Explain how the graph shows that peaks in sunspot activity occur roughly every 11 years.

____

____ **[3]**

2 **(a)** Solve this inequality.

$$5x - 7 \leqslant 33$$

(a) ______________________ **[2]**

(b) Represent your solution to part **(a)** on this number line.

[2]

3 **(a)** Helen's DIY store sells brass screws of different sizes.
She picks out 4 screws.
Their lengths, in inches, are as follows.

$$\frac{5}{8} \qquad 1\frac{1}{4} \qquad \frac{1}{2} \qquad \frac{3}{4}$$

Put these lengths in order of size, starting with the smallest.

(a) ______ ______ ______ ______ **[3]**
smallest

(b) Many years ago people did not know an exact value for π so approximations were used.

People (Date)	Their approximation to π
Egyptian (1800 BC)	3.1250
Indian (600 BC)	3.088
Chinese (100 AD)	3.14
Jewish (150 AD)	3.142 857
Modern (2016 AD)	3.141 593

(i) Write down any of these values that are larger than the Modern value.

(b)(i) ____________________ **[1]**

(ii) Work out the difference between the value used in 100 AD and the Modern value.
Give your answer correct to 2 significant figures.

(ii) ____________________ **[2]**

(c) The average speed for a journey can be found using this formula.

$$\text{Average speed} = \frac{\text{distance}}{\text{time}}$$

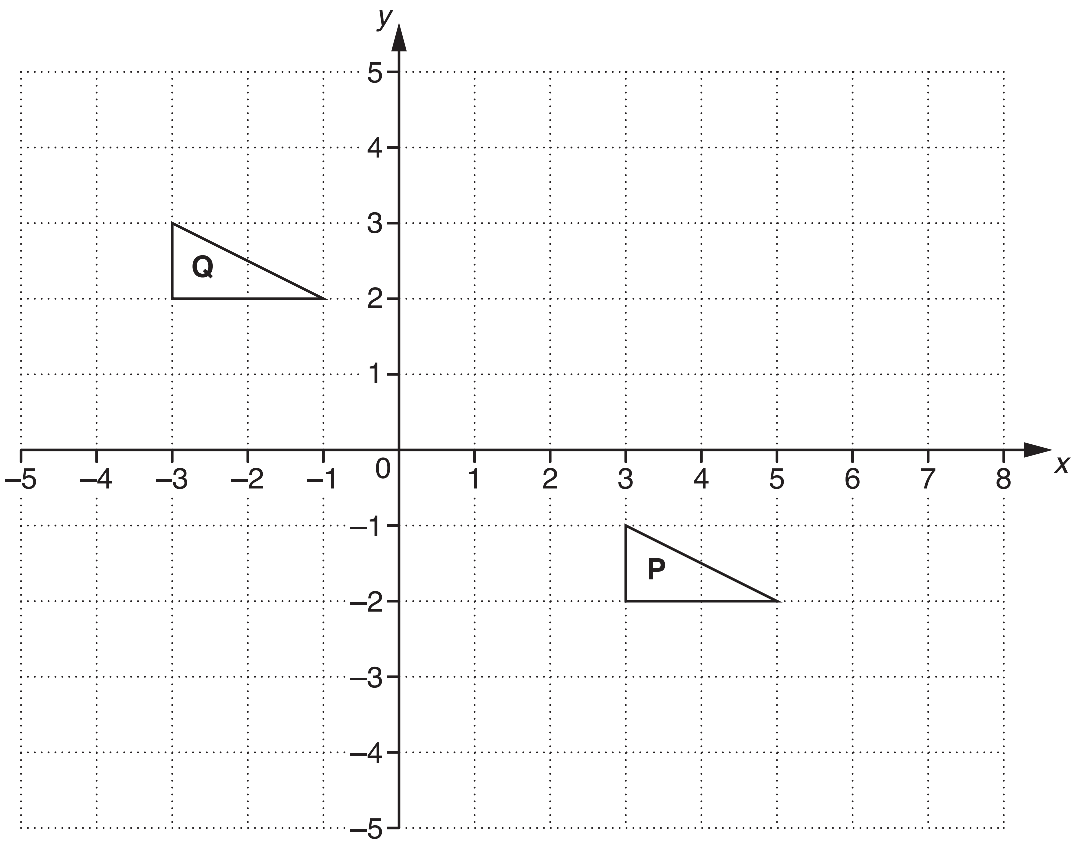
For each of the following journeys decide if the average speed will be a terminating decimal (T) or a recurring decimal (R).

Write T or R in the final column.

Distance (miles)	Time (hours)	
13	8	
425	24	
5300	450	
14 277	1250	

[3]

4 **(a)** Triangles **P** and **Q** are drawn on a coordinate grid.



(i) Use a column vector to describe the translation from **P** to **Q**.

(a)(i) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[2]**

(ii) Reflect triangle **P** in the line $x = 1$. **[2]**

(b) Alex rotates a shape. Lizzie enlarges the same shape.
They both end up with exactly the same image.
Whatever shape they use, their two images are always exactly the same.

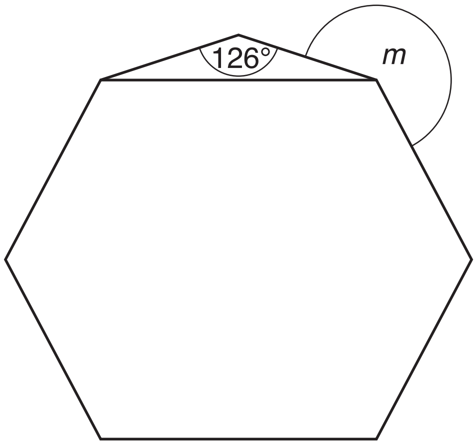
Describe fully their transformations.

Alex's rotation ____

Lizzie's enlargement ____ **[3]**

5* An isosceles triangle has one angle of 126°.
The base of this triangle is one of the sides of a **regular** hexagon.

Calculate the size of the angle marked m.



Not to scale

_______________________________ ° **[5]**

6 The time period, T seconds, of a pendulum of length L metres is given by this formula.

$$T = 6.28319\sqrt{\frac{L}{9.81}}$$

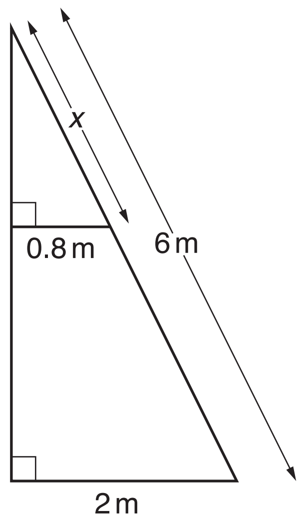
A pendulum has length 5.106 metres.

Work out an **estimate** of the time period of this pendulum.
Show clearly the estimates you use.

_______________________ seconds **[4]**

7 A 6 m long ladder rests against a vertical wall.
The foot of the ladder is 2 m from the wall on horizontal ground.
A horizontal platform of length 0.8 m is attached to the ladder and reaches the wall.

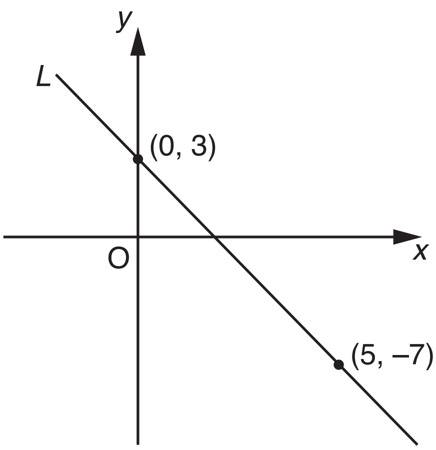
Calculate x, the distance along the ladder from the platform to the top of the ladder.



Not to scale

____________________________ m **[3]**

8 The line L passes through the points (0, 3) and (5, −7).



Not to scale

(a) Calculate the gradient of line L.

(a) ______________________________ **[2]**

(b) Write down the equation of line L.

(b) ______________________________ **[2]**

(c) Line M is perpendicular to line L and also passes through the point (0, 3).

Write down the equation of line M.

(c) ______________________________ **[2]**

9 **(a)** Solve, algebraically, these simultaneous equations.

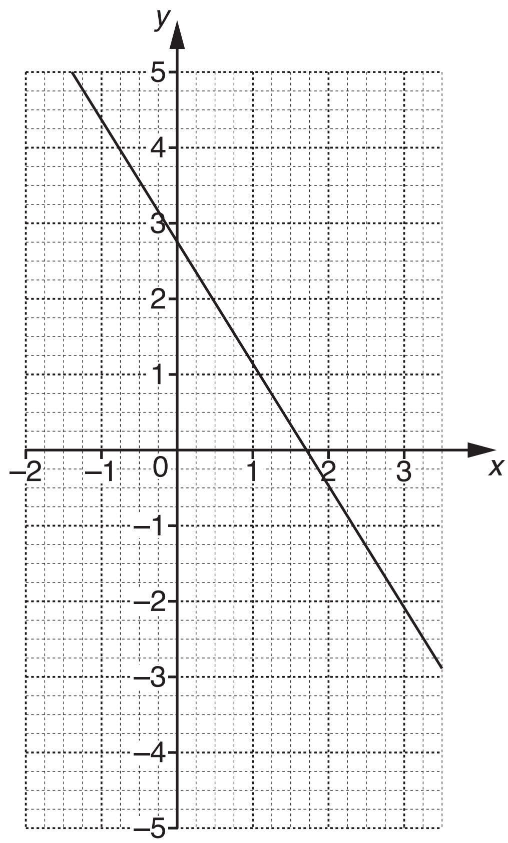
$$8x + 6y = 17$$
$$y = -4x - \frac{1}{2}$$

(a) $x =$ ______________________________

$y =$ ______________________________ **[3]**

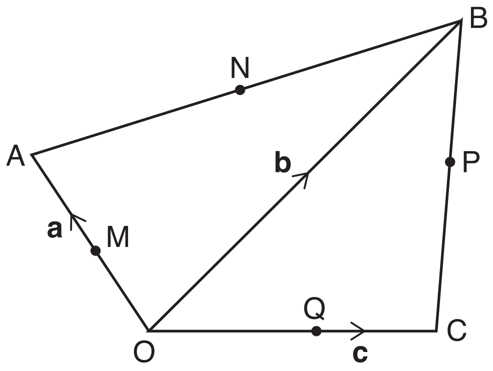
(b) The graph of $8x + 6y = 17$ is drawn on the grid.

Draw another graph on the grid and use it to comment on your answer to part **(a)**.



Comment ____ **[3]**

10 In quadrilateral OABC, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$.
M, N, P and Q are the midpoints of the four sides OA, AB, BC and CO.



Not to scale

(a) Find, in terms of **a**, **b** and **c**, an expression for $\overrightarrow{MQ}$.

(a) ______________________________ **[1]**

(b) Find, in terms of **a**, **b** and **c**, an expression for

(i) $\overrightarrow{AB}$,

(b)(i) ______________________________ **[1]**

(ii) $\overrightarrow{BC}$.

(ii) ______________________________ **[1]**

(c) Use your answers to part **(b)** to show that $\overrightarrow{NP} = \overrightarrow{MQ}$. **[1]**

11 A function is given by $f(x) = x^{\frac{1}{2}}$.

(a) Work out $f(36)$.

(a) ______________________________ **[1]**

(b) Work out $[f(64)]^{-\frac{1}{3}}$.
Give your answer in its simplest form.

(b) ______________________________ **[3]**

(c) Simplify $\dfrac{10}{f(2)}$.
Give your answer in the form $k\sqrt{2}$ where k is an integer.

(c) ______________________________ **[2]**

END OF QUESTION PAPER

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