General Certificate of Education
June 2005
Advanced Subsidiary Examination

MATHEMATICS (SPECIFICATION A) MAME
Unit Methods

Monday 23 May 2005 Morning Session

In addition to this paper you will require:
- an 8-page answer book;
- an insert for use in Question 4 (enclosed);
- a ruler;
- 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, including the insert for use in Question 4, 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.
- Further copies of the insert for use in Question 4 are available on request.

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

Answer **all** questions.

1 A random variable X has a probability distribution defined by:

x	0	2	3	5	7
$\mathbf{P}(X = x)$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{2}{8}$	k

(a) Write down the value of k. *(1 mark)*

(b) Calculate:

(i) the mean of X; *(2 marks)*

(ii) the variance of X. *(3 marks)*

2 The straight line

$$y = x + 3$$

intersects the curve

$$y = 3x^2 + 8x - 3$$

at two points.

(a) Show that, at these two points,

$$3x^2 + 7x - 6 = 0\,.$$ *(1 mark)*

(b) Hence find the coordinates of the two points. *(5 marks)*

3 (a) Express

$$x^2 - 10x + 29$$

in the form

$$(x + A)^2 + B\,,$$

where A and B are constants. *(2 marks)*

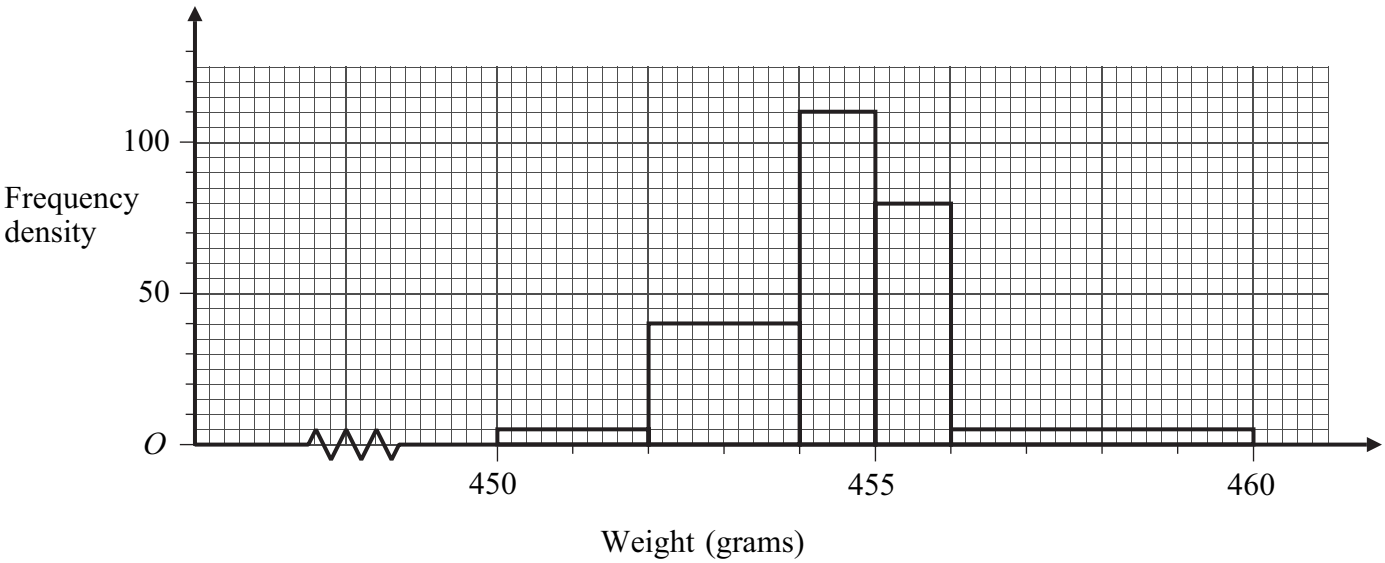
(b) Explain briefly why

$$x^2 - 10x + 29 > 0$$

for all values of x. *(2 marks)*

4 [**Figures 1 and 2**, printed on the insert, are provided for use in answering this question.]

The weights of the contents of 300 jars of jam are measured and the results are shown on the following histogram.



(a) On **Figure 1**, complete the table of cumulative frequencies. *(3 marks)*

(b) On **Figure 2**, draw a cumulative frequency graph to illustrate the distribution. *(3 marks)*

(c) Use your cumulative frequency graph to estimate the median of the distribution. *(2 marks)*

(d) State the 30th percentile of the distribution. *(1 mark)*

5 Write each of the following as a power of 3.

(a) $\sqrt{3}$ *(1 mark)*

(b) $3\sqrt{3}$ *(1 mark)*

(c) $\left(3\sqrt{3}\right)^3$ *(2 marks)*

(d) $\frac{1}{9}\sqrt{3}$ *(2 marks)*

6 A group of teenagers bought, in total, 25 items of clothing at two shops, Ace Gear and Boo Teak.

The following table shows how many tops, jeans and sweaters were bought at each of the two shops.

	Tops	**Jeans**	**Sweaters**
Ace Gear	3	7	5
Boo Teak	2	5	3

One item of clothing is chosen at random from these 25 items.

(a) Find the probability that the chosen item:

(i) is a top; *(1 mark)*

(ii) was bought from Boo Teak; *(1 mark)*

(iii) is a top and was bought from Boo Teak. *(1 mark)*

(b) State, with a reason, whether the events

'the chosen item is a top' and

'the chosen item was bought from Boo Teak'

are independent. *(2 marks)*

(c) Given that the chosen item is **not** a top, find the conditional probability that it was bought from Boo Teak. *(2 marks)*

7 Sam records the number of minutes, x, spent travelling on the bus to school each day over a period of 30 school days.

The results are summarised as follows:

$$\sum x = 1200, \quad \sum x^2 = 48\,270\,.$$

(a) Calculate the mean and standard deviation of the time that Sam spent travelling on the bus to school per day over this period. *(4 marks)*

(b) The **total** time, y minutes, that Sam spent travelling to school on each of the 30 days is given by

$$y = x + 10.$$

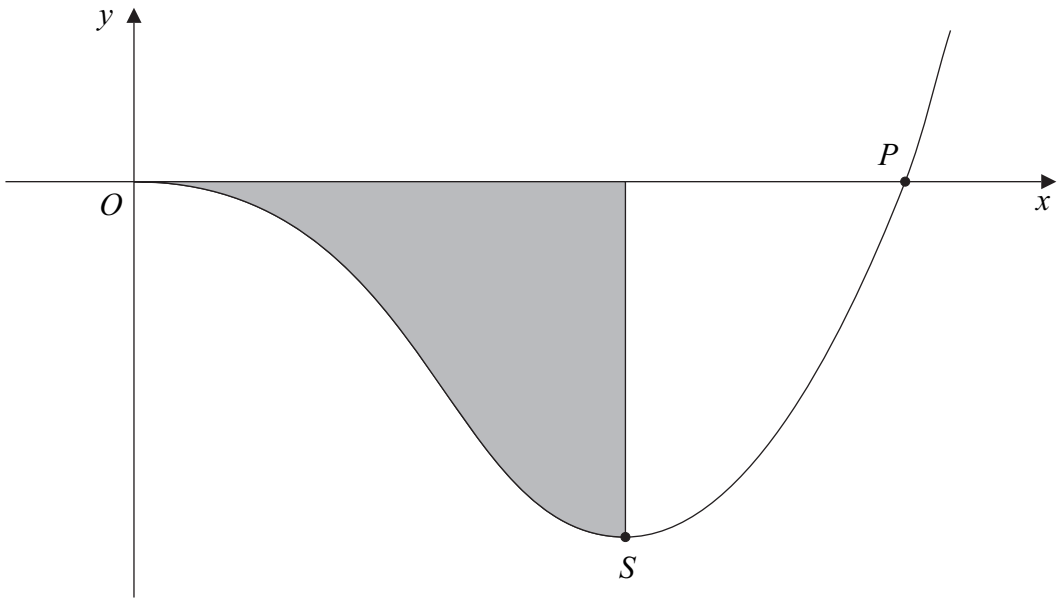
Write down the mean and standard deviation of y. *(2 marks)*

8 The diagram shows the graph of

$$y = x^4 - 18x^2 \qquad \text{for } x \geqslant 0.$$

The graph touches the x-axis at the origin O and crosses the x-axis at P.

The graph also has a stationary point S.



(a) Show that the x-coordinate of P is $3\sqrt{2}$. *(2 marks)*

(b) (i) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. *(3 marks)*

(ii) Find the gradient of the curve at P, giving your answer in the form $k\sqrt{2}$. *(2 marks)*

(iii) Show that the x-coordinate of S is 3. *(3 marks)*

(c) (i) Find $\displaystyle\int (x^4 - 18x^2)\,\mathrm{d}x$. *(3 marks)*

(ii) Hence find the area of the shaded region. *(3 marks)*

END OF QUESTIONS

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Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

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Insert for use in answering Question 4.

Fill in the boxes at the top of this page.

Fasten this insert securely to your answer book.

Weight, in grams, up to	450	452	454	455	456	460
Cumulative frequency	0	10				300

Figure 1 (for Question 4)

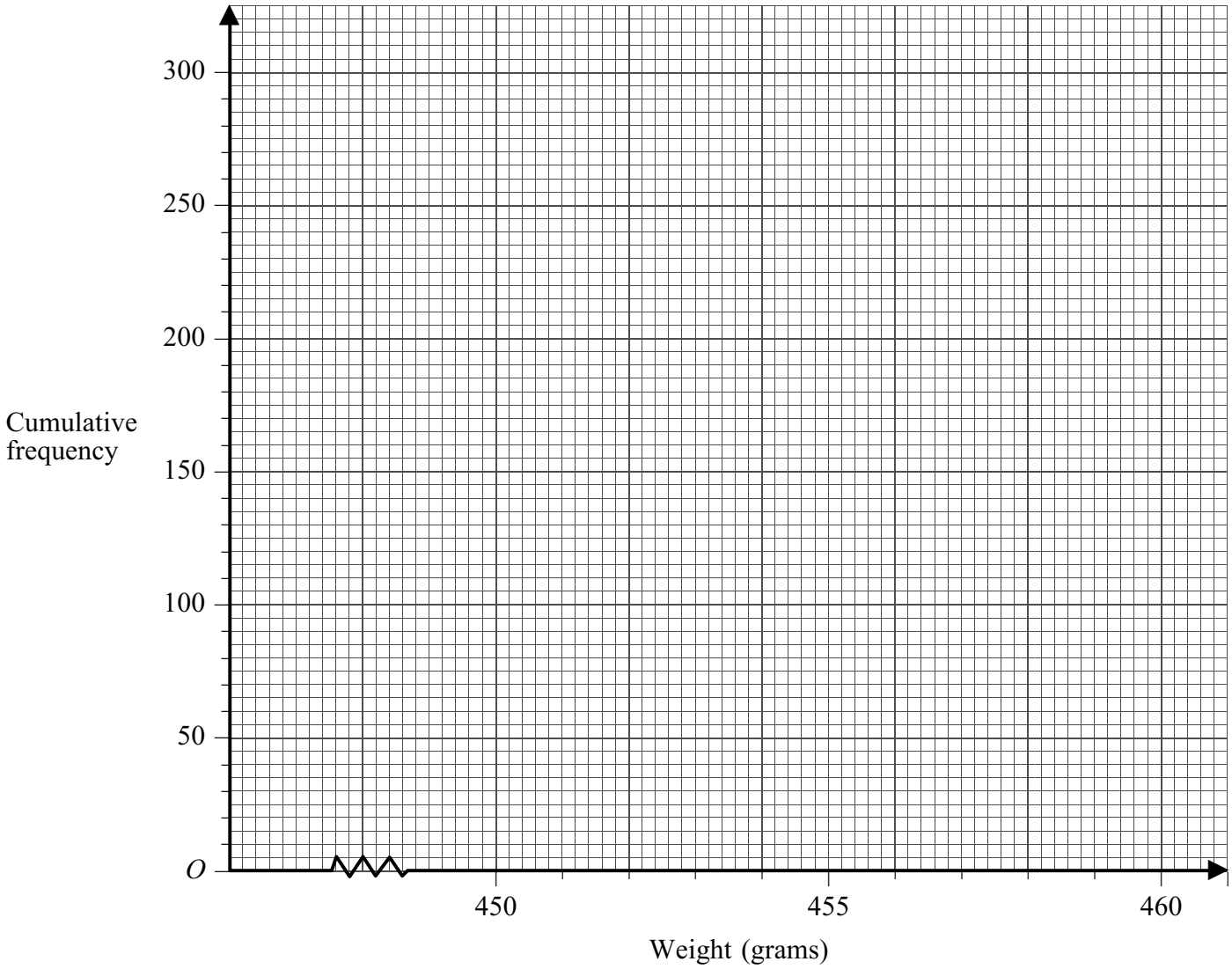

Figure 2 (for Question 4)