



**MATHEMATICAL STUDIES
STANDARD LEVEL
PAPER 2**

Friday 8 May 2009 (morning)

1 hour 30 minutes

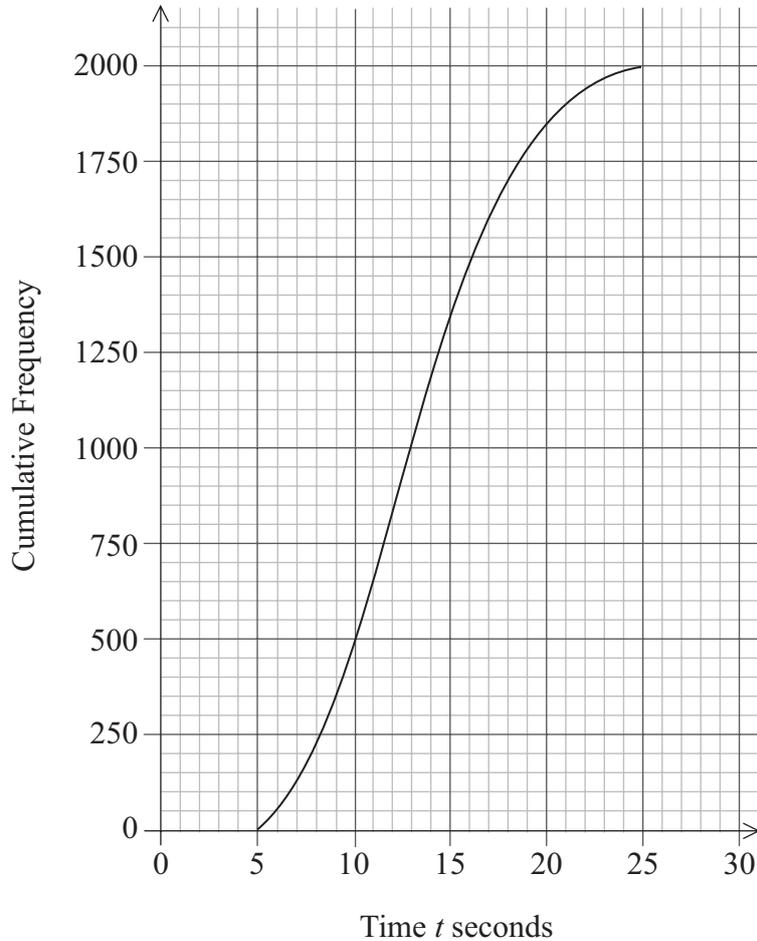
INSTRUCTIONS TO CANDIDATES

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures.

Please start each question on a new page. You are advised to show all working, where possible. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working. 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. [Maximum mark: 17]

The diagram shows the cumulative frequency graph for the time t taken to perform a certain task by 2000 men.



- (a) Use the diagram to estimate
 - (i) the median time;
 - (ii) the upper quartile and the lower quartile;
 - (iii) the interquartile range.

[4 marks]

(This question continues on the following page)

(Question 1 continued)

- (b) Find the number of men who take **more than** 11 seconds to perform the task. [3 marks]
- (c) 55 % of the men took less than p seconds to perform the task. Find p . [2 marks]

The times taken for the 2000 men were grouped as shown in the table below.

Time	Frequency
$5 \leq t < 10$	500
$10 \leq t < 15$	850
$15 \leq t < 20$	a
$20 \leq t < 25$	b

- (d) Write down the value of
- (i) a ;
- (ii) b . [2 marks]
- (e) Use your graphic display calculator to find an estimate of
- (i) the mean time;
- (ii) the standard deviation of the time. [3 marks]

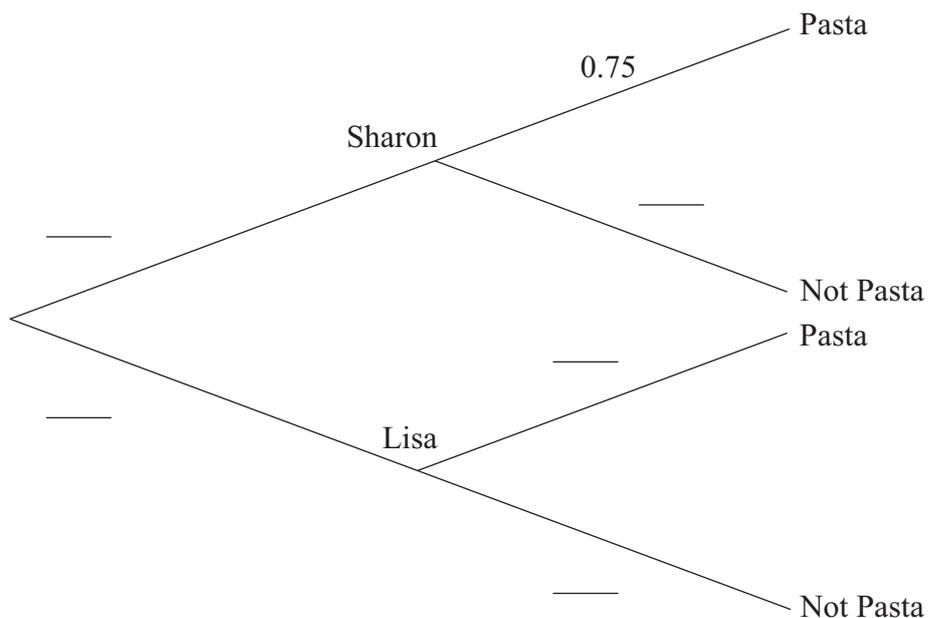
Everyone who performs the task in **less than** one standard deviation **below** the mean will receive a bonus. Pedro takes 9.5 seconds to perform the task.

- (f) Does Pedro receive the bonus? Justify your answer. [3 marks]

2. [Maximum mark: 21]

- (i) Sharon and Lisa share a flat. Sharon cooks dinner three nights out of ten. If Sharon does not cook dinner, then Lisa does. If Sharon cooks dinner the probability that they have pasta is 0.75. If Lisa cooks dinner the probability that they have pasta is 0.12.

- (a) **Copy and complete** the tree diagram to represent this information. [3 marks]

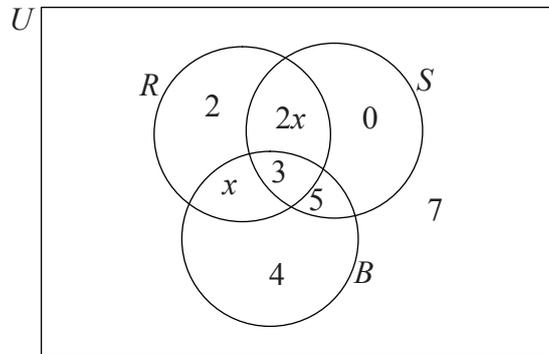


- (b) Find the probability that Lisa cooks dinner and they do not have pasta. [2 marks]
- (c) Find the probability that they do not have pasta. [3 marks]
- (d) Given that they do not have pasta, find the probability that Lisa cooked dinner. [3 marks]

(This question continues on the following page)

(Question 2 continued)

- (ii) A survey was carried out in a year 12 class. The pupils were asked which pop groups they like out of the *Rockers* (R), the *Salseros* (S), and the *Bluers* (B). The results are shown in the following diagram.



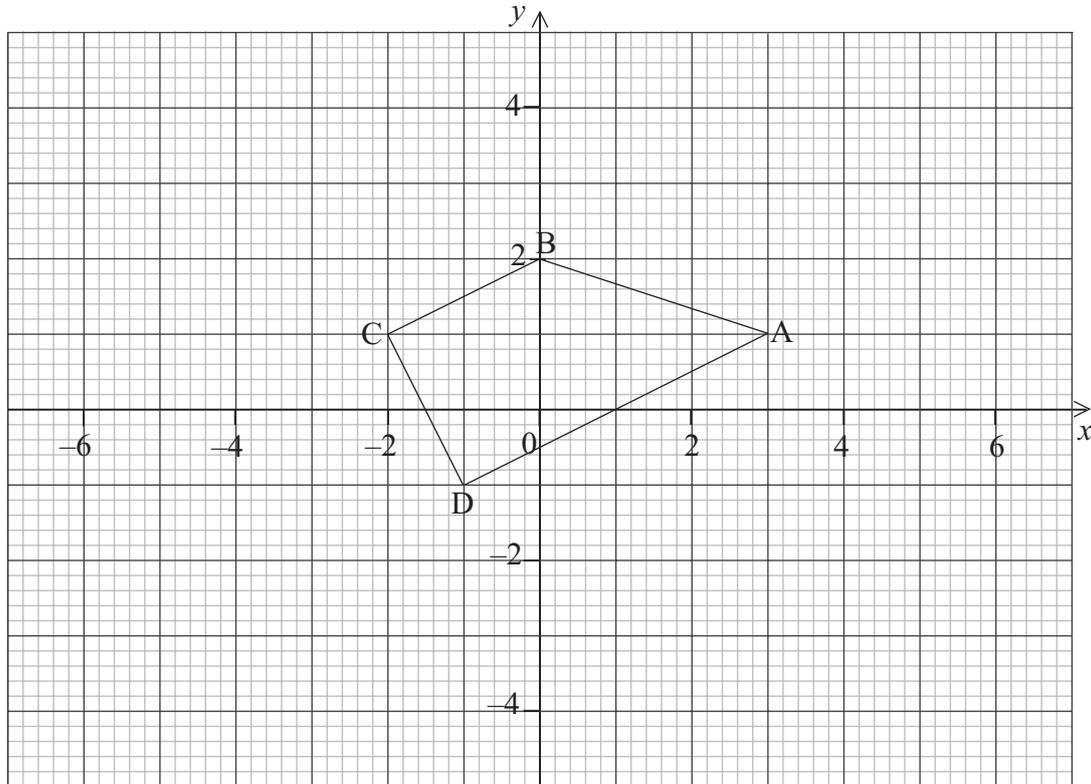
- (a) Write down $n(R \cap S \cap B)$. [1 mark]
- (b) Find $n(R')$. [2 marks]
- (c) Describe which groups the pupils in the set $S \cap B$ like. [2 marks]
- (d) Use set notation to describe the group of pupils who like the *Rockers* and the *Bluers* but do not like the *Salseros*. [2 marks]

There are 33 pupils in the class.

- (e) (i) Find x .
- (ii) Find the number of pupils who like the *Rockers*. [3 marks]

3. [Maximum mark: 13]

The vertices of quadrilateral ABCD as shown in the diagram are A(3, 1), B(0, 2), C(-2, 1) and D(-1, -1).



- (a) Calculate the gradient of line CD. [2 marks]
- (b) Show that line AD is perpendicular to line CD. [2 marks]
- (c) Find the equation of line CD. Give your answer in the form $ax + by = c$ where $a, b, c \in \mathbb{Z}$. [3 marks]

Lines AB and CD intersect at point E. The equation of line AB is $x + 3y = 6$.

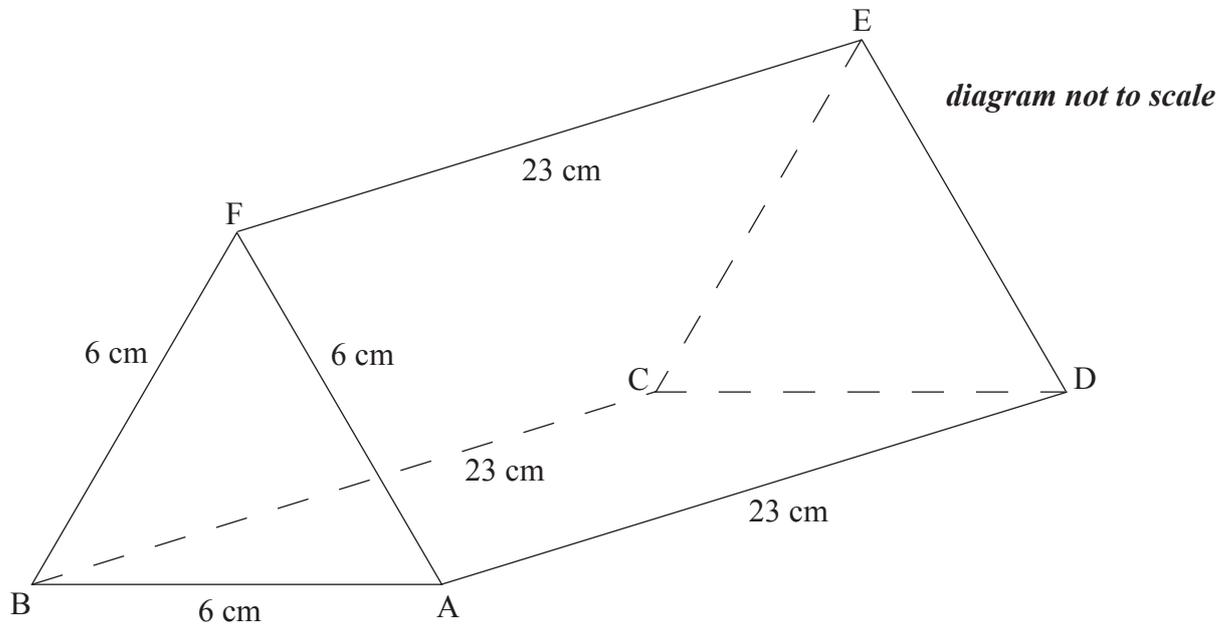
- (d) Find the coordinates of E. [2 marks]
- (e) Find the distance between A and D. [2 marks]

The distance between D and E is $\sqrt{20}$.

- (f) Find the area of triangle ADE. [2 marks]

4. [Maximum mark: 17]

A chocolate bar has the shape of a triangular right prism ABCDEF as shown in the diagram. The ends are equilateral triangles of side 6 cm and the length of the chocolate bar is 23 cm.



- (a) (i) Write down the size of angle BAF.
- (ii) Hence or otherwise find the area of the triangular end of the chocolate bar. [4 marks]
- (b) Find the total surface area of the chocolate bar. [3 marks]
- (c) It is known that 1 cm³ of this chocolate weighs 1.5 g. Calculate the weight of the chocolate bar. [3 marks]

A different chocolate bar made with the same mixture also has the shape of a triangular prism. The ends are triangles with sides of length 4 cm, 6 cm and 7 cm.

- (d) Show that the size of the angle between the sides of 6 cm and 4 cm is 86.4° correct to 3 significant figures. [3 marks]
- (e) The weight of this chocolate bar is 500 g. Find its length. [4 marks]

5. [Maximum mark: 22]

Consider the function $f(x) = 3x + \frac{12}{x^2}$, $x \neq 0$.

- (a) Differentiate $f(x)$ with respect to x . [3 marks]
- (b) Calculate $f'(x)$ when $x = 1$. [2 marks]
- (c) Use your answer to part (b) to decide whether the function, f , is increasing or decreasing at $x = 1$. Justify your answer. [2 marks]
- (d) Solve the equation $f'(x) = 0$. [3 marks]
- (e) The graph of f has a local minimum at point P. Let T be the tangent to the graph of f at P.
- (i) Write down the coordinates of P.
- (ii) Write down the gradient of T .
- (iii) Write down the equation of T . [5 marks]
- (f) Sketch the graph of the function f , for $-3 \leq x \leq 6$ and $-7 \leq y \leq 15$. Indicate clearly the point P and any intercepts of the curve with the axes. [4 marks]
- (g) (i) On your graph draw and label the tangent T .
- (ii) T intersects the graph of f at a second point. Write down the x -coordinate of this point of intersection. [3 marks]
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