



**MATHEMATICAL STUDIES  
STANDARD LEVEL  
PAPER 1**

Thursday 5 November 2009 (afternoon)

1 hour 30 minutes

Candidate session number

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**INSTRUCTIONS TO CANDIDATES**

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is required for this paper.
- Answer all the questions in the spaces provided.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.



Maximum marks will be given for correct answers. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working. Working may be continued below the box, if necessary. Solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer.

1. The temperatures in °C, at midday in Geneva, were measured for eight days and the results are recorded below.

7, 4, 5, 4, 8,  $T$ , 14, 4

The mean temperature was found to be 7 °C.

- (a) Find the value of  $T$ . [3 marks]
- (b) Write down the mode. [1 mark]
- (c) Find the median. [2 marks]

*Working:*

*Answers:*

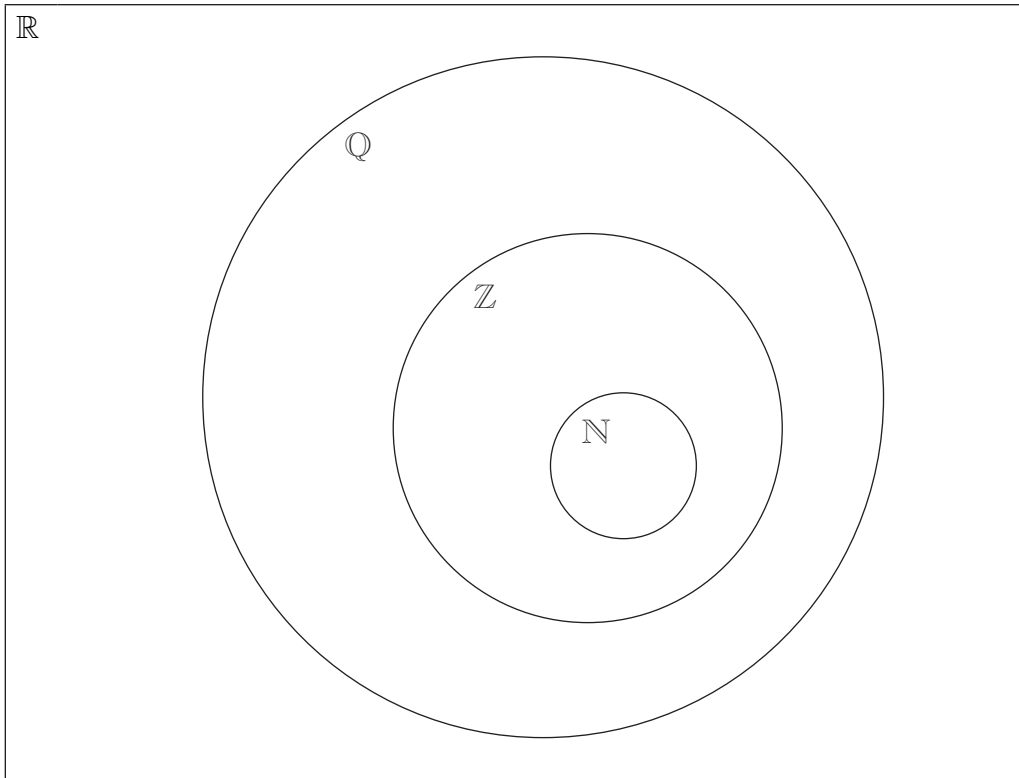
- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_



2. The Venn diagram shows the number sets  $\mathbb{N}$ ,  $\mathbb{Z}$ ,  $\mathbb{Q}$  and  $\mathbb{R}$ . Place each of the following numbers in the appropriate region of the Venn diagram.

$\frac{1}{4}, -3, \pi, \cos 120^\circ, 2.7 \times 10^3, 3.4 \times 10^{-2}$

[6 marks]

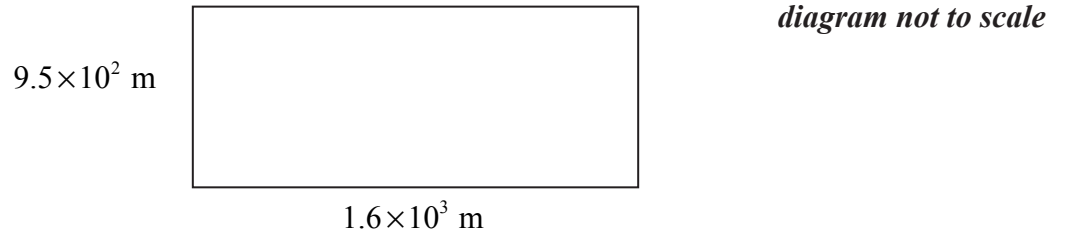


*Working:*

Blank area for working.



3. The following diagram shows a rectangle with sides of length  $9.5 \times 10^2$  m and  $1.6 \times 10^3$  m.



- (a) Write down the area of the rectangle in the form  $a \times 10^k$ , where  $1 \leq a < 10$ ,  $k \in \mathbb{Z}$ . [3 marks]

Helen's estimate of the area of the rectangle is  $1\,600\,000$  m<sup>2</sup>.

- (b) Find the percentage error in Helen's estimate. [3 marks]

*Working:*

*Answers:*

- (a) \_\_\_\_\_  
(b) \_\_\_\_\_



4. The first term of an arithmetic sequence is 7 and the sixth term is 22. Find
- (a) the common difference; *[2 marks]*
  - (b) the twelfth term; *[2 marks]*
  - (c) the sum of the first 100 terms. *[2 marks]*

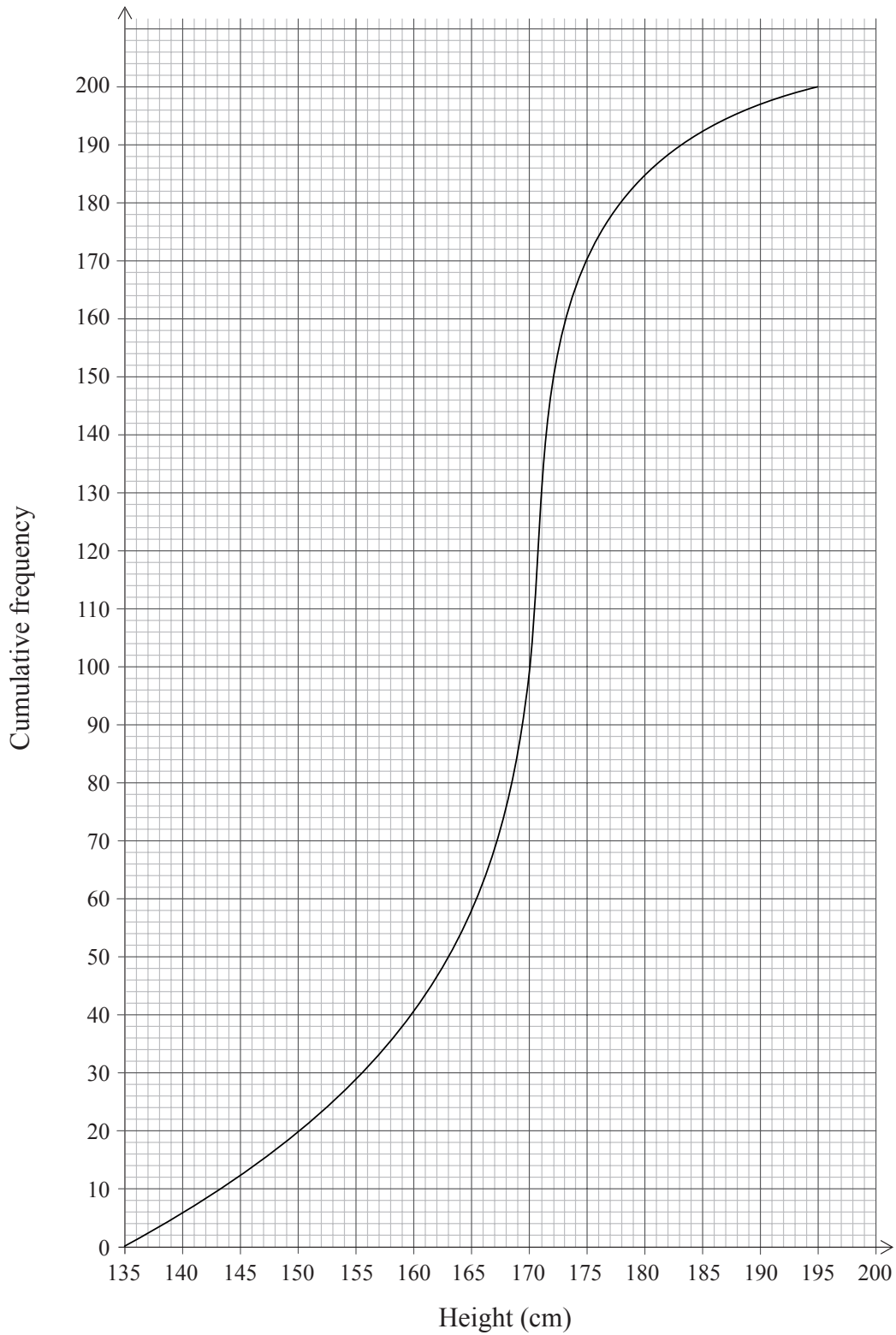
*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_



5. A cumulative frequency graph is given below which shows the height of students in a school.



- (a) Write down the median height of the students. [1 mark]
- (b) Write down the 25<sup>th</sup> percentile. [1 mark]
- (c) Write down the 75<sup>th</sup> percentile. [1 mark]



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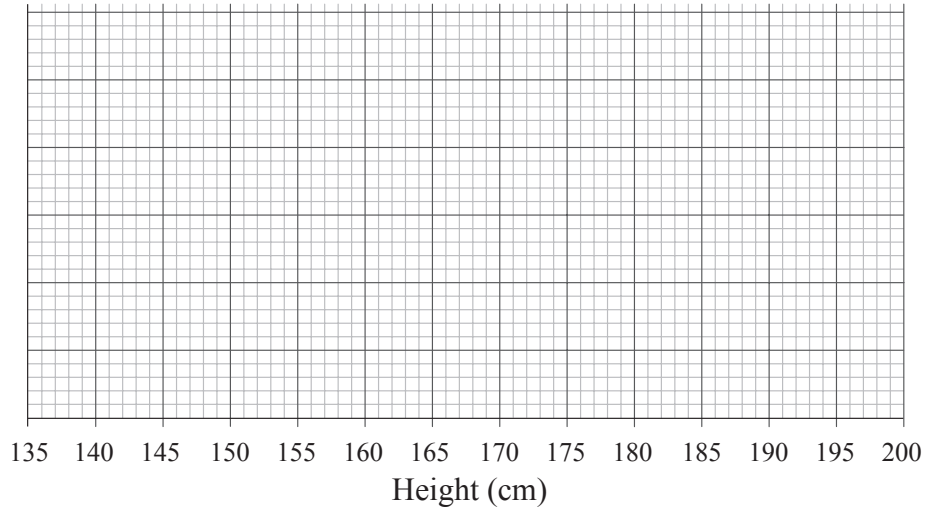
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*(Question 5 continued)*

The height of the tallest student is 195 cm and the height of the shortest student is 136 cm.

- (d) Draw a box and whisker plot on the grid below to represent the heights of the students in the school.

*[3 marks]*



*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_



6. Let  $f(x) = 2x^2 + x - 6$

(a) Find  $f'(x)$ . *[3 marks]*

(b) Find the value of  $f'(-3)$ . *[1 mark]*

(c) Find the value of  $x$  for which  $f'(x) = 0$ . *[2 marks]*

*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_





7. Consider the statement  $p$ :

“If a quadrilateral is a square then the four sides of the quadrilateral are equal”.

- (a) Write down the inverse of statement  $p$  in words. [2 marks]
- (b) Write down the converse of statement  $p$  in words. [2 marks]
- (c) Determine whether the converse of statement  $p$  is always true. Give an example to justify your answer. [2 marks]

*Working:*

*Answers:*

(a)

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(b)

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(c)

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8. The exchange rates between the British pound (GBP) and the United States dollar (USD) and between the USD and the Euro (EUR) are given below.

1 GBP	2.034 USD
1 USD	0.632 EUR

- (a) Find the exchange rate between GBP and EUR in the form  $1 \text{ GBP} = k \text{ EUR}$ , where  $k$  is a constant. Give your answer correct to **two decimal places**. *[2 marks]*

Isabella changes 400 USD into Euros and is charged 2 % commission.

- (b) Calculate how many Euros she receives. Give your answer correct to **two decimal places**. *[4 marks]*

*Working:*

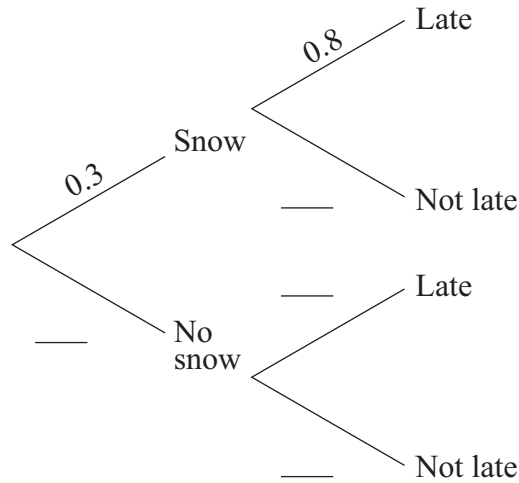
*Answers:*

- (a) \_\_\_\_\_  
(b) \_\_\_\_\_



9. The probability that it will snow tomorrow is 0.3.  
If it snows tomorrow the probability that Chuck will be late for school is 0.8.  
If it does not snow tomorrow the probability that Chuck will be late for school is 0.1.

(a) Complete the tree diagram below.



[3 marks]

- (b) Find the probability that it does not snow tomorrow and Chuck is late for school.

[1 mark]

- (c) Find the probability that Chuck is late for school.

[2 marks]

*Working:*

*Answers:*

(b) \_\_\_\_\_

(c) \_\_\_\_\_



10. A line joins the points A(2, 1) and B(4, 5).

(a) Find the gradient of the line AB. *[2 marks]*

Let M be the midpoint of the line segment AB.

(b) Write down the coordinates of M. *[1 mark]*

(c) Find the equation of the line perpendicular to AB and passing through M. *[3 marks]*

*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_



11. Given the function  $f(x) = 2 \times 3^x$  for  $-2 \leq x \leq 5$ ,

(a) find the range of  $f$ ; [4 marks]

(b) find the value of  $x$  given that  $f(x) = 162$ . [2 marks]

*Working:*

*Answers:*

(a) \_\_\_\_\_  
(b) \_\_\_\_\_



12. The population of big cats in Africa is increasing at a rate of 5 % per year. At the beginning of 2004 the population was 10 000.

- (a) Write down the population of big cats at the beginning of 2005. *[1 mark]*
- (b) Find the population of big cats at the beginning of 2010. *[2 marks]*
- (c) Find the number of years, from the beginning of 2004, it will take the population of big cats to exceed 50 000. *[3 marks]*

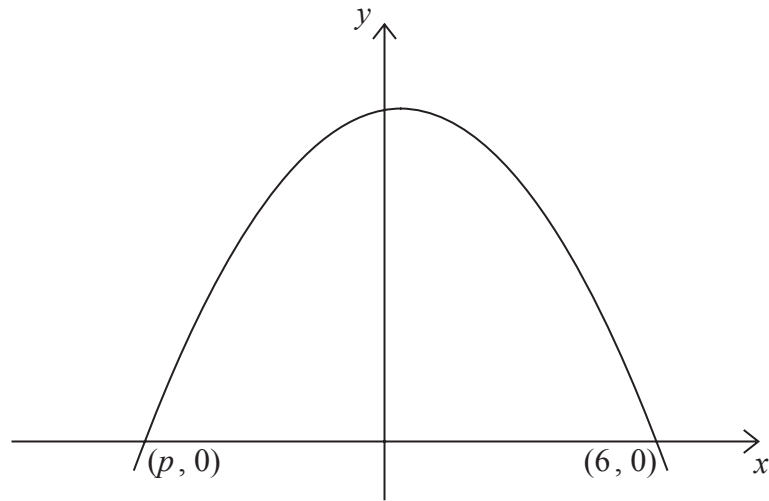
*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_
- (c) \_\_\_\_\_



13. The diagram below shows the graph of a quadratic function. The graph passes through the points  $(6, 0)$  and  $(p, 0)$ . The maximum point has coordinates  $(0.5, 30.25)$ .



- (a) Calculate the value of  $p$ . [2 marks]
- (b) Given that the quadratic function has an equation  $y = -x^2 + bx + c$  where  $b, c \in \mathbb{Z}$ , find  $b$  and  $c$ . [4 marks]

*Working:*

*Answers:*

- (a) \_\_\_\_\_
- (b) \_\_\_\_\_



14. A class consists of students studying Spanish or French or both. Fifteen students study Spanish and twelve study French.

The probability that a student studies French given that she studies Spanish is  $\frac{7}{15}$ .

- (a) Draw a Venn diagram in the space below to illustrate this information. *[3 marks]*

- (b) Find the probability that a student studies Spanish given that she studies one language only. *[3 marks]*

*Working:*

*Answer:*

(b) \_\_\_\_\_





15. Mr Tan invested 5000 Swiss Francs (CHF) in Bank A at an annual simple interest rate of  $r$  %, for four years. The total interest he received was 568 CHF.

(a) Calculate the value of  $r$ . *[3 marks]*

Mr Black invested 5000 CHF in Bank B at a nominal annual interest rate of 3.6 %, **compounded quarterly** for four years.

(b) Calculate the total interest he received at the end of the four years. Give your answer correct to **two decimal places**. *[3 marks]*

*Working:*

*Answers:*

(a) \_\_\_\_\_  
(b) \_\_\_\_\_

