

General Certificate of Education  
June 2004  
Advanced Subsidiary Examination



**MATHEMATICS (SPECIFICATION A)**  
**Unit Methods**

**MAME**

Monday 24 May 2004 Morning Session

**In addition to this paper you will require:**

- an 8-page answer book;
- the AQA booklet of formulae and statistical tables.

You may use a standard scientific calculator **only**.

Time allowed: 1 hour 20 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is MAME.
- Answer **all** questions.
- All necessary working should be shown; otherwise marks for method may be lost.
- The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
- Tie loosely any additional sheets you have used to the back of your answer book before handing it to the invigilator.

**Information**

- The maximum mark for this paper is 60.
- Mark allocations are shown in brackets.

**Advice**

- Unless stated otherwise, formulae may be quoted, without proof, from the booklet.

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Answer **all** questions.

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1 The numbers  $x$  and  $y$  satisfy the simultaneous equations

$$2x - y = 1$$

$$x^2 + y = 2.$$

(a) Show that

$$x^2 + 2x - 3 = 0. \quad (1 \text{ mark})$$

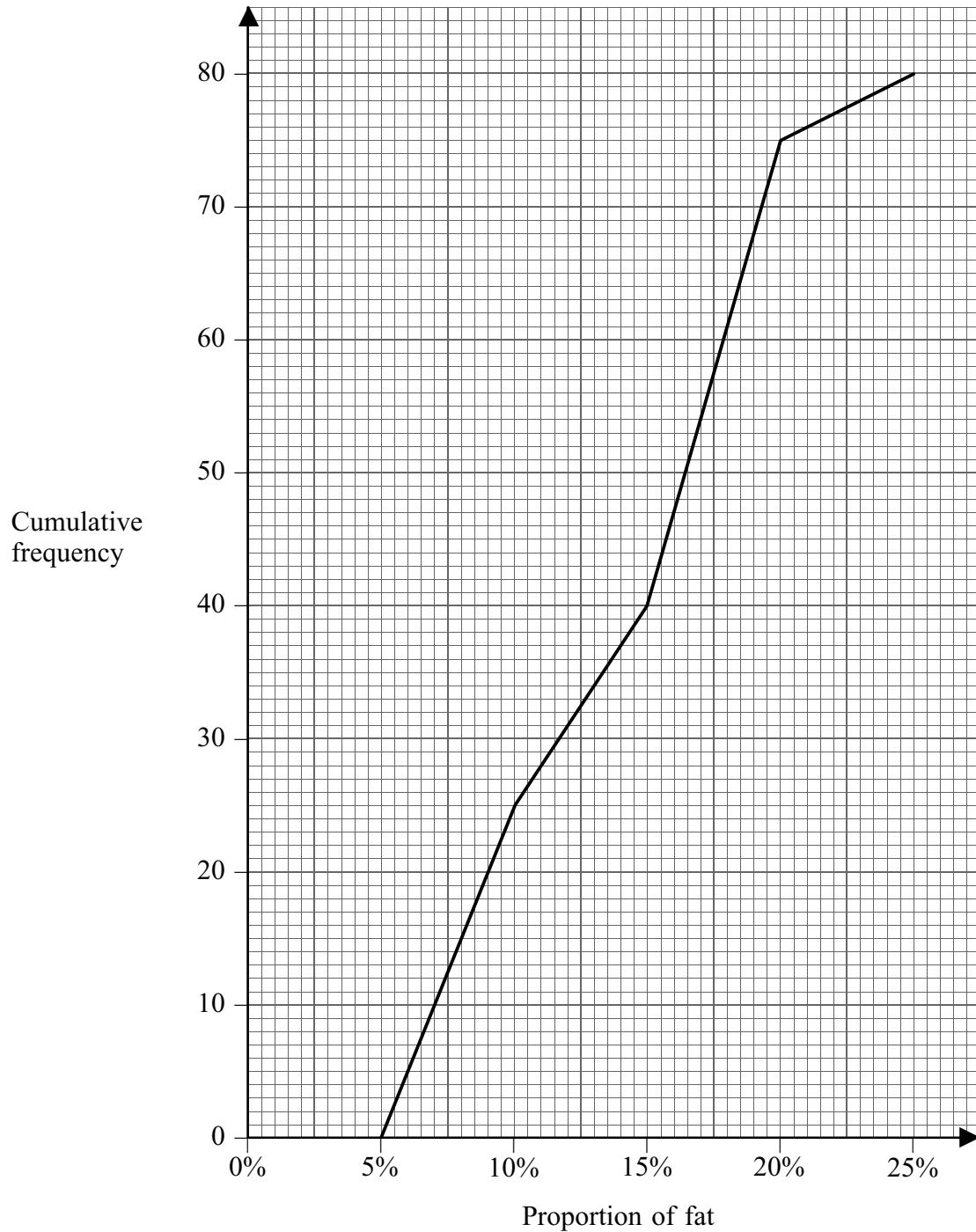
(b) Hence solve the simultaneous equations. (3 marks)

2 The probability distribution of a random variable  $X$  is given in the table below.

$x$	1	2	3	4
$\mathbf{P}(X=x)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{2}$

Calculate the mean and variance of  $X$ . (4 marks)

- 3 Tests are carried out on 80 sausages to determine the proportion of fat in each sausage. The results are summarised in the following cumulative frequency diagram.



From the diagram, find estimates for:

- (a) the median of the distribution; (1 mark)
- (b) the interquartile range. (4 marks)

- 4 A football club employs 30 players, of whom 13 have British nationality. The following table shows how many of each type of player are employed by the club.

	Goalkeepers	Defenders	Midfielders	Attackers
British	2	4	5	2
Other	2	5	7	3

One player is chosen at random from the 30 players.

- (a) Find the probability that the chosen player is:

(i) British; (1 mark)

(ii) a goalkeeper; (1 mark)

(iii) British and a goalkeeper; (1 mark)

(iv) a defender or a midfielder; (1 mark)

(v) British or an attacker but **not** both. (2 marks)

- (b) (i) Given that the chosen player is British, find the probability that he is a goalkeeper. (2 marks)

(ii) State, giving a reason, whether the events  
 ‘the chosen player is British’ and  
 ‘the chosen player is a goalkeeper’  
 are independent. (2 marks)

- 5 (a) Simplify the expression  $(\sqrt{3} - \sqrt{2})(\sqrt{3} + \sqrt{2})$ . (1 mark)

- (b) It is given that

$$k = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$$

(i) Express  $k$  in the form  $p + q\sqrt{6}$ , where  $p$  and  $q$  are integers. (3 marks)

(ii) Express  $\frac{1}{k}$  in the form  $r + s\sqrt{6}$ , where  $r$  and  $s$  are integers. (2 marks)

6 A curve is defined by

$$y = x^3 - 3x^2 + 6x.$$

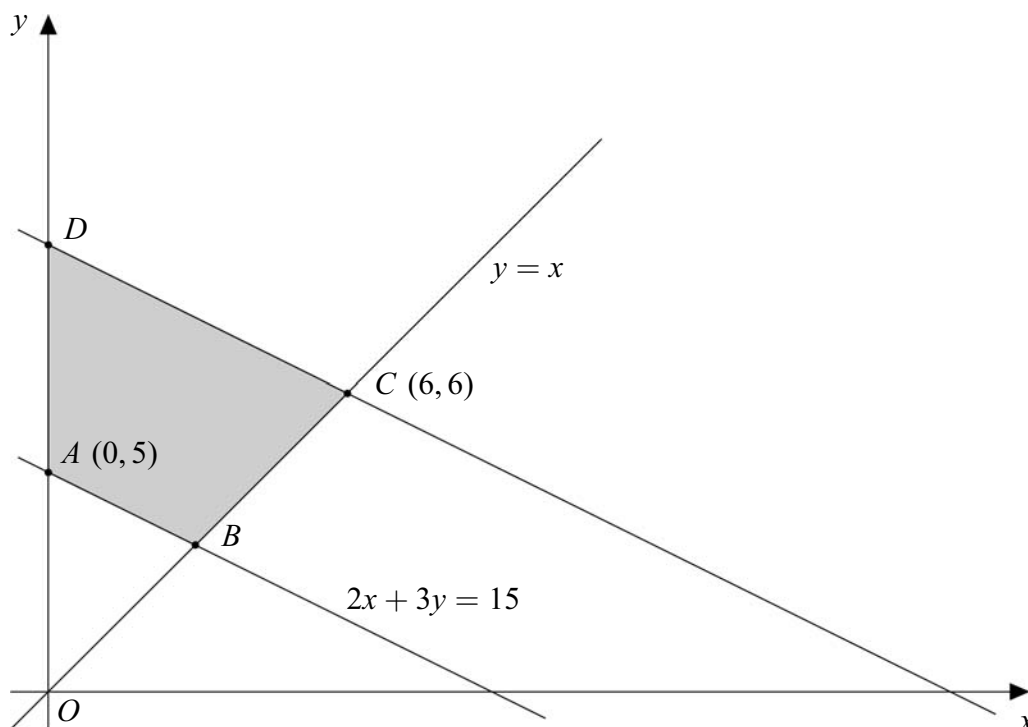
(a) (i) Find  $\int (x^3 - 3x^2 + 6x) dx$ . (2 marks)

(ii) Hence find  $\int_1^3 (x^3 - 3x^2 + 6x) dx$ . (3 marks)

(b) (i) Find  $\frac{dy}{dx}$ . (2 marks)

(ii) Show that  $y$  is an increasing function of  $x$  for all values of  $x$ . (3 marks)

7 The diagram shows a trapezium  $ABCD$ . The vertices  $A$  and  $C$  have coordinates  $(0, 5)$  and  $(6, 6)$  respectively. The sides  $AB$  and  $BC$  have equations  $2x + 3y = 15$  and  $y = x$  respectively.



Find:

(a) the coordinates of  $B$ ; (2 marks)

(b) the equation of the side  $CD$ , which is parallel to  $AB$ ; (3 marks)

(c) the coordinates of  $D$ , which lies on the  $y$ -axis; (1 mark)

(d) the area of  $ABCD$ . (4 marks)

8 (a) There are 50 books on a shelf. The number of pages,  $x$ , per book has a mean of 300 and a standard deviation of 60.

(i) Find the value of  $\Sigma x$ . *(2 marks)*

(ii) Show that  $\Sigma x^2 = 4\,680\,000$ . *(3 marks)*

(b) There are  $n$  books on another shelf. The number of pages,  $y$ , per book on this shelf has a mean of 240 and a standard deviation of 0.

Explain the significance of the zero standard deviation. *(1 mark)*

(c) The books on the two shelves have a combined mean of 280 pages per book.

(i) Show that  $n = 25$ . *(3 marks)*

(ii) Find the value of  $\Sigma y^2$ . *(2 marks)*

**END OF QUESTIONS**

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